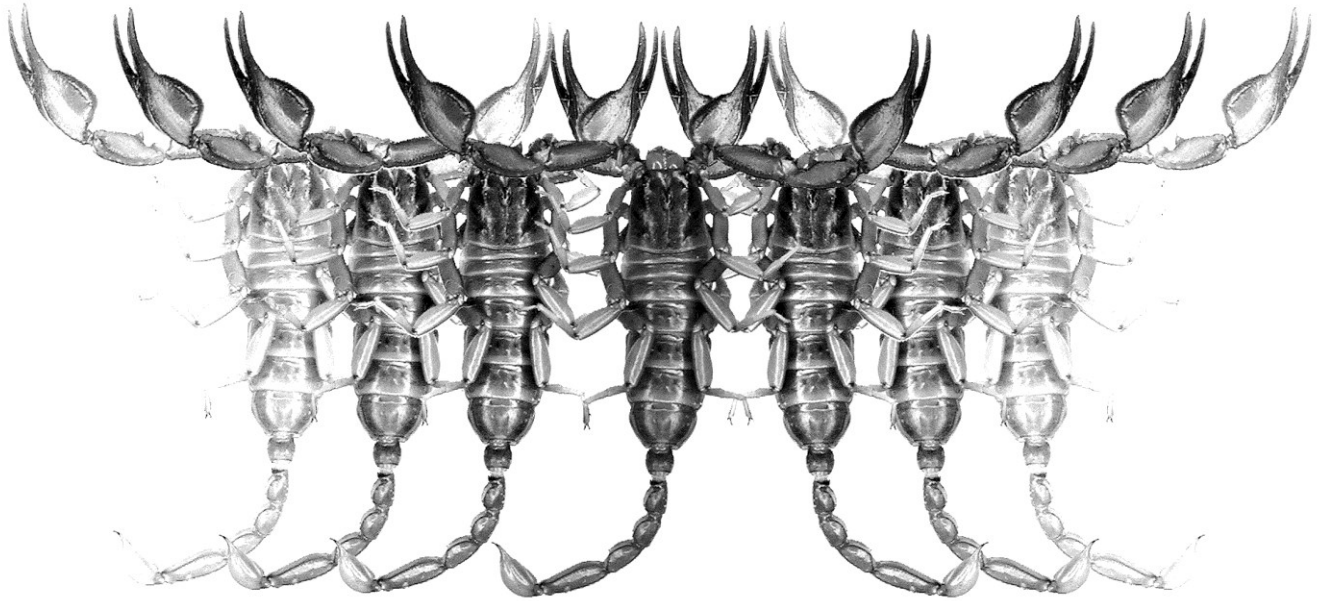


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Tityus carolineae sp. n. from Suriname and Guyana
(Scorpiones: Buthidae)

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Tityus carolineae sp. n. from Suriname and Guyana (Scorpiones: Buthidae)

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Summary

Tityus carolineae sp. n. from Suriname and Guyana is described and compared with other species of the "*Tityus metuendus*" complex, inside the "*Tityus asthenes*" group. *Tityus carolineae* sp. n. is the largest species of this complex, with total length of males 82–100 mm.

Introduction

The genus *Tityus* is by far the most diverse amongst all scorpions, with 211 species currently recognized as valid (Rein, 2013). As it could be expected for such a large genus, it has been divided many times into a very different array of species-groups according to every author (see an almost complete history in Fet & Lowe, 2000), and even once into subgenera (Lourenço, 2006), but the latter have not been widely accepted among scorpologists.

One of the species-groups that have received attention by taxonomists during the last decade is the so-called "*Tityus asthenes* group". After its listing as a catalogue by Fet & Lowe (2000), several additions have been published with description of new species, the re-description and/or revalidation of old synonyms, and the removal of some of its members (Armas *et al.*, 2002; Lourenço & Leguin, 2008; Teruel & García, 2008; Teruel, 2011a–b; Lourenço, 2012). In the present paper we describe yet another new species belonging to this group, which occurs in a few localities of the Guiana Shield.

Systematics

Tityus carolineae Kovařík, Teruel, Cozijn et
Seiter, **sp. n.**

(Figs. 1–18, 31–32)

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TYPE LOCALITY AND TYPE REPOSITORY. **Suriname**: Sipaliwini District, Oelemarie airstrip, 03°06'N 54°32'W; RMNH (National Museum of Natural History, Leiden, The Netherlands).

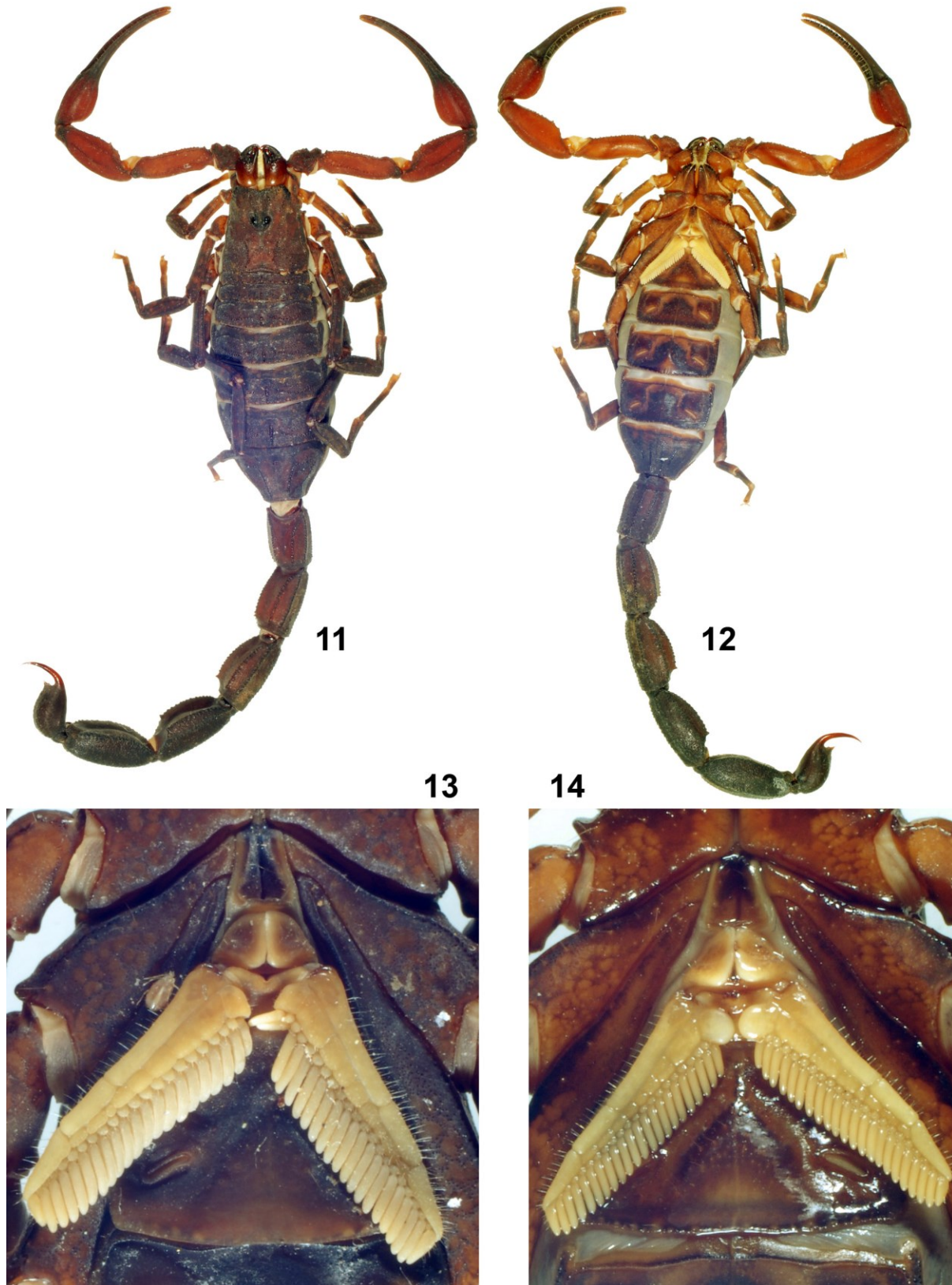
TYPE MATERIAL. **Suriname**: Sipaliwini District, Oelemarie airstrip, 03°06'N 54°32'W, January–March 1960, leg. N. van Aerle, don. D. C. Geijskes. 2♂ (holotype and paratype), RMNH, 1♂ (paratype), FKCP (first author's collection), 1♂ (paratype), RTOC (second author's collection); Coeroeni Island, ca 03°22'N 57°20'W, August 1957, leg. D. C. Geijskes, 3♂2♀1♀im.4juvs. (paratypes), RMNH, 1♂1♀ (paratypes), FKCP, 1♀ (paratype), RTOC. **Guyana**: Rupununi River next to Lethem, March 2012, leg. E. Kukulak, 1♂1♂im. (paratypes), RTOC, 1♂im. (paratype), NHMW 21889 (Naturhistorisches Museum Wien, Vienna, Austria).

ETYMOLOGY. The species name is dedicated to Miss Caroline Pepermans, Collections Manager at RMNH, who kindly allowed us access to the specimens herein designated as types and provided all facilities for their study, either directly at the museum or through loans.

DIAGNOSIS. Total length of males 82–100 mm, of females 70–84 mm. Body uniformly dark reddish brown to blackish, pedipalps reddish, with blackish fingers. Pedipalp chela large and robust in males, small and oval in females, in both sexes with very long fingers. Sternite V with a conspicuous smooth patch in both sexes, larger in males. Metasoma moderately elongate and markedly



Figures 1–10: *Tityus carolineae* sp. n. 1–9. Dorsal (1) and ventral (2) views, carapace and chelicerae (3), movable finger (4), and trichobothrial pattern of pedipalp (5. Chela dorsal. 6. Chela external. 7. Patella dorsal. 8. Patella external. 9. Femur dorsal), ♂ holotype. 10. Chela, external view, ♀ paratype.



Figures 11–14: *Tityus carolineae* sp. n. 11–12, 14. Dorsal (11) and ventral (12) views, and pectinal area (14), ♀ paratype. 13. Pectinal area, ♂ holotype.

enlarged distally only in males, with all carinae moderate and finely serrate to crenulate; dorsolateral carinae of metasomal segments II–IV with distal tooth enlarged. Telson oval and sparsely granulose; subaculear tubercle large and sharp, with two dorsal granules. Pedipalp fixed finger with 14–16 principal rows of denticles, movable finger with 13–16 principal rows of denticles; basal lobe/notch combination strong in males, weak in females. Pectines with 19–22 teeth in males, 18–22 in females; basal middle lamella obtusely angulose and slightly dilated in males, rounded and strongly dilated in females.

DESCRIPTION (male holotype). For habitus see Figs. 1–2. Chelicerae with dentition typical for the genus. Tegument coriaceous to very finely granulose, with a few coarser granules scattered. Legs with all carinae finely granulose to costate; intercarinal tegument coriaceous.

COLORATION (Figs. 1–10). Uniformly dark reddish brown to blackish. Chelicerae very densely reticulated with blackish brown all over the manus; fingers blackish. Pedipalps light reddish brown, essentially immaculate (only the tips of femur, patella and hand are infuscate); fingers blackish with yellowish tips. Pectines yellowish, immaculate. Sternite V with smooth patch yellowish.

MESOSOMA AND CARAPACE. Carapace (Fig. 3) trapezoidal, anterior margin very widely V-shaped. Anterior median and lateral ocular carinae weak, irregularly granulose, superciliary carinae strong, smooth, posterior median carinae strong, evenly granulose, other carinae obsolete to absent. Anterior median furrow, central transverse furrow, lateral central and posterior lateral furrows wide, shallow, central median and posterior median furrows wide, deep. Tegument coriaceous to very finely granulose, with a few scattered coarser granules. Median eyes separated by about one ocular diameter; three pairs of lateral eyes, which are smaller than median eyes. Tergites with the same granular sculpture as on carapace. Longitudinal carina strong, granulose; Tergite VII with two pairs of finely serrate to granulose lateral carinae. Sternum (Fig. 13) of type 1, long, narrow and markedly triangular. Pectines (Fig. 13) somewhat small, just reaching the coxa-trochanter joint of leg IV; pectinal tooth count 21/21; basal middle lamella acutely angulose and markedly dilated. Sternites with slit-like spiracles; sternite III with the lateral areas slightly depressed and very finely granulose to smooth; sternites IV–VI essentially smooth, sternite VII finely and densely granulose; posterior margin of sternite V with a large, smooth, yellowish, subtriangular patch, which is much wider than long and moderately bulky; sternite VII with two pairs of granulose lateral carinae.

METASOMA AND TELSON (Figs. 15–17). Metasoma somewhat elongate and markedly enlarged distally;

intercarinal tegument coriaceous, with scattered small granules; segment I with 10 complete carinae, segments II–IV with eight carinae (even though the lateral infra-median carinae are indicated on distal third of segment II by 1–2 granules), segment V with five carinae, all moderately developed and finely serrate to crenulate; dorsolateral carinae on II–IV with the distal tooth slightly to moderately enlarged. Telson oval, vesicle smooth to coriaceous, with a subgranulose ventromedian carina progressively elevated towards the subaculear tubercle, which is large, very sharp, placed close to the base of aculeus and with two large dorsal granules; aculeus long, sharp and strongly curved.

PEDIPALPS. For position and distribution of trichobothria on the patella of pedipalps see Figs. 5–9, orthobothriotaxic A- α . Femur with all carinae finely subserrate to granulose; intercarinal tegument very finely and densely granulose. Patella with all carinae finely granulose to costate; intercarinal tegument with the same granular sculpture as on femur, internal surface with several small, conical granules. Chela robust, noticeably wider than patella; hand with all carinae weak, costate to finely subgranulose, intercarinal tegument coriaceous; fingers very long, with basal lobe/notch combination strong, fixed finger with 15/15 principal rows of denticles, movable finger with 16/16 principal rows of denticles, apical subrow composed of four granules aligned similar to principal rows.

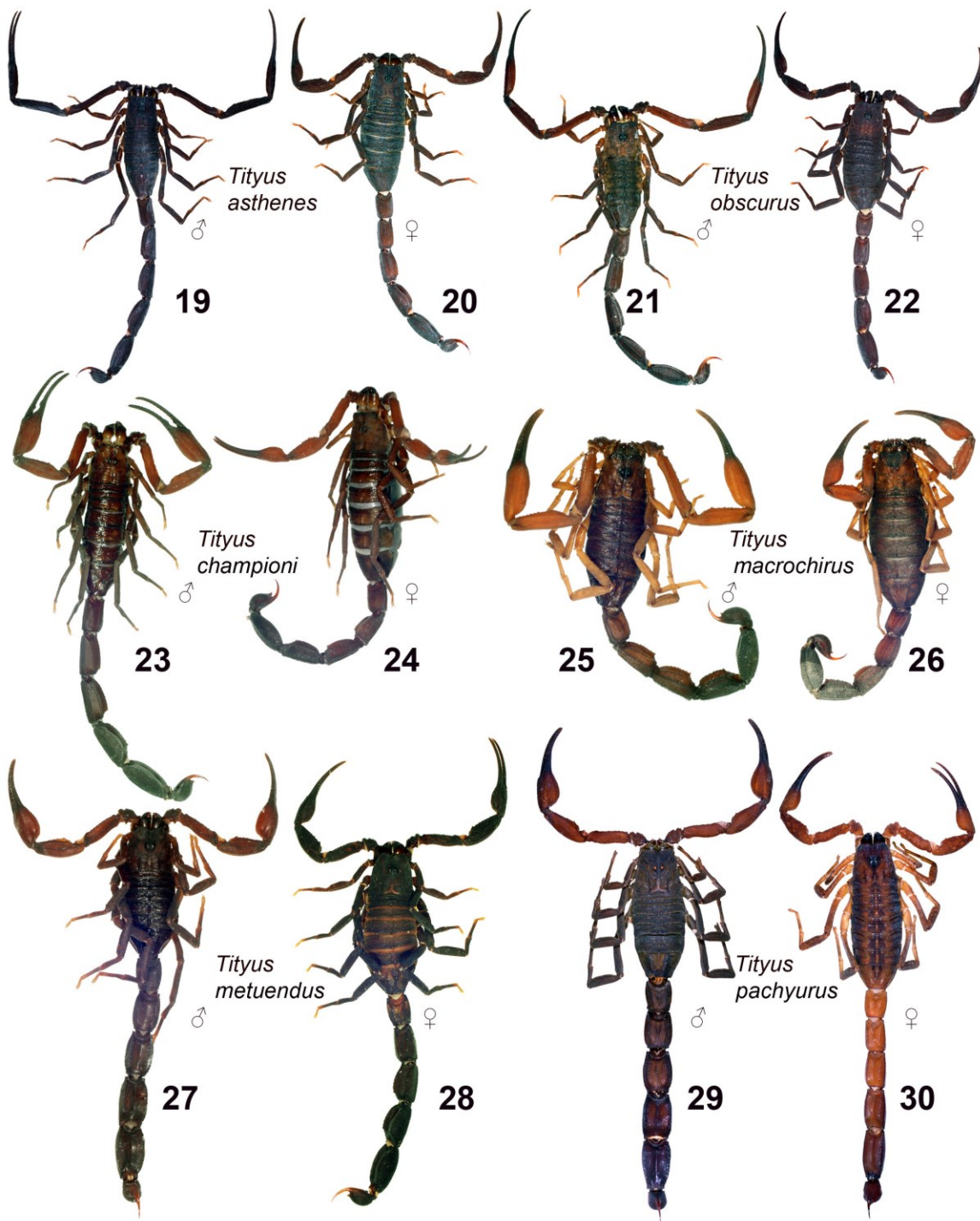
MEASUREMENTS IN MM. Total length of *male holotype* 91; carapace length 8.5, width 8.2; metasoma and telson length 58.2; first metasomal segment length 7.6, width 4.7; second metasomal segment length 9.4, width 4.6; third metasomal segment length 10.5, width 5.0; fourth metasomal segment length 11.2, width 5.7; fifth metasomal segment length 11.0, width 5.8; telson length 8.5; pedipalp femur length 10.2, width 2.4; pedipalp patella length 10.6, width 3.4; chela length 18.9; manus width 5.0; movable finger length 11.5.

FEMALE (Figs. 10–12, 14, 18). In general similar to the male, but there is a strong sexual dimorphism evidenced by: **1**) mesosoma relatively wider (Figs. 17 versus 18); **2**) metasoma shorter and essentially parallel-sided (Figs. 17 versus 18); **3**) pedipalp chela much smaller and as wide as or slightly wider than patella (Figs. 6 versus 10); **4**) pedipalp fingers with basal lobe/notch combination weak; **5**) pectines with basal middle lamella oval to round and more dilated, and with teeth shorter and narrower (Figs. 13 versus 14); **6**) genital papillae absent; **7**) sternite V with the smooth patch smaller.

Total length of female paratype 79; carapace length 7.8, width 7.7; metasoma and telson length 45.9; first metasomal segment length 5.8, width 4.2; second metasomal segment length 6.8, width 4.1; third metasomal segment length 7.5, width 4.3; fourth metasomal segment length 8.4, width 4.3; fifth metasomal segment length 9.1,



Figures 15–18: *Tityus carolineae* sp. n. 15–17. Metasoma and telson in lateral (15), dorsal (16) and ventral (17) views, ♂ holotype. 18. Metasoma and telson in ventral view, ♀ paratype.



Figures 19–30: Figures 19–22. "*Tityus asthenes*" complex. 19–20. *Tityus asthenes* Pocock, 1893, dorsal views of ♂ (76 mm) and ♀ (75 mm), Ecuador, Santo Domingo Province, Tandapi, FKCP. 21–22. *Tityus obscurus* (Gervais, 1843), dorsal views of ♂ (75 mm) and ♀ (78 mm), French Guiana, Saint-Laurent-du-Maroni District, Acarouany, FKCP. **Figures 23–26.** "*Tityus macrochirus*" complex. 23–24. *Tityus championi* Pocock, 1898, dorsal views of ♂ (84 mm), Costa Rica, Puntarenas Province, Península de Osa, Puesto Jiménez, Río Agujas, Agujas station, Sendero Zamia, 300 m a.s.l., RTOC: Sco-0136 and ♀ (62 mm), Costa Rica, Puntarenas Province, Albergue Cerro de Oro, 270 m a.s.l., RTOC: Sco-0138. 25–26. *Tityus macrochirus* Pocock 1897, dorsal views of ♂ (68 mm) and ♀ (60 mm), Colombia, Cundinamarca Department, Cáqueza, RTOC: Sco-0398. **Figures 27–30.** "*Tityus metuendus*" complex. 27–28. *Tityus metuendus* Pocock, 1897, dorsal views of ♂ (68 mm), Peru, Ucayali Department, Puerto Grau, ca 100 km SW Pucallpa, FKCP and ♀ (70 mm), Peru, Loreto Department, Mano Capa, one hour from Indiana City, Río Amazonas, FKCP. 29–30. *Tityus pachyurus* Pocock, 1897, dorsal views of ♂ (60 mm) and ♀ (68 mm), Colombia, Boyacá Department, Tipacoque, 1800–2200 m a.s.l., FKCP.



Figure 31: *Tityus carolineae* sp. n., ♂ paratype, Guyana, Rupununi River next to Lethem.

Sex	N	Pectinal tooth count					AVE	SD
		18	19	20	21	22		
Males	15		2	4	5	4	20.73	± 1.03
Females	20	1	2	11	4	2	20.20	± 0.95

Table 1: Pectinal tooth count variation in *Tityus carolineae* sp. n. Abbreviations: number of pectines (N), average (AVE), standard deviation (SD).

width 4.2; telson length 8.3; pedipalp femur length 7.6, width 2.1; pedipalp patella length 8.3, width 3.2; chela length 15.4; manus width 3.3; movable finger length 10.6.

VARIABILITY. Pectinal tooth counts vary as shown in Table 1. Absolute ranges are very similar in both sexes (males 19–20, females 18–20), but males do not show any modal tendency while in females it is clearly fixed at 20.

AFFINITIES. The described features distinguish *Tityus carolineae* sp. n. from all other species of the genus. The species currently assigned to the "*Tityus asthenes*" group can be divided according to the type of sexual dimorphism found in the adult male pedipalps (especially the chela), into three species complexes:

"*Tityus asthenes*" complex (Figs. 19–22). Males with pedipalps extremely long and slender, and the chela elongate and very thin (filiform), conspicuously narrower than the patella. It includes the following species:

Tityus antioquensis Lourenço et Otero, 1998; *Tityus apiacas* Lourenço, 2002; *Tityus asthenes* Pocock, 1893 (Figs. 19–20); *Tityus braziliae* Lourenço et Eickstedt, 1984; *Tityus dedoslargos* Francke et Stockwell, 1987; *Tityus matthieseni* Pinto-da-Rocha et Lourenço, 2000; *Tityus nematochirus* Mello-Leitão, 1940; *Tityus obscurus* (Gervais, 1844) (Figs. 21–22); *Tityus oteroi* Lourenço, 1998, *Tityus unus* Pinto-da-Rocha et Lourenço, 2000; and *Tityus vaissadei* Lourenço, 2002.

"*Tityus macrochirus*" complex (Figs. 23–26). Males with pedipalps very long but not extremely slender, and the chela elongate and robust, slightly to moderately wider than the patella. It includes the following species: *Tityus championi* Pocock, 1898 (Figs. 23–24); *Tityus dinizi* Lourenço, 1997; *Tityus macrochirus* Pocock, 1897 (Figs. 25–26); and *Tityus tucurui* Lourenço, 1988.

"*Tityus metuendus*" complex (Figs. 27–30). Males with pedipalps somewhat longer but not slender, and the chela robust and conspicuously wider than the patella. It includes the following species: *Tityus festae* Borelli,

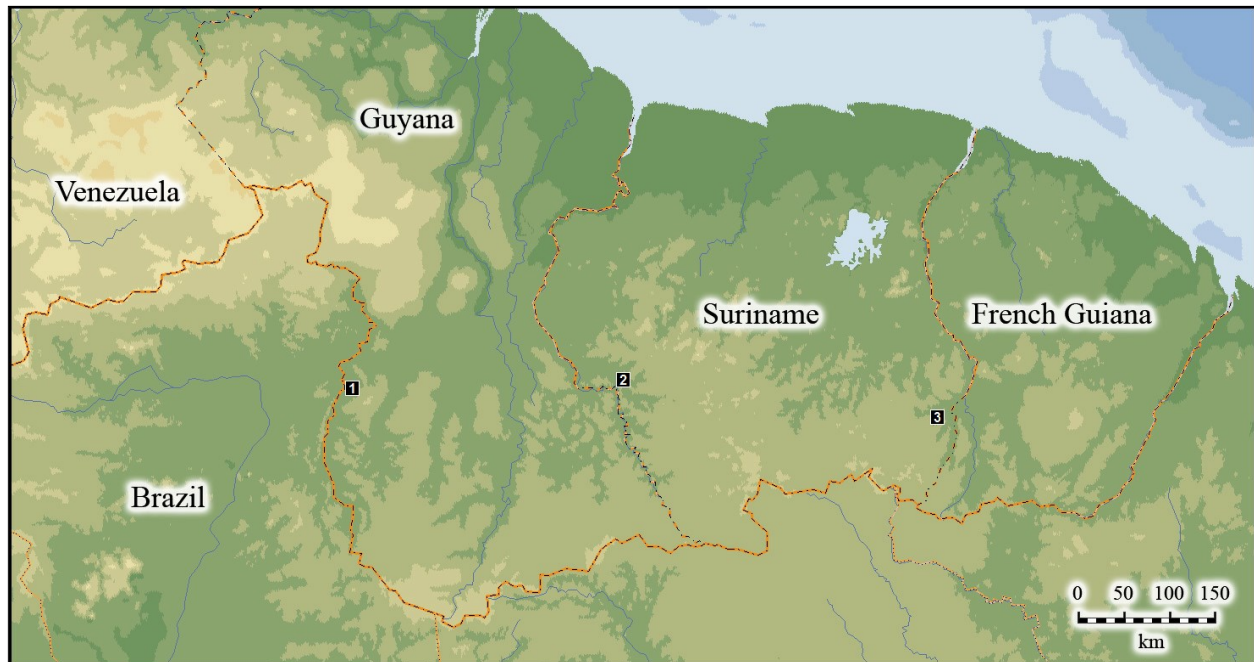


Figure 32: Distribution map of *Tityus carolineae* sp. n.: Rupununi (1), Coeroeni (2), Oelemarie (3).

1899; *Tityus metuendus* Pocock, 1897 (Figs. 27–28); *Tityus pachyurus* Pocock, 1897 (Figs. 29–30); *Tityus sabineae* Lourenço, 1994; and *Tityus timendus* Pocock, 1898.

It is clear that *Tityus carolineae* sp. n. belongs in the "*Tityus metuendus*" complex; the characters that allow its separation from other species of the complex are re-counted below.

T. festae. This species is known only from eastern Panama through northwestern Colombia (Lourenço, 1984; Lourenço & Méndez, 1984; Fet & Lowe, 2000). According to our study of the holotype and additional specimens from Panama, it is smaller (60–85 mm), the coloration of the adults is much darker (pitch black), the metasoma has all carinae composed by granules which are much coarser and more separated from each other, and the pedipalp chela is conspicuously less robust.

T. metuendus (Figs. 27–28). This species is widespread in west-central Amazonia, from Peru through Brazil (Lourenço, 1983, 2011; Fet & Lowe, 2000). According to specimens herein examined it is somewhat smaller (68–90 mm), the metasoma is shorter, stouter and has all carinae stronger and intercarinal spaces coarsely granulate, and the pedipalps are shorter and stouter.

T. pachyurus (Figs. 29–30). This species is widespread from Costa Rica through Colombia (Francke & Stockwell, 1987; Lourenço, 1997; Fet & Lowe, 2000). According to specimens herein examined it is smaller (54–76 mm), the coloration varies but always exhibits three wide, dark stripes along the tergites (very well

defined in juveniles and lighter adults, fainter in darker adults), the metasoma is shorter and has all carinae stronger, and the pedipalp chela is conspicuously less robust.

T. sabineae. This species is apparently endemic to central Colombia and remains very poorly known (Lourenço, 1994, 1997; Fet & Lowe, 2000). According to the original description (Lourenço, 1994) and additional photographs published elsewhere (Lourenço, 1997) it can be distinguished by the same characters given above for *T. metuendus*.

T. timendus. This species remains known only from the holotype adult male from Cachaví, in Esmeraldas, northwestern Ecuador (Pocock, 1897). According to its recent redescription provided by Lourenço (2012) it is much smaller (65 mm), the metasoma is shorter, distally narrowed and has the second and third segments with 10 complete carinae; the pedipalp chela is much smaller, only slightly wider than patella, and with the basal lobe/notch combination of the fingers much weaker.

It is also very likely that the "*Tityus forcipula*" group as currently recognized can be satisfactorily merged with the "*Tityus metuendus*" complex of the "*Tityus asthenes*" group, as its only differentiating character is the highly developed granulation of the dorso-lateral carinae of metasomal segments II–IV in the former (always with several very distinct spinoid to denticulate granules). However, such a step is beyond the scope of this paper; the same character can be used to distinguish *Tityus carolineae* sp. n. from all members of the "*Tityus forcipula*" group.

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