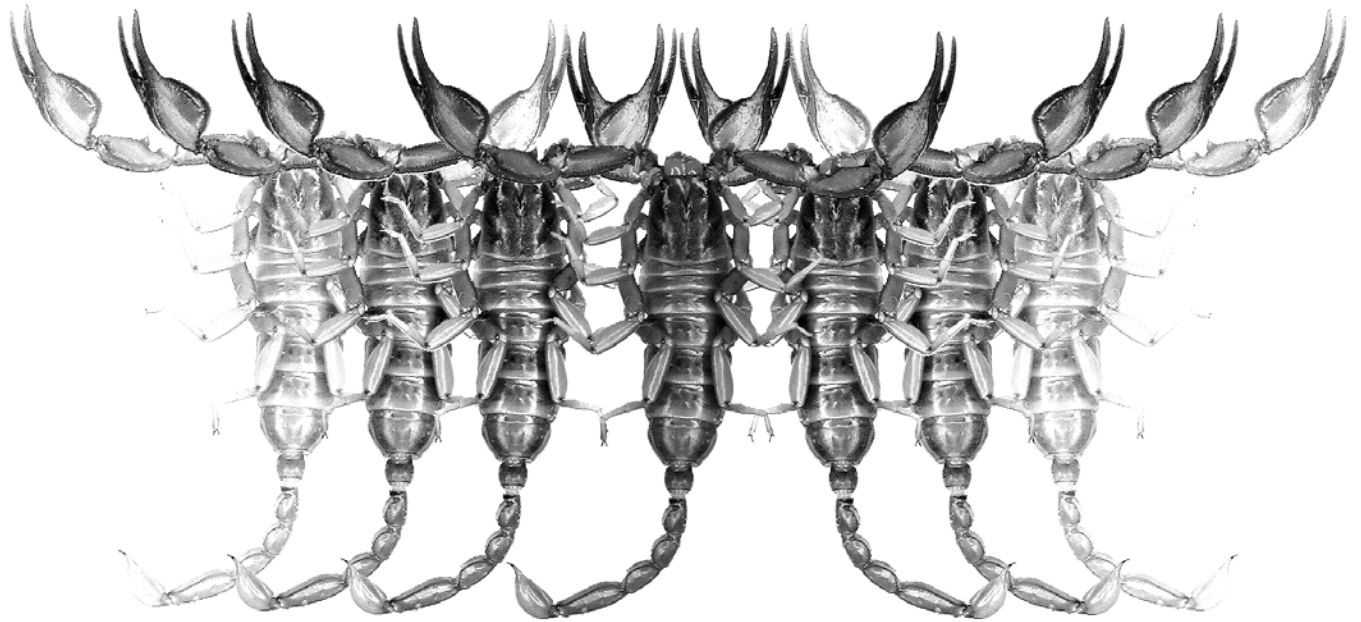


Euscorpium

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Rare or Poorly Known Scorpions from Colombia. III. On the Taxonomy and Distribution of *Rhopalurus laticauda* Thorell, 1876 (Scorpiones: Buthidae), with Description of a New Species of the Genus

Rolando Teruel and César A. Roncallo

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Rare or poorly known scorpions from Colombia. III. On the taxonomy and distribution of *Rhopalurus laticauda* Thorell, 1876 (Scorpiones: Buthidae), with description of a new species of the genus

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Summary

A new species of the genus *Rhopalurus* Thorell, 1876 is herein described from northeastern Colombia; the new species is closely related to (and has been previously confused with) *Rhopalurus laticauda* Thorell, 1876. Also, some comments on the taxonomy and distribution of the latter taxon are included.

Introduction

Both the genus and species *Rhopalurus laticauda* were described by Thorell (1876) on the basis of at least two specimens labeled "America merid., Columbia". Inside Colombia, it has been recorded from various sites which group into two very disjunct general areas widely separated by the Andean ranges: the Caribbean lowlands on the west and the Orinoquian llanos, a tropical grassland plain, east of the Andes (see a good compilation of those records in Botero-Trujillo & Fagua, 2007). Despite this controversial disjunction, all records have been assigned "de facto" to *R. laticauda*. When some morphological differences have been noticed, they have been regarded as simple intraspecific variations, and no further investigations have been conducted to reveal its actual taxonomic significance (Lourenço, 1991; Botero-Trujillo & Fagua, 2007).

As a part of a joint research project on the systematics of Colombian scorpions, the junior author and some collaborators undertook some field work in several areas of northeast Colombia. This effort has already yielded several important discoveries of both undescribed and poorly known species (Teruel & García, 2007, 2008a, 2008b; Teruel & Roncallo, 2007), including a few of specimens of the genus *Rhopalurus* from Riohacha which were at first referred to *R. laticauda* in the latter paper.

Based upon detailed literature records and additional specimens recently made available to us, we revisited the matter of eastern and western *R. laticauda* and arrived to the conclusion that these allopatric forms represent two somewhat cryptic species: one smaller, lighter, weakly

sculptured and with lower pectinal tooth counts restricted to the Caribbean lowlands, and another larger, darker, more strongly sculptured and with higher pectinal tooth counts, widespread across the Orinoquian. Since one of these species obviously represented an undescribed taxon, a question arose: which one should the name *R. laticauda* be applied to?

We were not able to obtain the types of *R. laticauda* for study, but in turn we found the answer in Lourenço's (1982) revision of the genus. This work includes two excellent photographs of one of the type specimens (full dorsal and ventral views), which depict a large, dark and strongly sculptured adult female which matches the Orinoquian specimens perfectly. Thus, the name *R. laticauda* must be applied to this trans-Andean taxon, and we describe the Caribbean lowlands taxon as new.

Methods & Material

All specimens were studied, measured and photographed under a Zeiss Stemi 2000-C stereomicroscope, equipped with line scale and grid ocular micrometers and a Canon PowerShot A620 digital camera, all calibrated to 20x. Digital images were slightly processed with Adobe Photoshop® 8.0, only to optimize bright and contrast features. Nomenclature and measurements follow Stahnke (1970), except for trichobothriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977), and sternum (Soleglad & Fet, 2003). In Table 1, all measurements are given in millimeters as length/width/depth except for the carapace, where these correspond to length/posterior width. To avoid an unnecessarily extended synonymy, only those papers

Dimensions		♂ holotype (Riohacha)	♀ paratype (Nazareth)
Carapace	L / Wp	4.8 / 4.8	5.9 / 6.3
Mesosoma	L	9.6	14.9
Tergite VII	L	3.1 / 5.2	4.0 / 7.3
Metasoma	L	24.7	27.7
Segment I	L / W	3.1 / 2.9	3.4 / 3.4
Segment II	L / W	3.6 / 3.0	4.1 / 3.4
Segment III	L / W	4.0 / 3.3	4.4 / 3.6
Segment IV	L / W	4.5 / 3.8	4.7 / 3.9
Segment V	L / W	4.7 / 3.9	5.4 / 3.8
Telson	L	4.8	5.7
Vesicle	L / W / H	2.5 / 1.8 / 1.6	2.8 / 3.2 / 1.9
Aculeus	L	2.3	2.9
Pedipalp	L	17.8	20.6
Femur	L / W	4.2 / 1.4	4.8 / 1.6
Patella	L / W	5.0 / 2.0	5.6 / 2.3
Chela	L	8.6	10.2
Hand	L / W / H	3.1 / 2.6 / 2.5	3.6 / 2.6 / 2.3
Movable finger	L	5.5	6.6
Total	L	39.1	48.5

Table 1: Measurements of two adults of *Rhopalurus caribensis* sp. n. Abbreviations: length (L), width (W), posterior width (Wp), depth (H).

which include information relevant to the purposes of this article have been included, such as the original description, redescription, nomenclatural changes, and records of new localities. All specimens are deposited in the first author's personal collection (RTO), with both collecting and identification labels originally written in Spanish (transcribed here into English only for coherence purposes).

Systematics

Rhopalurus laticauda Thorell, 1876
Figure 7

Rhopalurus laticauda Thorell, 1876: 9; Prado & Ríos-Patiño, 1939: 41–42; unnumbered figure on page 46; Mello-Leitão, 1945: 266, 280–284, fig. 115 (in part); Bücherl, 1959: 268; Lourenço, 1982: 107–108, 113, 115, 133–138, figs. 12–13, 78, tab. I (in part: types and record for southeastern Colom-

bia); Flórez, 2001: 28 (in part: records from Arauca, Casanare, and Meta); Botero-Trujillo & Fagua, 2007: 129–131, 133, figs. 4–6 (in part: specimens from Vichada and records from Arauca, Casanare, and Meta).

Diagnosis: species of medium size (males 50–60 mm, females 55–70 mm) for the genus. Body light brown, deeply infuscate on carapace, tergites I–VI, pedipalp fingers, metasomal segment V and telson; metasoma ventrally with a wide and solid blackish stripe. Pedipalp chelae robust in both sexes, more conspicuously in males; fingers without basal lobe/notch combination, but with moderate scallop in adult males; fingers with eight principal rows of granules, flanked by a few supernumerary granules. Sternite III and pectines with stridulatory apparatus reduced; sternite V with a vestigial smooth patch on males. Metasoma distally incrassate on both sexes, much more conspicuously in males; telson vesicle small, subaculear tubercle small, spinoid and far



Figure 1: Adult male holotype of *Rhopalurus caribensis* sp. n., entire dorsal view.

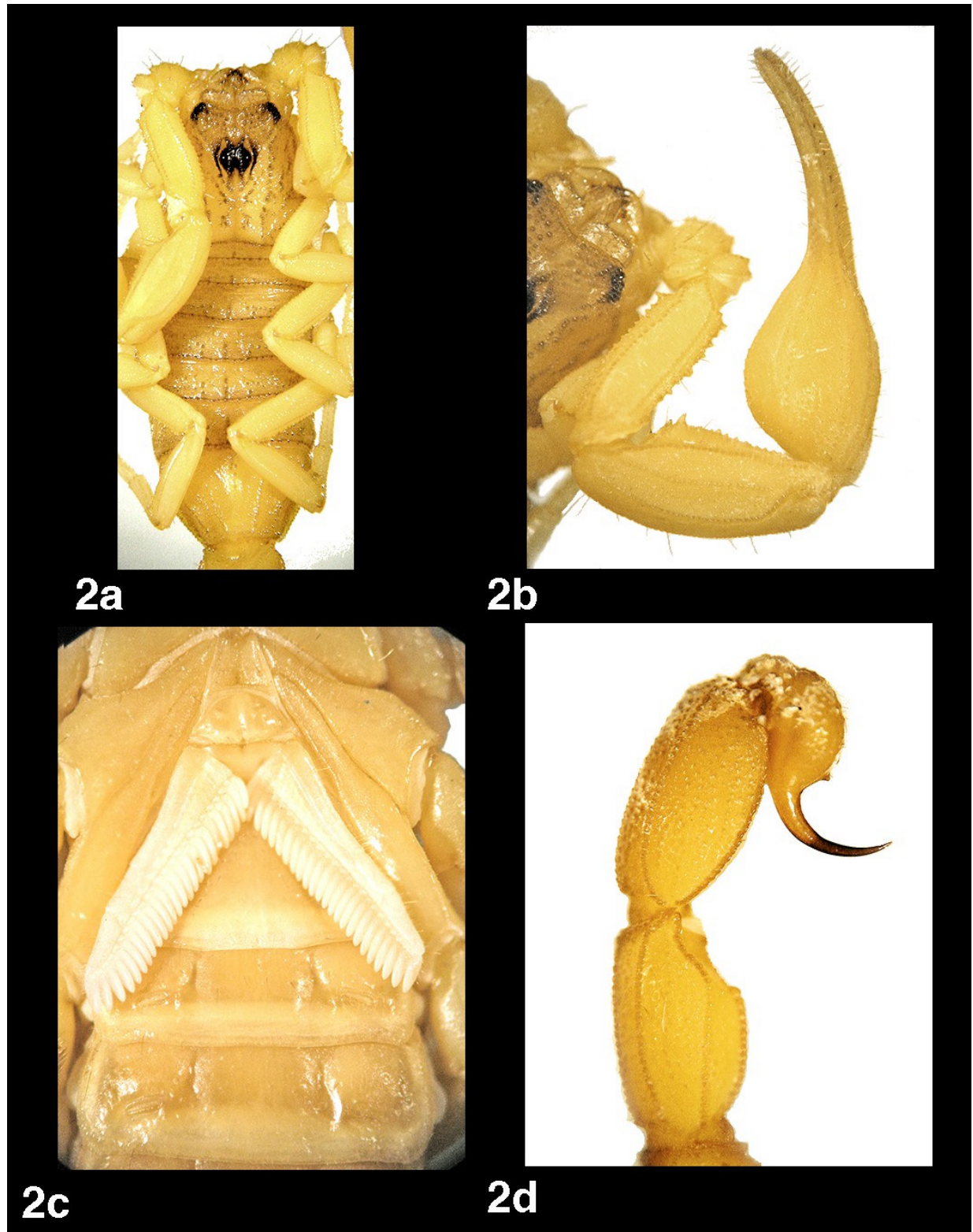


Figure 2: Adult male holotype of *Rhopalurus caribensis* sp. n.: a) carapace and tergites; b) pedipalp; c) sternoplectinal region; d) metasomal segments IV–V and telson, lateral view.

removed from the base of aculeus. Pectines with 23–26 teeth in males, and 20–24 in females.

Distribution (Fig. 7): this species is widespread south of the Andes, over the savannahs of the Orinoquia region of southeastern Colombia (Arauca, Casanare, Meta and Vichada departments) and possibly also north-central Venezuela.

Rhopalurus caribensis Teruel et Roncallo, **new species**
Figure 1–7, Tables. 1–2

Rhopalurus laticauda: Lourenço, 1982: 107–108, 113, 115, 133–138, figs. 12–13, 78, tab. I (misidentification: specimens from Magdalena); Lourenço, 1991: 282; fig. 5 (misidentification: specimens from Magdalena); Flórez, 2001: 28 (misidentification: records from Magdalena and La Guajira); Botero-Trujillo & Fagua, 2007: 129–131, 133, figs. 4–6 (misidentification: specimen from Atlántico and records from Magdalena and La Guajira); Teruel & Roncallo, 2007: 6 (misidentification: record from La Guajira).

Diagnosis: species of moderately small size (males 38–40 mm, female 48–50 mm) for the genus. Body light to pale yellow, with a pattern of diffuse gray spots over carapace and tergites; and metasomal segment V moderately infuscate; metasoma ventrally with all carinae infuscate and a thin, dark line between the ventro-submedian carinae. Pedipalp chelae robust in both sexes, more conspicuously in males; fingers without basal lobe/notch combination, but with subtle scallop in adult males; fingers with eight principal rows of granules, flanked by a few supernumerary granules. Sternite III and pectines with stridulatory apparatus greatly reduced; sternite V without smooth patch. Metasoma distally incrassate on both sexes, much more conspicuously in males; telson vesicle small, subaculear tubercle vestigial, blunt and far removed from the base of aculeus. Pectines with 22–25 teeth in males, and 19–22 in females.

Holotype: adult ♂ (RTO: Sco.0358): Colombia, La Guajira, Riohacha, Barrio “Adelaida,” 18 December 2006, coll. C. A. Roncallo.

Paratypes: Colombia, La Guajira, Riohacha, Colegio “Sagrado Corazón,” km 1 via Maicao; 27 November 2006, C. A. Roncallo; 2 adult ♂♂, 1 adult ♀, 1 juvenile ♂ (RTO: Sco.0359); Serranía de Macuira, 3 km west of Nazareth, 14 July 2007, coll. J. Echavarría; 1 adult ♀, 1 juvenile ♂ (RTO: Sco.0373).

Etymology: the specific name is a Latinized tribal adjective, derived from the general area where this species occurs (the Caribbean region of Colombia).

Distribution (Fig. 7): arid coastal to sub-coastal areas of northeastern Colombia north of the Andes (La Guajira and Atlántico Departments), and possibly also similar landscapes of extreme northwestern Venezuela (Zulia State).

Description (adult male holotype): **coloration** (Fig. 1) basically light yellow, paler on legs and coxosternal region; chelicerae densely reticulate with dark gray; carapace symmetrically spotted with dark gray (spots are denser and darker inside the interocular triangle and below main carinae and granules) and with margins deeply infuscate; tergites with the same color and pattern as tergites; metasoma with segment V moderately infuscate on lateral and ventral surfaces, all metasomal segments ventrally with ventrolateral and ventro-submedian carinae conspicuously darkened, and a very thin, dark line between the latter; telson infuscate, but lighter than metasomal segment V; pedipalp fingers of the same pale color as hand; pectines bright white.

Carapace (Fig. 2a) trapezoidal, with lateral ocular, central lateral and posterior median carinae irregularly fused in a single row of coarse granules, superciliary and central median carinae distinct, granulose, other carinae indistinct; tegument very finely and densely granulose, with many coarser granules scattered; median eyes separate by less than one ocular diameter; three pairs of lateral eyes, which are all relatively large and about the same size. **Tergites** (Fig. 2a) with the same sculpture as on carapace; median carina coarsely granulose in all tergites; VII with two pairs of serrate lateral carinae. **Chelicerae** (Fig. 2a) with dentition typical for the genus; tegument smooth and shiny. **Pedipalps** (Fig. 2b) orthobothriotaxic A- α . Femur with all carinae serrate to denticulate, intercarinal tegument densely granulose. Patella with all carinae crenulate to granulose, intercarinal tegument with the same granulation as on femur, internal surface with a few large, spiniform granules. Chela robust, much wider than patella; hand with all carinae moderate to strong, granulose to costate, intercarinal tegument with the same granulation as on patella but finer; fingers moderately hirsute and without basal lobe/notch combination, but with a subtle scallop instead, extending almost the entire length of the fingers when closed. Both fixed and movable fingers with eight principal rows of granules, each flanked on each side by 2–4 supernumerary granules; tip of movable finger with complex dentition, composed of two subrows of four external and two internal granules just basal to distal tooth. **Legs** (Figs. 1, 2a) with all carinae subserrate, intercarinal tegument finely granulose. **Sternum** (Fig. 2c) type 1 and triangular, typical for the genus. **Pectines** (Fig. 2c) elongate, with basal portion not enlarged (anterior and posterior margins are essentially parallel); pectinal tooth count 24/25; basal plate wider than long, with posterior margin slightly convex. **Sternites** (Fig. 2c)



Figure 3: Adult female paratype of *Rhopalurus caribensis* sp. n. from Nazareth, entire dorsal view.

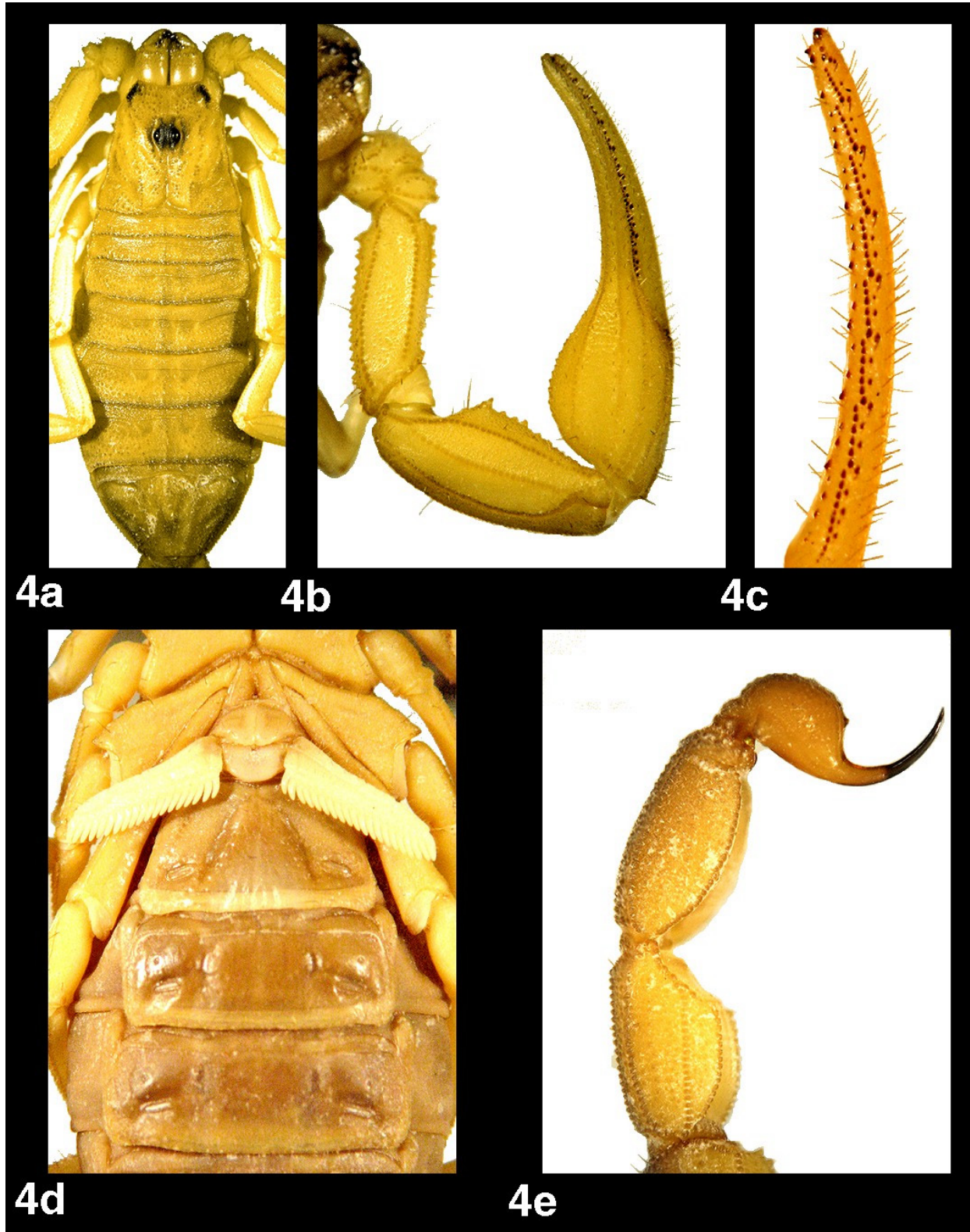


Figure 4: Adult female paratype of *Rhopalurus caribensis* sp. n. from Nazareth: **a)** carapace and tergites; **b)** pedipalp; **c)** movable finger, dorsal view; **d)** sternopectinal region; **e)** metasomal segments IV–V and telson, lateral view.

Sex	N	Pectinal teeth						Media	SD	
		19	20	21	22	23	24			25
♂♂	10				1	1	5	3	24.00	± 0.94
♀♀	6	1	1	2	2				20.83	± 1.17

Table 2: Variation of pectinal tooth count in *Rhopalurus caribensis* sp. n., including data from Botero-Trujillo & Fagua (2007). Abbreviations: number of pectines (N), standard deviation (SD).

III–VI smooth and shiny, spiracles elongate and slit-like; posterior margin of sternite V with a vestigial smooth patch, which is much wider than long and not bulky; sternite VII granulate, with two pairs of crenulate lateral carinae. **Metasoma** (Figs. 1, 2d) conspicuously incrassate distally, with each segment noticeably wider than the preceding, especially on V which is inflated; intercarinal tegument irregularly and densely granulate, especially on V; segments I–III with ten complete carinae (even though lateral inframedian carinae become progressively weaker), IV with eight, V with five, all strongly developed and coarsely crenulate to serrate; telson with vesicle small and moderately granulate, subaculear tubercle very weak, represented only by a small conical granule and far removed from the base of the aculeus, which is long, sharp and strongly curved.

Female (Fig. 3; Tabs. 1–2): in general is similar to the male, but there is a marked sexual dimorphism evidenced by: (1) larger size; (2) color pattern somewhat different: carapace and tergites olivaceous and with less contrasting dark spots, metasomal segment V and telson only slightly infuscate; (3) mesosoma relatively larger and wider; (4) metasoma and pedipalps shorter and less robust; (5) pedipalp fingers without scallop; (6) genital papillae absent; (7) pectines more slender, with lower tooth counts; (8) basal pectinal plate with markedly convex posterior margin.

Variation: there is a single size class in both males and females among the examined samples, with the former sex being slightly smaller than the latter (Tab. 1). Both fixed and movable fingers always have eight principal rows of granules. Pectinal tooth counts varied from 22–25 in males, and 19–22 in females (Tab. 2). Juveniles have pedipalps and metasoma slender, but exhibit the same basic coloration as adults, only slightly lighter and more contrasting (Fig. 5).

Ecological notes: two of the three sites where we have personally found *R. caribensis* sp. n. are located in suburban Riohacha city: the holotype was found under a large rock on sandy/clay soil, and the four paratypes from Colegio “Sagrado Corazón” were found in the schoolyard proper, hidden inside the cracks of student benches on shaded areas (Fig. 6). On the other hand, the two para-

types from Nazareth were found inside the hollow trunk of dry cactuses, in the coastal desert east of the Macuira range.

According to the available data, *R. caribensis* sp. n. lives in xeric coastal to sub-coastal areas. In Riohacha and Macuira, it lives syntopically with other two scorpion species also adapted to xeric environments: the buthid *Centruroides margaritatus* (Gervais, 1841), and the scorpionid *Tarsoporosus macuira* Teruel et Roncallo, 2007. See also Botero-Trujillo & Fagua (2007) for additional information of this species as *R. laticauda*.

Comparisons: *R. caribensis* sp. n. is more closely related to (and has been confused with) *R. laticauda*, which can be easily distinguished on the basis of color pattern (conspicuously darker, with deeply infuscate carapace and tergites and a wide blackish stripe on ventral metasoma), general habitus (larger and more robust), shape of pedipalp chelae in males (with noticeably longer and more scalloped fingers), sculpture of tegument (carapace, tergites and metasoma with granulation coarser and more abundant, metasomal segments with all carinae stronger), and pectinal tooth counts (23–26 in males, 20–24 in females; see Botero-Trujillo & Fagua, 2007: table I).

Remarks: all previous literature records pertinent to this species have been published under the name *R. laticauda*. Botero-Trujillo & Fagua (2007) recorded and illustrated an adult female from Atlántico department (Puerto Colombia, El Nisperal), but the brief morphological features and excellent photos given in that paper undoubtedly demonstrate that this specimen belongs to *R. caribensis* sp. n., as is the case for the adult female and juvenile from Santa Marta, discussed and illustrated by Lourenço (1982, 1991).

We have examined a single specimen from Zulia in northeastern Venezuela (adult male, RTO: Sco.0328), which compares favorably to the types of *R. caribensis* sp. n. but shows some morphological and chromatic differences when compared to those Colombian samples. Unfortunately, this specimen is not in the best condition and thus we cannot decide if the observed differences imply either discrete inter-populational variations, or an artifact of inadequate preservation. Nevertheless, it is very possible that this species occurs also in arid lowlands



Figure 5: Juvenile male paratype of *Rhopalurus caribensis* **sp. n.** from Nazareth, entire dorsal view.

of northwestern Zulia, as Manzanilla & De Sousa (2003) recorded and briefly described specimens from Paragachón which also seem to match *R. caribensis* **sp. n.**

General Comments

Finding that the genus *Rhopalurus* is represented in Colombia by more than one species is not surprising, as the still ongoing studies conducted by the senior author on this genus have revealed that most species widely recorded in the literature are, in fact, cryptic complexes of closely related taxa (Teruel, 2006; Teruel & Armas, 2006; R. Teruel, unpublished data). Almost all of these species also show very well defined distributions which can easily be correlated to evident ecological conditions, mostly dependant upon or associated to vegetation cover. This seems also to be true for the two Colombian species, with *R. caribensis* **sp. n.** occurring in the arid Caribbean

lowlands and *R. laticauda* in the more humid savannah of the Orinoquian Llanos (Fig. 7). This pattern is entirely congruent with the results obtained by Kattan et al. (2004), who conducted a cluster analysis using diversity and endemism data of five high-rank animal taxa (rodents, bats, birds, frogs, and butterflies), and found that these two areas indeed represent very different biogeographic subregions which they called “Perijá-Sierra Nevada” and “Eastern Andean Slope,” respectively.

The distribution of both species inside neighboring Venezuela is still enigmatic because much alike Colombia, all records of this genus from the country have been assigned to *R. laticauda* and even the few morphological studies that have been made (e.g., Manzanilla & De Sousa, 2003) have failed in distinguishing different taxa, and a thorough revision is thus badly needed. Nevertheless, following the same ecological analysis we can hypothesize that the Vene-

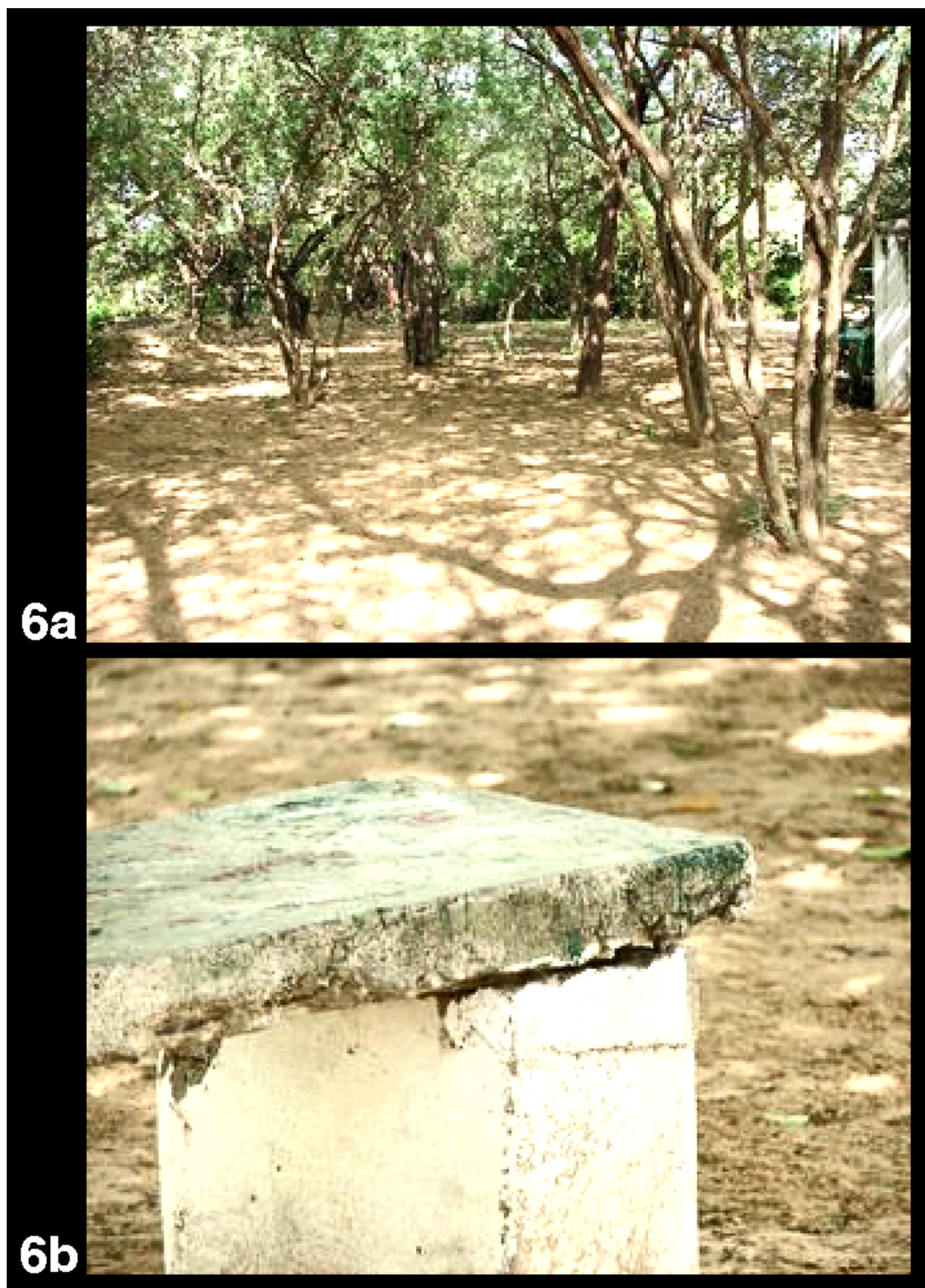


Figure 6: Two views of Colegio "Sagrado Corazón", occupied by a population of *Rhopalurus caribensis* sp. n.: a) general habitat at schoolyard; b) crevice in bench, where a paratype male was found.



Figure 7: Geographical distribution of the genus *Rhopalurus* in Colombia: **a)** general allopatric area of *R. caribensis* sp. n. [1] and *R. laticauda* [2], the question marks indicate possible penetrations inside Venezuela; **b)** confirmed locality records for *R. caribensis* sp. n.: Puerto Colombia [1], Bahía de Guairaca [2], Riohacha [3], Nazareth [4].

zuelan members of *Rhopalurus* are at least two, because *R. caribensis* sp. n. almost undoubtedly extends into northwestern Zulia and *R. laticauda* is possibly well distributed across the Orinoquian basin south of the Mérida range (Venezuelan Andes).

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References

BOTERO-TRUJILLO, R. & G. FAGUA. 2007. Additions to the knowledge of the geographical

distribution of some Colombian scorpions (Buthidae: *Ananteris*, *Rhopalurus*, *Tityus*). *Revista Ibérica de Aracnología*, 14: 129–134.

BÜCHERL, W. 1959. Escorpiões e escorpionismo no Brasil. X. Catálogo da coleção escorpiônica do instituto Butantan. *Memorias do instituto Butantan*, 29: 255–275.

FLÓREZ, E. 2001. Escorpiones de la familia Buthidae (Chelicerata: Scorpiones) de Colombia. *Biota Colombiana*, 2(1): 25–30.

FRANCKE, O. F. 1977. Scorpions of the genus *Diplocentrus* Peters from Oaxaca, Mexico. *Journal of Arachnology*, 4: 145–200.

KATTAN, G.H., F. PADU, V. ROJAS & G. MORALES. 2004. Biological diversification in a complex region: a spatial analysis of faunistic diversity and biogeography of the Andes of Colombia. *Journal of Biogeography*, 31: 1829–1839.

LOURENÇO, W. R. 1982. Révision du genre *Rhopalurus* Thorell, 1876 (Scorpiones: Buthidae). *Revue Arachnologique*, 4: 107–141.

LOURENÇO, W. R. 1991. Les scorpions de Colombie, II. Les faunes des régions de Santa Marta et de la

- Cordillère orientale. Approche biogéographique. *Senckenbergiana biologica*, 71(4/6): 275–288.
- MANZANILLA, J. & L. DE SOUSA. 2003. Ecología y distribución de *Rhopalurus laticauda* Thorell 1876 (Scorpiones: Buthidae) en Venezuela. *Saber*, 15(1–2): 3–14.
- MELLO-LEITÃO, C. DE. 1945. Escorpiões sul-americanos. *Arquivos do Museu Nacional*, 40: 7–468.
- PRADO, A. & J. L. RÍOS-PATIÑO. 1939. Contribución al estudio de los escorpiones de Colombia. *Memorias do instituto Butantan*, 13: 41–43.
- SOLEGLAD, M. E. & V. FET. 2003. The scorpion sternum: structure and phylogeny (Scorpiones: Orthosterni). *Euscorpius*, 5: 1–34.
- STAHNKE, H. L. 1970. Scorpion nomenclature and mensuration. *Entomological News*, 81: 297–316.
- TERUEL, R. 2006. Apuntes sobre la taxonomía y biogeografía del género *Rhopalurus* Thorell 1876 (Scorpiones: Buthidae), con la descripción de dos nuevas especies de Cuba. *Boletín de la Sociedad Entomológica Aragonesa*, 38: 43–54.
- TERUEL, R. & L. F. DE ARMAS. 2006. Un nuevo *Rhopalurus* Thorell 1876 (Scorpiones: Buthidae) de Cuba oriental. *Boletín de la Sociedad Entomológica Aragonesa*, 39: 175–179.
- TERUEL, R. & L. F. GARCÍA. 2007. A new species of *Ananteris* Thorell, 1891 from Cordillera Central in Colombia, with some notes on the taxonomy of the genus (Scorpiones: Buthidae). *Euscorpius*, 60: 1–8.
- TERUEL, R. & L. F. GARCÍA. 2008a. Rare or poorly known scorpions from Colombia. I. Redescription of *Tityus macrochirus* Pocock 1897 (Scorpiones: Buthidae). *Euscorpius*, 63: 1–11.
- TERUEL, R. & L. F. GARCÍA. 2008b. Rare or poorly known scorpions from Colombia. II. Redescription of *Tityus columbianus* (Thorell 1876) (Scorpiones: Buthidae). *Euscorpius*, 64: 1–14.
- TERUEL, R. & C. A. RONCALLO. 2007. A new species of *Tarsoporosus* Francke 1978 (Scorpiones: Scorpionidae: Diplocentrinae) from northeastern Colombia. *Euscorpius*, 61: 1–34.
- THORELL, T. 1876. On the classification of scorpions. *Annals and Magazine of Natural History*, 4(17): 1–15.
- VACHON, M. 1974. Études des caractères utilisés pour classer les familles et les genres des scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum national d'Histoire naturelle*, 3e sér., 140 (Zool., 104): 857–958.