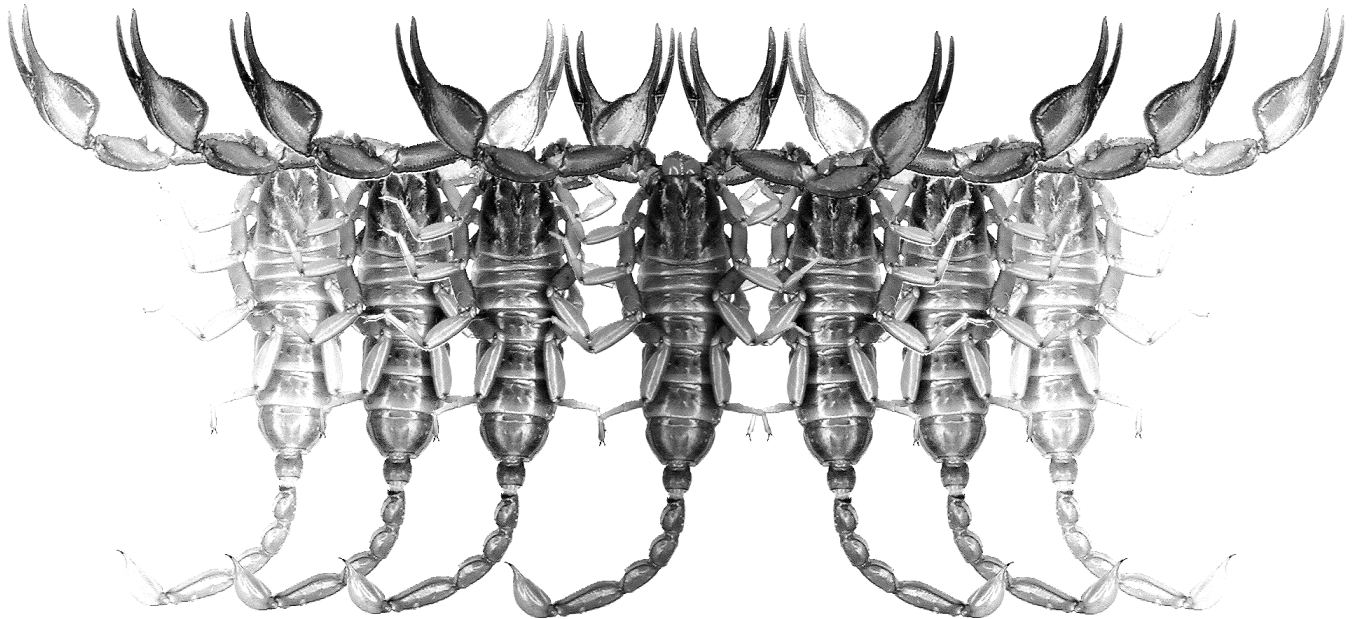


Euscorpius

Occasional Publications in Scorpiology



Scorpions 2011

John L. Cloudsley-Thompson 90th Birthday Commemorative Volume

Redescription of *Tityus pictus* Pocock, 1893 and *Tityus smithii* Pocock, 1893, with Notes on the *Tityus* Species from the Lesser Antilles (Scorpiones: Buthidae)

Rolando Teruel

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Euscorpius

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Redescription of *Tityus pictus* Pocock, 1893 and *Tityus smithii* Pocock, 1893, with notes on the *Tityus* species from the Lesser Antilles (Scorpiones: Buthidae)

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Summary

In the present paper, the taxonomic status of *Tityus pictus* Pocock, 1893 and all of its junior synonyms is revised. *Tityus smithii* Pocock, 1893 is restored as a valid species, and the subspecies *Tityus smithii microdon* Pocock, 1893 (currently *T. pictus microdon*) is regarded as its junior synonym. Both *T. pictus* and *T. smithii* are redescribed, supplementary information on their morphological variability are given, and their geographical distribution is updated, including a new locality record for the latter. Also, the taxonomic position and relationships of all Lesser Antillean species of the genus are clarified: it is demonstrated that *T. exstinctus* Lourenço, 1995 and *Tityus insignis* Pocock, 1889 are actually more closely related to *T. pictus* and *T. smithii*, and they all form a morphologically compact group of species which shows no clear affinities to any other species-group but "*crassimanus*" and "*quisqueyanus*".

Introduction

In the first revision of the Antillean scorpions ever published, Pocock (1893) described two closely-related species from the Lesser Antilles: the monotypic *Tityus pictus* from St. Vincent, and the polytypic *Tityus smithii* with the nominal subspecies restricted to Grenada plus the subspecies *T. s. microdon* from the Grenadines (Mustique and Bequia). The original descriptions of both *T. pictus* and *T. smithii* were somewhat short but nevertheless complete, supplemented by excellent figures (some even presented at real-size), a table of measurements, and a detailed and accurate morphological comparison (Pocock, 1893).

A few years later, Kraepelin (1899) downgraded *T. smithii* to a subspecies of *T. pictus*, and this taxonomical arrangement was followed either explicitly or implicitly by all posterior authors who referred to these taxa (Mello-Leitão, 1931, 1939, 1945; Lourenço, 1984, 1992, 1995, 2006; Armas, 1988; Kovařík, 1998; Fet & Lowe, 2000).

However, the status of *T. smithii microdon* became obscure, mostly because it was almost forgotten in the literature: only three relevant references to this taxon were published in this time-lapse. First, Lourenço (1984) implicitly treated it at the same taxonomic level of *T. pictus* and *T. smithii* as "different populations of a single polymorphic species", but did not enter a valid synonymy. Second, Armas (1988) implicitly mentioned it by the same combination originally introduced by Pocock (1893): *T. smithii microdon*. And last, Fet & Lowe (2000)

unraveled its nomenclatural history and listed it as *T. pictus microdon*.

The relationships of both *T. pictus* and *T. smithii* within the genus have also remained controversial. For example, Pocock (1893) originally associated them to *Tityus melanostictus* Pocock, 1893; Mello-Leitão (1939) placed them in his clearly artificial "Group C" (actually a very large and heterogeneous assemblage of too dissimilar species); and last, Fet & Lowe (2000) listed them in the "*clathratus*" group, a placement followed by Lourenço (2006) as the subgenus *Tityus (Archaeotityus)*.

Nevertheless, neither *T. pictus* nor *T. smithii* exhibit any of the morphological characters used as diagnostic for this species-group (Fet & Lowe, 2000; Lourenço, 2002) or subgenus (Lourenço, 2006), and also the characters used originally by Pocock (1893) to diagnose *T. pictus* and *T. smithii* are the same currently used for this level, which renders the synonymy of both taxa not satisfactory. To clarify all of these problems a special effort was conducted to compare additional samples of these species, which succeeded in obtaining topotypes of both *T. pictus* and *T. smithii*, as well as a very important sample from the Grenadines. The study of all these specimens revealed that both taxa indeed represent clearly distinct species, and also that the subspecies *T. smithii microdon* cannot be retained as valid. In order to clarify their status, herein we present a complete and widely illustrated redescription of *T. pictus* and *T. smithii*, which is also complemented by variability data, an update of their geographical distribution, and a detailed discussion on their relationships to the remaining species

of *Tityus* from the Lesser Antilles and their position inside the genus.

Methods & Material

The 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. 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 trichobotriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977), and sternum (Soleglad & Fet, 2003). In the table, all measurements are given in millimeters as length/width/depth except for the carapace, where these correspond to length/posterior width. Abbreviations for the repositories of the specimens mentioned herein are BMNH (The Natural History Museum, London, U.K.; formerly British Museum), RMNH (Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands), FKPC (personal collection of František Kovařík, Prague, Czech Republic), and RTO (first author's personal collection).

Systematics

Tityus pictus Pocock, 1893 Figs. 1–3, 14, Tabs. 1–2, 5–7

Tityus pictus Pocock, 1893: 377, 382–384, 409, pl. XXX, figs. 8–8a; Kraepelin, 1899: 75, 86; Mello-Leitão, 1931: 126, 143; Mello-Leitão, 1939: 60–61, 65, 74, tab. IIc; Armas, 1982: 6, tab. 2 (in part: record from St. Vincent only); Lourenço, 1984: 91–92, 97–102, 104, figs. 20–27, tab. I (in part: specimens and record from St. Vincent only); Armas, 1988: 93 (in part: record from St. Vincent only); Lourenço, 1992: 45; fig. 1 (in part: record from St. Vincent only); Lourenço, 1995: 28, fig. 1 (in part: record from St. Vincent only); Kovařík, 1998: 122 (in part); Fet & Lowe, 2000: 230, 255–256; Lourenço, 2006: 60.

Tityus pictus pictus: Mello-Leitão, 1945: 310; Lourenço, 1984: 97–99, tab. I; Armas, 1988: 80–81; Fet & Lowe, 2000: 256; Lourenço, 2006: 60.

Diagnosis: species of medium size (males 47–65 mm, female 51–54 mm) for the genus. Body light yellowish brown, with a moderately dense pattern of dark brown spots; tergites with three well-defined but irregular dark stripes; pedipalp fingers, metasomal segments IV–V and telson blackish. Pedipalp chela elongate and incrassate in males, oval in females. Sternite V with an inconspicuous smooth patch in males. Metasoma conspicuously attenuate and only slightly enlarged distally in

males, with all carinae very weak to moderate and finely subcostate to serrato-crenulate; dorsolateral carinae of metasomal segments II–IV with distal tooth not enlarged. Telson inflate and coriaceous; subaculear tubercle vestigial. Pedipalp fixed finger with 13 principal rows of granules, movable finger with 14–15; basal lobe/notch combination strong in males, moderate in females. Pectines with 20–21 teeth in males, and 18–21 in females; basal middle lamella obtusely angulose and slightly dilated in males, rounded and strongly dilated in females.

Type data: 2 adult ♂♂ and 3 adult ♀♀ syntypes (BMNH: 1894.10.14.21–25; not examined): St. Vincent; commonly found on Bromelias, on trees Coneralid at the bases of leaves, rare in houses or under bark; H. H. Smith coll. **Note:** see Remarks for a detailed discussion on this topic.

Distribution (Fig. 14): this species has been collected only at St. Vincent, and it appears to be endemic from this island.

Redescription (adult male topotype): **Coloration** (Figs. 1–2) basically light yellowish brown, irregularly spotted with medium to dark brown all over the body and appendages; spots lighter (pale to light brown) on pedipalps, metasomal segments I–III and venter. Chelicerae densely reticulated with blackish brown all over the manus; fingers blackish. Pedipalps diffusely spotted with light brown; fingers blackish. Carapace with interocular area densely infusate; tergites with three well-defined dark stripes, composed of reticulate to irregular spots; coxosternal region immaculate; pectines pale yellowish, immaculate; sternites irregularly spotted, almost immaculate mesially. Legs densely spotted with light brown. Metasomal segments I–III very diffusely spotted with pale brown on all surfaces, segments IV–V and telson blackish. **Carapace** (Fig. 2a) trapezoidal, anterior margin very widely V-shaped; anterior median, superciliary, central median and posterior median carinae finely granulose (the latter fused into irregular rows), other carinae obsolete to absent; tegument finely and densely granulose, with coarser granules scattered; median eyes separated by more than one ocular diameter; three pairs of lateral eyes, which are all a little smaller than median eyes. **Tergites** (Fig. 2a) with the same granular sculpture as on carapace; longitudinal carina well defined and finely granulose; VII with two pairs of finely serrate lateral carinae. **Chelicerae** (Fig. 2a) with dentition typical for the genus; tegument smooth and shiny. **Pedipalps** (Figs. 1a–b, 2b) orthobothriotaxic A-α. Femur with all carinae finely granulose; intercarinal tegument very finely and densely granulose. Patella with all carinae finely granulose to subgranulose; intercarinal tegument with the same granular sculpture as on femur, internal surface with several conical granules. Chela elongate and incrassate, noticeably wider than patella (Tabs. 1, 2, 5); hand with nine carinae, all moderate and very finely subgranulose to costate, intercarinal tegument

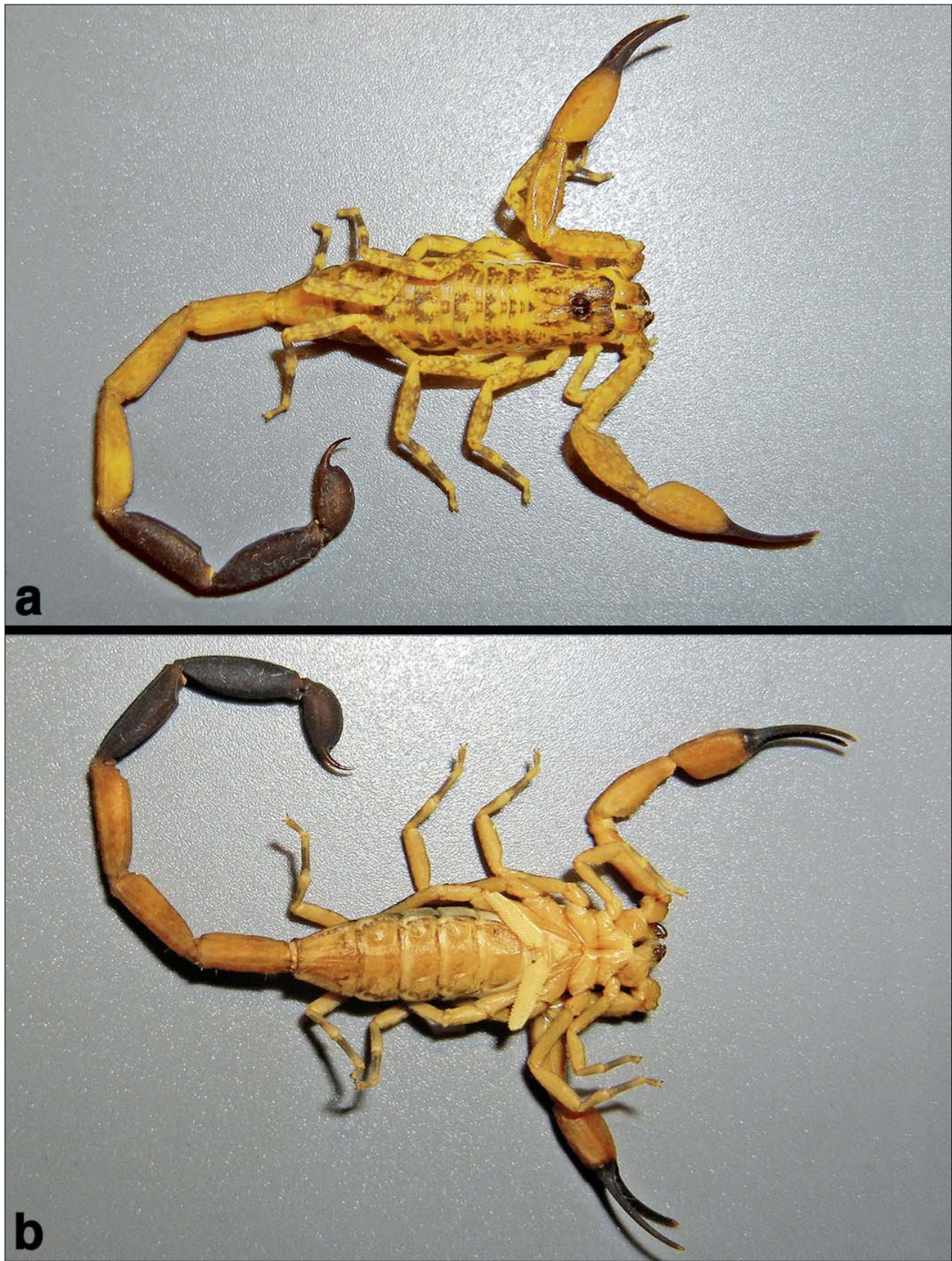


Figure 1: Large adult male topotype of *Tityus pictus*: **a.** entire dorsal view; **b.** entire ventral view.

Character		♂ BMNH	♂ IES	♀ BMNH
Carapace	L/Wp	4.3 / 4.9	5.7 / 5.8	5.9 / 6.4
Mesosoma	L	12.1	15.5	13.4
Tergite VII	L	–	4.5 / 4.9	–
Metasoma	L	30.1	43.5	31.6
Segment I	L/W	3.5 / 2.0	5.7 / 2.5	3.7 / 2.7
Segment II	L/W	4.6 / 1.8	7.0 / 2.4	4.7 / 2.6
Segment III	L/W	5.2 / 1.9	7.8 / 2.4	5.1 / 2.6
Segment IV	L/W	5.4 / 2.1	8.0 / 2.6	5.5 / 2.7
Segment V	L/W	6.0 / 2.2	8.0 / 2.7	6.1 / 2.6
Telson	L	5.4	7.0	6.5
Vesicle	L/W/H	3.6 / 1.9 / 1.9	4.4 / 2.4 / 2.6	4.4 / 2.2 / 2.4
Aculeus	L	1.8	2.6	2.1
Pedipalp	L	20.0	24.9	23.4
Femur	L/W	5.0 / 1.4	6.3 / 1.6	5.8 / 1.8
Patela	L/W	5.3 / 1.9	6.6 / 2.3	6.4 / 2.6
Chela	L	9.7	12.0	11.2
Hand	L/W/H	4.0 / 2.2 / 2.0	5.0 / 2.9 / 2.5	3.8 / 2.5 / 2.2
Movable finger	L	5.7	7.0	7.4
Total	L	46.5	64.7	50.9

Table 1: Measurements of three adults of *Tityus pictus* from St. Vincent. Abbreviations: length (L), width (W), posterior width (Wp), depth (H), not measured (–). Data of BMNH specimens from Lourenço (1984: tab. I).

Ratio	♂	♂	♀
1. Chela (L/W)	4.14	4.41	4.48
2. Hand (W) / Patela (W)	1.26	1.16	0.96
3. Movable finger (L) / Hand (W)	2.41	2.59	2.96
4. Metasoma (L) / Carapace (L)	7.63	7.00	5.36
5. Metasomal segment I (L/W)	2.28	1.75	1.37
6. Metasomal segment IV (L/W)	3.08	2.57	2.04
Total (L)	64.7	46.5	50.9

Table 2: Age- and sex-related variation of some morphometric proportions in adult topotypic *Tityus pictus* (data from Tab. 1). Abbreviations: length (L), width (W).



Figure 2: Large adult male topotype of *Tityus pictus*: **a.** carapace; **b.** pedipalp, dorsal view; **c.** sternopectinal region; **d.** sternite V; **e.** metasomal segments I–III, lateral view; **f.** metasomal segments IV–V and telson, lateral view; **g.** telson, lateral close-up.

coriaceous to very finely and densely granulose; fingers with basal lobe/notch combination strong, fixed finger with 13/13 principal rows of granules, movable finger with 14/15, apical subrow composed by four granules aligned similar to principal rows. **Legs** (Figs. 1a–b) with all carinae subcostate to granulose; intercarinal tegument very finely and densely granulose. **Sternum** (Fig. 2c) type 1, markedly pentagonal. **Pectines** (Fig. 2c) somewhat small, just reaching the coxa-trochanter joint of leg IV; pectinal tooth count 20/20; basal middle lamella obtusely angulose and slightly dilated. **Sternites** (Figs. 2c–d) with oval-elongate spiracles; sternite III with the lateral areas slightly depressed and very finely granulose, mesially smooth, IV–VI essentially smooth, VII finely and densely granulose; posterior margin of

sternite V with a large and smooth patch, which is whitish, subtriangular, much wider than long and moderately bulky; sternites VI–VII with two pairs of granulose lateral carinae. **Metasoma** (Figs. 2e–g) markedly elongate but slightly enlarged distally; intercarinal tegument coriaceous, with small granules scattered; segment I with ten complete carinae, II–IV with eight (even though the lateral inframedian carinae are present on distal third of II), V with five, all moderately developed and finely subcostate to serrato-crenulate; dorsolateral carinae on II–IV with the distal tooth not enlarged; telson oval in lateral view, vesicle inflate and coriaceous, with a subgranulose ventromedian carina progressively elevated towards the subaculear tubercle, which is very small, conical, placed

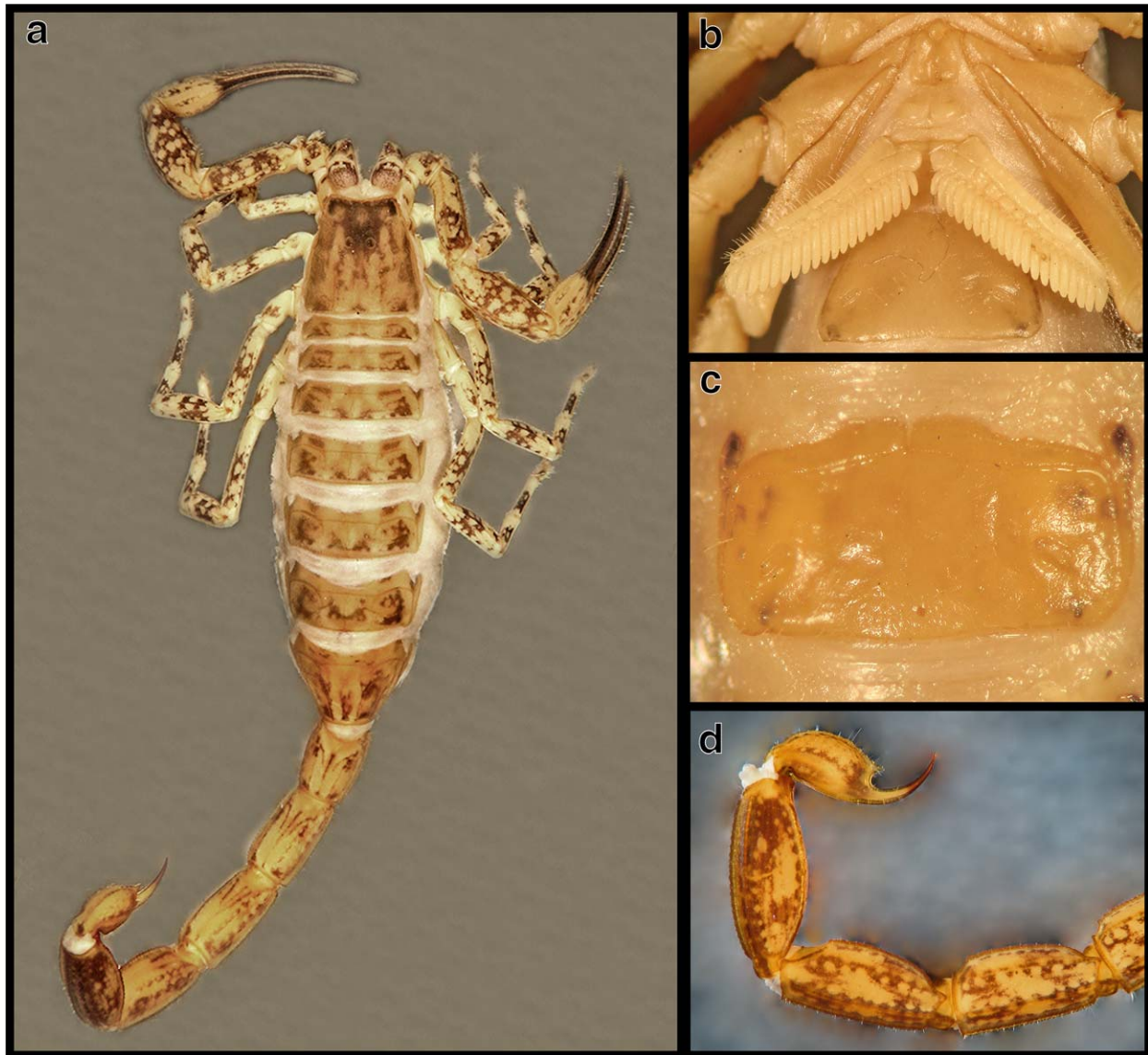


Figure 3: Juvenile female topotype of *Tityus pictus*: **a.** entire dorsal view; **b.** sternopectinal region; **c.** sternite V; **d.** metasomal segments III–V and telson, lateral view.

close to the base of aculeus and lacks any granules; aculeus short, sharp and evenly curved.

Female (juvenile topotype, adult data taken from Pocock [1893] and Lourenço [1984]. Tabs. 1–2, 5–7): in general similar to the male, but there is a strong sexual dimorphism evidenced by: **(1)** mesosoma relatively wider; **(2)** metasoma shorter and stouter; **(3)** pedipalp chela much smaller, short-oval in shape and narrower than patella; **(4)** pedipalp fingers with basal lobe/notch combination weaker; **(5)** pectines with lower tooth counts, and basal middle lamella oval and strongly dilated.

Variation: the adult size of *T. pictus* varies from 46.5–64.7 mm in males, and 50.9–54.0 mm in females

(Tab. 1). Pocock (1893) recorded 63.5 mm (male) and 54 mm (female) for two syntypes, Lourenço (1984) measured another pair of syntypes with lengths of 46.5 mm (male) and 50.9 mm (female), and the topotype male herein examined has a size of 64.7 mm; these data suggest that there are two different size classes in males, but only one in females.

The small male syntype measured by Lourenço (1984) also exhibits less marked sexual dimorphism when compared to the large males: pedipalp chela less incassate and metasomal segments shorter and less slender (Tabs. 1–2). This progressive size-related gradation on the expression of dimorphic characters has already been documented for many other species of this

genus (Lourenço, 1983; Armas et al., 2002; Montoya & Armas, 2002; Kovařík, 2007; Teruel & Armas, 2006; Rojas-Runjaic & Armas, 2007; Teruel, 2000, 2011; Teruel & García, 2008a–b; Teruel & Sánchez, 2009, 2010; Teruel & Kovařík, 2011).

The variation of pectinal tooth counts known for *T. pictus* is compiled in Table 6. Both Pocock (1893) and Lourenço (1984) recorded 20–21 in males and 18–21 in females; it should be mentioned here that Pocock (1893) gave only ranges for each sex, but Lourenço (1984) presented actual individual counts. Also, the two additional topotypes herein examined (male and female) have 20/20 pectinal teeth.

The variation of the number of principal rows of granules on pedipalp fingers known for *T. pictus* is compiled in Table 7. Pocock (1893) recorded 13 rows, but Lourenço (1984) recorded 15 rows for the movable finger of the same specimens without any comments on this discrepancy. In the two additional specimens herein studied, the fixed finger has 13/13 rows, and the movable finger has 14/15 rows in the adult male and 14/14 in the juvenile female.

Juveniles (Fig. 3) are very similar to adults, but can be distinguished by the somewhat different coloration (basically paler, with metasomal segments IV–V and telson of the same color as the rest of metasoma), a less sclerotized cuticle (especially in metasoma and pedipalps), the pedipalp chelae relatively smaller and narrower than patella, metasoma relatively more slender and parallel-sided, and a totally different subaculear tubercle (much stronger, sharp and with dorsal and ventral granules).

Ecological notes: according to the information kindly provided by one of the collectors (GA), the specimens herein examined were collected under barks of trees in forest, sympatric with *Didymocentrus minor* Francke 1976 (under rocks in the ground).

Material examined: SAINT VINCENT AND THE GRENADINES, Saint Vincent, Mt. St. Andrew, 19 October 2004, G. Alayón & M. da Silva leg., 1 adult ♂ topotype (IES); Brighton Village, 22 October 2004, G. Alayón & M. da Silva leg., 1 juvenile ♀ topotype (IES).

Remarks: for a detailed comparison between this species and *T. smithii*, see General Remarks.

The status and composition of the name-bearing types of *T. pictus* is currently confused. Pocock (1893) did not designate a holotype, and based the original description on an undetermined number of specimens: measurements of one adult male and female were actually given, and in page 383 he mentioned “... *the largest examples of T. pictus*...” [italics herein added], which clearly implies the existence of at least three specimens.

Lourenço (1984) examined two adult males and three adult females (BMNH: 1894.10.14.21–25), and in

page 99 he stated that these specimens “... *could not be warranted to be part of the original type-series of Pocock. At least one of these females corresponds very well to the female described by Pocock*...” [original text in French, translation and italics herein added], and in page 101 he first wrote that the specimen with 20/19 pectinal teeth “... *could be the type female*...” [original text in French, translation and italics herein added], and then referred to the whole sample as the “*type-series?*” [original text in French, translation and italics herein added].

Fet & Lowe (2000: 255) considered that Lourenço (1984) had designated the above-referred female as the lectotype, and the remaining four specimens as paralectotypes. Nevertheless, such lectotype designation is not valid according to the Article 74.5 of the International Code of Zoological Nomenclature (CINZ, 2000: 85), because Lourenço (1984) never selected **unambiguously** this female as the lectotype (i.e., all three references to any “type” were clearly conditional by the use of the modal auxiliary verb “could” or a question sign). Nor is Fet & Lowe (2000) a case of inadvertent lectotype designation, because it does not fulfill the Article 74.7.3 of the Code (CINZ, 2000: 86): it does not contain an **explicit** declaration of such a purpose.

Apart from this, Lourenço (1984: 101) contradictorily listed two females from Grenada (catalogued BMNH: 1894.10.20.7–16) as the types of both *T. pictus* (twice on text lines 8th and 22nd) and *T. smithii* (once on figure captions 21–27), obviously because he considered both taxa as synonyms. Again, this neither does represent a valid designation of a lectotype because: **(1)** according to the Article 72.9 of the Code (CINZ, 2000: 81), if two or more species-level nominal taxa become included into a single species-level nominal taxon, their name-bearing types remain unaltered, and for both *T. pictus* and *T. smithii* these are Pocock's original type-series; **(2)** the two above-mentioned females from Grenada are not original types of *T. smithii* either (see below, in the Remarks section of this species).

Because of all these reasons, it is clear that the name-bearing type of *T. pictus* is a series of syntypes, most likely the BMNH sample catalogued 1894.10.14.21–25. It is highly recommended here that any other author who eventually decides to designate a lectotype, must select the adult male measured and illustrated by Pocock (1893: 382–383; pl. XXX, fig. 8; the size match between the table and figure demonstrate that both refer to the same specimen about 63.5 mm long), following the Recommendation 74B of the Code that gives preference to a syntype which has been illustrated (CINZ, 2000: 86). It also concurs with the fact that all diagnostic characters of *T. pictus* are best expressed in this sex.

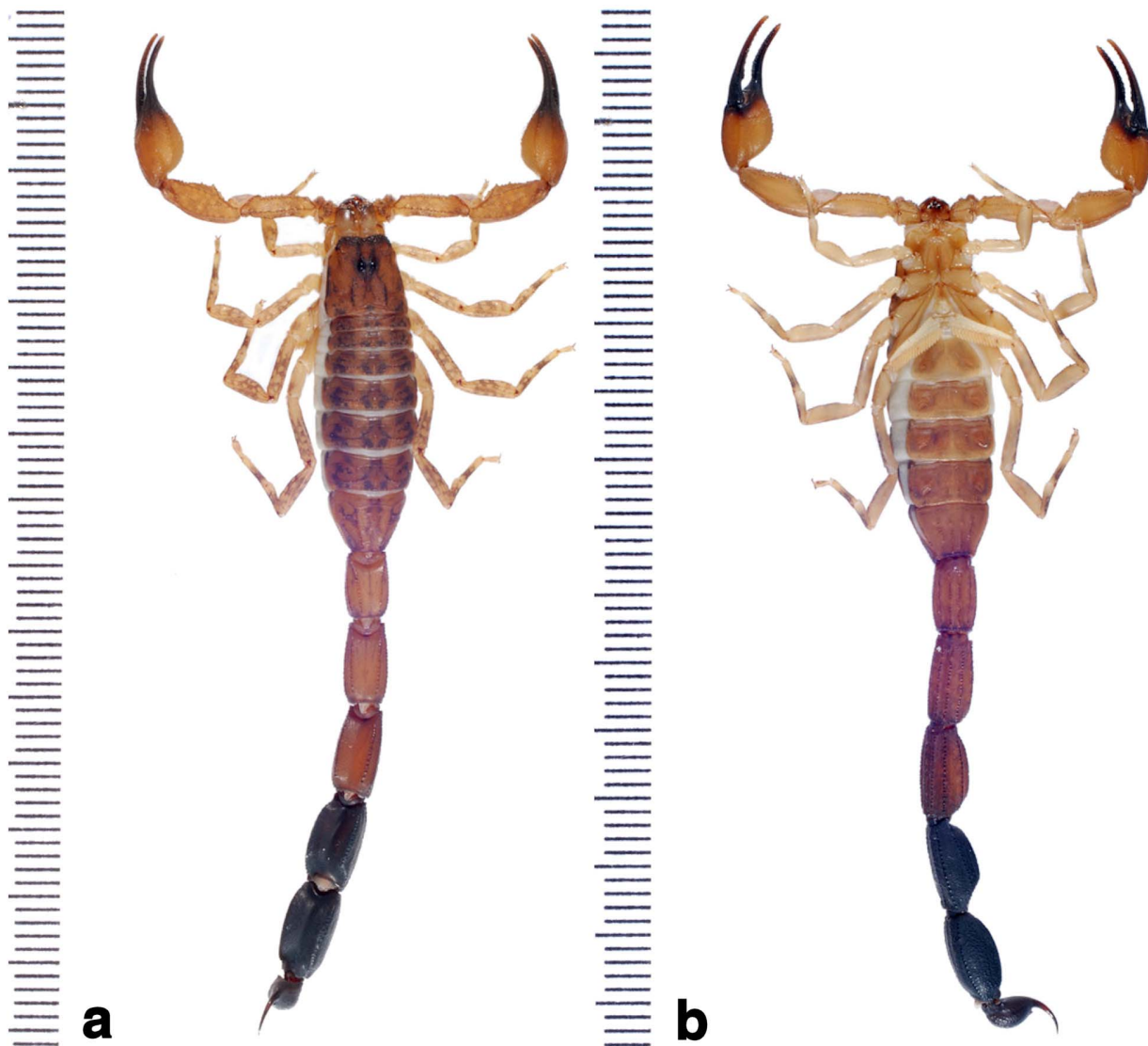


Figure 4: Adult male topotype of *Tityus smithii*: **a.** entire dorsal view; **b.** entire ventral view. Photos courtesy František Kovařík.

***Tityus smithii* Pocock, 1893, stat. rest.**
Figs. 4–15, Tabs. 3–7

Tityus smithii Pocock, 1893: 377, 383–384, 409, pl. XXX, figs. 9–9a; Lourenço, 1984: 91–92, 97–102, 104, figs. 20–27; tab. I; Kovařík, 1998: 122 (in synonymy).

Tityus pictus smithii: Kraepelin, 1899: 75, 86; Mello-Leitão, 1931: 126, 143; Mello-Leitão, 1939: 60–61, 65, 74, tab. IIc; Mello-Leitão, 1945: 310; Lourenço, 1984: 97–99, figs. 20–27, tab. I; Armas, 1988: 81, 93; Fet & Lowe, 2000: 256; Lourenço, 2006: 60.

Tityus smithii microdon Pocock, 1893: 384; Armas, 1988: 81. **New synonym.**

Tityus pictus microdon: Lourenço, 1984: 92, 97, 99; Fet & Lowe, 2000: 256; Lourenço, 2006: 60.

Tityus pictus: Mello-Leitão, 1931: 126, 143 (misidentification); Armas, 1982: 6, tab. 2 (misidentification: records from Grenada and the Grenadines); Lourenço, 1984: 97–99, figs. 20–27, tab. I (misidentification: specimens and records from Grenada and the Grenadines); Armas, 1988: 81, 93 (misidentification: specimens and records from Grenada and the Grenadines); Lourenço, 1992: 45, fig. 1 (misidentification: records from Grenada and the Grenadines); Lourenço, 1995: 28, fig. 1 (misidentification: records from Grenada and the Grenadines); Kovařík, 1998: 122 (misidentification); Fet & Lowe, 2000: 256 (misidentification).

Character		♂	♂	♀	♀
		Union	Union	Grenada	Union
Carapace	L/Wp	6.0 / 6.4	7.6 / 8.0	5.5 / 6.3	7.4 / 9.4
Mesosoma	L	12.2	22.3	18.3	20.0
Tergite VII	L	4.3 / 5.7	6.9 / 7.6	–	4.8 / 7.5
Metasoma	L	39.8	52.8	33.5	44.4
Segment I	L/W	5.0 / 3.3	6.8 / 4.7	4.1 / 3.4	5.5 / 4.2
Segment II	L/W	6.2 / 3.3	8.3 / 4.7	5.1 / 3.2	6.7 / 4.0
Segment III	L/W	7.0 / 3.4	9.3 / 4.8	5.5 / 3.3	7.2 / 4.2
Segment IV	L/W	7.3 / 3.7	9.4 / 5.3	5.8 / 3.4	8.0 / 4.3
Segment V	L/W	7.0 / 3.8	9.2 / 5.3	6.4 / 3.4	8.0 / 4.3
Telson	L	7.3	9.8	6.6	9.0
Vesicle	L/W/H	3.8 / 2.3 / 2.3	5.1 / 3.0 / 3.0	4.0 / 2.2 / 2.2	4.5 / 2.7 / 2.6
Aculeus	L	3.5	4.7	2.6	4.5
Pedipalp	L	25.5	32.1	23.0	27.8
Femur	L/W	5.9 / 1.8	7.5 / 2.3	5.5 / 1.8	6.5 / 2.3
Patela	L/W	6.5 / 2.6	7.7 / 3.4	6.1 / 2.7	7.4 / 3.4
Chela	L	13.1	16.9	11.4	13.9
Hand	L/W/H	5.4 / 3.8 / 3.4	7.2 / 5.3 / 5.0	4.2 / 2.6 / 2.4	5.0 / 3.8 / 3.5
Movable finger	L	7.7	9.7	7.2	8.9
Total	L	58.0	82.7	57.3	71.8

Table 3: Measurements of four adults of *Tityus smithii* from Grenada (BMNH) and Union (RTO). Abbreviations: length (L), width (W), posterior width (Wp), depth (H), not measured (–). Data of BMNH specimen from Lourenço (1984: tab. I).

Ratio	♂	♂	♀	♀
1. Chela (L/W)	3.19	3.45	3.66	4.38
2. Hand (W) / Patela (W)	1.56	1.46	1.12	0.96
3. Movable finger (L) / Hand (W)	1.83	2.03	2.34	2.77
4. Metasoma (L) / Carapace (L)	6.95	6.63	6.00	6.09
5. Metasomal segment I (L/W)	1.45	1.52	1.31	1.21
6. Metasomal segment IV (L/W)	1.77	1.97	1.87	1.71
Total (L)	82.7	58.0	71.8	57.3

Table 4: Age- and sex-related variation of some morphometric proportions in adult *Tityus smithii* (data from Tab. 3). Abbreviations: length (L), width (W).

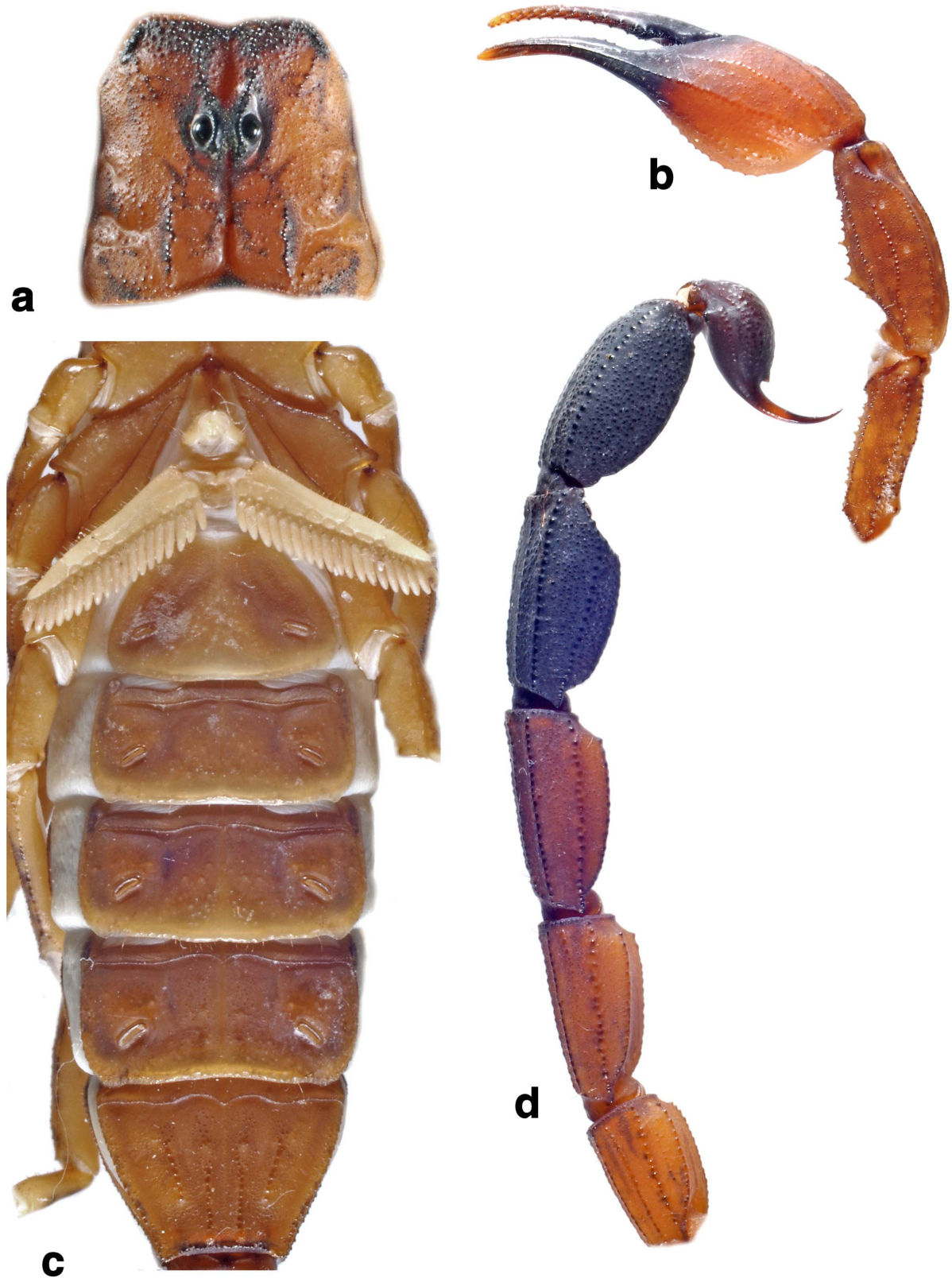


Figure 5: Adult male topotype of *Tityus smithii*: **a.** carapace; **b.** pedipalp, dorsal view; **c.** venter; **d.** metasoma, lateral view. Photos courtesy František Kovařík.

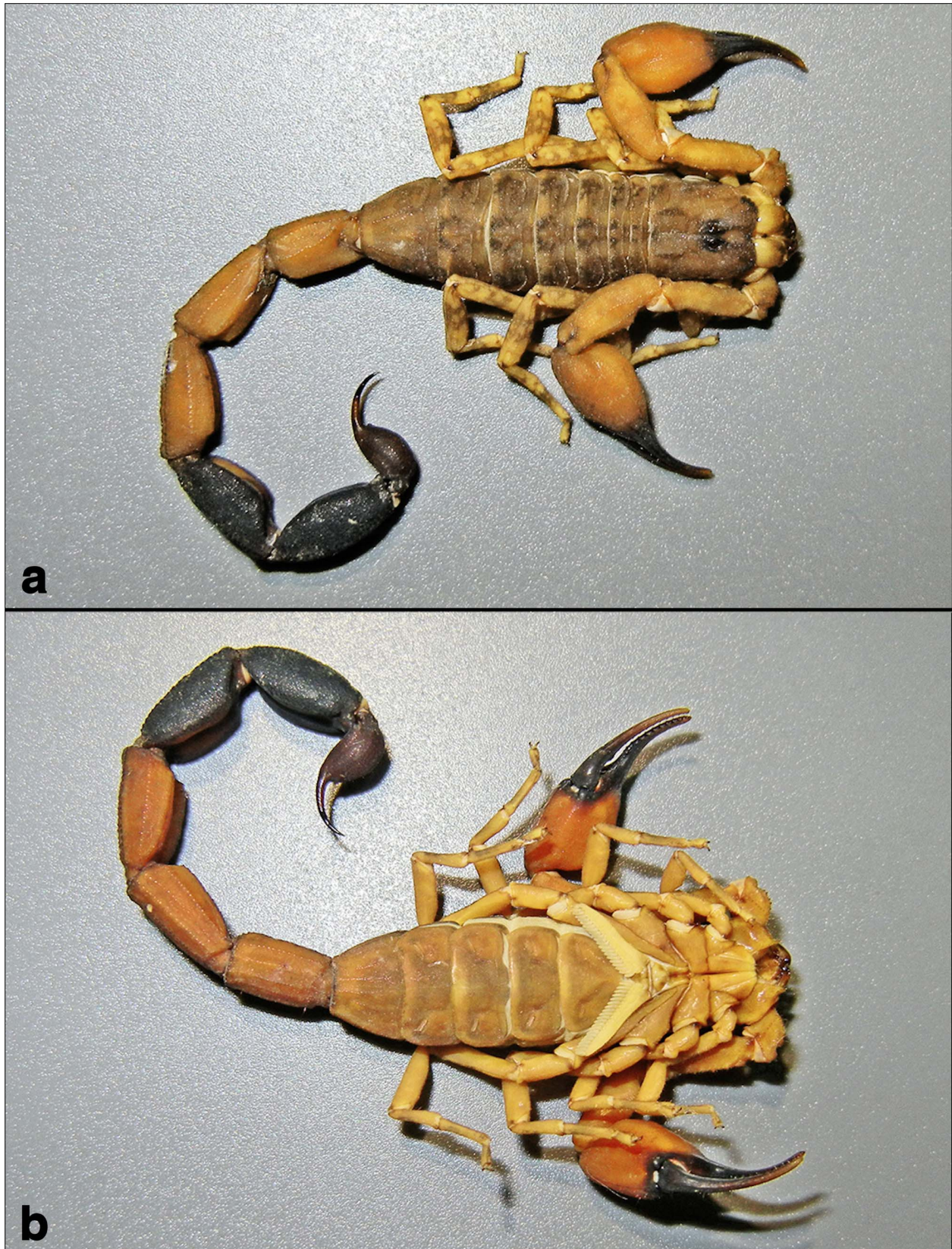


Figure 6: Large adult male of *Tityus smithii* from Union: **a.** entire dorsal view; **b.** entire ventral view.

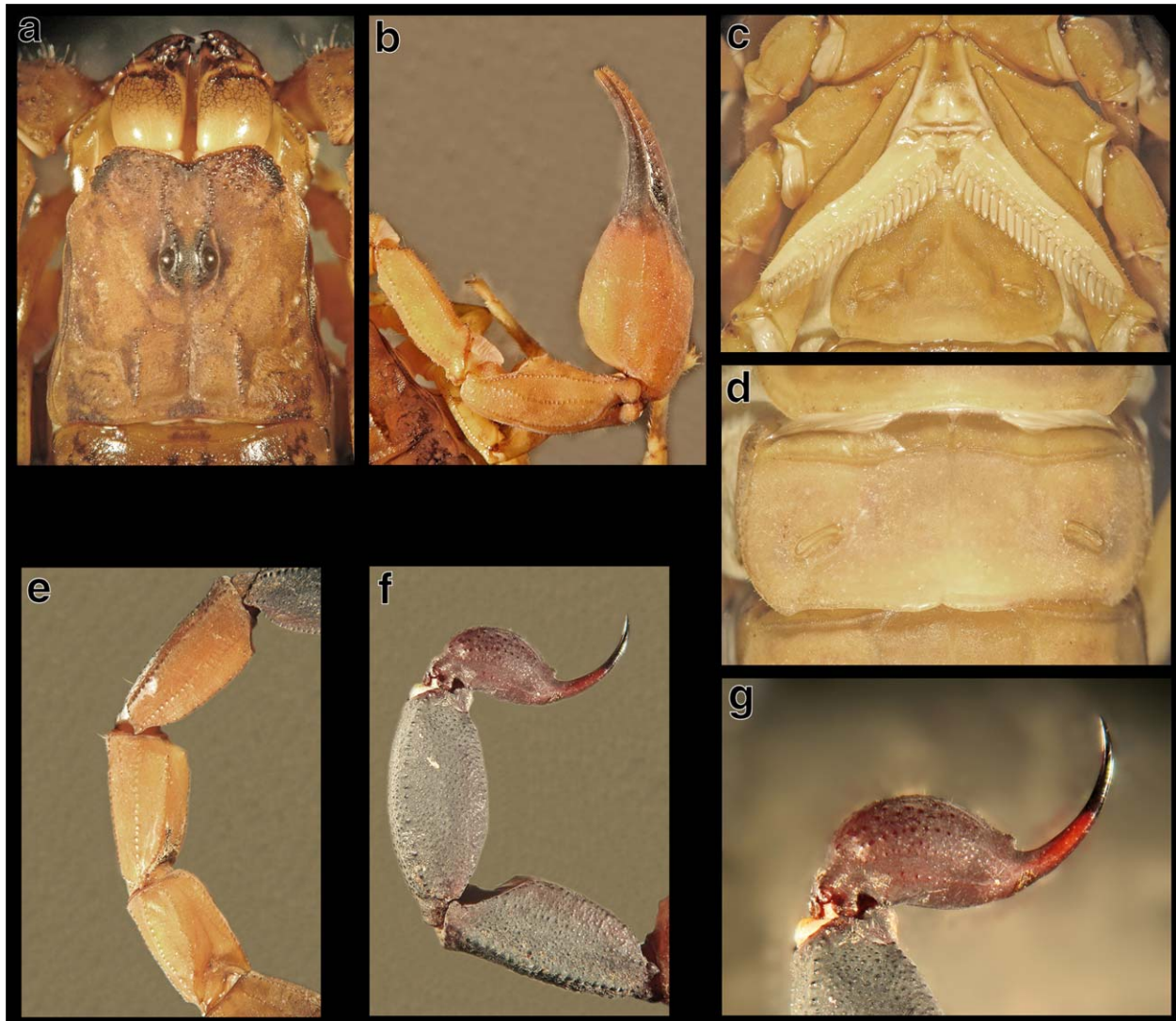


Figure 7: Large adult male of *Tityus smithii* from Union: **a.** carapace; **b.** pedipalp, dorsal view; **c.** sternopectinal region; **d.** sternite V; **e.** metasomal segments I–III, lateral view; **f.** metasomal segments IV–V and telson, lateral view; **g.** telson, lateral close-up.

Diagnosis: species of moderately large size (males 58–83 mm, females 57–72 mm) for the genus. Body yellowish brown, with a moderately dense pattern of dark brown spots; tergites with three poorly to well defined, irregular dark stripes; pedipalp fingers, metasomal segments IV–V and telson blackish. Pedipalp chela inflate and globular in larger males, incrassate in smaller males and subtriangular in females. Sternite V with a large smooth patch in males. Metasoma slightly attenuate and conspicuously enlarged distally in males, with all carinae weak to moderate and coarsely granulose to crenulate; dorsolateral carinae of metasomal segments II–IV with distal tooth not enlarged. Telson not inflate and coarsely granulose; subaculear tubercle obsolete to small. Pedipalp fixed finger with 13–14 principal rows of granules, movable finger with 14–15; basal lobe/notch combination very strong in males, moderate in females.

Pectines with 19–22 teeth in males, and 19–21 in females; basal middle lamella obtusely angulose and slightly dilated in males, pyriform and strongly dilated in females.

Type data: 3 adult ♂♂ and 3 adult ♀♀ syntypes (BMNH; not examined): Grenada; R. V. Sherring coll. **Note:** see Remarks for a detailed discussion on this topic.

Distribution (Fig. 14): this species is widely distributed over the Lesser Antilles south of St. Vincent, where it has been collected at the islands of Bequia, Mustique, Union and Grenada. It probably occurs also in most (if not all) of the remaining Grenadines and satellite islets of Grenada.

Redescription (large adult male from Union; see also high-resolution color photos of an adult male topotype in Figs. 4–5): **Coloration** (Figs. 6–7, 13b–c) basically yellowish brown, irregularly spotted with medium to dark brown all over the body and appendages; spots much

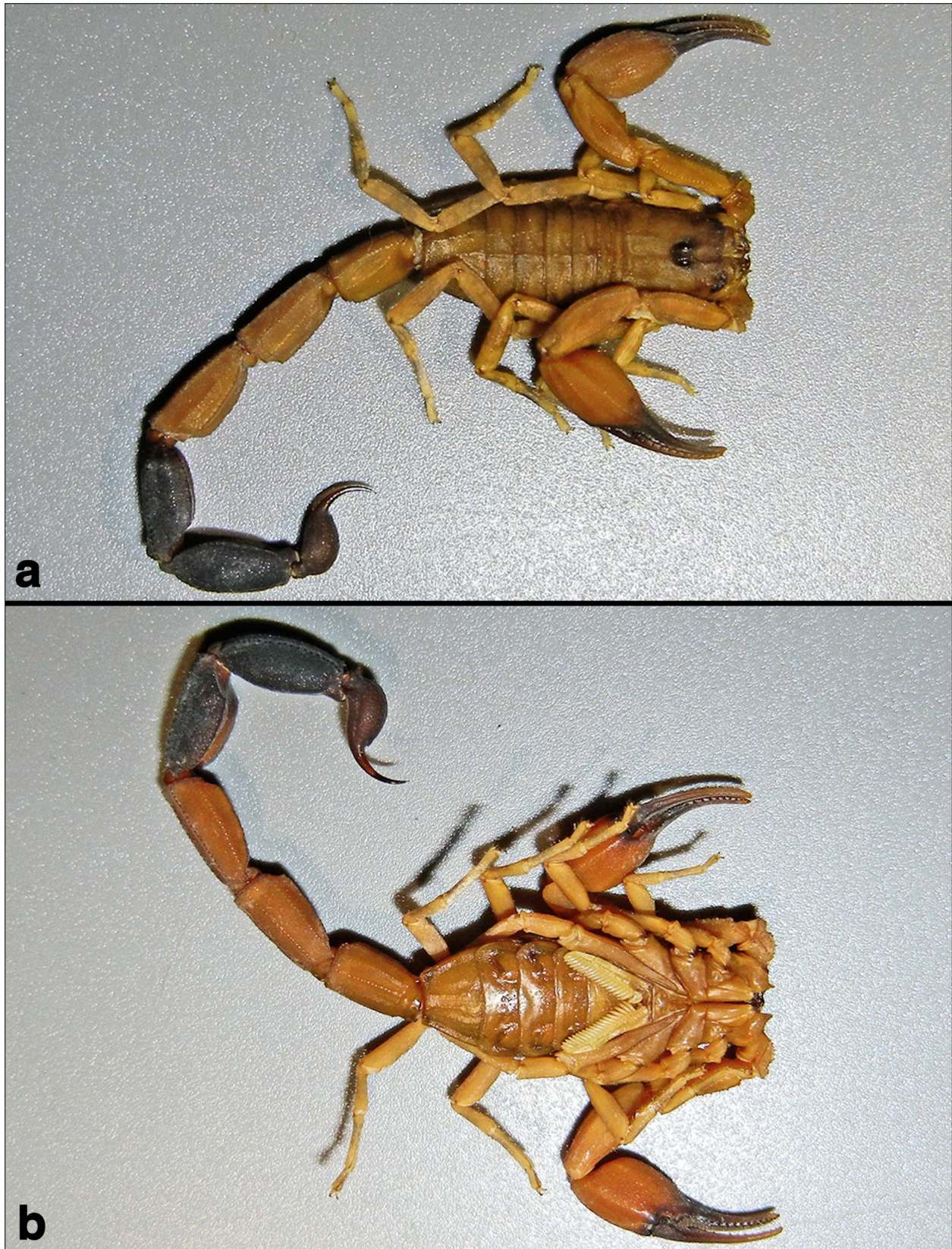


Figure 8: Small adult male of *Tityus smithii* from Union: **a.** entire dorsal view; **b.** entire ventral view.



Figure 9: Small adult male of *Tityus smithii* from Union: (a) pedipalp, dorsal view; (b) metasomal segments IV–V and telson, lateral view; (c) telson, lateral close-up.

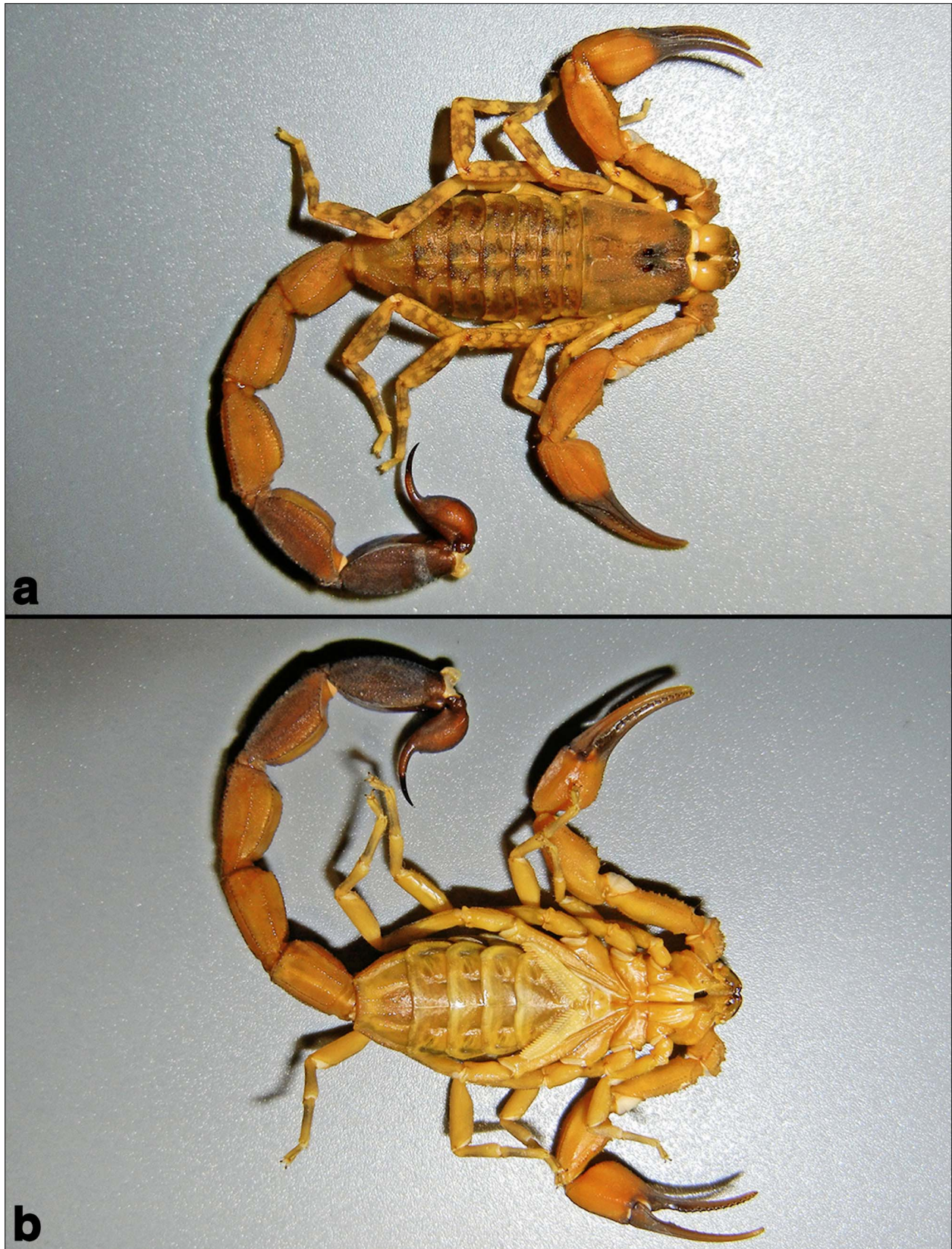


Figure 10: Adult female of *Tityus smithii* from Union: a. entire dorsal view; b. entire ventral view.

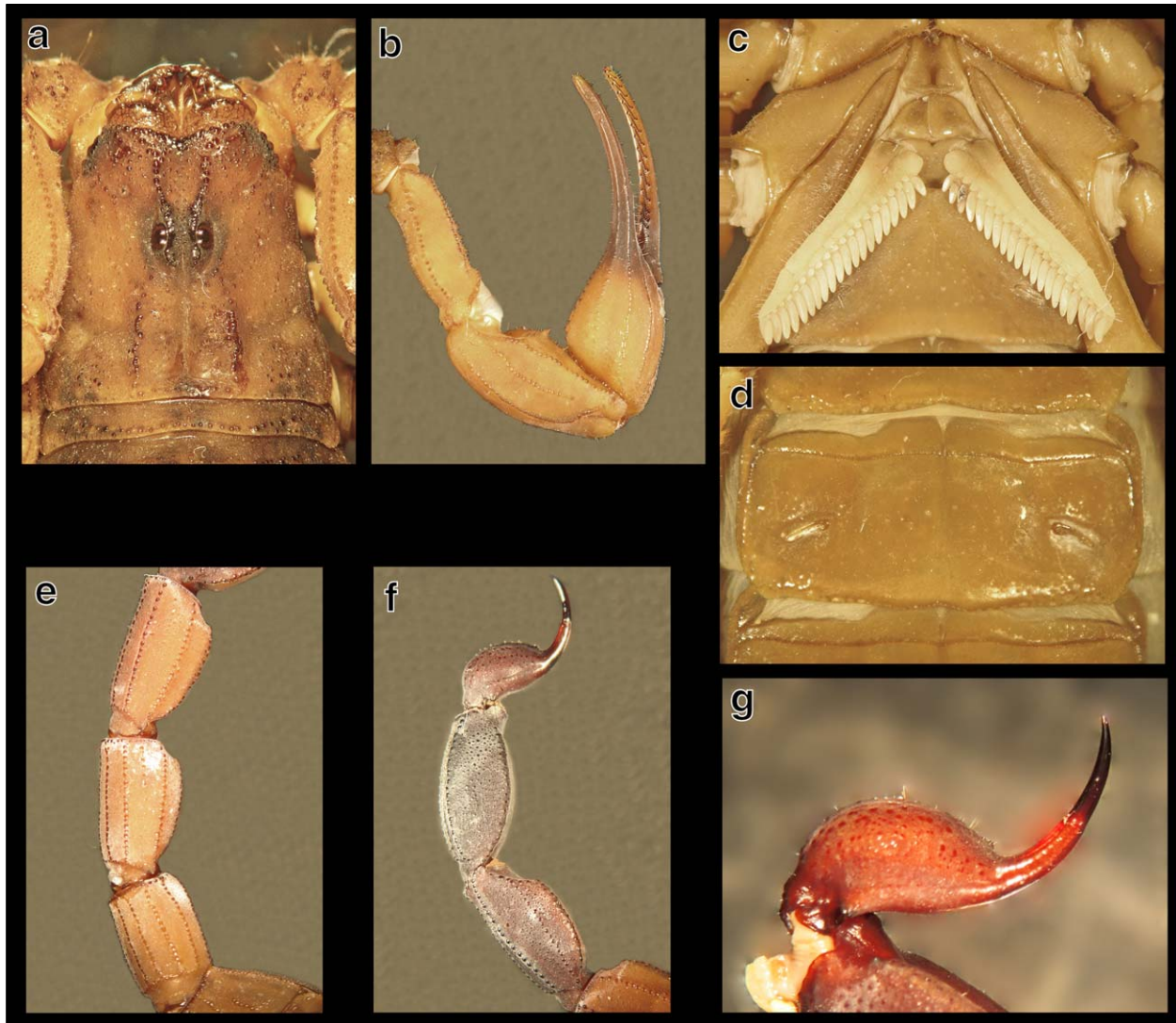


Figure 11: Adult female of *Tityus smithii* from Union: **a.** carapace; **b.** pedipalp, dorsal view; **c.** sternopectinal region; **d.** sternite V; **e.** metasomal segments I–III, lateral view; **f.** metasomal segments IV–V and telson, lateral view; **g.** telson, lateral close-up.

lighter (pale to light brown) on pedipalps, metasomal segments I–III and venter. Chelicerae densely reticulated with blackish brown on distal half of manus only; fingers blackish. Pedipalps very faintly spotted with pale brown; fingers blackish. Carapace with interocular area irregularly infuscate; tergites with three well-defined dark stripes, composed of irregular spots; venter essentially immaculate; pectines light yellow, immaculate. Legs irregularly spotted with medium brown. Metasomal segments I–III very faintly spotted with pale brown on all surfaces; segment IV with dorsal surface reddish-yellow, lateral and ventral surfaces blackish; segment V and telson blackish. **Carapace** (Fig. 7a) trapezoidal, anterior margin very widely V-shaped; anterior median, lateral ocular, central median and posterior median carinae coarsely granulose (the latter fused into irregular rows), superciliary carinae very coarsely subgranulose, other

carinae obsolete to absent; tegument finely and densely granulose, with coarser granules scattered; median eyes separated by about one ocular diameter; three pairs of lateral eyes, which are all much smaller than median eyes. **Tergites** (Fig. 6a) with the same granular sculpture as on carapace; longitudinal carina well defined and coarsely granulose; VII with two pairs of coarsely serrate lateral carinae. **Chelicerae** (Fig. 7a) with dentition typical for the genus; tegument smooth and shiny. **Pedipalps** (Figs. 6a–b, 7b) orthobothriotaxic A- α . Femur with all carinae coarsely granulose; intercarinal tegument densely granulose, with many coarser granules scattered. Patella with all carinae coarsely granulose to costate; intercarinal tegument with the same granular sculpture as on femur, internal surface with a few conical granules. Chela inflates and globular, much wider than patella (Tabs. 3–5); hand with nine carinae, all moderate and finely granulose to

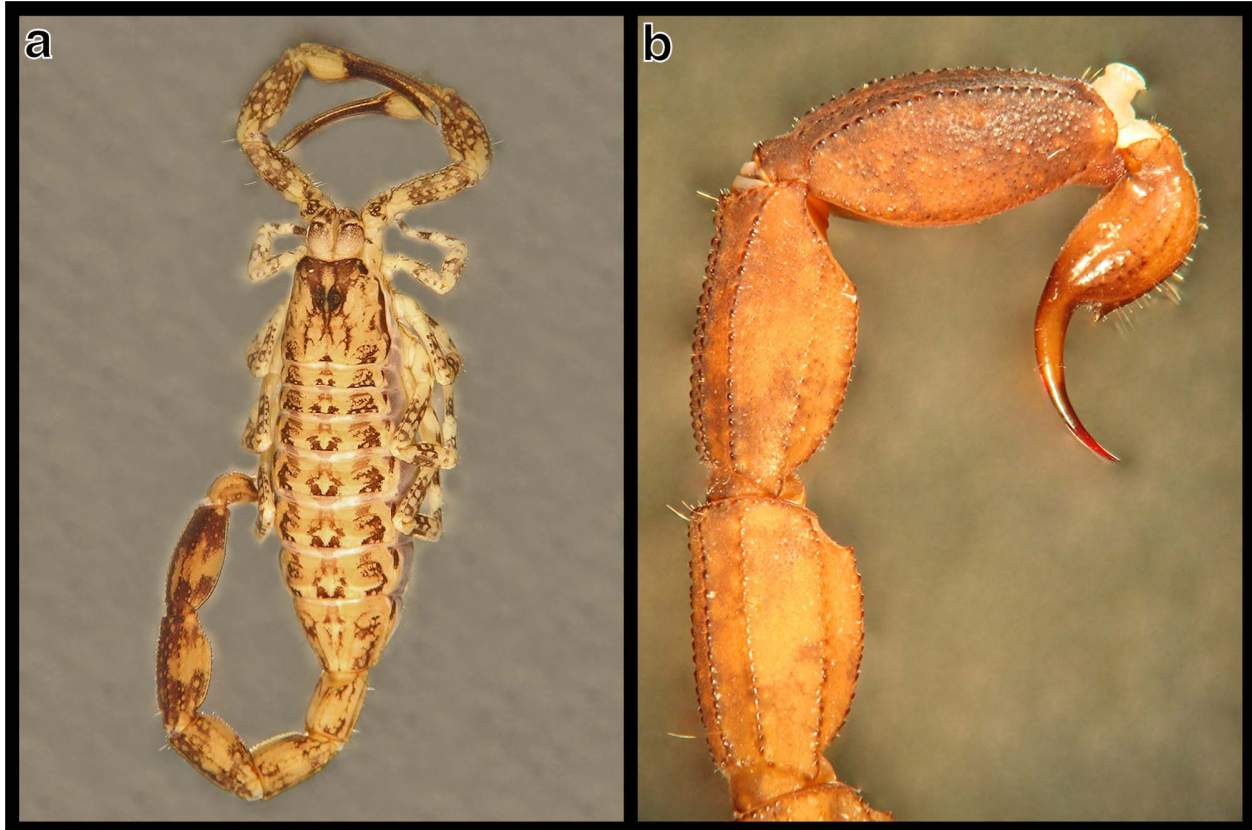


Figure 12: Juvenile female of *Tityus smithii* from Union: (a) entire dorsal view; (b) metasomal segments III–V and telson, lateral view.

subgranulose, intercarinal tegument with the same granular sculpture as on femur and patella; fingers with basal lobe/notch combination very strong, fixed finger with 14/14 principal rows of granules, movable finger with 15/15, apical subrow composed by four granules aligned similar to principal rows. **Legs** (Figs. 6a–b) with all carinae serrate to granulose; intercarinal tegument finely and densely granulose. **Sternum** (Fig. 7c) type 1, subtriangular. **Pectines** (Fig. 7c) somewhat small, just reaching the coxa-trochanter joint of leg IV; pectinal tooth count 21/21; basal middle lamella obtusely angulose and vestigially dilated. **Sternites** (Figs. 7c–d) with slit-like spiracles; sternite III with the lateral areas slightly depressed and finely granulose, mesially coriaceous, IV–VI coriaceous, VII finely and densely granulose; posterior margin of sternite V bilobed, with a large and smooth patch, which is yellowish, subtriangular, much wider than long and moderately bulky; sternites VI–VII with two pairs of granulose lateral carinae. **Metasoma** (Figs. 7e–g) slightly elongate and markedly enlarged distally; intercarinal tegument very fine and densely granulose, with coarser granules scattered; segment I with ten complete carinae, II–IV with eight (even though the lateral inframedian carinae are present on distal half of II), V with five, all moderately

developed and coarsely granulose to crenulate; dorso-lateral carinae on II–IV with the distal tooth vestigially enlarged; telson oval in lateral view, vesicle not inflated and sparsely granulose, with a subgranulose ventro-medial carina progressively elevated towards the subaculear tubercle, which is very small, conical, placed adjacent to the base of aculeus and lacks any granules; aculeus long, sharp and evenly curved.

Female (Union Island, Figs. 10–11, 13d; Tabs. 3–7): in general is similar to the male, but there is a strong sexual dimorphism evidenced by: (1) mesosoma relatively wider; (2) metasoma shorter and stouter; (3) pedipalp chela much smaller, obtusely subtriangular in shape and narrower to slightly wider than patella; (4) pedipalp fingers with basal lobe/notch combination weaker; (5) genital papillae absent; (6) pectines with basal middle lamella pyriform and strongly dilated; (7) sternite V with smooth patch slightly smaller and less bulky; (8) metasomal segments IV–V and telson dark reddish-brown.

Variation: the adult size of *T. smithii* varies from 58.0–82.7 mm in males, and 57.3–71.8 mm in females (Tab. 3). Pocock (1893) recorded 62.5 mm for a male and 59–63 mm for two females, and Lourenço (1984) measured two females of 57.3 and 69.3 mm. The topo-

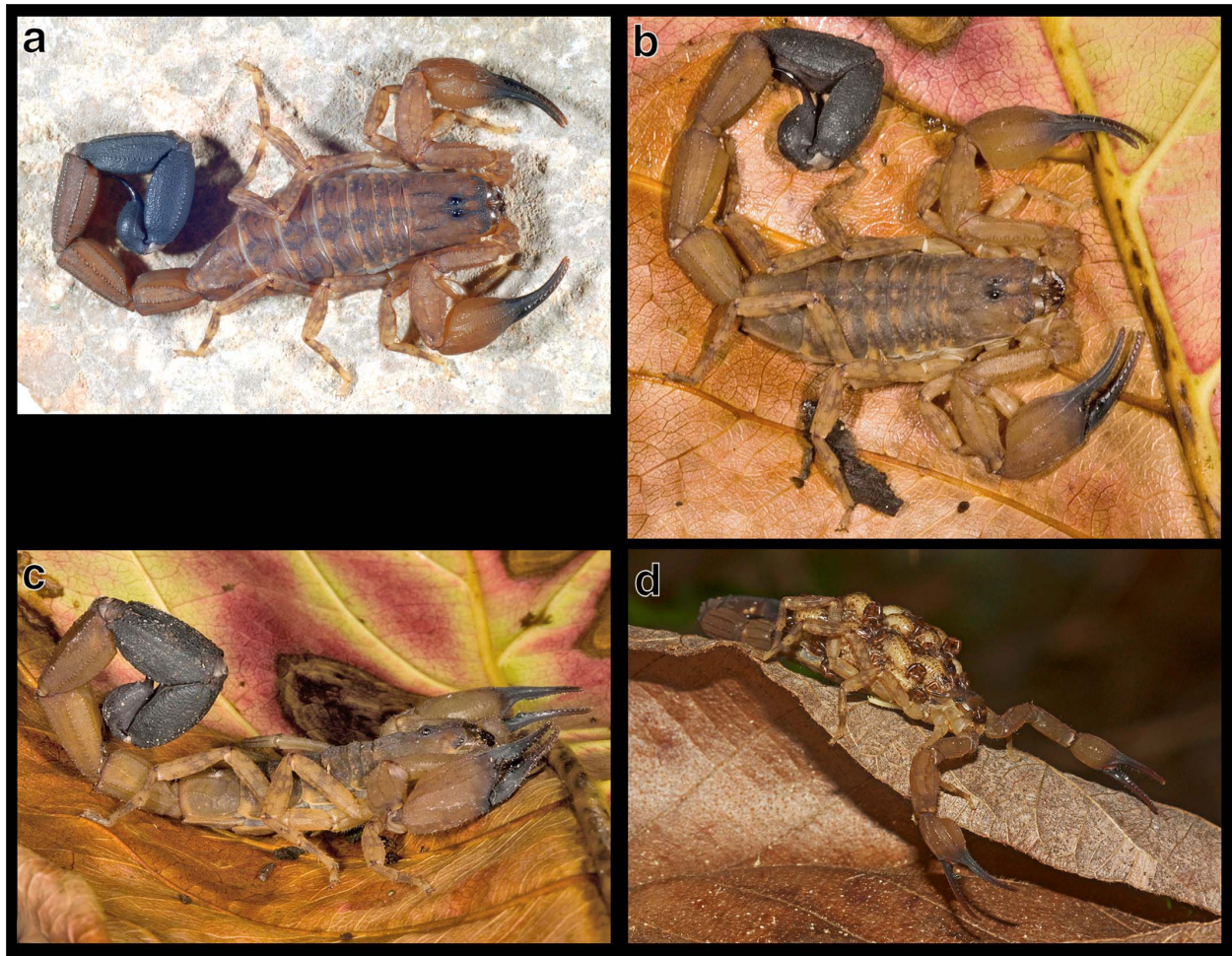


Figure 13: Live individuals of *Tityus smithii*, in their natural habitat: **a.** large adult male topotype; **b–c.** large adult male from Union; **d.** adult female from Union, with litter. Photos courtesy František Kovařík a., Alejandro J. Sánchez b–c. and Mel J. Rivera d.

type male from FKPC matches Pocock's syntype in size, but in the sample from Union the total length is 58.0–82.7 mm in males and 68.6–71.8 in females. These data suggest that there are two different size-classes in each sex.

The degree of expression of sexual dimorphism is positively correlated to the size in both sexes (Figs. 4–11, 13; Tabs. 3–4): the maximum robustness of pedipalp chela, metasomal segments and finger basal lobe/notch combination invariably corresponds to the largest males and females, and vice versa; the dimorphism is well-evident in all size-classes. This progressive size-related gradation on the expression of dimorphism has been documented also for *T. pictus* (see above), as well as many other species of this genus (Lourenço, 1983; Armas et al., 2002; Montoya & Armas, 2002; Kovařík, 2007; Teruel & Armas, 2006; Rojas-Runjaic & Armas, 2007; Teruel, 2000, 2011; Teruel & García, 2008a–b; Teruel & Sánchez, 2009, 2010; Teruel & Kovařík, 2011).

The coloration of the adults shows slight variations in the examined sample. In most specimens from Union,

the three dark stripes of the mesosoma are completely separated by light areas in a perfectly defined pattern (Figs. 6a, 10a, 13b); nevertheless, in the male from Grenada and one female from Union the dark spots are interconnected by reticulations, and the three-striped pattern is diffuse (Figs. 4a, 13a). Also, two males and one female from Union have the dark pattern all over the body and appendages much fainter (Fig. 8–9a) than the remaining specimens.

The posterior margin of sternite V does show important variations among specimens from Union: it exhibits the complete gradation from essentially straight to deeply bilobed (Figs. 6b, 7d, 10b, 11d).

Similar variation is present in the size of the subaculear tubercle among the adults of both sexes: it varies from obsolete (a few specimens from Union) through small (most specimens, including the topotype male).

The variation of pectinal tooth counts known for *T. smithii* is compiled in Table 6. Pocock (1893) recorded 20–21 for males and 18–21 for females, and Lourenço

Ratio	♂♂		♀♀	
	<i>T. pictus</i>	<i>T. smithii</i>	<i>T. pictus</i>	<i>T. smithii</i>
1. Chela (L/W)	4.14–4.41	3.19–3.45	4.48	3.66–4.38
2. Hand (W) / Patela (W)	1.16–1.26	1.46–1.56	0.96	0.96–1.12
3. Movable finger (L) / Hand (W)	2.41–2.59	1.83–2.03	2.96	2.34–2.77
4. Metasoma (L) / Carapace (L)	7.00–7.63	6.63–6.95	5.36	6.00–6.09
5. Metasomal segment I (L/W)	1.75–2.28	1.45–1.52	1.37	1.21–1.31
6. Metasomal segment II (L/W)	2.56–2.92	1.77–1.88	1.81	1.59–1.67
7. Metasomal segment III (L/W)	2.74–3.25	1.94–2.06	1.96	1.67–1.71
8. Metasomal segment IV (L/W)	2.57–3.08	1.77–1.97	2.04	1.71–1.87
9. Metasomal segment V (L/W)	2.73–2.96	1.74–1.84	2.35	1.86–1.88
10. Telson (L) / Aculeus (L)	2.69–3.00	2.08–2.09	3.09	2.00–2.54

Table 5: Diagnostic comparison between adult *Tityus pictus* and *Tityus smithii*, on the basis of some morphometric proportions (data from Tabs. 1, 3). Abbreviations: length (L), width (W).

Species	Sex	N	Pectinal teeth					Mean	SD
			18	19	20	21	22		
<i>T. pictus</i>	♂♂	6			5	1		20.17	± 0.37
	♀♀	8	1	1	5	1		19.75	± 0.83
<i>T. smithii</i>	♂♂	14		4	5	4	1	20.14	± 0.91
	♀♀	16		3	6	7		20.25	± 0.75

Table 6: Variation of pectinal tooth counts in *Tityus pictus* and *Tityus smithii*, including data from Lourenço (1984). Abbreviations: number of pectines (N), standard deviation (SD).

(1984) recorded 19–21 teeth for three females. Among the additional specimens herein studied, the pectinal tooth counts varied from 19–22 in males and 18–21 in females; no differences were detected among different insular populations.

The variation of the number of principal rows of granules on pedipalp fingers known for *T. smithii* is compiled in Table 7. Pocock (1893) did not present any data in the original description, and Lourenço (1984) recorded 15 rows for the movable finger of three females. Among the additional specimens herein studied, the number of principal rows of granules showed an interesting sex-related bias: all males have 14/14 on fixed

finger and 15/15 on movable finger, but among females count varied from 13–14 on fixed finger and 14–15 on movable finger. Similar examples of sex-related variation in this character have been already documented for other species of the genus (Teruel & Armas, 2006; Teruel & García, 2008b; Teruel & Sánchez, 2010).

Juveniles (Fig. 12) are very similar to adults, but can be distinguished by the somewhat different coloration (basically paler, with metasomal segments IV–V and telson of the same color as the rest of metasoma), a less sclerotized cuticle (especially in metasoma and pedipalps), the pedipalp chelae relatively smaller and narrower than patella, metasoma relatively more slender

Species	Sex	Finger	N	Principal rows of granules		Mean	SD	
				14	15			
<i>T. pictus</i>	♂♂	Fixed	2	2		13.00	–	
		Movable	6		1	5	14.83	± 0.37
	♀♀	Fixed	2	2			13.00	–
		Movable	8		2	6	14.75	± 0.43
<i>T. smithii</i>	♂♂	Fixed	12		12	14.00	–	
		Movable	12			12	15.00	–
	♀♀	Fixed	10	6	4		13.40	± 0.49
		Movable	16		6	10	14.63	± 0.48

Table 7: Variation of principal rows of granules in *Tityus pictus* and *Tityus smithii*, including data from Lourenço (1984). Abbreviations: number of rows (N), standard deviation (SD).

and parallel-sided, and a totally different subaculear tubercle (much stronger, sharp and with two dorsal granules).

Ecological notes: according to the information kindly provided by one of the collectors (MJR), in Union Island this species is common and shows some ecological plasticity: it lives under rocks and rotten logs, as well as inside termite nests in dry coastal forest (Figs. 13, 15), syntopically with *Tityus atriventer* Pocock, 1897; one female was observed carrying a litter of about 15 larvae on her back (Fig. 13d).

Material examined: GRENADA (no other data), 1 adult ♂ topotype (FKPC). SAINT VINCENT AND THE GRENADINES, Parish of the Grenadines, Union Island (**new record**), Chatham Bay Trail, 12°35.800 N 61°26.700 W, 31–234 m above sea level, 4–22 June 2010, M. J. Rivera & E. Bentz leg., 1 adult ♂ (IES), 3 adult ♂♂, 2 adult ♀♀, 3 juvenile ♂♂, 2 juvenile ♀♀ (Sco-0472).

Remarks: for a detailed comparison between this species and *T. smithii*, see General Remarks.

The status and composition of the name-bearing types of *T. smithii* is currently confused. Pocock (1893) did not designate a holotype, but declared to have based the original description on three adult males and three adult females from Grenada; two adult males and two adult females from the Grenadines (Mustique and Bequia) were also mentioned, but described “... as [...] a variety [...] called microdon...” [italics herein added].

Lourenço (1984) examined two adult females from Grenada deposited at BMNH (catalogue number 1894.10.20.7–16), in page 99 he affirmed that both specimens belonged “... to the type-series...” [original text in French, translation and italics herein added], and in pages 101–102 he listed them first as “types” [italics herein added], and then as “lectotype” and “paratype” [italics herein added].

On the other hand, Fet & Lowe (2000: 255–256) overlooked this apparently valid designation by Lourenço (1984), and listed as syntypes all specimens from Grenada and Grenadines originally mentioned by Pocock (1893).

Nevertheless, such lectotype designation by Lourenço (1984) is not valid according to the Article 72.4.1.1 of the Code (CINZ, 2000: 84), because there is enough evidence that it was not based upon an actual syntype of *T. smithii*. First of all, Pocock (1893) explicitly mentioned R. V. Sherring as the collector of the types, but the two females studied by Lourenço (1984) were reportedly collected by H. H. Smith. Second, according to the numbering system applied by the BMNH the sample studied by Lourenço (1984) was originally composed of 10 specimens (this is what the range “7–16” means in the catalogue number), but the original description was based only in six specimens as explicitly stated by Pocock (1893). And third, in the original description of *Tityus atriventer*, Pocock (1897: 519) himself declared that its types (coincidentally also from Grenada and collected by H. H. Smith) were “... received too late for notice in my paper upon the West Indian Scorpions...”; this implies that the sample collected by H. H. Smith at Grenada was available to him only after the description of *T. smithii* was either submitted or published, as well as the fact that the types of *T. atriventer* and the specimens of *T. smithii* studied by Lourenço (1984) bear BMNH catalogue numbers (1894.10.20.29–30 and 1894.10.20.7–16, respectively) which indicate that all of them came from a single original sample which was later taxonomically divided. Thus, this case exactly fulfills the Article 74.2 of the Code (CINZ, 2000: 85), which renders invalid any designation of lectotype which has been demonstrated to be based upon a non-syntype specimen; this applies also to the wrong designation by Lourenço (1984: 101) of these two females first as syntypes, and then as lectotype

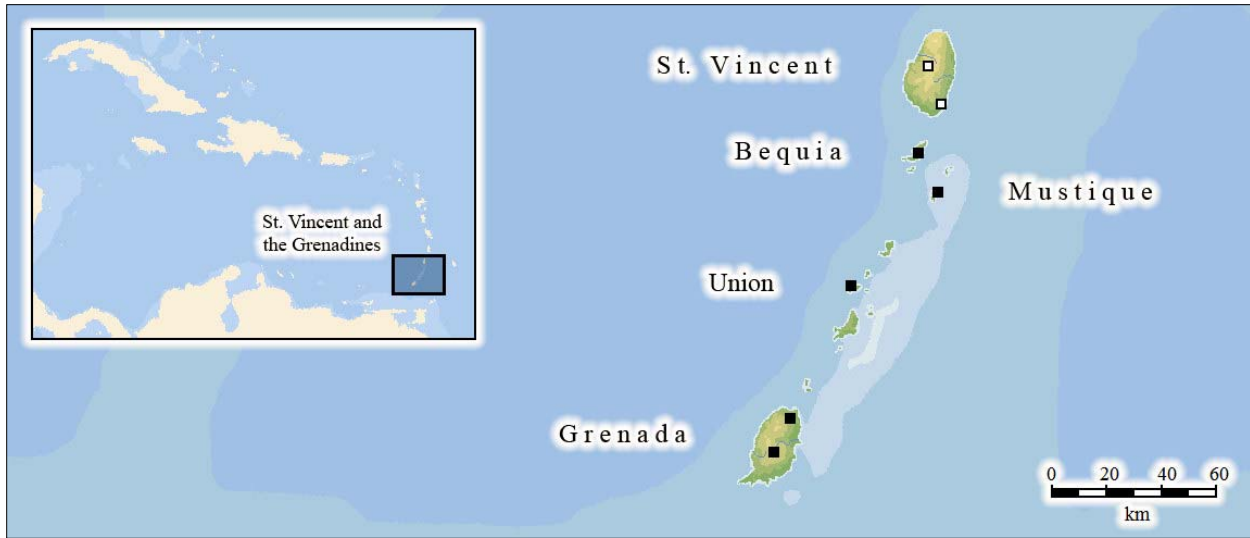


Figure 14: Geographical distribution of *Tityus pictus* (white squares) and *Tityus smithii* (black squares).

and paralectotype of *T. pictus* (see above, in the Remarks section of this species).

It is highly recommended here that any other author who eventually decides to designate a lectotype, must select the adult male from Grenada measured and illustrated by Pocock (1893: 383–384; pl. XXX, fig. 9; the size match between the table and figure demonstrate that both refer to the same specimen about 62.5 mm long), following the Recommendation 74B of the Code that gives preference to a syntype which has been illustrated (CINZ, 2000: 86). It also concurs with the fact that all diagnostic characters of *T. smithii* are best expressed in this sex.

Apart from this, Fet & Lowe (2000: 255–256) wrongly listed as syntypes of *T. smithii* the four specimens from the Grenadines originally mentioned by Pocock (1893). According to the Article 72.4.1 of the Code (CINZ, 2000: 78), these specimens are not syntypes because Pocock (1893) explicitly excluded them all from the type-series by assigning them to the new "variety" he named *microdon* (see below).

Pocock (1893) described the subspecies *T. smithii microdon* on the basis of two couples of adults from Mustique and Bequia, and it was diagnosed by three characters: (1) subaculear tubercle obsolete; (2) pedipalp chelae more robust; (3) pedipalp movable finger with the distal third paler. However, the sample from Union herein examined (11 specimens) renders this distinction invalid, as it contains some specimens which match the definition of each subspecies exactly, together with others that have the same characters either mixed or present in intermediate states (i.e., the width of pedipalp chela is directly correlated to the size of the specimens, but the size of the subaculear tubercle and the color pattern do vary randomly; see Variation above). This is further supported

by the comparison of this sample to a series of high-resolution color photos of an adult male from Grenada (kindly provided by František Kovařík), which revealed that this topotype is morphologically identical to a same-sized male from Union. Last, in view of the geographical distribution of these populations (with the morphologically intermediate specimens located coincidentally at the center of the area; see Fig. 14), it is evident that the recognition of subspecies is not justified. Thus, the present nomenclatural act is proposed: *Tityus smithii* Pocock, 1893 = *Tityus smithii microdon* Pocock, 1893, **new synonym**.

General Remarks

The specific distinction between *T. pictus* and *T. smithii* is a very interesting case, because both species are identical in two important characters which are usually used as diagnostic at this taxonomic level (pectinal tooth count and number of principal rows of granules on pedipalp fingers), but they are in turn very easy to distinguish from each other even to unaided eye on the basis of other characters. The most important of these features is the sexual dimorphism of the adults, which show a completely opposite trend in both taxa: the metasomal segments and pedipalp chelae of the males are much more elongate and slender than those of females in *T. pictus*, but much more robust in *T. smithii*; such different is so obvious that it was already highlighted by Pocock (1893) in the original description of both species. Lourenço (1984) observed this dissimilitude, but incorrectly dismissed it as "a case of polytypism [...] of interbreeding insular populations" [original text in French, translation and italics herein added], obviously because he could not examine any adult males of *T. smithii* (which otherwise



Figure 15: Habitat of *Tityus smithii* at Chatham Bay Trail, Union: **a.** general view from seashore; **b.** closer view from hilltop. Photos courtesy Mel J. Rivera.

have remained either undiscovered or unavailable apart from the syntypes).

The additional samples herein studied have confirmed that Pocock (1893) was correct in most points of his original distinction between *T. pictus* and *T. smithii*. With the addition of further characters, adults of both taxa can be distinguished by: (a) a very different shape of pedipalps and metasoma, most remarkably in males; (b) a very different shape of telson, with the vesicle bulbous and the aculeus very short in *T. pictus*, but with the vesicle flattened and the aculeus remarkably longer in *T. smithii*; (c) differences in pedipalpal and metasomal carination, with carinae composed of fine granules in *T. pictus*, but coarse granules in *T. smithii*; (d) size conspicuously larger in *T. smithii*. Pocock (1893) also addressed slight differences in coloration, but the variation herein observed renders this character useless; the only exception is the base color, which is more yellowish in *T. pictus* and more brownish in *T. pictus*. All the above mentioned differences can be clearly seen in the figures and tables of this paper.

Their geographical distribution also shows an interesting pattern: *T. pictus* appears to be endemic from the island of St. Vincent, while *T. smithii* is widely distributed across Grenada and Grenadines. Despite the finding of the latter at Bequia (just 8 km south of St. Vincent), both species have never been collected together in the same island.

On the other hand, the present contribution sets the number of *Tityus* known from the Lesser Antilles to five. It is worth to make here some comments on the remaining three species:

1. ***Tityus atriventer* Pocock, 1897:** originally described from Grenada, it was recently redescribed and recorded from the Grenadines (Teruel & Kovařík, 2011). It has been long recognized as a member of the “*clathratus*” species-group (Pocock, 1897; Mello-Leitão, 1939; Lourenço, 1984, 2006; Fet & Lowe, 2000; Teruel & Kovařík, 2011).
2. ***Tityus exstinctus* Lourenço, 1995:** described from a single adult male, collected in 1884 in Martinique. Lourenço (1995: 29–31) stated that its closest relative was *Tityus trinitatis* Pocock, 1897 (an endemic species from Trinidad & Tobago), but this association is clearly wrong in view of the deep differences shown by both species in almost all taxonomically important characters (i.e., *T. trinitatis* is a member of the “*androcottoides*” species-group which is characterized by the partial to complete fusion of the ventrosubmedian carinae of the metasoma, but in *T. exstinctus* these carinae are not fused, which is the condition present in all other species-groups of the genus); ironically, this incongruence was even illustrated and mentioned on the same paper (Lourenço, 1995: 29–31; figs. 8–9).

The original description and figures of Lourenço (1995) clearly demonstrate that its closest relatives are in fact *T. pictus* and *T. smithii*, as *T. exstinctus* matches both species perfectly in three key characters (pedipalp movable finger with 14 principal rows of granules, pectines with 22 teeth, and telson with subaculear tubercle minute and aculeus shorter than vesicle), apart from coloration (yellowish brown with a pattern of dark spots, pedipalp fingers, metasomal segments IV–V and telson darker) and general shape of the pedipalps and metasoma.

3. ***Tityus insignis* (Pocock, 1889):** it is endemic from St. Lucia and its satellite islets (Pocock, 1893; Lourenço, 1984; Lourenço & Cloudsley-Thompson, 1999). It was associated by Pocock (1889, 1893) to *T. americanus*, which is a Buthidae *incertae sedis* according to Fet & Lowe (2000). Mello-Leitão (1939) placed it first in his “Group C” (which was actually a “catch-all” where most species of the genus were placed despite how dissimilar they could be), and then in the “*asthenes*” group (Mello-Leitão (1945); this second placement was implicitly followed by Lourenço (1984), who definitely later (Lourenço, 2006) placed it in the subgenus *Tityus (Atreus)*. Nevertheless, such association is incorrect: its closest relatives clearly are *T. exstinctus*, *T. pictus* and *T. smithii*, on the basis of the general shape and sculpture of the pedipalps and metasoma, and especially the shape of the telson (with subaculear tubercle minute to obsolete, and aculeus shorter than vesicle; see Pocock [1893: fig. 1a], Lourenço [1984: figs. 1, 10–11, 13], and Figs. 16a–c herein). Even the few characters which could disassociate *T. insignis* from these three species are not so important when examined in more detail: (a) its coloration is much darker to blackish, but in lighter specimens the typical spotted pattern of *T. exstinctus*, *T. pictus* and *T. smithii* is still traceable (Fig. 16a); (b) the higher numbers of pectinal teeth (21–25) and principal rows of granules on pedipalp movable finger (17) are congruent with the much larger size of this species (90–110 mm), a trend that has already been documented in other species-groups of this genus (Teruel & Armas, 2006; Rojas-Runjaic & Armas, 2007).

With the present contribution, the taxonomy of the Lesser Antilles members of *Tityus* has changed. Previously considered as a heterogeneous assemblage (Lourenço, 1984; Armas, 1988), it is herein demonstrated to be a much more homogeneous composite of five species which belong to only two well-defined lineages: (*T. atriventer*) and (*T. exstinctus* + *T. insignis* + *T. pictus* + *T. smithii*).

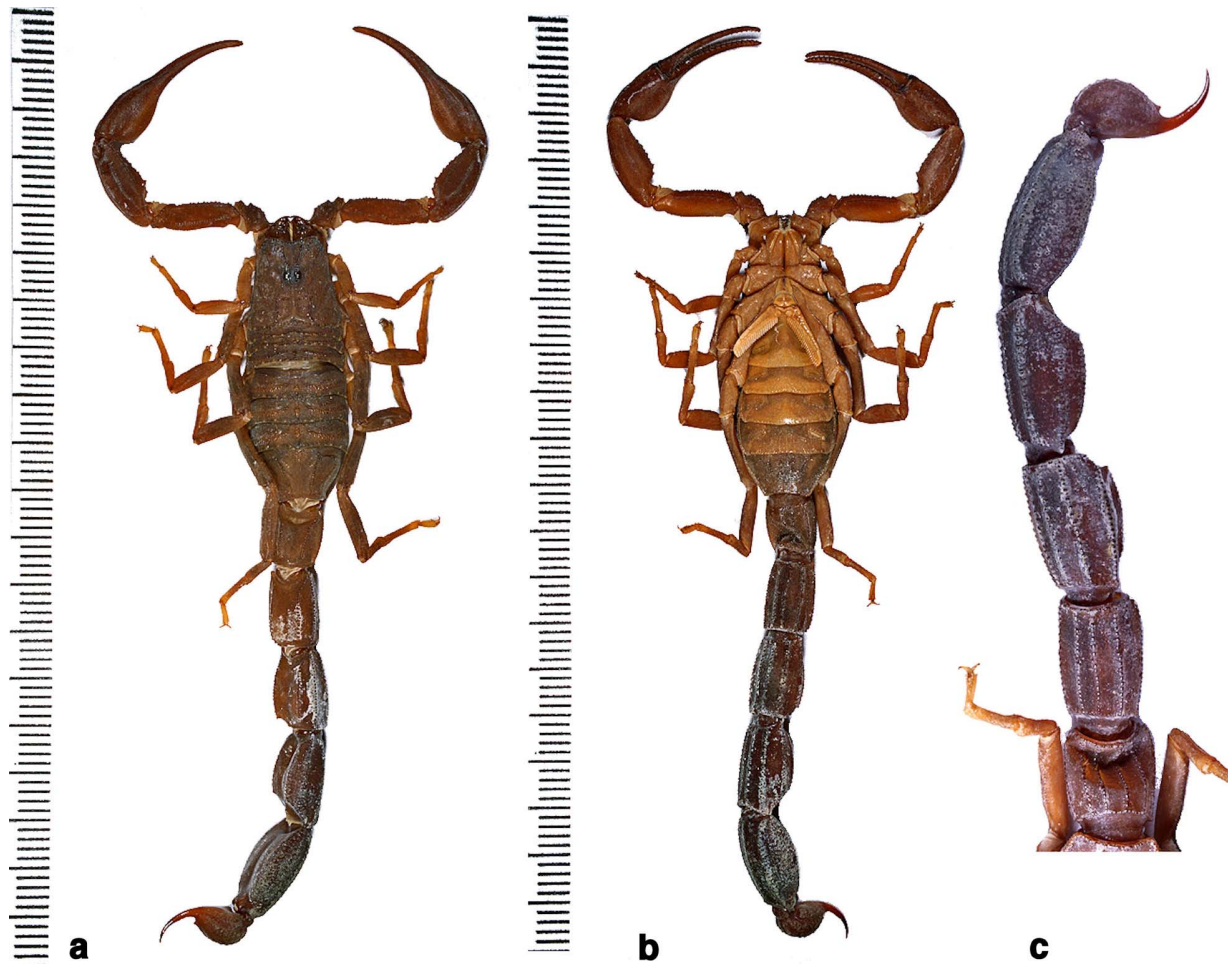


Figure 16: Adult female topotype of *Tityus insignis* (RMNH): **a.** entire dorsal view; **b.** entire ventral view; **c.** metasoma, lateral view. Photos courtesy František Kovařík.

The first species belong to the “*clathratus*” species-group, which is widespread and well-diversified across South-America and adjacent Central America (Costa Rica and Panama). It appears to be a recent immigrant into the Antilles, on the basis of its geographical distribution: *T. atriventer* is its only member present in (and endemic from) the Lesser Antilles (Teruel & Kovařík, 2011), while about 20 other species occur in the continental part of its range, including Trinidad & Tobago (Lourenço, 2006, 2008; Rojas-Runjaic & Armas, 2007; Teruel & Roncallo, 2010).

The remaining four species form a morphologically compact group, but it has been recognized as such only in this paper because in a similar way to *T. extinctus* and *T. insignis*, the relationships of both *T. pictus* and *T. smithii* to the other members of the genus have been largely controversial. Pocock (1893) originally associated them to *Tityus melanostictus* Pocock, 1893, which is currently placed in its own species-group (Fet & Lowe, 2000). Mello-Leitão (1939) placed them in his “Group C”

(already commented on above), and finally, Fet & Lowe (2000) listed them in the “*clathratus*” group, a placement implicitly retained by Lourenço (2006) as the subgenus *Tityus* (*Archaeotityus*). These four species (*T. extinctus*, *T. insignis*, *T. pictus* and *T. smithii*) are much more closely related to each other than to any other member the genus, and also cannot be satisfactorily placed either in any of the species-groups of Fet & Lowe (2000), nor in the subgenera of Lourenço (2006). The only potential matches are first the “*crassimanus*” group as defined by Teruel & Armas (2006), and second the “*quisqueyanus*” group as defined by Armas & Abud (2004), but this relationship still needs to be investigated in detail.

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References

- ARMAS, L. F. DE. 1982. Algunos aspectos zoológicos de la escorpiofauna antillana. *Poeyana*, 238: 1–17.
- ARMAS, L. F. DE. 1988. *Sinopsis de los escorpiones antillanos*. La Habana: Editorial Científico-Técnica, 102 pp.
- ARMAS, L. F. DE & A. J. ABUD. 2004. Adiciones al género *Tityus* C. L. Koch, 1836 en República Dominicana, con la descripción de dos especies nuevas (Scorpiones: Buthidae). *Revista Ibérica de Aracnología*, 10: 53–64.
- ARMAS, L. F. DE, C. VÍQUEZ & M. MONTOYA. 2002. Complementos a la descripción de *Tityus dedoslargos* (Scorpiones, Buthidae). *Revista de Biología Tropical*, 50(1): 161–167.
- COMISIÓN INTERNACIONAL DE NOMENCLATURA ZOOLOGICA [CINZ]. 2000. *Código Internacional de Nomenclatura Zoológica*. 4ª edición. (Spanish translation by M. A. Alonso-Zarazaga), 156 pp.
- FET, V. & G. LOWE. 2000. Family Buthidae C. L. Koch, 1837. Pp. 54–286 in Fet, V., W. D. Sissom, G. Lowe & M. E. Braunwalder. *Catalog of the Scorpions of the World (1758–1998)*. New York, NY: The New York Entomological Society.
- FRANCKE, O. F. 1977. Scorpions of the genus *Diplocentrus* Peters from Oaxaca, Mexico. *Journal of Arachnology*, 4: 145–200.
- KOVAŘÍK, F. 2007. Description of *Tityus mraceki* sp.n. from Colombia and synonymization of *T. meridanus* González-Sponga with *T. nematochirus* Mello-Leitão (Scorpiones: Buthidae). *Euscorpius*, 54: 1–7.
- KRAEPELIN, K. 1899. Scorpiones und Pedipalpi. Pp. 1–265 in F. Dahl (ed.). *Das Tierreich. Herausgegeben von der Deutschen Zoologischen Gesellschaft. 8. Arachnoidea*. Berlin: R. Friedländer und Sohn Verlag.
- LOURENÇO, W. R. 1983. La faune des scorpions de Guyane française. *Bulletin du Muséum national d'Histoire naturelle*, 4^e série, section A, 5(3): 771–808.
- LOURENÇO, W. R. 1984. Considérations sur les espèces de *Tityus* (Scorpiones, Buthidae) décrites des Petites Antilles. *Revue Arachnologique*, 5(3): 91–105.
- LOURENÇO, W. R. 1992. Les peuplements des Scorpions des Antilles; facteurs historiques et écologiques en association avec les stratégies bi-démographiques. *Studies on Neotropical Fauna and Environment*, 27(1): 43–62.
- LOURENÇO, W. R. 1995. The remarkable discovery of a new and extinct species of *Tityus* from Martinique in the Lesser Antilles (Chelicerata, Scorpiones, Buthidae). *Anales de la Universidad Nacional Autónoma de México, Serie Zoológica*, 66(1): 27–32.
- LOURENÇO, W. R. 2002. *Scorpions of Brazil*. Paris: Les Éditions de l'If, 308 pp.
- LOURENÇO, W. R. 2006. Nouvelle proposition de découpage sous-générique du genre *Tityus* C. L. Koch, 1836 (Scorpiones, Buthidae). *Boletín de la Sociedad Entomológica Aragonesa*, 39: 55–67.
- LOURENÇO, W. R. 2008. Nouvelles considérations sur le statut taxonomique e quelques espèces du genre *Tityus* C. L. Koch, 1836 (Scorpiones, Buthidae) décrites de la Colombie. *Acta Biologica Paraense, Curitiba*, 37(3–4): 195–209.
- MELLO-LEITÃO, C. DE. 1931. Divisão e distribuição do gênero *Tityus* Koch. *Annaes da Academia Brasileira de Ciências*, 3(3): 119–150.
- MELLO-LEITÃO, C. DE. 1939. Revisão do gênero *Tityus*. *Physis*, 17: 57–76.
- MELLO-LEITÃO, C. DE. 1945. Escorpiões sul-americanos. *Arquivos do Museu Nacional*, 40: 7–468.

- MONTOYA, M. & L. F. DE ARMAS. 2002. Escorpiones (Arachnida) del Archipiélago de Bocas del Toro, Panamá. *Revista de Biología Tropical*, 50(1): 155–160.
- POCOCK, R. I. 1893. Contributions to our knowledge of the arthropod fauna of the West Indies. Part I. Scorpiones and Pedipalpi, with a supplementary note upon the freshwater Decapoda of St. Vincent. *Journal of the Linnaean Society*, 24: 374–409.
- ROJAS-RUNJAIC, F. J. M. & L. F. DE ARMAS. 2007. Dos nuevas especies venezolanas del grupo *Tityus clathratus* y notas sobre *Tityus ramirezi* Esquivel de Verde, 1968 (Scorpiones: Buthidae). *Boletín de la Sociedad Entomológica Aragonesa*, 41: 53–66.
- 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. 2000. Complementos a la descripción de *Tityus michelii* Armas, 1982 (Scorpiones: Buthidae). *Boletín de la Sociedad Entomológica Aragonesa*, 27: 65–67.
- TERUEL, R. 2011. La verdadera identidad de *Tityus championi* Pocock 1898 (Scorpiones: Buthidae). *Boletín de la Sociedad Entomológica Aragonesa*, 48: 367–373.
- TERUEL, R. & L. F. DE ARMAS. 2006. Revisión del grupo "*Tityus crassimanus*" (Scorpiones: Buthidae), con la descripción de una nueva especie de la República Dominicana. *Boletín de la Sociedad Entomológica Aragonesa*, 39: 139–143.
- 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. & F. KOVAŘÍK. 2011. Redescription and taxonomic position of *Tityus atriventer* Pocock, 1897 (Scorpiones: Buthidae). *Euscorpius*, 115: 1–9.
- TERUEL, R. & C. A. RONCALLO. 2010. Rare or poorly known scorpions from Colombia. IV. Additions, synonymies and new records (Scorpiones: Buthidae, Scorpionidae). *Euscorpius*, 105: 1–15.
- TERUEL, R. & A. J. SÁNCHEZ. 2009. Una nueva especie de *Tityus* del grupo "*crassimanus*" (Scorpiones: Buthidae) de Puerto Rico. *Boletín de la Sociedad Entomológica Aragonesa*, 45: 329–333.
- TERUEL, R. & A. J. SÁNCHEZ. 2010. Contribución al conocimiento de *Tityus obtusus* (Karsch 1879), escorpión endémico de Puerto Rico (Scorpiones: Buthidae). *Boletín de la Sociedad Entomológica Aragonesa*, 46: 467–473.
- 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*, 3^e série, 140 (Zoologie, 104): 857–958.