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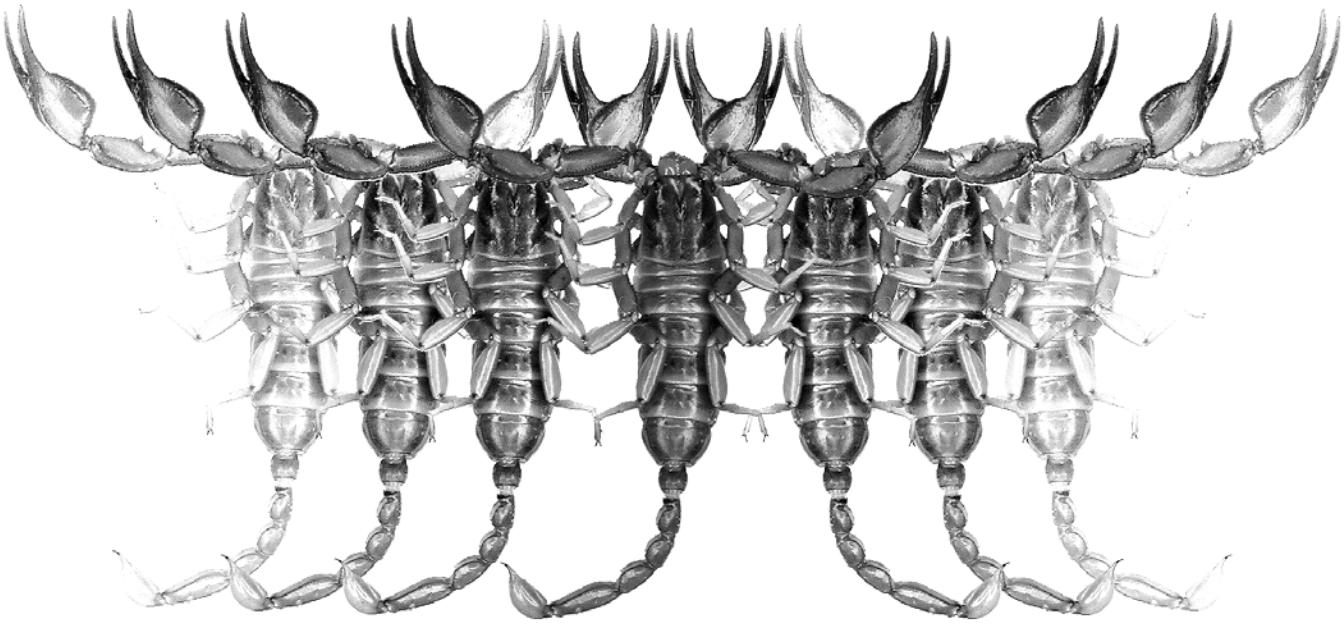

Rare or Poorly Known Scorpions from Colombia. I. Redescription of *Tityus macrochirus* Pocock, 1897 (Scorpiones: Buthidae)

Rolando Teruel & Luis Fernando García H.

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Rare or poorly known scorpions from Colombia. I. Redescription of *Tityus macrochirus* Pocock, 1897 (Scorpiones: Buthidae)

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Summary

A fully illustrated redescription is herein presented of *Tityus macrochirus* Pocock, 1897, based upon a series of specimens of both sexes recently collected in a new location near the type locality. We include an update of its geographical distribution and detailed information about age-related individual variation.

Introduction

The buthid *Tityus macrochirus* was described by Pocock (1897) on the basis of several specimens of both sexes allegedly collected in Bogotá, Colombia. Despite the fact that this capital area of Colombia has obviously become the best sampled region in the country, and that such large scorpions should hypothetically be easier to find there, no specimens other than the types have ever been recorded in the literature. In his monograph on South-American scorpions, Mello-Leitão (1945) declared that this species was unknown to him and simply transcribed Pocock's original description in Portuguese. In his revision of the "*Tityus forcipula*" complex, Lourenço (1984) only had one of Pocock's type specimens available (an adult male). From this reference on, each of the few papers which have mentioned this species have merely repeated or commented on the original type specimens and data (Lourenço & Flórez, 1990; Lourenço & Otero Patiño, 1998; Lourenço, 1998, 1999, 2000; Fet & Lowe, 2000), and even Flórez (2001) overlooked it in his recent catalog of Colombian buthid scorpions.

As a part of a joint research project on the systematics of Colombian scorpions, one of the authors (LFGH) and some of his collaborators undertook extensive field work in several areas of Colombia around and near Bogotá, an effort that has already yielded several important discoveries of both undescribed and poorly known species (Teruel & García, 2007; Teruel & Roncallo, 2007; R. Teruel, L. F. García & C. A. Roncallo, unpublished data). Amongst these specimens we obtained a remarkable finding: 17 specimens of *T. macrochirus* from near the type locality. This not only represents the rediscovery of *T. macrochirus* just 110 years after its original description, but also enabled us both to redescribe this enigmatic species, and provide a new locality record for it, expanding the species' range. Thus, we provide a detailed and fully illustrated redescription of *T. macrochirus*, the first data on morphological variability, and a few notes on the ecology for this fascinating scorpion.

Methods & Material

This redescription is entirely based upon the samples herein examined, but all previously published data of the type specimens have also been included. 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 brightness and contrast. Nomenclature and measurements follow Stahnke (1970), except for trichobotriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977) and sternum (Soleglad & Fet, 2003). All measurements (Table 1) are given in millimeters as length/width/depth except for the carapace, where these correspond to length/posterior width. All specimens are deposited in the authors' personal collections, with both collecting and identification labels originally written in Spanish (transcribed here into English).

Abbreviations: LFGH, personal collection of Luis Fernando García H., Bogotá, Colombia; RTO, personal collection of Rolando Teruel, Santiago de Cuba, Cuba.

Dimensions		♂	♂	♂	♀	♀
Carapace	L/Wp	5.7 / 6.0	6.5 / 7.3	7.3 / 8.0	5.1 / 6.4	7.0 / 7.8
Mesosoma	L	11.5	13.2	17.6	13.5	16.4
Tergite VII	L	3.5 / 5.6	4.5 / 6.7	5.0 / 7.6	3.6 / 6.0	4.7 / 8.4
Metasoma	L	30.9	38.1	44.0	30.3	37.6
Segment I	L/W	3.1 / 3.0	4.5 / 3.5	5.3 / 3.9	3.5 / 3.2	4.9 / 3.7
Segment II	L/W	4.5 / 2.9	5.7 / 3.6	6.6 / 4.1	4.5 / 3.1	5.3 / 3.4
Segment III	L/W	5.2 / 3.0	6.4 / 3.8	7.5 / 4.2	5.0 / 3.0	6.0 / 3.6
Segment IV	L/W	5.9 / 3.1	7.1 / 3.9	8.3 / 4.3	5.4 / 3.0	6.8 / 3.7
Segment V	L/W	6.1 / 3.2	7.3 / 3.9	8.3 / 4.4	5.8 / 3.0	7.1 / 3.7
Telson	L	6.1	7.1	8.0	6.1	7.5
Vesicle	L/W/H	3.6 / 2.2 / 2.1	4.1 / 2.8 / 2.5	4.5 / 3.0 / 2.8	3.6 / 2.2 / 2.0	4.0 / 2.7 / 2.5
Aculeus	L	2.5	3.0	3.5	2.5	3.5
Pedipalp	L	26.9	33.1	40.4	22.8	29.5
Femur	L/W	7.0 / 1.6	9.0 / 2.1	10.5 / 2.2	5.6 / 1.6	7.5 / 2.0
Patella	L/W	7.4 / 2.1	9.0 / 2.5	10.9 / 2.9	6.3 / 2.2	8.0 / 2.6
Chela	L	12.5	15.1	19.0	10.9	14.0
Hand	L/W/H	5.0 / 2.1 / 2.1	6.6 / 2.9 / 3.0	8.5 / 3.6 / 3.9	3.8 / 2.1 / 2.1	5.0 / 2.9 / 2.7
Movable finger	L	7.5	8.5	10.5	7.1	9.0
Total	**L**	**48.1**	**57.8**	**68.9**	**48.9**	**61.0**

Table 1: Measurements of five adult *Tityus macrochirus* from Cáqueza. Abbreviations: length (L), width (W), posterior width (Wp), depth (H).

Systematics

***Tityus macrochirus* Pocock 1897**
Figures 1–7; Tables 1–4.

Tityus macrochirus Pocock, 1897: 512–513, 516–517, fig. 3-3b; Mello-Leitão, 1945: 302, 312, 417–418; Lourenço, 1984: 732, 733; Tab. I; Lourenço & Flórez, 1990: 72; Lourenço, 1997: 63, 75; Lourenço, 1998: 492–493, 496, fig. 4; Lourenço & Otero Patiño, 1998: 303, 306; Lourenço, 1999: 5; Fet & Lowe, 2000: 249; Lourenço, 2000: 458–459, fig. 13.

Diagnosis: Species of moderately large size (males 48–69 mm, females 49–64 mm) for the genus. Body dark reddish to blackish brown, with a diffuse dark pattern all over the body and appendages, pedipalps and legs yellowish brown, pedipalp fingers and metasomal segments IV–V infuscate to blackish. Femur and patella very elongate in males, not modified in females; chela very elongate and incrassate in males. Sternite V with a very large and smooth patch on posterior third, larger and bulky in males. Metasoma not attenuate and weakly enlarged distally in both sexes, slightly more so in males. Dorsolateral carinae of metasomal segments II–IV strongly denticulate, with distal tooth noticeably enlarged. Telson vesicle smooth and hirsute; subaculear tubercle spiniform, with two dorsal granules. Pedipalp fixed finger with 13–15 principal rows of granules, movable finger with 15–16; basal lobe/notch combination strong in males, moderate in females. Pectines with 16–18 teeth in males, and 15–17 in females, which have the basal middle lamella strongly dilated.

Type data: Several male and female syntypes (BMNH): Colombia, Bogotá, M. I. da Costa. Not examined (see Remarks section). **Notes:** Pocock (1897: 512) explicitly stated that the type series included several specimens of which he selected one adult female and one adult male for the original description, but did not designate a holotype. Thus, Lourenço's (1984: 733) statement of a single male type-specimen ("*seul l'exemplaire-type mâle*") is incorrect, as well as Fet & Lowe's (2000: 249) declaration of a holotype male and a paratype female; further, none of these two statements meets the requirements of the Article 74 of the International Code of Zoological Nomenclature (Comisión…, 2000) for lectotype designation. Nevertheless, we think that the same male specimen mentioned by Lourenço (1984) and Fet & Lowe (2000), which is deposited at BMNH under catalogue number 1894.6.15.2.11, should be designated as the lectotype of *T. macrochirus*.

Distribution (Fig. 7): Only two nearby populations of *T. macrochirus* are known, both located in mid-Cordillera Central (Colombian Andes, see "Remarks").

Redescription (based upon a large adult male, see "Variation"): **coloration** (Figs. 1a–1b) basically dark

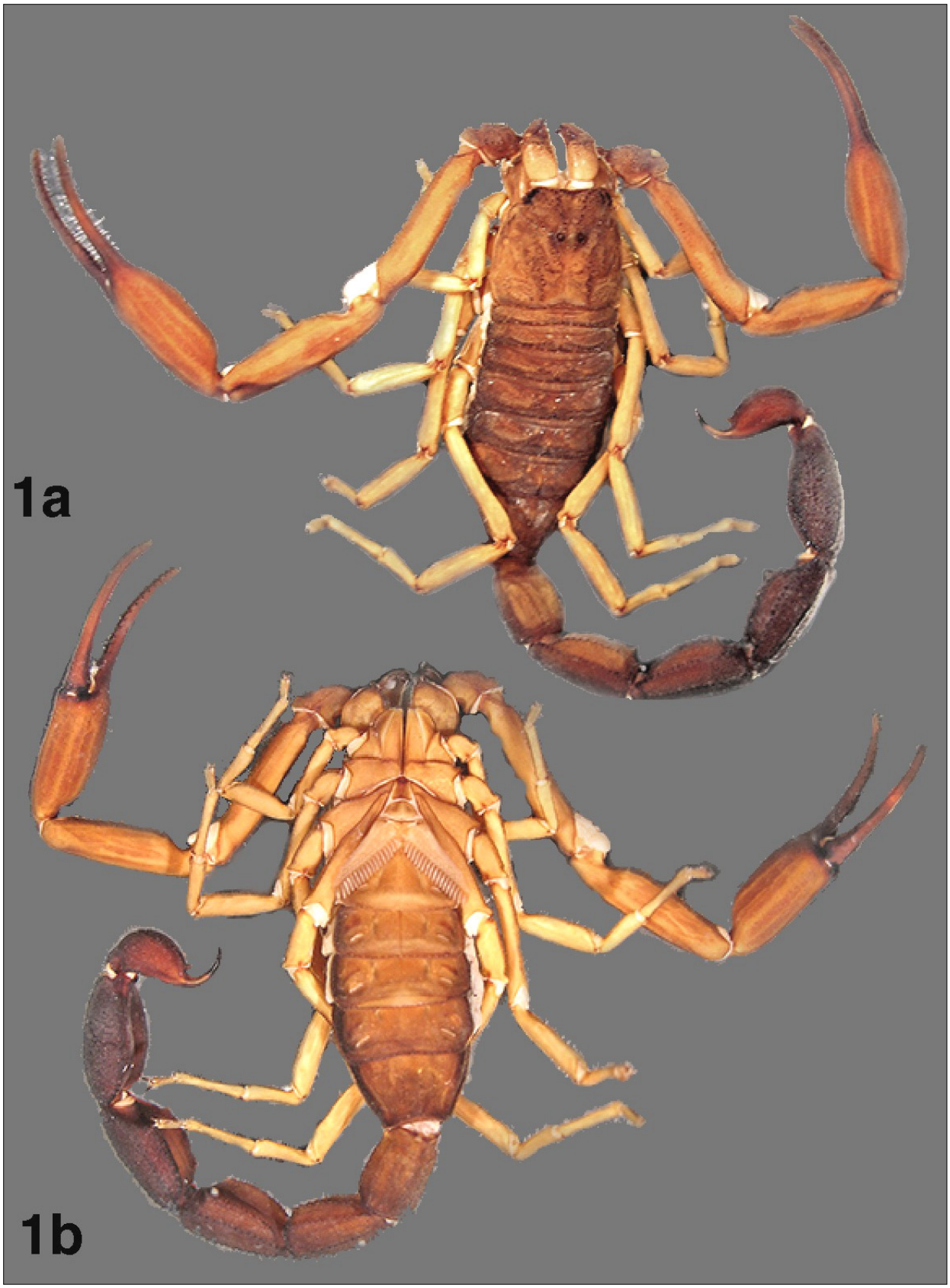

Figure 1: Large adult male of *Tityus macrochirus* from Cáqueza: **a)** entire dorsal view; **b)** entire ventral view.

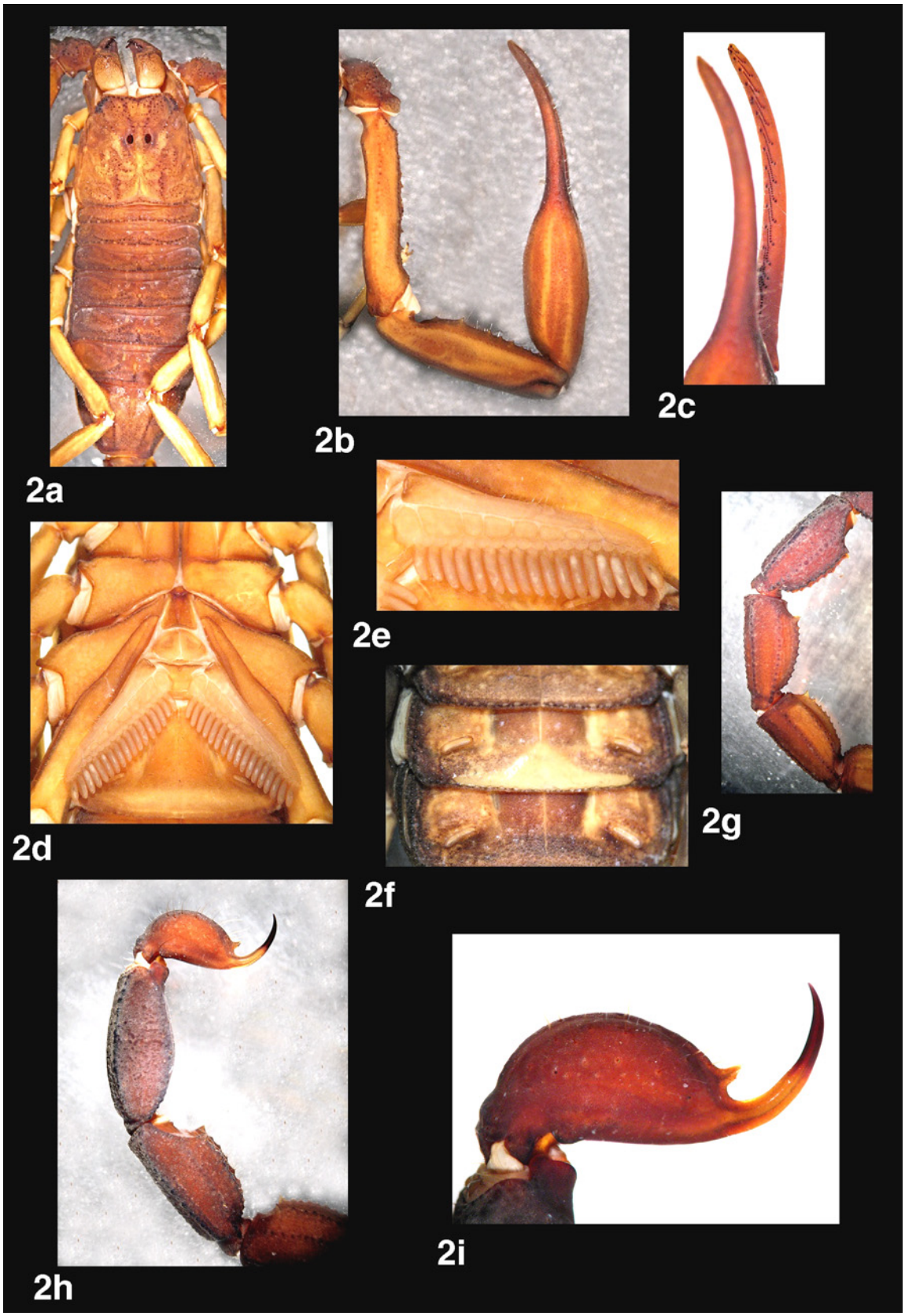

Figure 2: Large adult male of *Tityus macrochirus* from Cáqueza: **a)** prosoma and mesosoma, dorsal view; **b)** pedipalp, dorsal view; **c)** movable finger, dorsal view; **d)** sternopectinal region, ventral view; **e)** pecten, ventral view; **f)** sternites V–VI, ventral view; **g)** metasomal segments II–IV, lateral view; **h)** metasomal segments IV–V and telson, lateral view; **i)** telson, lateral close-up.

Figure 3: Large adult male of *Tityus macrochirus* from Cáqueza compared 1x1 to a small adult male from the same population.

reddish brown, with a diffuse dark pattern all over the body and appendages; metasomal segments IV–V and telson infuscate, telson dark reddish; pedipalps light brown, with fingers infuscate; legs yellowish brown; chelicerae densely and finely reticulated with blackish brown; pectines yellowish and immaculate. **Carapace** (Fig. 2a) trapezoidal; anterior median, median ocular and posterior median carinae irregularly granulose, other carinae indistinct; tegument coriaceous to finely granulose, with larger granules scattered; median eyes separate by more than one ocular diameter; three pairs of lateral eyes. **Tergites** (Fig. 2a) with the similar granulation as on carapace, longitudinal carina short and moderately granulose; VII with two pairs of granulose lateral carinae. **Chelicerae** (Fig. 2a) with typical dentition for the genus; tegument smooth and shiny. **Pedipalps** (Figs. 2b–2c) orthobothriotaxic A-α. Femur elongate, with all carinae weak, granulose, intercarinal tegument coriaceous to finely granulose, with larger granules scattered. Patella elongate, with carinae similar but weaker than on femur; intercarinal tegument with the same granulation as on femur, internal surface with several spiniform granules of various sizes. Chela very elongate and incrassate (2.60 times longer than carapace, 5.28 times longer than wide and 1.24 times wider than patella); hand 1.16 times longer than carapace and with all carinae vestigial, smooth to subgranulose, intercarinal tegument coriaceous, with many small but sharp granules scattered, larger and sharper on internal surface; fingers very attenuate (1.44 and 1.26 times longer than carapace and metasomal segment V, respectively) with basal lobe/notch combination strongly developed, fixed finger with 15/15 principal rows of granules, movable finger with 16/16, apical subrow composed by four granules aligned similar to principal rows. **Legs** (Fig. 1a–1b) with all carinae granulose, intercarinal tegument coriaceous to finely granulose. **Sternum** (Fig. 2d) type 1, triangular, typical for the group. **Pectines** (Figs. 2d–2e) large, with sclerotized fulcra; pectinal tooth count 17/17; basal middle lamella vestigially dilated. **Sternites** (Figs. 2d–2f) smooth to coriaceous, with small granules scattered; spiracles long, almost slit-like; posterior margin of sternite V with a very large and smooth patch, which is pale yellowish, subtriangular and much wider than long; sternite VII with two pairs of granulose lateral carinae. **Metasoma** (Figs. 1a–1b, 2g–2i) not attenuate and weakly enlarged distally, with each segment slightly wider than the preceding; intercarinal tegument densely granulose, with coarse granules scattered on segments I–IV, coarsely rugose on lateral surfaces of V, carinae on all segments with several very long and reddish macrosetae; segment I with ten complete carinae, II–IV with eight (even though vestiges of lateral inframedian carinae are present distally on III as linearly arranged, isolated granules), V with five, all strongly developed and coarsely dentate except for the dorsolaterals on II–IV, which are strongly denticulate and have the distal tooth noticeably enlarged; telson slightly bulbose, vesicle oval, smooth and remarkably hirsute, with bases of macrosetae invaginated and looking like punctuations; ventromedian carina absent; subaculear tubercle relatively small, spiniform and equipped with two small dorsal granules; aculeus long, sharp and evenly curved.

Female (Figs. 4–5; Tabs. 1–2): There is a strong sexual dimorphism evidenced by: (1) pedipalp chelae not elongate; (2) pedipalp fingers with weaker basal lobe/notch combination; (3) mesosoma much wider; (4) genital papillae absent; (5) pectines with basal middle lamella strongly dilated; (6) sternite V with smooth patch

	Ratio	♂	♂	♂	♀	♀
1.	Chela (L) / Carapace (L)	2.60	2.32	2.19	2.14	2.00
2.	Hand (L) / Carapace (L)	1.16	1.02	0.88	0.75	0.71
3.	Metasomal Segm. V (L/W)	1.89	1.87	1.91	1.93	1.92
4.	Chela (L/W)	5.28	5.21	5.95	5.19	4.83
5.	Metasomal Segm. I (L/W)	1.36	1.29	1.03	1.09	1.32
6.	Chela (W) / Patella (W)	1.24	1.16	1.00	0.95	1.12
Total (L)		**68.9**	**57.8**	**48.1**	**48.9**	**61.0**

Table 2: Age- and sex-related variation of some morphometric ratios in five adult *Tityus macrochirus* from Cáqueza. Abbreviations: length (L), width (W).

Sex	N	Pectinal teeth				Mean	SD
		15	16	17	18		
♂♂	14		3	9	2	16.93	±0.62
♀♀	19	1	12	6		16.26	±0.56

Table 3: Variation of pectinal tooth counts in *Tityus macrochirus*, including data of the types given by Pocock (1897) and Lourenço (1984). Abbreviations: number of pectines (N), standard deviation (SD).

Sex	Finger	N	Principal Rows of Granules				Mean	SD
			13	14	15	16		
♂♂	Fixed	14	1		13		14.86	±0.53
	Movable	14			4	10	15.71	±0.47
♀♀	Fixed	20		7	13		14.65	±0.49
	Movable	20			8	12	15.60	±0.50

Table 4: Variation of the number of principal rows of granules of pedipalp fingers in *Tityus macrochirus*, including data of the types given by Pocock (1897) and Lourenço (1984). Abbreviations: number of fingers (N), standard deviation (SD).

smaller and not bulky; (7) metasomal segments slightly shorter, with less convex lateral sides; (8) metasomal carinae stronger and sharper.

Variation: In the examined sample, adult specimens are represented by several discrete size classes, clearly separated by total length average gaps of 11 mm; there are three size classes in males and two in females (Fig. 3; Tab. 1). The most interesting finding is that even though sexual dimorphism is always well-marked in all size classes (Tab. 2), smaller males may be intermediate between larger males and females for some morphometric ratios (1–3), stand apart for some others (4–5) or even match females for one ratio (6).

Also, there are random variations of sculpture of metasomal segments and coloration in both sexes: regardless size or age, in some specimens the dorsolateral carinae and intercarinal granulation are either stronger or weaker than on average, and some are either lighter or darker than average. Juveniles look very much like adult females, but the base color is lighter and the dark pattern is much more contrasting (Fig. 6), a common feature for all members of the "*Tityus asthenes*" group; also, the pedipalp chela is noticeably more slender and its tegument is less sclerotized, especially on carinae. Juvenile females show the basal middle lamella of the pectines weakly dilated.

Similar variations have already been detected in other species of this group (Montoya & Armas, 2002), and in all cases the variations affect characters which have been traditionally used as species diagnostics [i.e., adult size, color pattern, degree of attenuation of pedipalps and metasoma, development of metasomal carinae and sculpture of the tegument, see the available keys published by Lourenço (1998, 2000) and Lourenço & Otero Patiño (1998)]. This makes it necessary to be especially prudent when only single or a few adult males are available per sample, because different size classes may lead to wrong identifications.

Pectinal tooth counts varied from 16–18 (mode 17) in males, and 15–17 (mode 16) in females (Tab. 3). The number of primary rows of granules varied from 13–15

Figure 4: Adult female of *Tityus macrochirus* from Cáqueza: **a)** entire dorsal view; **b)** entire ventral view.

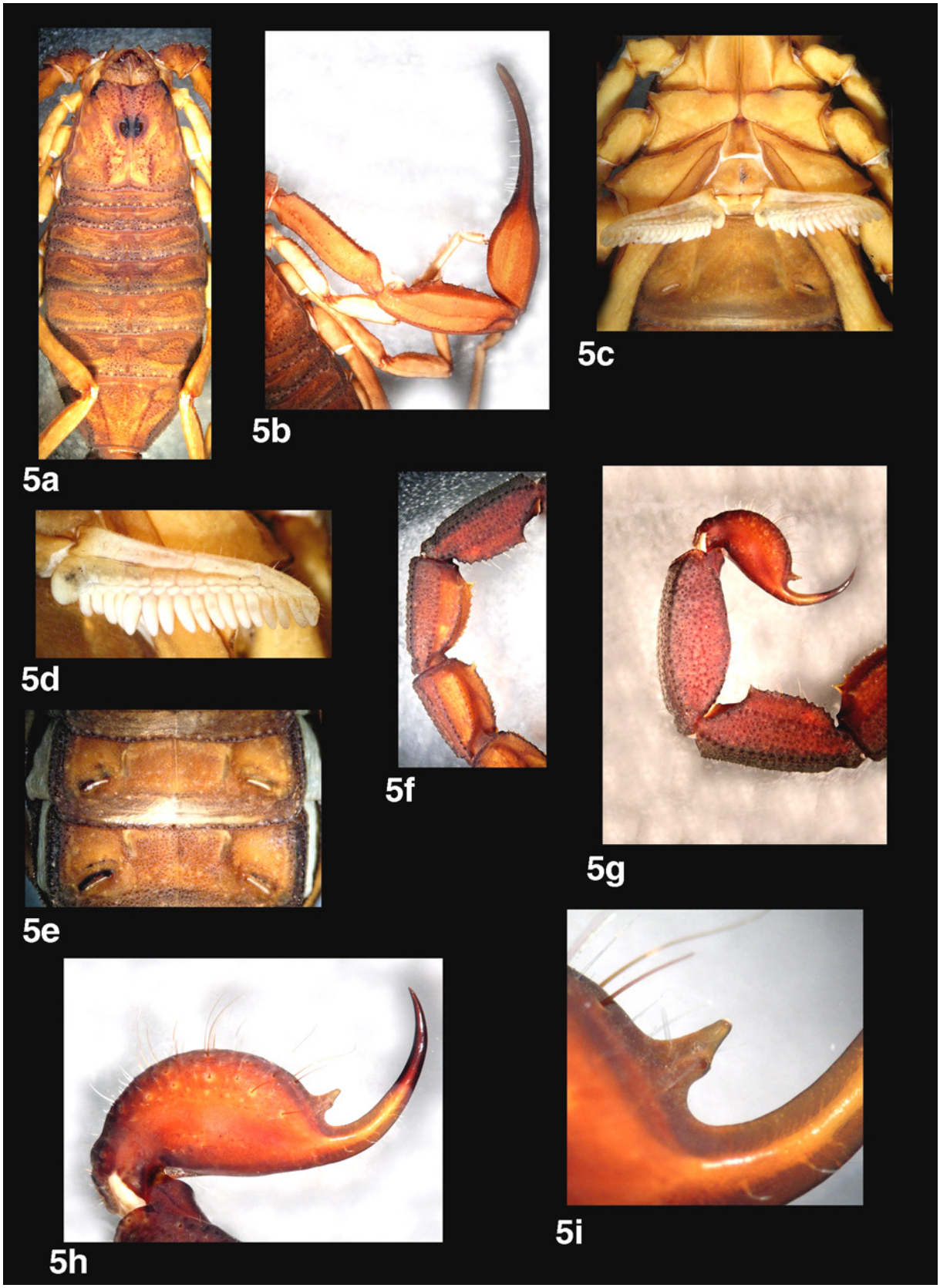

Figure 5: Adult female of *Tityus macrochirus* from Cáqueza: **a)** prosoma and mesosoma, dorsal view; **b)** pedipalp, dorsal view; **c)** sternopectinal region, ventral view; **d)** pecten, ventral view; **e)** sternites V–VI, ventral view; **f)** metasomal segments II–IV, lateral view; **g)** metasomal segments IV–V and telson, lateral view; **h)** telson, lateral close-up; **i)** subaculear tubercle, lateral close-up.

Figure 6: Juvenile female of *Tityus macrochirus* from Cáqueza, dorsal view.

(mode 15) on fixed finger and 15–16 (mode 16) on movable finger (Tab. 4).

Ecological notes: According to the main collector of the samples (Yisela Gómez, pers. comm.), all specimens recorded herein were found among debris and rotten furniture, inside or around abandoned houses in suburban Cáqueza city, at an altitude of 1,700 meters. This seems to indicate that this species possesses some tolerance to anthropic modification of its environment. No other scorpion species were found living together with *T. macrochirus* (although, in the same general area, the usual diversity is two to four scorpion species (Buthidae and Chactidae) in each locality).

Comparisons: Amongst all Colombian members of the "*Tityus asthenes*" group, *T. macrochirus* is the most easy to recognize on the basis of the very unusual proportions of the adult male pedipalps relative to the rest of the body. This is the only species which possesses the combination of very attenuate pedipalps and incrassate chelae. In the remaining members of this conspicuous (due to large size and dark color) group, the adult male pedipalps either exhibit all segments attenuated and slender (i.e., *Tityus asthenes* Pocock, 1893 and *T. nematochirus* Mello-Leitâo, 1940), or not attenuated and incrassate (i.e., *Tityus festae* Borelli, 1899 and *T. pachyurus* Pocock, 1897). Another character which is unequivocally diagnostic for *T. macrochirus* is the sculpture of the telson vesicle: completely smooth, with the bases of macrosetae invaginated and looking like punctuations, as it was already assumed by Pocock (1897: 512) in the original description.

Material examined: Colombia, Cundinamarca (new record), Cáqueza, 1,700 m a.s.l., April 2006, Y. Gómez, 1♂, 3♀♀ (RTO: Sco.0371). December 2006 to January 2007, Y. Gómez, 5♂♂, 5♀♀, 1 juvenile ♀ (RTO: Sco.0378), 1♂, 1♀ (LFGH).

Remarks: Even though we did not examine the types of *T. macrochirus*, we have no doubts about the identity of the specimens herein recorded because all of them match exactly the description, measurements and figures orig-

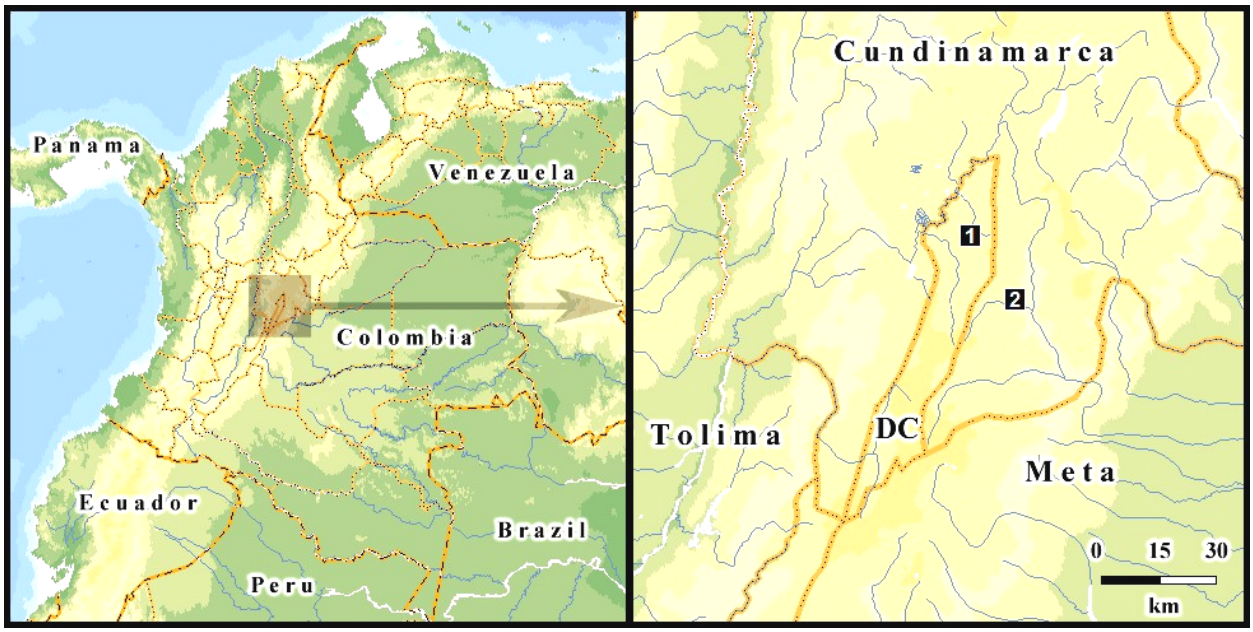

Figure 7: Known geographical distribution of *Tityus macrochirus*: **1)** Bogotá; **2)** Cáqueza.

inally provided by Pocock (1897), as well as the diagnosis and measurements given by Lourenço (1984) from one of those types; moreover, our sample comes from the same general area where the type locality is enclaved.

Since its original description, *T. macrochirus* has never been found again in the type locality. As the new population herein recorded is only 20 km southeast from Bogotá, maybe the name in the collecting label merely refers to the general area (such labeling inaccuracies were fairly common in the late 19th century, when the types were collected and sent to the BMNH), or maybe a population actually existed, but was depleted by the razing and continuous urbanization of this city since the advent of the 20th century. The first option seems more likely because most *Tityus* species are associated with very specific conditions of vegetation and altitude, and the climatic conditions of both localities are rather different: Cáqueza is located inside an intramontane valley at much lower altitude (Bogotá is at 2,640 m a.s.l), and its climate is warmer and more humid.

This is apparently a very rare and/or localized species, because despite that the high plateau of the Cordillera Central centered in Bogotá has been the most intensively sampled region in Colombia, no additional specimens of *T. macrochirus* have been recorded until now. An alternate possibility is that this species may have been collected before, but the specimens have been misidentified or gone unnoticed in collections. This possibility is very likely, however, as samples belonging to the "*Tityus asthenes*" group can be reliably identified only when adult males are available, and even in this case the age-related polymorphism herein recorded (see "Variation" above) should be taken into account to warrant an accurate identification.

Acknowledgments

The help received from several persons was decisive to this contribution. The family Gómez-Gutiérrez, especially Yisela Gómez (Cáqueza, Colombia), opportunely searched for scorpions at our request and this effort yielded the rediscovery of *T. macrochirus*. Juliana Cadena, Evelyn Gómez and Gloria Hidalgo (Bogotá, Colombia) kindly hand-carried the specimens to the first author. Wilson R. Lourenço (Museum National d'Histoire Naturelle, Paris, France), Luis F. de Armas (Instituto de Ecología y Sistemática, Havana, Cuba), Jan O. Rein (Trondheim, Norway), Michel Montoya (San José, Costa Rica), and Eduardo Flórez (Instituto de Ciencias Naturales, Universidad Nacional, Bogotá, Colombia), timely provided important copies and/or reprints of the scorpion literature at our repeated request. Luis F. de Armas and Matthew R. Graham (University of Nevada, Las Vegas, USA) made detailed and careful peer reviews of the manuscript.

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