

A NEW SPECIES OF LIZARD, GENUS *CALYPTOMMATUS*, FROM THE  
CAATINGAS OF THE STATE OF PIAUÍ, NORTHEASTERN BRAZIL  
(SQUAMATA, GYMNOPHTHALMIDAE)

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ABSTRACT

*Calyptommatus confusionibus*, *sp. n.* is described based on ten specimens obtained at Toca da Cabocla (08° 5' 28" S, 43° 26' 58" W), Parque Nacional da Serra das Confusões, State of Piauí, Brazil. The new species is characterized by the presence of a distinctive supraocular between the frontonasal and parietal scales, and by the presence of four supralabials, the third being the largest one. The new species is very similar in other characteristics to the three previously described species of *Calyptommatus*.

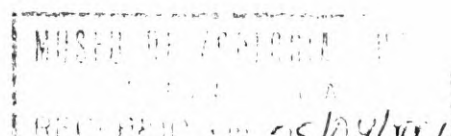
Keywords: *Calyptommatus confusionibus*, new species, Squamata, Gymnophthalmidae.

INTRODUCTION

Two years ago, we initiated a collaborative program with IBAMA's (Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis) Regional Office, sponsored by the Fundação Boticário, to undertake an intensive

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survey of the terrestrial vertebrates within the yet largely unknown transitional areas of Cerrados and Caatingas from the southeastern part of the State of Piauí. Although the main goal of the program was directed to sampling the Cerrados of the Estação Ecológica de Uruçuí-Una, we had the opportunity to visit the recently created Parque Nacional da Serra das Confusões, near the border of the States of Piauí and Bahia, an area physiologically dominated by the semiarid Caatingas. During this exploratory trip of two days to the latter area, sand tracks typical of species of the genus *Calyptommatus* Rodrigues, 1991, were observed on the predominantly sandy soils. This finding helped to stimulate the organization of a field campaign undertaken during the months of September and October 2000. The survey of the area yielded a diverse collection of lizards, including a new species of *Calyptommatus* named herein after the type locality.

#### MATERIAL AND METHODS

All the comparative material of *Calyptommatus* used in the present paper corresponds to that reported by Rodrigues (1991a), and is deposited in the herpetological collection of the Museu de Zoologia da Universidade de São Paulo (MZUSP). Snout-vent length and tail length were measured to the nearest 1 mm with a ruler. Scale proportions and leg length were made with the aid of an ocular micrometer. Scale nomenclature and scale counts follow Rodrigues (1991a), except for the scale named internasal which is referred to herein as the frontonasal.

#### *Calyptommatus confusionibus*, sp. nov.

*Holotype*. MZUSP 88077, an adult male from Toca da Cabocla (Serra Grande), Parque Nacional da Serra das Confusões: State of Piauí: Brazil (08°55' 28''S, 43°26'58''W); collected by Miguel Trefaut Rodrigues, Hussam Zaher and Felipe Curcio in 2.x.2000, field number MRT 4622.

*Paratypes*. MZUSP 88072—88076 and 88078-88081, same data as for the holotype; collected by Miguel Trefaut Rodrigues, Hussam Zaher and Felipe Curcio between 29.ix.2000 and 13.x.2000, field numbers MRT 4564, 4567, 4585, 4600, 4621, 4623, 5019, 5023, and 5024, respectively.

*Diagnosis*. A *Calyptommatus* characterized by keeled dorsals, a distinctive supraocular between frontonasal and parietal scales, a frontonasal wider than long, and four supralabials, the third being the largest and located below the eye.

*Description of the holotype.* (Figs. 1—3). Body long, snout prominent, without pronounced constrictions on the neck or base of tail; no evidence of collar fold. Rostral broad, wider than high, contacting first supralabial, nasal and frontonasal. On lateral view, the rostral forms a straight angle, with about two thirds of its total length visible on dorsal view of the head, the other one third extends straight ventrally, on the same plane with the symphysal, broadly projecting anteriorly to the latter. Frontonasal polygonal, wider than long, in broad contact with rostral, nasal, loreal, supraocular and interparietal; reaching the level of the ocular. Rostral-frontonasal contact straight, as wide as interparietal-internasal contact. Interparietal about twice as long as wide and longer than parietals and frontonasal; slightly wider and straight anteriorly; angulose or rounded posteriorly, with almost straight and slightly posteriorly converging lateral margins. Parietals irregularly hexagonal, longer than wide, contacting supraocular, superciliar, ocular, subocular, temporal and interparietal; smaller and narrower than interparietal, never reaching the level of its posterior margin. Prefrontals, frontal, and frontoparietals absent. A small but distinctive pentagonal supraocular, contacting frontonasal, interparietal, superciliar and ocular and indenting sutures between interparietal-parietal and superciliar-parietal. The supraocular is smaller than first supralabial, and about the same size as the ocular. A diagonally directed, postero-anteriorly oriented polygonal superciliar contacts nasal, second supralabial, subocular, ocular, parietal, supraocular and frontonasal. Superciliar larger than wide, wider anteriorly, its largest suture with frontonasal. Subocular above third supralabial, longer than wide, smaller than superciliar, contacting superciliar anteriorly, and temporal and parietal posteriorly. Eyelid absent, covered by an ocular scale, slightly longer than large and smaller than first supralabial, totally inserted between subocular, superciliar and parietal. Ocular semitransparent anteriorly, opaque and pigmented near posterior border. Nasal pentagonal, contacting first and second supralabials, rostral, frontonasal and superciliar; longer than wide, wider at the level of suture between referred supralabials. Nostril located on the anterior half of nasal. Loreal and frenocular absent (eventually fused with superciliar). Four supralabials in the following order of increasing size: first, second, third, and fourth; fourth below eye, third and fourth wider, fourth longest and larger ventrally. The first three angulose, expanding straight and horizontally on the ventral surface of head. A greatly enlarged temporal, slightly longer than wide above third and fourth supralabials, and contacting subocular, parietal, a small cycloid scale and a lateral scale. The latter (named tympanic from now on), much higher than long, about as large as posterior margin of temporal and imbricating slightly posteriorly with the latter. This tympanic scale covers the external ear opening (which is thus absent in the species) and reaches the fifth infralabial. A tympanic

recesses can be visualized at the level of the contact between tympanic scale and last supralabial, when viewed ventrally and after raising the ventral edge of the tympanic scale.

Mental broad with convex anterior border and straight posterior margin, wider than long, contacting first supralabial, and situated clearly posterior to ventral edge of rostral. Postmental single, wider than long, contacting first and second infralabials. Two pairs of genials in broad contact at midline, the first pair with the longest midline suture; second pair of genials largest; both pairs wider at the suture and in contact with infralabials. Five infralabials in the following order of increasing size: first, second/fifth, third, and fourth. All head scales with several and irregularly distributed small sensorial organs, best visible on dry skin. Two longitudinal series of transversally enlarged gular scales, smooth, imbricate, disposed in 7 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 scales. Interbrachial region with five transversally disposed scales: a central one, the longest and narrowest, marginated by two quadrangular scales almost identical in size and shape to ventrals, and by one paraventral longer than wide. Ventrals in four longitudinal rows, the external one larger and the others slightly longer than wide; slightly imbricated, smooth, quadrangular; 39 transverse rows between gulars and preanal region.

Anterior dorsal scales cycloid, smooth and imbricate, mostly wider than long, sometimes irregular in size, gradually changing to a longer shape until the level of row 7 and toward hexagonal and keeled scales from this point to the level of leg insertion; 48 regularly transverse rows between interparietal and posterior level of leg insertion; 19 scales around midbody. Lateral neck scales smooth, cycloid, imbricate; the uppermost scale row being larger and higher than long, similar to the tympanic scale; other lateral neck scales smaller, irregular in size and shape and disposed in two more or less recognisable 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 and much larger scales.

Preanal region with four scales, the two lateral ones larger than and separated on the midline by centrals that contact longitudinally. Four preanal pores present. Dorsal part of tail with scales smaller, wider and less keeled than posterior dorsals; some being only slightly keeled. Except for the dorsal region described above, tail with a squamation mostly identical to their corresponding parts of the body. Regenerated posteriormost part of tail with scales identical to normal tail, except dorsally where scales are smooth or keeled. Differences between dorsal, lateral and ventral scales fade away towards the tip of the tail.

Forelimbs absent. Forelimb level distinctively marked by an elongated scale present at the contact area between interbrachial region and flank. Hindlimbs reduced to a needle-shaped vestigial leg bud covered by 5 scales from the base to the tip; nail absent. When stretched, leg bud never exceeds in length the level of second ventral scale row of tail. Tail shorter than body.

Dorsal surface of body and tail light-brown with irregular darker brown spots. A wide lateral dark-brown stripe, formed by a highly irregular reticulate pattern, extends from nasal to tip of tail. Ventral portion of the lateral stripe lighter and less conspicuous than the dorsal portion. Ventral part of body and tail immaculate, with only some occasional dark spots on the tail. Hindlimb buds light-brown dorsally with a reticulate pattern identical to that of lateral stripe; ventrally immaculate.

Measurements of the holotype (mm): snout-vent length 64mm; body diameter 4.7mm; tail broken and regenerated; right leg bud 4.0mm, left leg bud 3.7mm.

*Variation.* Measurements for all ten specimens are shown in Table 1 (all adult individuals; left and right leg buds showed almost identical measures). Transverse ventral rows varied from 38 to 41; scales around midbody from 18 to 20, and transverse rows of dorsals from 46 to 49 (n= 10). All specimens have seven transverse rows of gular scales, except for one that showed six rows. Number of infralabials varied between five and six, with two specimens showing both counts. All males have four preanal pores and the number of interbrachials (five) and supralabials (four) were invariable. Anal pores are absent in females.

Although the description of the holotype closely matches the morphology present in the paratypes, the following variation was also observed. In one specimen (MZUSP 88074) the left supraocular was absent. On both sides of MZUSP 88078 the ocular was divided on its posterior corner, forming what we could call a postocular. In MZUSP 88081, the posterior part of left superciliary is fragmented. A tiny nail is clearly present in MZUSP 88075, 88078, and 88079. Coloration is mostly constant among all specimens examined.

*Comparisons.* Only three species of *Calyptommatus* have been described until now: *C. leiolepis*, *C. nicterus* and *C. sinebrachiatus* (Rodrigues, 1991a). They are small limb-reduced, and elongated lizards. Apparently as a result of adaptation to a fossorial life, females have a longer SVL but a shorter tail length than males, a condition also found in snakes. The larger body size is also expressed in slightly higher counts of transverse rows of dorsal and ventral scales (Rodrigues, 1991a). *Calyptommatus confusionibus* fits this description perfectly, being morphologically similar to its three congeneric species. Tables 2 and 3 show the frequency distribution of dorsal scales and scales around

midbody, for all species of *Calyptommatus*, separated by sex. Although our sample is small when compared to the data available for other species (Rodrigues, 1991a), the same sexual dimorphism pattern in scale counts is evident, especially for dorsal scales (Table 2). Tables 2 and 3 also show that dorsal scales and scales around midbody fail to completely separate all four species of *Calyptommatus* from each other. However, *C. confusionibus* differs most strongly from the geographically closest species *C. leiolepis*.

*Calyptommatus confusionibus* is the only species with a distinctive supraocular which prevents a parietal-frontonasal contact. *Calyptommatus sinebrachiatus*, *C. nicterus*, and *C. leiolepis*, which lack the supraocular, show a broad contact between frontonasal and parietal. *Calyptommatus confusionibus* is also unique in having only four supralabials (all others have five), the third one being equal in size and position to the third and fourth supralabials of other three species. It must be emphasized that both conditions, which are here viewed as diagnostic of *C. confusionibus*, have been previously reported as being part of the variation found in large samples representing the other three species of *Calyptommatus*. In the earlier study, Rodrigues (1991a) examined 117 specimens of *C. leiolepis* from Ibiraba and 79 from Alagoado, 47 specimens of *C. sinebrachiatus* from Santo Inácio, and 95 specimens of *C. nicterus* from Vacaria, all localities from the sand dune area of the State of Bahia. Only one specimen of *C. leiolepis* from Ibiraba showed fusion of third and fourth supralabials. Two specimens of *C. leiolepis* from Alagoado also presented a small supraocular; in one specimen, the character was symmetric, whereas the other retains it only on the right side. Other anomalies of *C. leiolepis* also present in *C. confusionibus* are: a symmetric division of the posterior part of the superciliar in one specimen from Ibiraba (only at the left side in one individual of *C. confusionibus*) and a symmetric division of the higher portion of the ocular, forming a "post-ocular" in one specimen from Alagoado (symmetrically represented also in one specimen of *C. confusionibus*).

*Calyptommatus leiolepis* is geographically closest to *C. confusionibus*. As far as we know, both are distributed only on the left bank of the Rio São Francisco; the linear distance from the type locality of *C. confusionibus* to the closest locality where *C. leiolepis* occurs is less than 100 kilometers. *Calyptommatus leiolepis* can be clearly recognized from *C. confusionibus* by its completely smooth and rounded dorsal scales. Among the two other species, only one specimen of *C. nicterus* shows symmetric presence of "post-oculars". In sum, despite the large number of specimens examined, none of these variations were common and no individual possessed more than one of the diagnostic characters. A more detailed examination will possibly confirm that some of the

similar variations are probably the result of convergences. Evidence for that comes the fact that the “supraoculars” of *C. confusionibus* and those present in the specimens of *C. leiolepis* are probably not homologous. In fact, the supraocular of *C. confusionibus* most likely derives from the frontonasal, whereas the “supraocular” of *C. leiolepis* derives from a subdivision of the anteriormost part of the parietal. Table 4 summarizes the morphological variation present among the species of *Calyptommatus*.

#### DISCUSSION

The recently created Parque Nacional da Serra das Confusões corresponds to an area of approximately 500.000 hectares in the south central part of the State of Piauí, near the Bahia border (Figure 7). The borderline between these two states is locally dominated by crystalline mountain ranges that form the watershed between the rivers flowing toward the Rio São Francisco and those discharging into the Rio Parnaíba. Except for small isolated mountains, all the area is dominated by an extensive arenitic plateau, the Chapada dos Gerais, slightly inclined towards the west, and largely dissected by the drainage (Castro, 1977). All of the National Park is enclosed within the drainage of the Rio Parnaíba, with altitudes ranging from 450 to approximately 700 meters.

During the field trip, we sampled three widely separated and physiologically different areas: Toca da Cabocla (the type locality), Lagoa do Jacú (08°40'37"S, 43°29'09"W), and Olho d'Água da Santa (09°13' 10"S, 43°29'27"W). Straight distances among the three areas do not exceed more than 50 Km. Toca da Cabocla is in the core area of Serra Grande or Serra Geral (local reference names for the Chapada dos Gerais), a large arenitic plateau deeply dissected by an intermittent river drainage. Lowland areas below the altimetric level of Serra Grande are dominated by sandy soils, where residual and scattered rock outcrops are found. The latter are identical to those exposed on the dissected valleys present along the intermittent watercourses. The whole area is dominated by the Caatinga vegetation, which is relatively dense in the sandy soils areas and partially covered by abundant dry leaf litter (Leguminosaeae, Euphorbiaceae being the most common); the tallest trees attain a height of 6-7 meters. Rocky outcrops are mainly characterized by Cactaceae, Bromeliaceae and Euphorbiaceae, among other plants. According to the local people, this area was almost entirely burned 33 years ago.

At “Toca da Cabocla”, we placed a set of pit-fall traps with drift fences

(eightly 30 liters buckets, about 40 cm diameter and 60 cm high) that were monitored for 15 days, totalling an effort of 1160 pit-falls/day. This effort resulted in the collection of 11 specimens of *C. confusionibus*.

Lagoa do Jacú is a lowland area (locally called “Baixão”) dominated by arboreal and mostly evergreen Caatingas forming a continuous forest cover, without sandy soils. Although our effort in this area was of 520 pit-falls/ day, we failed to collect any specimen of *Calyptommatus*.

Our results were also unsuccessful at “Olho d’Agua da Santa”, a highly dissected area on the plateau border, mainly characterized by ruiniform arenitic outcrops. The area is mainly covered by rocky formations which are highly and irregularly dissected on their border, and where Cactaceae, Bromeliaceae, Velloziaceae, and Leguminosae represent the predominant vegetation. A mix of Caatinga vegetation and scattered large trees, with leathery leaves and thickened bark (similar to plants of the Cerrado), grow on the crevices and sharp edges of the ruiniform arenitic outcrops. Eventually, the crevices deepen and widen into large canyons dominated by an especially tall forest where the highest trees grow to 30 m. In all this area, particularly toward the valleys, soils were predominantly sandy, especially along the intermittent streams. Pit-fall effort totalled 1360 pit-falls/day in this area.

Considering the significant sampling effort using pit-falls traps, it is evident that *C. confusionibus* is much more rare than its congeners. We also failed to obtain more specimens by searching intensively among the sub-surface sand and below leaf litter, a method that have proven highly successful with the other three species. Comparative data from pit-fall captures in other localities confirm the relative scarcity of *C. confusionibus*. At Santo Inácio, we collected 103 specimens of *C. sinebrachiatus* after an effort of 720 pit-fall traps/day. Similarly, 49 specimens of *C. leiolepis* were obtained at Ibiraba, with an effort of 250 pit-fall/day. Furthermore, buckets used at Santo Inácio and Ibiraba were smaller (about 18 liters, 30 cm diameter, 40 cm high) than those used at Serra das Confusões. The scarcity of tracks also confirms the above. Tracks were only occasionally observed at Toca da Cabocla and sandy areas nearby, but never in the other sampled areas.

The presence of *Calyptommatus* in the Serra das Confusões is expected, since it has been previously reported (as *Calyptommatus* sp.) for the Parque Nacional da Serra da Capivara (Olmos, 1998). This famous archaeological and paleontological site (see Fumdhm, 1996; Parenti *et. al.*, 1998) is separated from the Toca da Cabocla by about 100 km in straight-line distance, in an area where sandy soils are frequent.



The other species of *Calyptommatus* are restricted to the large Quaternary sand dune fields of the Rio São Francisco (Rodrigues 1991a, 1996). *Calyptommatus leiolepis* occurs along the left bank of the river and is limited to two geographically isolated dune fields (Figure 7). *Calyptommatus leiolepis* and *C. nicterus* are restricted to adjacent sandy areas of the right bank of the Rio São Francisco (Rodrigues, 1996). On the other hand, *C. confusionibus* seems isolated from the former species, in a sandy area belonging to a different drainage, although not distant from the São Francisco dunes. Since all species of *Calyptommatus* are strictly dependent on sandy soils which presently form isolated patches within each of the two distinct drainages, it seems premature to propose an evolutionary/ecological scenario for the group without any explicit phylogenetic hypothesis. Nevertheless, one can imagine a few possible scenarios that would explain the present disjunct distribution of *C. confusionibus*. A contact via dispersion by adjacent sandy soils in the watershed area is possible but would not prevent effective gene flow. A possible northwestern extension of the São Francisco sand dunes, as a result of intense wind activities during the Pleistocene, seems to represent a more plausible mechanism (Barreto, 1998; Oliveira, 1999). During these periods under a drier climate, southeastern winds were responsible for the dune edification in that area (Barreto, 1998; Oliveira, 1999). These periods of more intense winds occurred repeatedly in the area (Oliveira, 1999). We suggest that this mechanism is the best explanation, given our present knowledge, for the occurrence of *Calyptommatus confusionibus* at Serra das Confusões.

#### ACKNOWLEDGMENTS

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Table 1. Measurements (mm) of the type series of *Calyptommatus confusionibus*: snout-vent length (SVL); tail length (TL); right and left leg bud (RLB and LLB respectively), and diameter at midbody (MD).

MZUSP #	SEX	SVL	TL	RLB	LLB	MD
88072	female	67	50	4.0	4.0	4.8
88073	male	72	73	4.0	4.0	4.3
88074	female	68	broken	4.0	4.0	5.4
88075	female	69	broken	4.0	4.0	5.1
88076	male	61	broken	3.6	3.6	4.8
88077	male	64	broken	4.0	4.0	4.7
88078	male	60	broken	3.0	3.0	3.9
88079	male	62	broken	4.0	4.0	4.2
88080	female	71	broken	4.0	4.0	5.3
88081	male	64	broken	4.0	4.4	4.3

Table 2. Frequency distribution of number of dorsal scales in the four species of *Calyptommatus*.

	<i>C. sinebrachiatus</i>		<i>C. leiolepis</i>		<i>C. nicterus</i>		<i>C. confusionibus</i>			
	male	female	male	female	male	female	male	female		
			Ibiraba		Alagoado					
42			10		3					
43	6		21	2	14	1				
44	12		22	16	14	9				
45	2	6	3	28	1	11	11			
46	2	9	2	14		13	15	4	2	
47		6		3		1	9	20	2	2
48		2				1	3	23	1	1
49								6		1

Table 3. Frequency distribution of number of scales around midbody in the four species of *Calyptommatus*.

	<i>C. sinebrachiatus</i>		<i>C. leiolepis</i>				<i>C. nicterus</i>		<i>C. confusionibus</i>	
	male	female	male	female	male	female	male	female	male	female
			Ibiraba		Alagoado					
15			4	1						
16			31	13	7	4	4	1		
17	2	5	22	45	23	15	24	23		
18	15	8	1	2	2	16	11	26	4	
19	5	10						4	2	3
20										1

Table 4. Comparative body size and range of character variation in species of *Calyptommatus*. Dorsal scales: (k) strongly keeled, (s) smooth, (sk) slightly keeled.

Character	<i>C. sinebrachiatus</i>	<i>C. nicterus</i>	<i>C. leiolepis</i>	<i>C. confusionibus</i>
Sample size	47	95	196	10
Maximun SVL, Males	56	62	59	72
Maximun SVL, Females	71	69	71	71
Dorsals	43—48	46—48	42—47	46—49
Scales around midbody	17—19	17—18	15—18	18—20
Ventrals	34—39	36—39	33—39	37—41
Supralabials	5	5	5	4
Infralabials	5	5	5	5—6
Supraocular	absent	absent	absent	present
Dorsal scales in the adult	k	sk	s	Sk

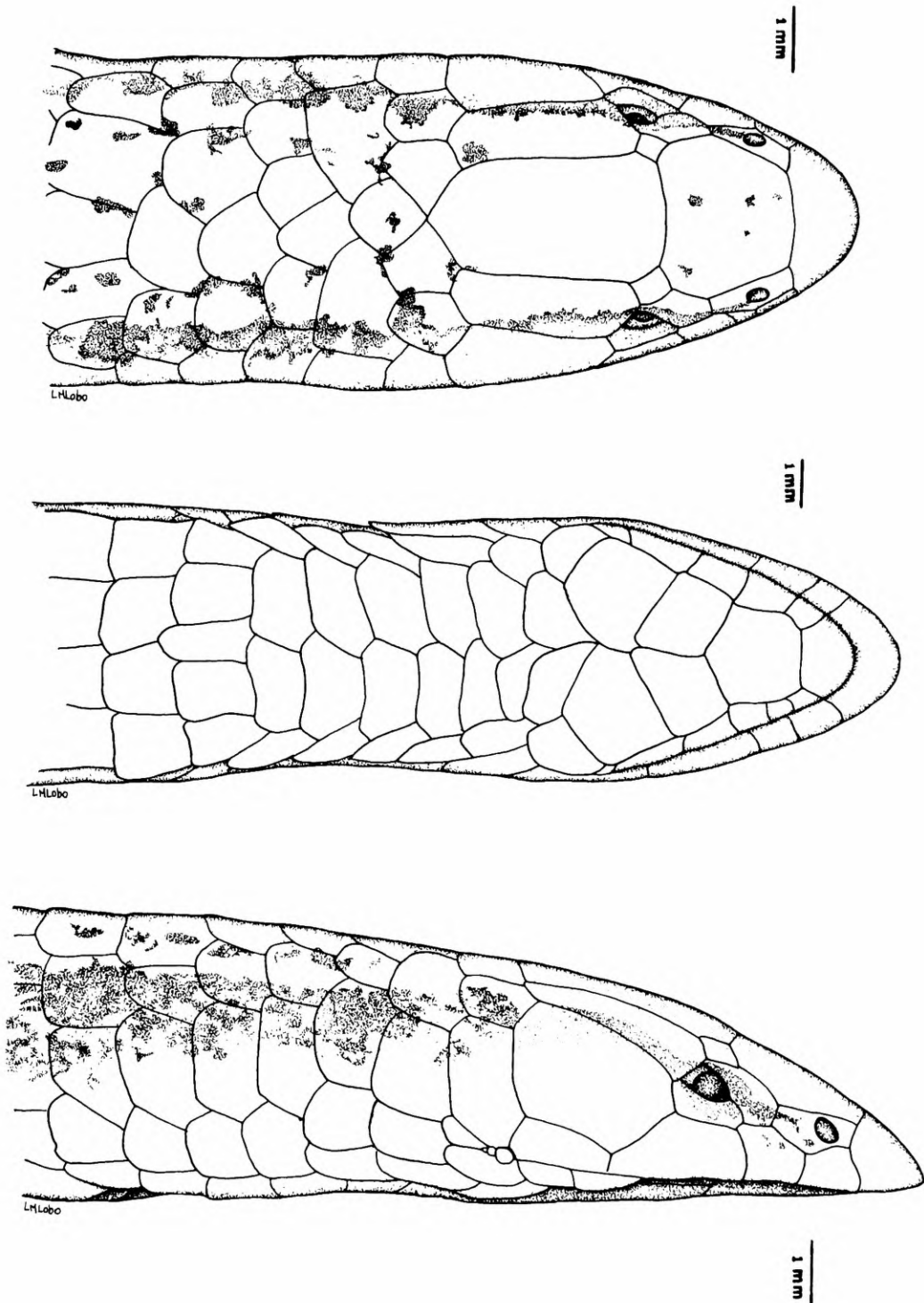


Figure 1. Dorsal, ventral, and lateral view of head and neck of the holotype of *Calyptommatius confusionibus* (MZUSP 88077).

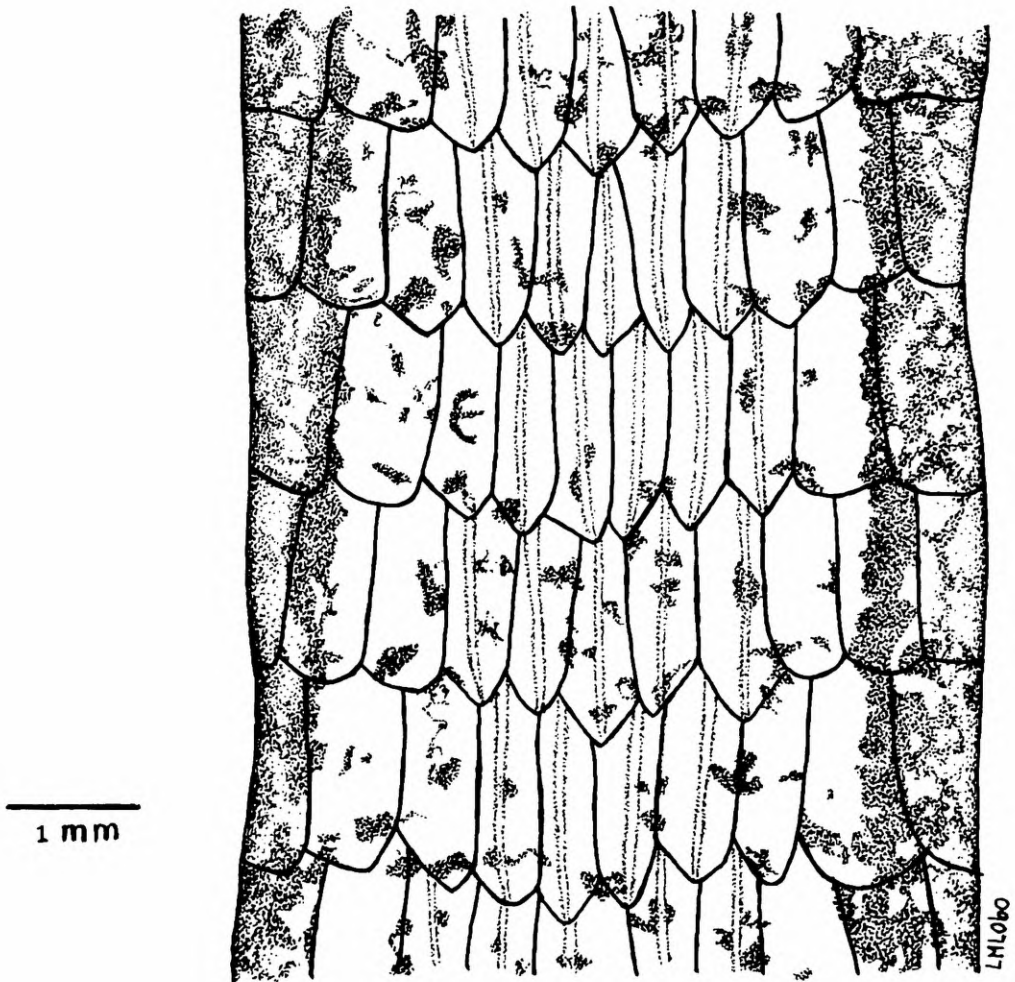


Figure 2. Middorsal body region of the holotype of *Calyptommatus confusionibus* (MZUSP 88077) view from above.

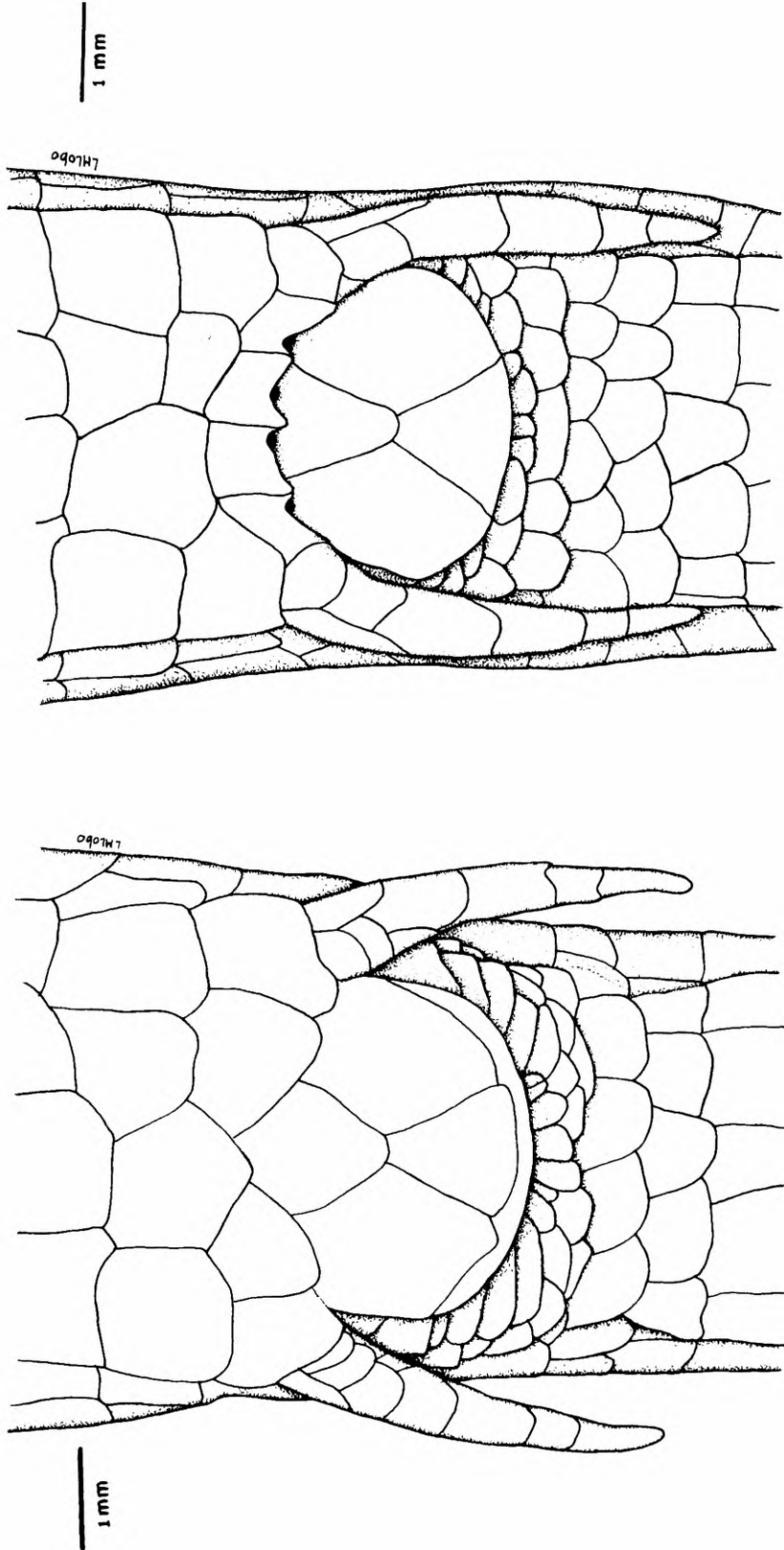


Figure 3. Ventral view of the hindlimbs and preanal region of a female (left, MZUSP 88072), and a male (MZUSP 88077) of *Calyptommatus confusiohibus*.



Figure 4. *Calyptommatus confusionibus*, Serra das Confusões, Piauí, Brazil.

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Figure 5. *Calyptommatus confusionibus*, Serra das Confusões, Piauí, Brazil



Figure 6. Habitat of *Calyptommatus confusionibus* near Toca da Cabocla, PI, Brazil.



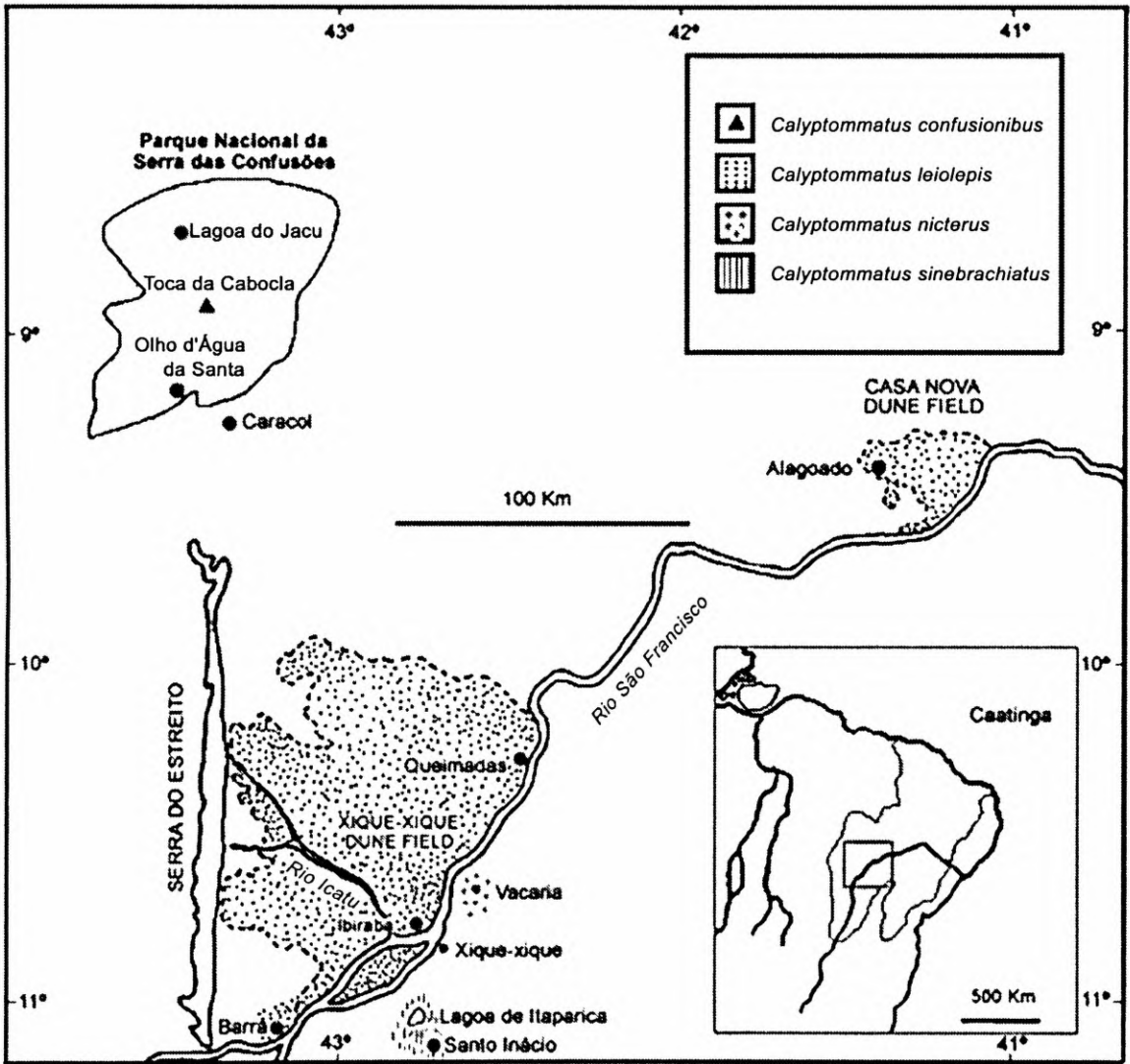


Figure 7. Geographical distribution of *Calyptommatus*.

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