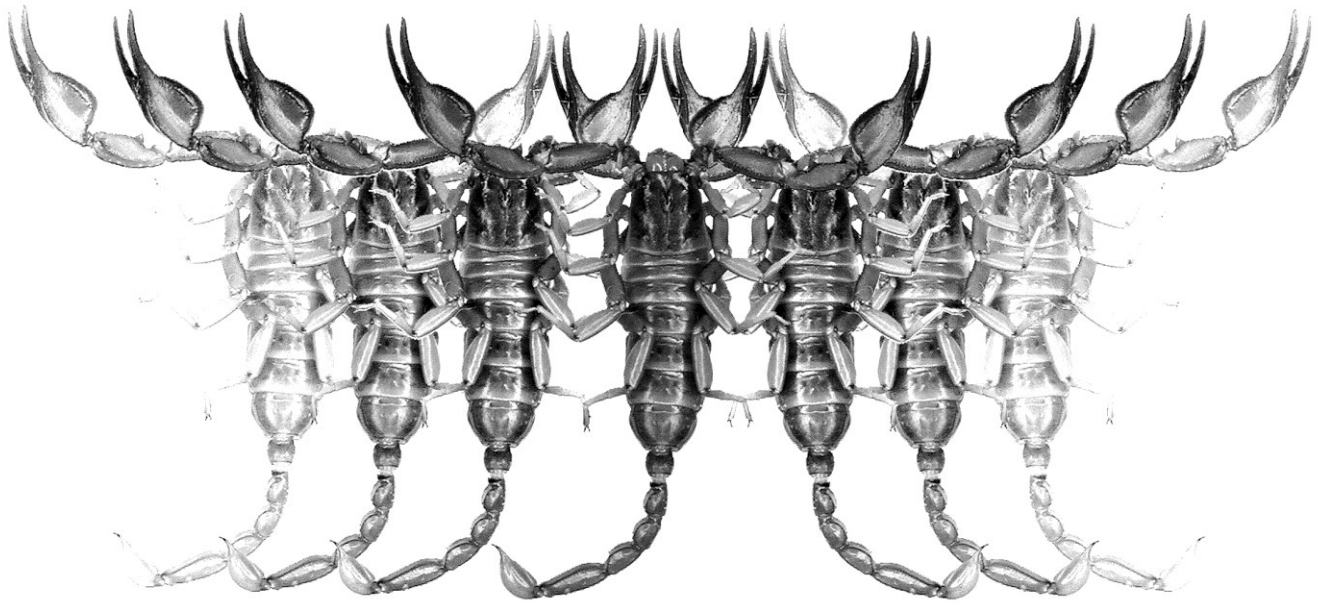


Euscorpius

Occasional Publications in Scorpiology



Four New Scorpion Species (Scorpiones: Buthidae) from Amazonian Peru

**František Kovařík, Rolando Teruel, Graeme Lowe
& Stefan Friedrich**

October 2015 — No. 210

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Publication date: 15 October 2015

<http://zoobank.org/urn:lsid:zoobank.org:pub:F0123FE1-7FDD-4DB5-BD59-B19EC9856B22>

Four new scorpion species (Scorpiones: Buthidae) from Amazonian Peru

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<http://zoobank.org/urn:lsid:zoobank.org:pub:F0123FE1-7FDD-4DB5-BD59-B19EC9856B22>

Summary

We describe four new species of buthid scorpions from a single Amazonian locality in Peru, situated at the pre-Andean piedmont: *Ananteris ashaninka* **sp. n.**, *Tityus dillerorum* **sp. n.** (a member of the “*melanostictus*” species-group), *Tityus panguana* **sp. n.** (a member of the “*bolivianus*” species-group), and *Tityus wachteli* **sp. n.** (a member of the “*clathratus*” species-group). Additional information is given on their taxonomy, distribution, ecology, and reproductive biology, fully complemented with color photos of live and preserved specimens, as well as their habitat.

Introduction

The Panguana Biological Field Station and Private Protected Area (hereafter ACP Panguana, after the Spanish abbreviation of Área de Conservación Privada) is located in the pre-Andean primary lowland rainforest of the Amazonian Peru, about 140 km from the eastern slopes of the Andes (09°37'S 74°56'W). It is situated at an altitude of 230–260 m at the Río Yuyapichis (a tributary of the Río Pachitea, which leads into the Río Ucayali, a headwater stream of the Amazon) and can be reached by boat or on foot only. It is a hilly area of 940 hectares, interspersed with various kinds of water bodies. Vegetation types include primary high forest that is never flooded, bog, alluvial and secondary forests, as well as some plantations and meadows on the western fringe. Eastwards the station borders on the territory of the Asháninka indigenous people whose primary rain forest lands extend for 50 km through the Sira mountain range (elevations up to 2,500 m). The annual average temperature is 25°C. Precipitation ranges between 2,000 and 3,000 mm, accumulating mostly during a 180-day period from October to April. In the forest, air humidity is around 90% throughout the year.

ACP Panguana—named after a local panguana bird, *Crypturellus undulatus* (fam. Tinamidae)—was founded in 1968 by the German biologists Dr. Maria Koepcke and Prof. Dr. Hans-Wilhelm Koepcke. Since 2000, the station is directed by the founders' daughter, Dr. Juliane

Diller, together with her husband Erich Diller, and the size of the area has been increased through land purchase. In 2011, Panguana was granted the status of a private protected area by the Peruvian government, and in 2014 the station was turned into an incorporated foundation. The leader of Panguana, Dr. Juliane Diller, holds a full-time job as the head of the library and as deputy director of the Bavarian State Collection of Zoology in Munich, Germany. Nevertheless, Dr. Diller spends several weeks at Panguana during at least two stays there every year. Her husband, Erich Diller, a former curator of Insecta Hymenoptera at the ZSMC, accompanies and supports her in all matters. Permanent caretakers at Panguana are Carlos Vásquez, called “Moro”, his wife Nery, and his son Hibrain. They operate a little farm in the direct neighborhood of the station.

The Panguana project provides facilities for taxonomic and ecological field research intended to contribute to the understanding of primary rain forests in general, and to the protection and preservation of the unique local ecosystem, which is still threatened by slash-and-burn agriculture and gold panning. Studies at Panguana benefit from a long-standing cooperation with the Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos in Lima, especially Prof. Dr. Gerardo Lamas Müller and Dr. Diana Silva Dávila. Since the 1980's, researchers from ZSMC and many other scientific institutes and countries have used the Panguana facil-



Year	Collecting permit number	Export permit number	Issued by (authority)
2004	063-2004-INRENA-IFFS-DCB	004329-AG-INRENA	INRENA (Instituto Nacional de Recursos Naturales)
2007	097-2007-INRENA-IFFS-DCB	010670-AG-INRENA	INRENA
2008	124-2008-INRENA-IFFS-DCB	011855-AG-INRENA	INRENA
2010	0427-2010-AG-DGFFS-DGEFFS	003889-AG-DGFFS	DGFFS (Dirección General Forestal y de Fauna Silvestre)
2011	0462-2011-AG-DGFFS-DGEFFS	006672-AG-DGFFS	DGFFS
2012	0318-2012-AG-DGFFS-DGEFFS	009708-AG-DGFFS	DGFFS
2013	0276-2013-AG-DGFFS-DGEFFS	000521-MINAGRI-DGFFS	DGFFS
2015	007-2014-SERFOR-DGGSPFFS	0001757-SERFOR	SERFOR (Servicio Nacional Forestal y de Fauna Silvestre)

Table 1: Collection permit information.



Figures 1–5: Figure 1. Panguana field station. **Figure 2.** Dr. Juliane and Erich Diller at Río Yuyapichis. **Figure 3.** Nery and “Moro” Vásquez. **Figure 4.** Erich Diller with Malaise trap. **Figure 5.** Franz Wachtel in Panguana.



Figure 6: Children at school in Pampas Verde, the Asháninka village close to Panguana.

ities. An example of the many recent projects is called “Soil arthropods in Panguana (Peru) - Species inventory of primary rain forest using DNA-barcoding and traditional taxonomy (PANGArth)”. This project is carried out by the ZSMC Arthropoda section. A list of publications since 2001 can be found at: <http://www.zsm.mwn.de/panguana/publications.htm>.

Methods & Material

Nomenclature and measurements follow Stahnke (1971), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977), pedipalp chela carinae (Acosta et al., 2008, as interpreted by Armas et al., 2011), hemispermatophore (Stockwell, 1989), and sternum (Soleglad & Fet, 2003). Unless otherwise noted, all morphologically diagnostic characters mentioned in the text refer to adults of both sexes. For the genus *Tityus* C. L. Koch, 1836, there is deep divergence amongst authors about its internal division, e.g., subgenera vs. species-groups; we continue to follow here the traditional species-groups as cataloged by Fet & Lowe (2000).

Label data are transcribed literally here, but further information about localities (e.g., political-administrative divisions such as regions, provinces and districts) is added between brackets. Specimens studied herein are preserved in ethanol 80% ethanol and deposited in the following collections: FKCP (František Kovařík, private collection, Prague, Czech Republic), FWCG (Franz Wachtel, private collection, Grünwald, Germany), MUSM (Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru), RTOC (Rolando Teruel, private collection, Santiago, Cuba), ZMUH (Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany), ZSMC (Bavarian State Collection of Zoology, Munich, Germany).

All specimens studied herein were collected and exported legally, see Table 1 for the appropriate permits.

Systematics

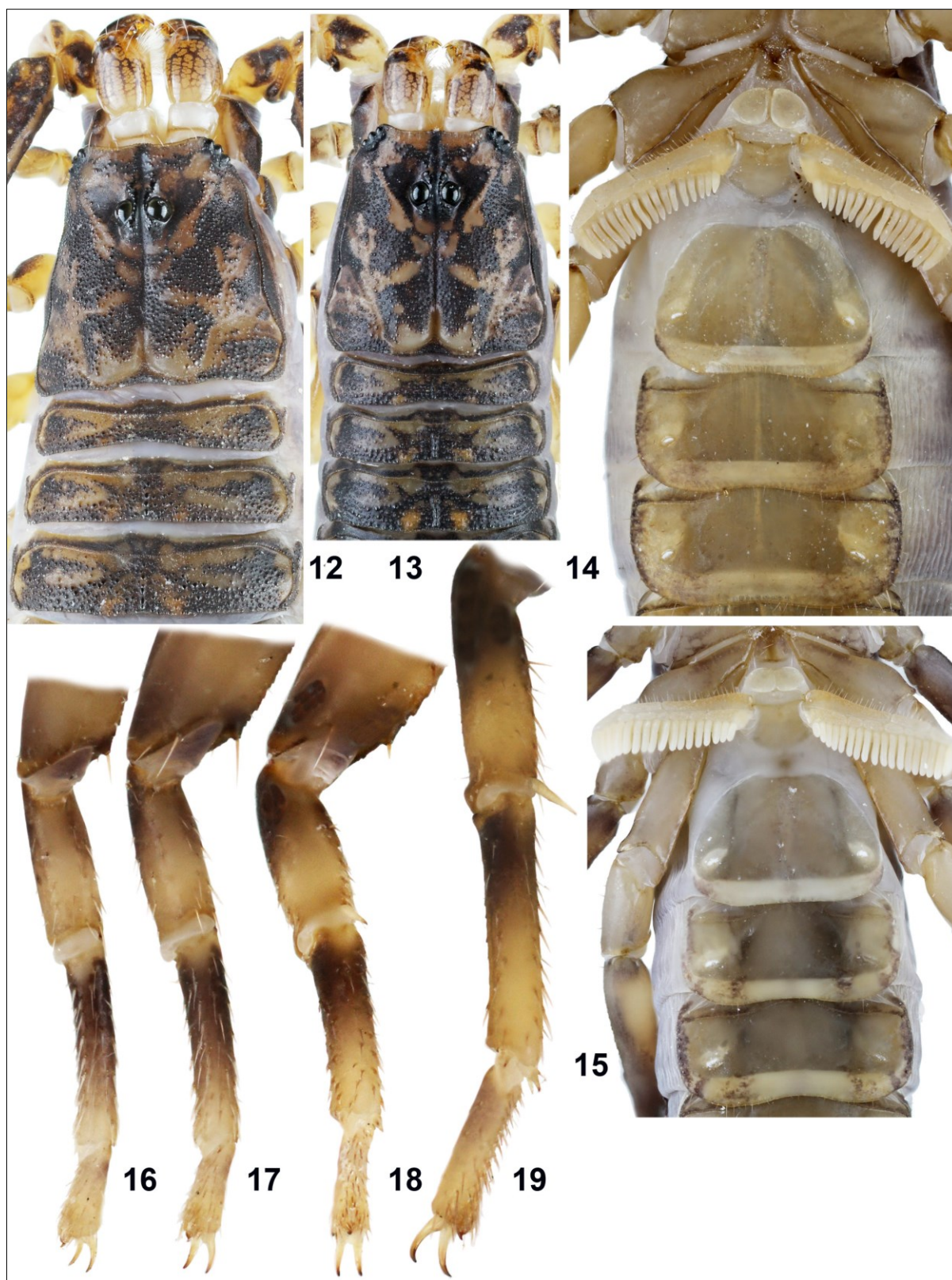
Family Buthidae C. L. Koch, 1837

Ananteris ashaninka Kovařík, Teruel, Lowe et Friedrich, **sp. n.**
(Figures 7–34; Table 3)

<http://zoobank.org/urn:lsid:zoobank.org:act:4565FD2E-FF52-4654-805F-9C7D469ACED2>



Figures 7–11: *Ananteris ashaninka* sp. n., holotype female, dorsal (7), ventral (8) views, and metasoma and telson, lateral (9), ventral (10), and dorsal (11) views. 1-cm scale bar for Figures 7 and 8.



Figures 12–19: *Ananteris ashaninka* sp. n. **Figures 12, 14, 16–19:** holotype female, chelicerae, carapace and tergites I–III (12), sternoplectinal region and sternites III–V (14), distal segments of legs I–IV (16–19), retroventral view. **Figures 13, 15:** paratype juvenile female, FKCP, chelicerae, carapace and tergites I–III (13), sternoplectinal region and sternites III–V (15).

TYPE LOCALITY AND HOLOTYPE DEPOSITORY. Peru, [Huánuco Region], Huánuco Department, [Puerto Inca Province, Yuyapichis District], ACP Panguana, Río Yuyapichis, 09°37'S 74°56'W, 230–260 m a. s. l. (Fig. 132), MUSM.

TYPE MATERIAL. Peru, [Huánuco Region], Huánuco Department, [Puerto Inca Province, Yuyapichis District], ACP Panguana, Río Yuyapichis, 09°37'S 74°56'W, 230–260 m a. s. l., 1.V.–21.V.2015, leg. S. Friedrich, F. Wachtel & M. Steinherr, 1 ♀ (holotype, MUSM, Figures 7–12, 14, 16–30), 2 juvenile ♀ (paratypes, ZSMC No. ZSMA20157512 and FKCP, Figs. 13, 15, 31–34).

ETYMOLOGY. The selected epithet is an indeclinable noun in apposition, taken from the name of the indigenous people who have been inhabiting the area even before the rise of the Inca Empire. Self-named "Asháninka" or "Asháninca", it belongs to the Arawak linguistic family, being the most important native people of Amazonian Peru. They are also acknowledged by their strong will for freedom and their repeated struggles against their oppression and the plundering of their natural resources.

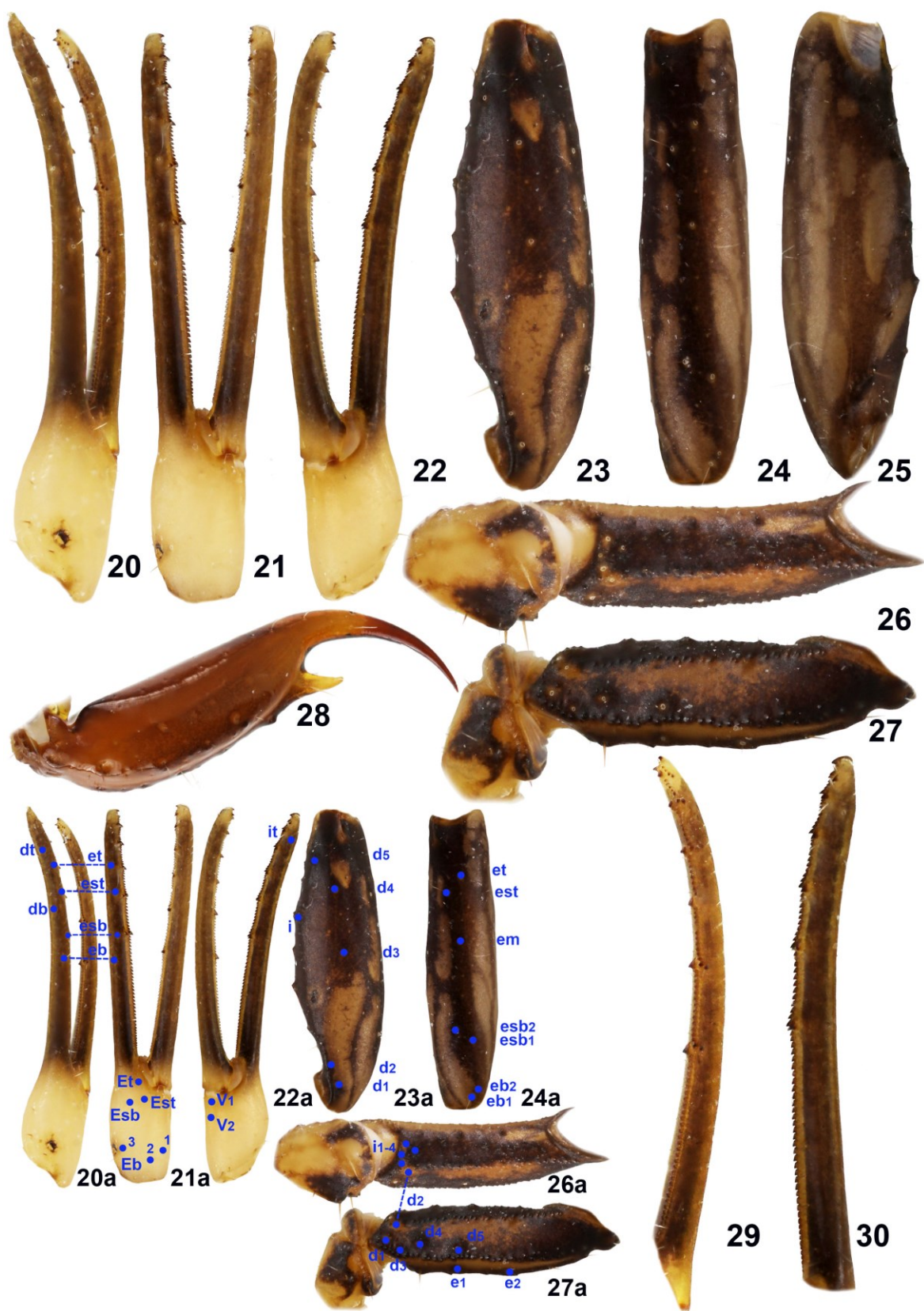
DIAGNOSIS (female only, male unknown). Adult size medium (26 mm) for the genus. Coloration predominantly dark: base yellowish brown, very densely spotted with blackish brown all over, but not clearly arranged into stripes on tergites; chelicerae densely reticulate with blackish brown, pedipalp chelae with manus immaculate pale and fingers blackish, metasomal segments IV–V and telson reddish brown. Pedipalp chelae with manus very small, completely acarinate and without internal denticles; fixed and movable fingers both with six principal rows of denticles, basal lobe/notch combination absent. Pectines with 16–18 teeth (mode 17); fulcra absent; basal middle lamella greatly enlarged, angulose. Sternite V with the smooth patch indistinct; spiracles short, slit-like. Metasoma short and robust, with 10/10/8/8/5 complete to essentially complete, finely serrate to serratocrenulate carinae; dorsal lateral carinae on segments III–IV with terminal denticles greatly enlarged; all intercarinal spaces densely, roughly granulose. Telson vesicle elongate oval, smooth and glossy, with subaculear tubercle large and spiniform.

DESCRIPTION (adult female holotype). **Coloration** (Figs. 7–8) base light yellowish brown, very densely reticulated and spotted with blackish brown all over the body and appendages except on the ventral region, which is spotted only on coxapophyses I and lateral part of sternites. Chelicerae light yellowish brown; manus densely reticulated with blackish brown, sparser basally and at fixed finger base; fingers deeply infuscate. Ped-

ipalp femur predominantly dark, very densely spotted with blackish along all carinae, almost interconnected medially; patella predominantly dark, even more densely spotted with blackish brown, with the irregular, oval-elongate paler areas concentrated on basal half; chela strikingly bicolor, with manus immaculate pale yellow and fingers blackish with yellowish tips. Carapace predominantly dark, symmetrically and densely spotted with blackish brown, irregularly arranged into three parallel, wide and discontinuous oblique stripes; eyes and ocular tubercles black. Tergites predominantly dark, symmetrically and densely reticulated and spotted with blackish brown, not arranged into longitudinal stripes and with the pale, chevron-shaped lateral areas typical of most species of the genus well evident. Pectines immaculate yellowish brown, with basal portion and basal plate slightly darker due to heavier sclerotization. Sternites predominantly pale, only with lateral areas irregularly infuscate as a pair of dark longitudinal stripes that become darker, better defined and more compact distally towards sternite VII; V with the smooth patch indistinct. Legs densely spotted with blackish brown on all surfaces but apically paler, with essentially all segments irregularly to faintly annulated. Metasoma with base color progressively darker distally, with segments IV–V dark reddish; all surfaces very densely spotted with blackish brown, with pattern becoming denser and darker on distal half of every segment, but conspicuously discontinuous ventrally on I–III. Telson vesicle dark reddish, with blackish infuscation arranged into four parallel, longitudinal dark stripes, subaculear tubercle yellowish but infuscate basally; aculeus with basal third yellowish brown and distal two-thirds dark reddish-brown.

Chelicerae (Fig. 12). With dentition typical for the genus; teeth relatively large and sharp. Tegument smooth and glossy, dorsodistal portion of manus with coarse, glossy granules irregularly arranged transversally, defining a depressed area. Setation very dense ventrally, but essentially lacking dorsally, except for five rigid, whitish macrosetae around depressed area of manus.

Pedipalps (Figs. 20–27, 29–30). Size and shape standard for the genus, almost glabrous. Orthobothriotaxic A-β; manus *Eb*₂ essentially above *Eb*₃, *Est* slightly basal to *Esb*; fixed finger with all trichobothria displaced to distal half, *eb* displaced to subdorsal position, *est* and *et* situated between *db* and *dt*, with all four trichobothria essentially equidistant (as in most species of the genus). Femur slender, almost straight and essentially bare; all carinae moderate and irregularly granulose; intercarinal tegument coriaceous, with small granules irregularly scattered mostly around trichobothria; internal (*i*) trichobothria not surrounding any specially developed denticle or spur. Patella very slender, straight, essentially bare, and round in cross-section;



Figures 20–30: *Ananteris ashaninka* sp. n., holotype female. Pedipalp chela, dorsal (20), external (21), and ventral (22) views. Pedipalp patella, dorsal (23), external (24), and ventral (25) views. Pedipalp femur and trochanter, internal (26) and dorsal (27) views. The trichobothrial pattern is indicated in Figures 20a–24a and 26a–27a. Pedipalp movable (29) and fixed (30) finger. Telson (28).

all carinae obsolete to absent; intercarinal tegument coriaceous, internally with about 10 small to moderate, conical tubercles. Chela very slender and sparsely setose; manus very small, oval (1.56 times longer than wide), much narrower than patella (ratio 0.66), and with the basal half only slightly widest, all carinae absent, intercarinal tegument coriaceous, without any denticles on internal surface; fingers very long and slender (movable finger 3.18 times longer than underhand), evenly curved, sparsely setose, both fingers with 6/6 principal rows of denticles, movable finger with an apical subrow of four denticles (large terminal denticle not included, all rows with both internal and external accessory denticles very large and claw-like), basal lobe/notch combination absent.

Carapace (Fig. 12). Trapezoidal and somewhat wider than long; anterior margin very widely W-shaped (i.e., frontal lobes widely concave, converging into a widely convex median projection), with scattered setation. Carination essentially absent or obscured by surrounding granulation: the only definable carinae are the coarsely, irregularly granulate superciliaries. Furrows: anterior median, median ocular, central median, posterior median and posterior marginal fused, narrow and very deep, posterior laterals and lateral centrals long, narrow and shallow. Tegument very densely and evenly covered by glossy granules of different sizes (mostly medium and coarse), except along furrows and two smooth, oblique, subtriangular patches in front of the median eyes. Median eyes very large and separated by much less than one ocular diameter, lateral eyes much smaller but also relatively large, subequal and conspicuously protruding anteriorly.

Sternum (Fig. 14). Standard for the genus: type 1, very small, longer than wide, and subtriangular in shape, with three pairs of macrosetae. Tegument irregularly granulose.

Genital operculum (Fig. 14). Medium-sized, halves moderately separated and roundly subtriangular in shape, with 1–2 pairs of macrosetae; tegument smooth and glossy. Genital papillae absent. Pre-pectinal plate absent.

Pectines (Fig. 14). Size and shape standard for the group: not reaching leg IV trochanter, subrectangular and moderately setose. Tooth count 16/17, teeth long, narrow, straight, and conspicuously increasing in length distally. Basal middle lamella greatly enlarged and angulose, causing every pectine to have a conspicuous basal part without teeth. Fulcra completely absent. Basal plate moderately sclerotized, much wider than long; anterior margin with deep V-shaped anteromedian notch that continues through posterior margin as a longitudinal furrow; tegument smooth and glossy.

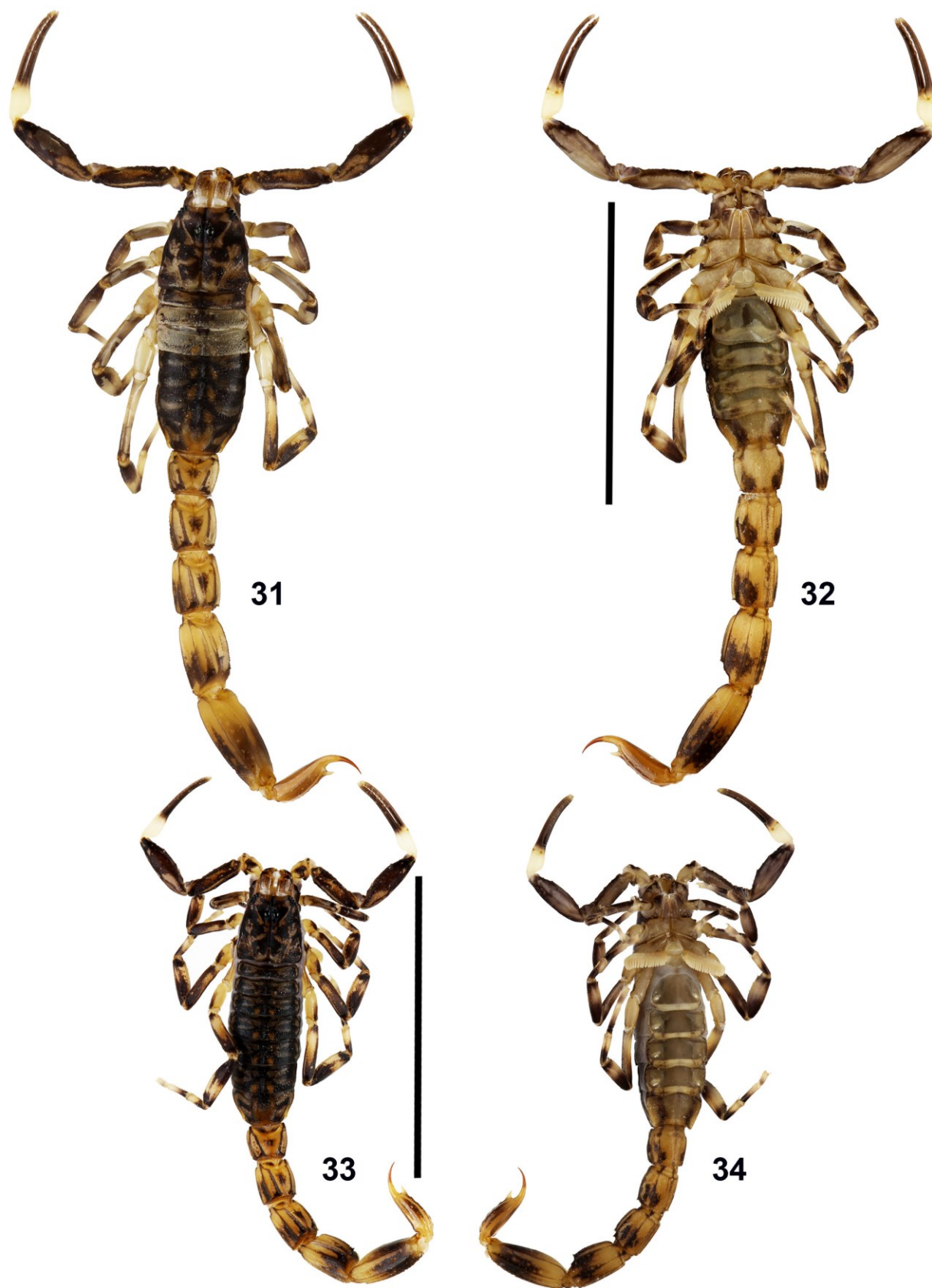
Legs (Figs. 16–19). Long and slender, with all carinae finely serrate, intercarinal tegument coriaceous to finely granulose. Tibial spurs absent on I–II, very long

and thin on III–IV; prolateral and retrolateral pedal spurs short and thick, increasing in development backwards from very small and poorly sclerotized on leg I through large and heavily sclerotized on IV. Ventral surface of telotarsi round and with less than 10 dark, thin spiniform setae not clearly arranged into rows. Claws very long and strongly curved.

Mesosoma (Figs. 12, 14). Tergites very densely and evenly covered by glossy granules of different sizes, mostly medium and coarse; I–VI with only one median longitudinal carina which is long, very strong, granulose and formed by coarse, glossy granules that do not project beyond posterior margin; VII with only four carinae (paired submedians and laterals, the median longitudinal carina is either absent or became obscured by surrounding granulation), which are very long and serrate. Sternites sparsely setose; spiracles oblique, short but slit-like; tegument of III–V with a satin sheen and essentially smooth (only with traces of vestigial granules posterolaterally) and acarinate, of VI similarly sculptured but with traces of four carinae (paired submedians and laterals), of VII densely granulose and with the two pairs of carinae poorly defined from surrounding granulation; posterior margin of III–VII concave; III with a posteromedian smooth patch which is very large, triangular, wider than long, flat, glossy, and translucent; smooth patch of V indistinct.

Metasoma (Figs. 9–11). Size and shape standard for the genus. Relatively short and robust, narrower distally. Segments I–II with ten complete to essentially complete carinae, III–IV with eight, V with five: dorsal laterals finely serrate on I–IV, absent on V, terminal denticle greatly enlarged as a sharp tubercle on III–IV; lateral supramedians finely serrate to serratocrenulate on I–V; lateral inframedians finely serrate to serrato-crenulate on I–II, absent on III–V (with irregular remnants on II–V that do not form true carinae); ventral laterals finely serrate to serratocrenulate on I–V; ventral submedians finely serrate on I–IV, absent on V; ventral median absent on I–IV, complete and finely serrate to serratocrenulate on V. Intercarinal tegument densely covered by rough granules of different sizes (mostly medium and coarse) in all surfaces, becoming progressively coarser and denser distally in every segment; dorsal furrow complete, moderately narrow and deep on segments I–IV, spatulate and shallower on V; setation sparse and irregular on all segments.

Telson (Figs. 9–11, 28) very slender. Vesicle elongate oval (2.65 times longer than wide, 1.06 times wider than deep) and only with a few scattered setae; tegument smooth and glossy; ventral median carina coarsely but vestigially granulose, raised abruptly into the subaculear tubercle which is very large, spiniform, smooth, and subtly curved upwards apically. Aculeus very sharp, shorter than vesicle and shallowly curved.



Figures 31–34: *Ananteris ashaninka* sp. n. **Figures 31–32:** paratype juvenile female, ZSMC, dorsal (31) and ventral (32) views. **Figures 33–34:** paratype juvenile female, FKCP, dorsal (33) and ventral (34) views. Scale bar: 10 mm.

DIMENSIONS (MM)		<i>T. dillerorum</i> sp. n.		<i>T. panguana</i> sp. n.	
		♂ holotype	♀ paratype	♂ holotype	♀ paratype
Carapace	L / W	5.80 / 6.10	6.00 / 6.60	6.85 / 6.65	7.05 / 6.95
Mesosoma	L	14.60	15.00	17.90	20.10
Tergite VII	L / W	4.15 / 5.65	4.35 / 6.75	4.80 / 5.30	5.00 / 6.55
Metasoma et telson	L	37.90	35.3	46.45	40.00
Segment I	L / W / H	4.75 / 3.35 / 2.95	4.50 / 3.45 / 2.85	5.75 / 3.05 / 2.95	5.05 / 3.25 / 2.90
Segment II	L / W / H	5.90 / 3.15 / 3.15	5.55 / 3.05 / 3.00	7.30 / 3.00 / 2.80	5.80 / 3.10 / 2.85
Segment III	L / W / H	6.55 / 3.35 / 3.55	5.95 / 3.00 / 3.05	8.05 / 2.90 / 2.85	6.55 / 3.20 / 3.05
Segment IV	L / W / H	7.10 / 3.55 / 3.60	6.55 / 3.03 / 3.20	8.90 / 3.05 / 2.80	7.30 / 3.40 / 3.05
Segment V	L / W / H	7.30 / 3.75 / 3.45	6.75 / 3.00 / 3.05	9.70 / 3.00 / 2.90	8.55 / 3.40 / 3.10
Telson	L / W / H	6.30 / 2.53 / 2.50	6.00 / 2.25 / 2.25	6.75 / 2.50 / 2.45	6.75 / 2.60 / 2.40
Vesicle	L	3.90	3.80	4.75	9.00
Aculeus	L	3.00	2.90	2.70	5.90
Pedipalp	L	23.65	22.45	29.35	27.90
Femur	L / W	6.15 / 1.75	5.65 / 1.80	7.55 / 1.55	7.05 / 1.86
Patela	L / W	6.30 / 2.50	6.10 / 2.55	8.30 / 2.20	7.75 / 2.35
Chela	L	11.20	10.70	13.5	13.10
Manus	L / W / H	4.00 / 3.70 / 3.30	3.65 / 2.50 / 2.08	4.70 / 3.10 / 3.10	4.25 / 2.65 / 2.55
Movable finger	L	7.20	7.05	8.80	8.85
Total	L	58.30	56.30	68.50	67.15

Table 2: Comparative measurements of adults of *Tityus dillerorum* sp. n. and *Tityus panguana* sp. n. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (H).

VARIATION. The juvenile to subadult paratypes differ from the adult holotype in characters typical for the genus (Figs. 13, 15, 31–34): size smaller, coloration basically paler (pale to whitish yellow) and with the dark pattern more contrasting, but with metasomal segments IV–V and telson not darkened, tegument noticeably less sclerotized and with overall sculpturing less developed, and pedipalp manus even smaller and more slender.

Number of principal rows of denticles always six in both fixed and movable fingers.

Pectinal tooth counts of the two juvenile female paratypes 17/16 and 18/17.

AFFINITIES (female only). The genus *Ananteris* Thorell, 1891 is known to be represented in Peru by only one very recently described species, *A. cisandinus* Lourenço, 2015. This species is so far known from a single locality in the far north of the country (Cerros de Campanquiz, in Loreto Department) and is very different from *A. ashaninka* sp. n. on the basis of the following characters: **1)** telson and sternite VII immaculate to only sparsely spotted; **2)** sternum shorter and wider than long; **3)** much lower pectinal tooth count of 12/12; **4)** metasoma somewhat more slender, with conspicuously less granulate intercarinal spaces; **5)** metasomal segment V and ventral surface of IV and telson with much weaker to obsolete carinae (the former segment is even round in cross-section).

Amongst all *Ananteris* species confirmed to occur in the countries bordering Peru, the most similar to *A. ashaninka* sp. n. on morphological grounds is actually *A.*

terueli Kovářík, 2006 (only known from Amazonian northwestern Bolivia), which can easily be distinguished by: **1)** dark pattern of tergites arranged into three well-defined longitudinal stripes; **2)** lower pectinal tooth counts of 14–15; **3)** metasoma somewhat more slender, with conspicuously less granulate intercarinal spaces; **4)** metasomal segments with 10/10/8/8/2 much weaker carinae, especially V which is round in cross-section and has only the lateral supramedian carinae complete.

DISTRIBUTION. Known only from the type locality.

REMARKS. The genus *Ananteris* is now known to be represented in Peru by two species, but the wide geographical separation between both and the fact that several other species have been described from basically all adjacent countries, very near to the Peruvian border, both suggest that it is likely much more diverse and widespread.

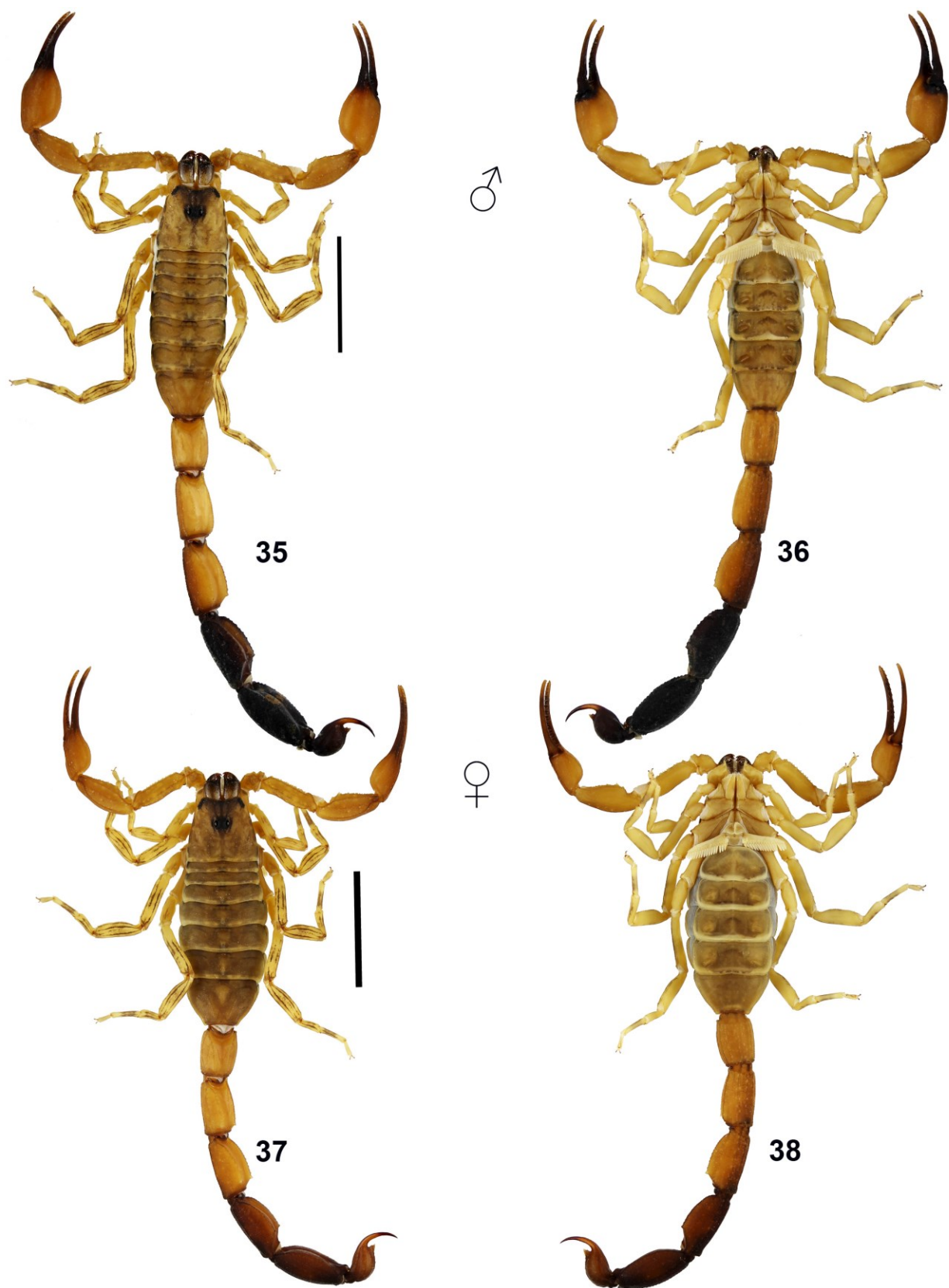
Tityus dillerorum Kovářík, Teruel, Lowe et Friedrich, sp. n.

(Figures 35–68, 138–141; Table 2)

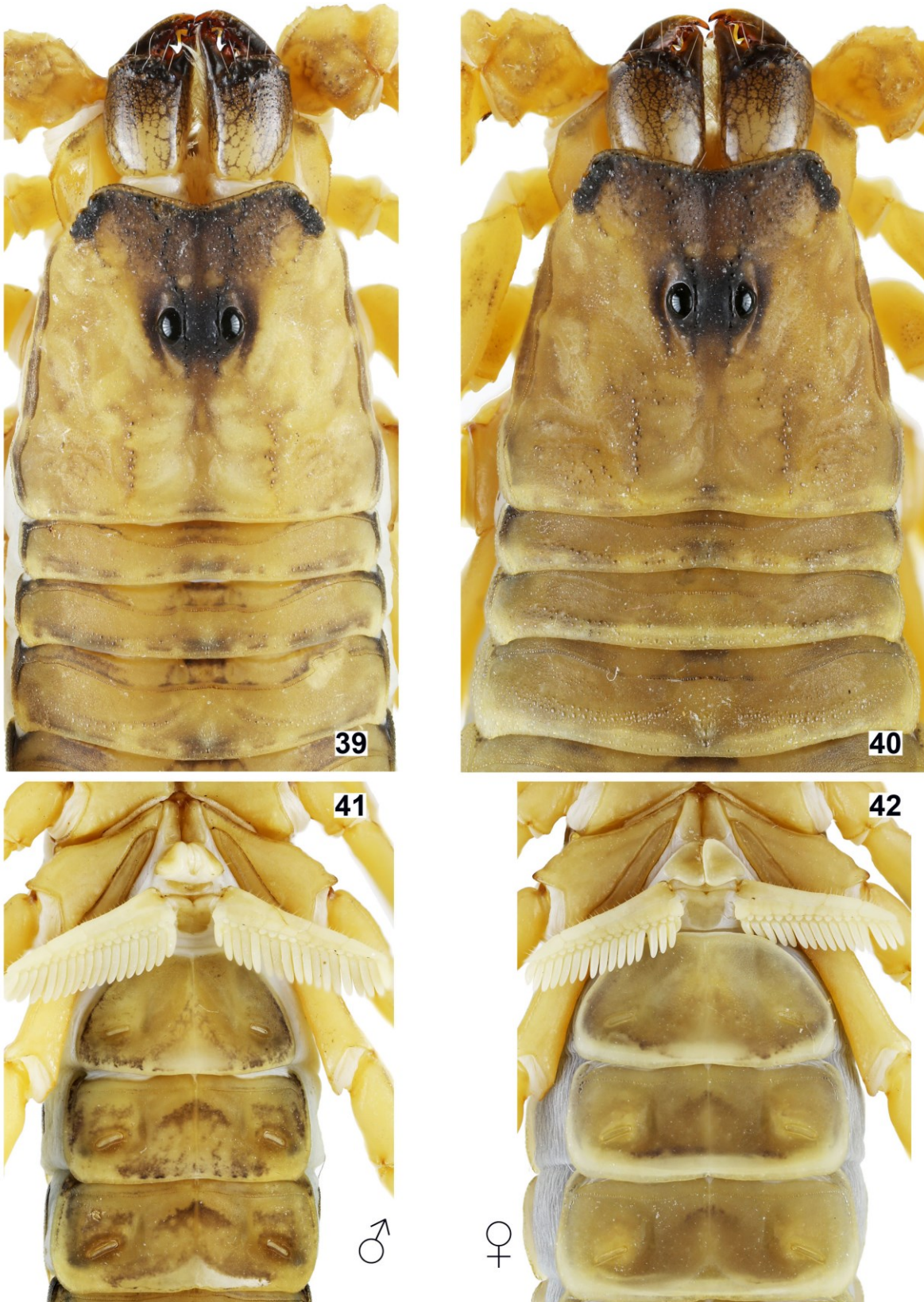
<http://zoobank.org/urn:lsid:zoobank.org:act:3F47DBE9-104F-47C8-BE45-78081C829F02>

Tityus gasci: Lourenço & Dastych, 2001: 55 (misidentification).

TYPE LOCALITY AND HOLOTYPE DEPOSITORY. Peru, [Huánuco Region], Huánuco Department, [Puerto Inca Province, Yuyapichis District], ACP Panguana, Río Yu-



Figures 35–38: *Tityus dillerorum* sp. n. **Figures 35–36:** holotype male, dorsal (35) and ventral (36) views. **Figures 37–38:** paratype female, dorsal (37) and ventral (38) views. Scale bar: 10 mm.



Figures 39–42: *Tityus dillerorum* sp. n. **Figures 39 and 41:** holotype male, chelicerae, carapace and tergites I–III (39), sternopleural region and sternites III–V (41). **Figures 40 and 42:** paratype female, chelicerae, carapace and tergites I–III (40), sternopleural region and sternites III–V (42).

yapichis, 09°37'S - 74°56'W, 230–260 m a. s. l. (Fig. 68), MUSM.

TYPE MATERIAL. Peru, [Huánuco Region], Huánuco Department, [Puerto Inca Province, Yuyapichis District], ACP Panguana, Río Yuyapichis, 09°37'S - 74°56'W, 230–260 m a.s.l., 20.IX–15.X.2011, 1♂ (holotype, MUSM, Figs. 35–36, 39, 41, 43–45, 49–56, 60–66), 1♀ (paratype, ZSMC No. ZSMA20157501, Figs. 37–38, 40, 42, 46–48, 57–59, 67), X.2010, leg. E. Diller, 1♂ (paratype, ZSMC No. ZSMA20157502), 20.VII.1982, forest clearance, in wood, leg. E.-G. Burmeister, 1♀ (paratype, FKCP, labeled as *Tityus gasci*), 20.IX–9.X.2007, leg. E.-G. Burmeister, 2♂ (paratypes, MUSM), 18.IX–3.X.2010, leg. E.-G. Burmeister, 1 juvenile ♂ (paratype, ZSMC No. ZSMA20157503), 21.IX–8.X.2012, leg. K. Schönitzer, 1♂ (paratype, FKCP), Nebenfluss des Río Pachitea, 23.XI–11.XII.2008, leg. K. Schönitzer, F. Glaw & F. Wachtel, 2♂ (paratypes, MUSM *et* RTOC).

ETYMOLOGY. The selected epithet is a patronym honoring Dr. Juliane Diller, the head of ACP Panguana, and her husband Erich Diller for their outstanding efforts in Peruvian nature protection. In Panguana, they provide invaluable facilities for rain forest research.

DIAGNOSIS. A member of the “*melanostictus*” species-group. Adult size moderately large (male 53–59 mm, female 55–56 mm) for the group. Coloration basically light yellowish brown, faintly and sparsely spotted with medium brown all over the body and appendages except legs, which are conspicuously striped with blackish brown; carapace with ocular triangle deeply infusate; tergites with three faint, irregular longitudinal dark stripes; pedipalp fingers, metasomal segments IV–V and telson much darker, blackish (male) to reddish (female). Pedipalp chelae with manus large, robust, much wider than patella (ratio 1.48), and vestigially carinate in male, small, oval slender, slightly narrower than patella (ratio 0.98), and strongly carinate in female; fixed and movable fingers with 12–13 and 13–14 principal rows of denticles, respectively, basal lobe/notch combination strong in male, weak in female. Pectines with 16–18 teeth (mode 17) in both sexes; basal middle lamella suboval and only vestigially enlarged in both sexes. Sternite V with the smooth patch large, triangular, and much wider than long in both sexes, bulky and whitish in male, much smaller, flat and translucent in female; spiracles long, slit-like. Metasoma moderately long and slender in both sexes, moderately wider distally (male) to parallel-sided (female), with 10/8/8/8/5 complete to essentially complete, very weakly granulose to subserrate carinae; dorsal lateral carinae on segments II–IV with terminal denticle conspicuously enlarged; all intercarinal spaces coriaceous, with weak granulation scattered. Telson vesicle globose (male) to short oval

(female), finely granulose, with subaculear tubercle large, sharply conical and with two dorsal granules.

DESCRIPTION (adult male holotype). **Coloration** (Figs. 35–36) base light yellowish brown, very faintly and sparsely spotted with medium brown all over the body and appendages, except on ventral region of prosoma (immaculate pale) and legs (with all carinae deeply infusate and intercarinal blackish lines, which give a conspicuously striped appearance). Chelicerae pale yellow; manus heavily reticulated with blackish brown all over, much darker and denser distally; fingers entirely blackish. Pedipalp femur and patella very faintly and sparsely infusate; chela with manus essentially immaculate pale, only with vestigial traces of irregular infuscation externally and with base of fingers deeply infusate to blackish, fingers blackish with yellowish tips. Carapace symmetrically but very faintly and sparsely spotted with medium brown, interocular triangle deeply infusate to blackish; eyes and ocular tubercles black. Tergites symmetrically but very sparsely spotted with medium brown, irregularly arranged into three longitudinal stripes. Pectines immaculate yellowish to whitish, with basal portion and basal plate progressively darker due to heavier sclerotization. Sternites symmetrically spotted with medium brown, not arranged into stripes; V with the smooth patch conspicuously paler and immaculate, whitish. Metasoma with base color progressively darker distally, with segments IV–V blackish; all surfaces faintly but moderately reticulated with medium brown, with pattern becoming denser both ventrally and distally in every segment. Telson vesicle very deeply infusate to blackish, subaculear tubercle gradually paler distally; aculeus with basal half yellowish brown and distal half blackish.

Chelicerae (Fig. 39). With dentition typical for the genus; teeth relatively large and sharp. Tegument glossy but with abundant fine granulation scattered, dorsodistal portion of manus with coarse, glossy granules irregularly arranged transversally, defining a depressed area. Setation very dense ventrally, but essentially lacking dorsally, except for six rigid, whitish macrosetae around depressed area of manus.

Pedipalps (Figs. 49–56). Standard-sized for the group but noticeably robust, almost glabrous. Orthobothriotaxic A- α , but with chelal trichobothria *est-et-db-et* placed in distal half of finger and essentially with no “petite” trichobothria (basically all trichobothria with noticeably small, subequal areolae). Femur almost straight and essentially bare; all carinae moderately weak, granulose to subdenticulate; intercarinal tegument finely and densely granulose; internal (*i*) trichobothria surrounding a moderate, conical spur. Patella straight and essentially bare; all carinae moderately weak, granulose to subdenticulate; intercarinal tegument very finely and densely granulose, internally with a few larger con-



Figures 43–48: *Tityus dillerorum* sp. n. **Figures 43–45.** Holotype male, metasoma and telson, lateral (43), ventral (44), and dorsal (45) views. **Figures 46–48.** Paratype female, metasoma and telson, lateral (46), ventral (47), and dorsal (48) views.

ical tubercles and many small denticles of similar size. Chela robust and sparsely setose; manus large, inflated oval (1.08 times longer than wide), much wider than patella (ratio 1.48), and with the basal half only slightly widest, all carinae vestigial to very weak, subcostate to subgranulose, intercarinal tegument coriaceous and with minute but dense granulation scattered on all surfaces and with a few small, sharp, conical granules internally; fingers long (movable finger 1.80 times longer than underhand), evenly curved, sparsely setose, fixed finger

with 14/14 principal rows of denticles, movable finger with 13/13 plus an apical subrow of four denticles and a large internal accessory denticle (large terminal denticle not included), basal lobe/notch combination strong.

Carapace (Fig. 39). Trapezoidal and slightly wider than long; anterior margin widely V-shaped, with scattered setation. Carination essentially absent: the only definable carinae are the irregularly fused anterior medians and superciliaries (moderately granulose to subgranulose), and the also irregularly fused central med-

ians and posterior medians (moderately granulose). Furrows: anterior median, median ocular, central median, posterior median and posterior marginal fused, wide and moderately deep, posterior laterals long, wide and shallow, other furrows indistinct. Tegument very finely and densely granulose, with slightly coarser granulation scattered, coarser and denser in ocular triangle. Median eyes large and separated by more than one ocular diameter, lateral eyes much smaller but also relatively large.

Sternum (Fig. 41). Standard for the genus: type 1, medium-sized, longer than wide, and triangular in shape, with two pair of long macrosetae. Tegument coriaceous to very finely granulose.

Genital operculum (Fig. 41). Medium-sized, halves widely separated and roundly subtriangular in shape, with a few setae scattered; tegument coriaceous. Genital papillae medium-sized, conspicuously protruding. Pre-pectinal plate heavily sclerotized and widely crescent-shaped, with a large and oval median depression.

Pectines (Fig. 41). Size and shape standard for the group: just reaching leg IV trochanter, subtriangular and moderately setose. Tooth count 18/18, teeth long and only slightly swollen. Basal middle lamella suboval and only vestigially enlarged. Basal plate highly sclerotized, about as long as wide; anterior margin with a narrow and deep V-shaped anteromedian notch, posterior margin essentially straight; tegument coriaceous.

Hemispermaphore (Figs. 138–141). Trunk elongate, slender; flagellum either undeveloped or severed in specimen examined; capsule region with 3 lobes; internal lobe broad, laminar, triangular, with strong dorsal carina terminating in acute vertex; basal lobe a prominent, rounded-triangular, dorso-externally convex laminate process; external lobe narrow, very elongate, laminate, apically rounded.

Legs (Figs. 62–65). Slender, with all carinae finely crenulate to serrate, intercarinal tegument very finely and densely granulose. Prolateral and retrolateral pedal spurs long and thick. Ventral surface of telotarsi round and with many thin, dark setae irregularly arranged into two longitudinal, broad, dense rows converging basally. Claws long and strongly curved.

Mesosoma (Figs. 39, 41). Tergites very finely and densely granulose, with slightly coarser granulation scattered, coarser and denser along posterior third of every tergite; I–VI with only one well-defined median longitudinal carina which is short, moderately strong, granulose to crenulate, formed by isolated, medium-sized, glossy granules that do not project beyond posterior margin; VII with the standard five carinae which are long and crenulate to serrate. Sternites coriaceous to finely and densely granulose, much denser and stronger in depressed lateral areas of III; spiracles oblique, long and slit-like; posterior margin of III–VI

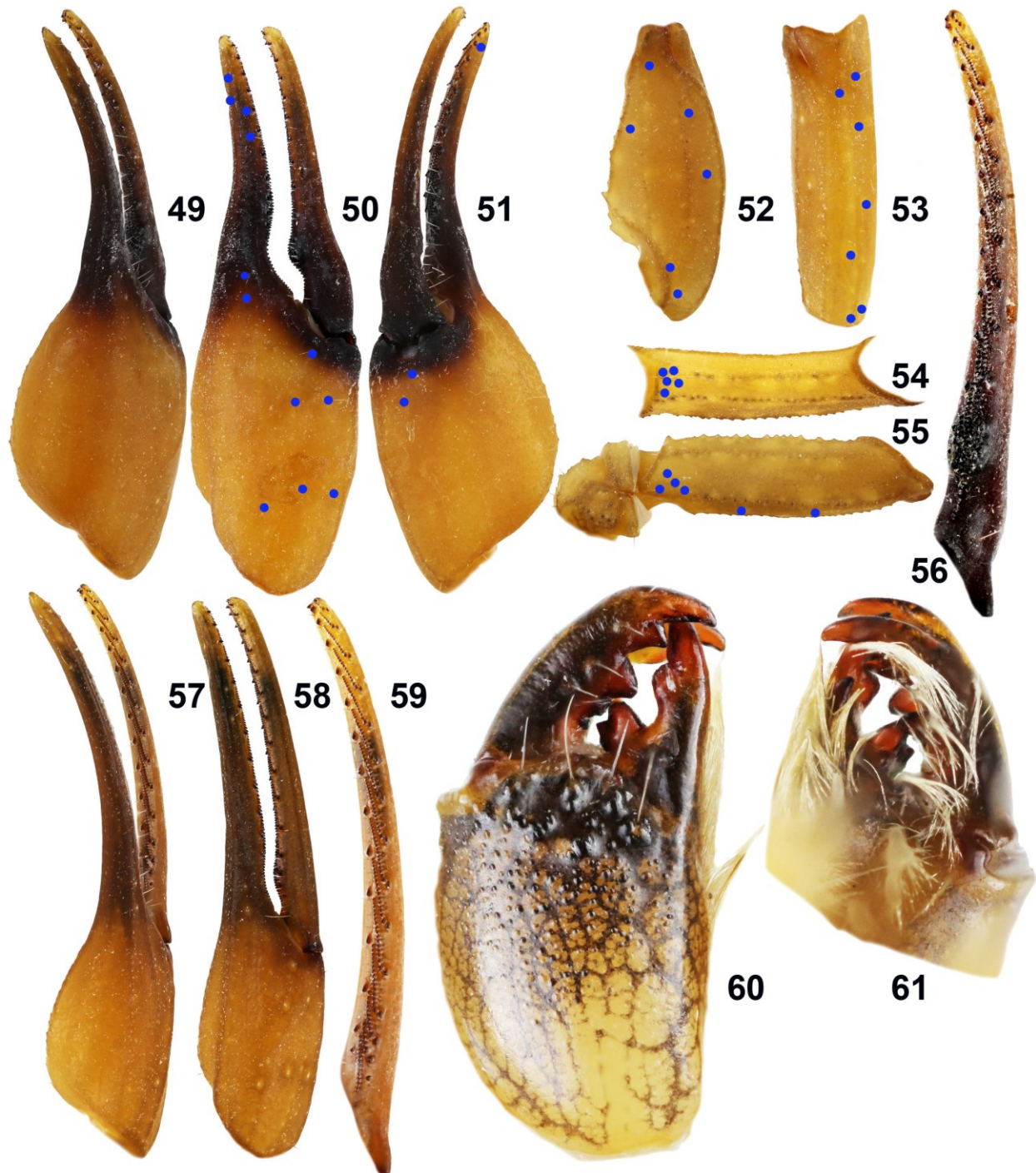
widely bilobed, VII widely concave; smooth patch of V large, triangular, much wider than long, bulky, whitish, and glossy.

Metasoma (Figs. 43–45, 66). Moderately long, slender and progressively wider distally. Segment I with ten complete carinae, II–IV with eight, V with five: dorsal laterals weakly crenulate to subserrate and with conspicuously enlarged terminal denticle on I–IV, absent on V; lateral supramedians weakly crenulate to subserrate on I–III, vestigially granulose to subcrenulate on IV (irregular, poorly defined), weakly granulose but irregular on V; lateral inframedians weakly crenulate to subserrate on I, absent on III–V (but indicated by a very short basal remnant of true carina on II); ventral laterals weakly crenulate to subserrate on I–III, vestigially granulose to subcrenulate on IV (irregular, poorly defined), weakly granulose but irregular on V; ventral submedians weakly crenulate to subserrate on I–III, vestigially granulose to subcrenulate on IV (irregular, poorly defined), absent on V; ventral median absent on I–IV, vestigially granulose to subcrenulate on V (regular but poorly defined). Intercarinal tegument coriaceous, with weak granulation scattered on all surfaces but coarser and denser laterally and ventrally on IV–V, somewhat obscuring distinction of carinae; dorsal furrow complete, moderately narrow and deep on all segments; setation sparse, with two pairs of whitish ventrolateral macrosetae on I–IV, three pairs on V.

Telson (Figs. 43–45, 66). Vesicle globose (1.54 times longer than wide, 1.01 times wider than deep) and only with a few setae of different sizes scattered; tegument coriaceous, with many small granules scattered on all surfaces except dorsally; ventral median carina vestigially granulose, raised abruptly into the subaculear tubercle which is large, sharply conical and ornate with two dorsal granules. Aculeus long, sharp, only slightly shorter than vesicle and shallowly curved.

FEMALE (paratype: Figs. 37–38, 40, 42, 46–48, 57–59, 67; Table 2). Similar to male in coloration, but with well-marked sexual dimorphism: **1)** size slightly smaller; **2)** overall coloration paler and less conspicuously patterned, especially on pedipalps and metasoma; **3)** pedipalp manus much smaller, oval slender, slightly narrower than patella, and more strongly carinated; **4)** fingers longer, thinner and with lobe/notch combination much weaker; **5)** genital papillae absent; **6)** pectines shorter, with teeth shorter and narrower; **7)** mesosoma wider, with sides more convex; **8)** smooth patch of sternite V much smaller, essentially flat and translucent; **9)** metasomal segments and telson narrower.

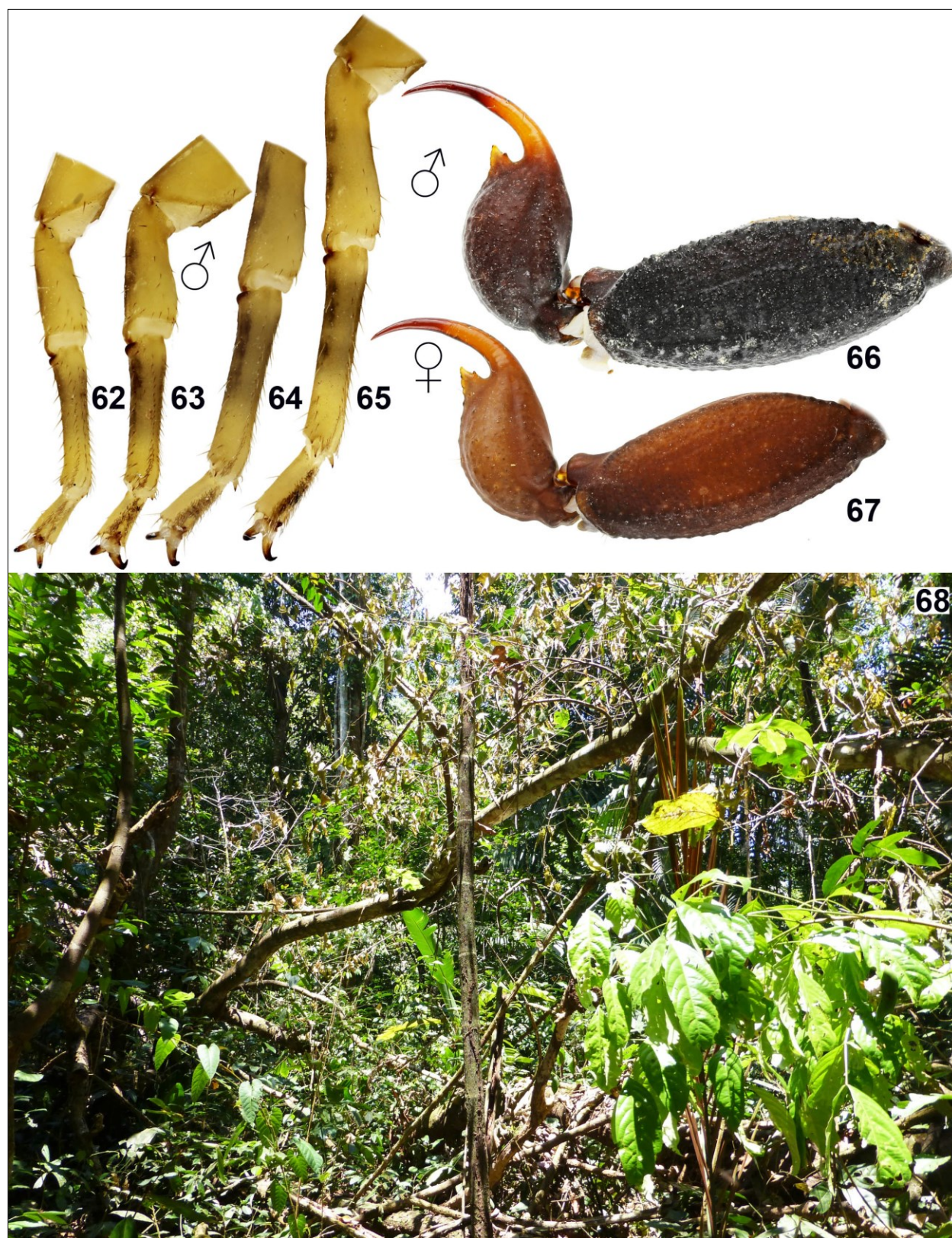
VARIATION. Pectinal tooth count varied as follows: 16–18 (4x16, 9x17, 3x18), females 16–18 (1x16, 2x17, 1x18). The number of principal rows of denticles on movable finger in both sexes was 13–14 (5x13, 5x14).



Figures 49–61: *Tityus dillerorum* sp. n. **Figures 49–56, 60–61.** Holotype male. Pedipalp chela, dorsal (49), external (50), and ventral (51) views. Pedipalp patella, dorsal (52) and external (53) views. Pedipalp femur, internal (54) and femur and trochanter dorsal (55) views. The trichobothrial pattern is indicated in Figures 50–55. Pedipalp movable finger (56). Left chelicera, dorsal (60) and ventral (61) views. **Figures 57–59.** Paratype female. Pedipalp chela, dorsal (57) and external (58) views. Pedipalp movable finger (59).

AFFINITIES. Across the entire “*melanostictus*” species-group, the unique combination of coloration (yellowish, only sparsely spotted with medium brown),

sexual secondary dimorphism of pedipalps (manus large and very robust in male, small and slender in female), and metasomal shape and sculpture (distally wider in



Figures 62–68: *Tityus dillerorum* sp. n. **Figures 62–66.** Holotype male. Distal segments of legs I–IV (62–65), retrolateroventral view. Telson and fifth metasomal segment lateral (66). **Figure 67.** Paratype female, telson and fifth metasomal segment lateral. **Figure 68.** Panguana, typical habitat of *Tityus dillerorum* sp. n.

male, very weakly carinated in both sexes), presented by *T. dillerorum* **sp. n.** is shared only by two Amazonian species: *Tityus raquelae* Lourenço, 1988 and *Tityus strandi* Werner, 1939 (both supposedly widespread across Amazonian Brazil). Both taxa are indeed very closely related to *T. dillerorum* **sp. n.**, but can be safely distinguished from it as follows:

- *T. raquelae*: 1) coloration with the dark spots highly reduced, especially over carapace and tergites which lack the deep infuscation in the interocular triangle and the irregular trifasciate pattern, respectively; 2) male with pedipalp manus much narrower and more strongly carinate; 3) male with metasomal segment V and telson markedly less robust; 4) female pectines with basal middle lamella conspicuously more enlarged and round in shape; 5) female sternite V with smooth patch smaller and bulkier, and with posterior margin acutely projected medially.

- *T. strandi*: 1) adult size larger (60–70 mm); 2) male with metasomal segments IV–V and telson much paler, reddish brown; 3) male with pedipalp manus more strongly denticulate on internal surface; 4) metasoma with somewhat stronger carinae in both sexes.

Moreover, *T. dillerorum* **sp. n.** has been previously misidentified as *Tityus gasci* Lourenço, 1981, but the two species are very distinct from each other and not even closest relatives (see below, in Remarks section).

DISTRIBUTION. Known only from the type locality.

REMARKS. Lourenço & Dastych (2001: 55) misidentified as *T. gasci* one male and one juvenile from ZMUH, collected at the type locality of *T. dillerorum* **sp. n.** Nevertheless, both species are not even closely-related taxa, as it is evident from the completely opposite sexual secondary dimorphism they exhibit: adult male has metasomal segments remarkably longer and more slender than female in the former, but shorter and more robust in the latter. Moreover, the correct affinities of *T. gasci* with respect to the other congeners have not yet clearly established, but *T. dillerorum* **sp. n.** is a typical member of the “*melanostictus*” species-group.

Tityus panguana Kovářík, Teruel, Lowe et Friedrich, **sp. n.**

(Figures 69–101, 142–145; Table 2)

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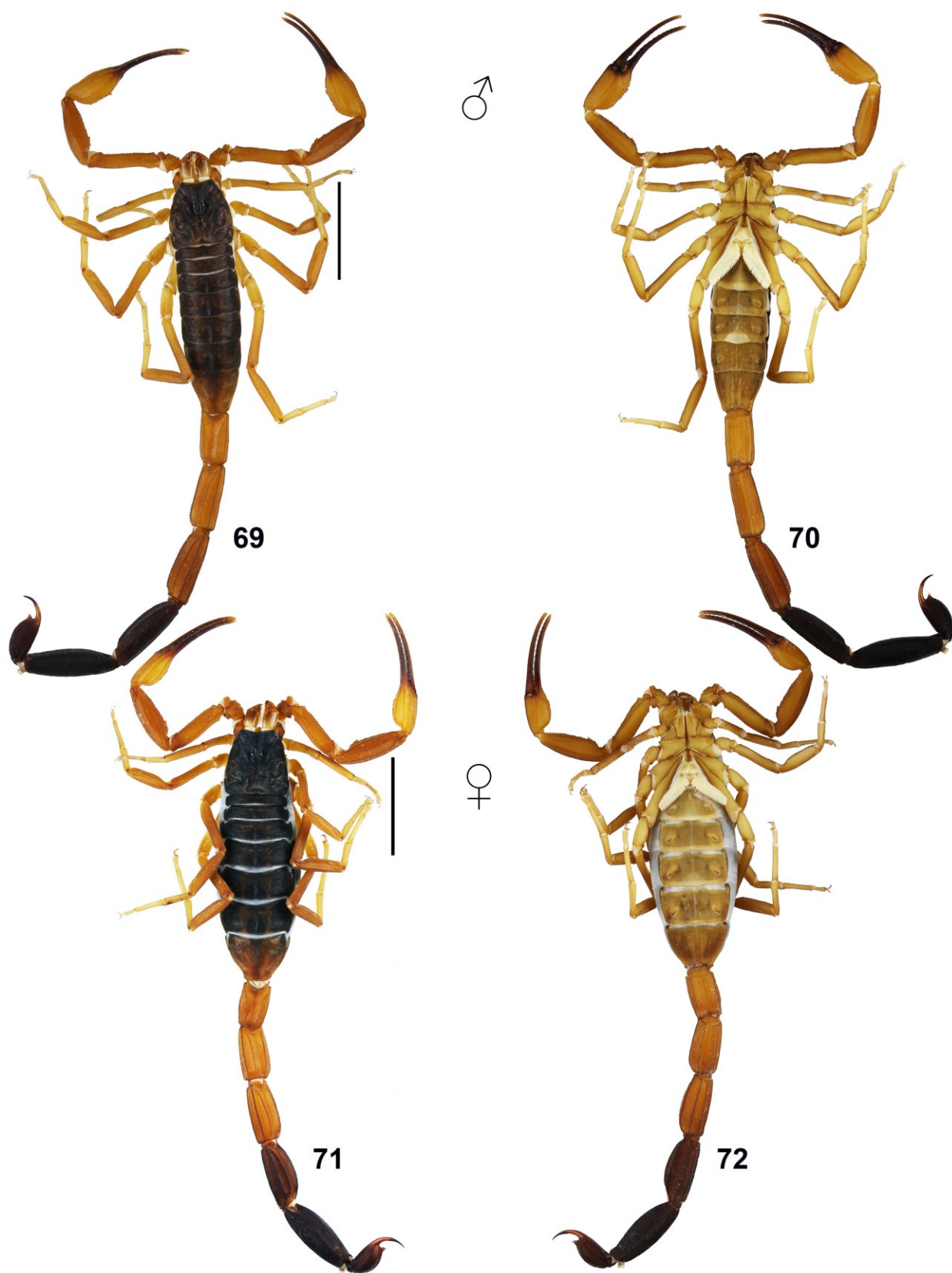
TYPE LOCALITY AND HOLOTYPE DEPOSITORY. Peru, [Huánuco Region], Huánuco Department, [Puerto Inca Province, Yuyapichis District], ACP Panguana, Río Yuyapichis, 09°37'S 74°56'W, 230–260 m a. s. l. (Fig. 101), MUSM.

TYPE MATERIAL. Peru, [Huánuco Region], Huánuco Department, [Puerto Inca Province, Yuyapichis District], ACP Panguana, Río Yuyapichis, 09°37'S 74°56'W, 230–260 m a. s. l., 1.V–21.V.2015, leg. S. Friedrich, F. Wachtel & M. Steinherr, 1 ♂ (holotype, MUSM, Figs. 69–70, 73, 76–83, 87–94, 97), 1 ♀ (paratype, FKCP, Fig. 71–72, 74–75, 84–86, 95–96, 98), 1 subadult ♂ (paratype, ZSMC No. ZSMA20157505, Figs. 99–100), 1 juvenile ♀ (paratype, MUSM), 20.VII.1982, leg. E.-G. Burmeister, forest clearance, in wood, 1 ♀ (paratype, ZSMC No. ZSMA20157504).

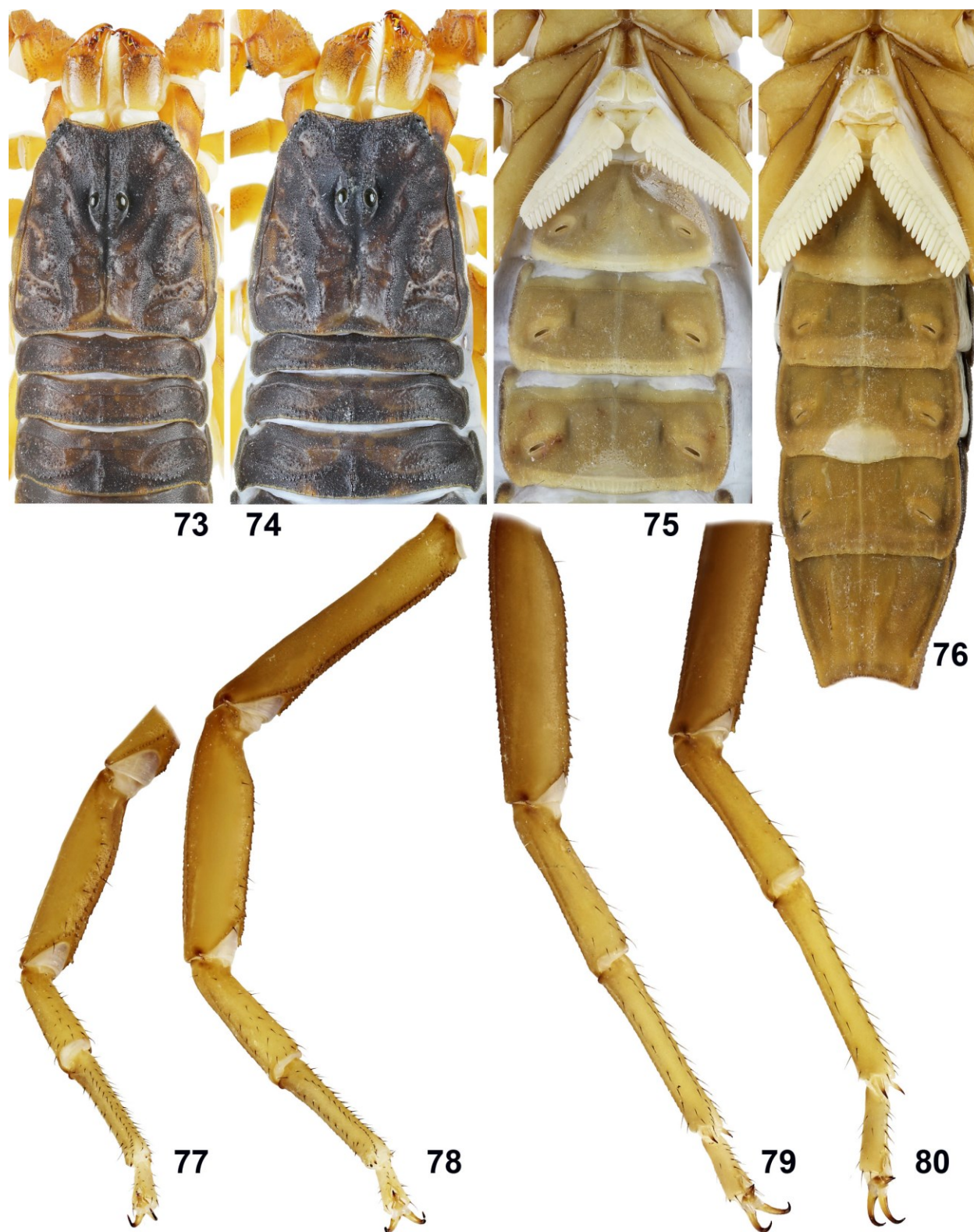
ETYMOLOGY. The selected epithet is an indeclinable noun in apposition, taken from the name of the locality where this species was collected. Panguana is also an important protected area, aimed to the conservation of Peruvian biodiversity.

DIAGNOSIS. A member of the “*bolivianus*” species-group. Adult size large (male 69 mm, female 65–67 mm) for the group. Coloration basically light brown; carapace and tergites essentially blackish, with a very dense and confluent pattern of blackish spots not clearly arranged into a trifasciate pattern; pedipalp fingers, metasomal segments IV–V and telson blackish. Pedipalp chelae with manus elongate, strongly carinate, wider than patella (ratio 1.41 in male, 1.13 in female), and with internal surface conspicuously denticulate in both sexes, large and subrectangular in male, smaller and oval in female; fixed and movable fingers with 13–14 principal rows of denticles, respectively, basal lobe/notch combination strong in male, weak in female. Pectines with 19–21 teeth in male, 18–20 in female; basal middle lamella angulose and only vestigially enlarged in male, oval and greatly enlarged in female. Sternite V with the smooth patch very large and wider than long in both sexes, ellipsoid, bulky and whitish in male, somewhat smaller, almost flat and translucent in female; spiracles long, slit-like. Metasoma very long, slender and essentially parallel-sided in both sexes (conspicuously longer in male), with 10/8/8/8/3 complete to essentially complete, moderately serrate to granulose to subcrenulate carinae; dorsal lateral carinae on segments II–IV with terminal denticles not enlarged; all intercarinal spaces coriaceous, with abundant minute but rough granulation scattered. Telson vesicle oval, vestigially granulose, with subaculear tubercle large, spiniform and with two dorsal granules.

DESCRIPTION (adult male holotype). **Coloration** (Figs. 69–70) base light brown, immaculate all over except as follows. Chelicera manus very densely and finely reticulated with blackish brown all over, much darker and denser distally but not on fingers base; fingers pale immaculate. Pedipalp femur and patella somewhat darker and with an orange shade; chela paler



Figures 69–72: *Tityus panguana* sp. n. **Figures 69–70:** holotype male, dorsal (69) and ventral (70) views. **Figures 71–72:** paratype female, dorsal (71) and ventral (72) views. Scale bar: 10 mm.



Figures 73–80: *Tityus panguana* sp. n. **Figures 73, 76–80:** holotype male, chelicerae, carapace and tergites I–III (73), sternopectinal region and sternites III–VII (76), distal segments of legs I–IV (77–80), retroventral view. **Figures 74–75:** paratype female, chelicerae, carapace and tergites I–III (74), sternopectinal region and sternites III–V (75).

but with base of fingers deeply infusate to blackish, fingers blackish with yellowish tips. Carapace almost uniformly blackish, with a very dense and confluent pattern of blackish spots, and a few symmetrical but isolated, small pale areas. Tergites with the same pattern as carapace, with similar small pale areas faintly suggesting but not clearly defining a trifasciate pattern. Pectines immaculate yellowish to whitish, with basal portion and basal plate progressively darker due to heavier sclerotization. Sternites immaculate; V with the smooth patch sharply contrasting, whitish. Metasoma immaculate bicolor, with segments I–III light brown and IV–V blackish, carinae subtly infusate. Telson vesicle blackish, subaculear tubercle gradually paler distally; aculeus with basal half brown and distal half blackish.

Chelicerae (Fig. 73). With dentition typical for the genus; teeth relatively large and sharp. Tegument glossy but with abundant fine granulation scattered, dorsodistal portion of manus with coarse, glossy granules irregularly arranged transversally, defining a depressed area. Setation very dense ventrally, but essentially lacking dorsally, except for five rigid, whitish macrosetae around depressed area of manus.

Pedipalps (Figs. 87–94). Somewhat long and robust for the group, almost glabrous. Orthobothriotaxic A- α , but with chelal trichobothria *est-et-db-et* displaced to distal third of finger and essentially with no "petite" trichobothria (basically all trichobothria with noticeably small, subequal areolae). Femur almost straight and essentially bare; all carinae strongly denticulate to serrate; intercarinal tegument finely and densely granulose; internal (*i*) trichobothria surrounding a moderate, crest-like spur. Patella straight and essentially bare; all carinae strongly crenulate; intercarinal tegument very finely and densely granulose, internally with many conical tubercles of similar size but basally larger. Chela robust and sparsely setose; manus large, subrectangular (1.52 times longer than wide), wider than patella (ratio 1.41), and with the distal half only slightly widest, all carinae moderate to strong, granulose to crenulate, intercarinal tegument coriaceous and with minute but dense granulation scattered on all surfaces and with many large, sharp, conical granules (some bifid) internally; fingers very long and slender (movable finger 1.87 times longer than underhand), evenly curved, sparsely setose, fixed finger with 14/14 principal rows of denticles, movable finger with 14/14 plus an apical subrow of five denticles and a large internal accessory denticle (large terminal denticle not included), basal lobe/notch combination strong and leaving a conspicuous S-shaped gap when fingers closed.

Carapace (Fig. 73). Trapezoidal and slightly longer than wide; anterior margin widely V-shaped, with scattered setation. Carination almost entirely obscured by surrounding granulation: the only definable carinae are the completely fused anterior medians and super-

ciliaries (finely and moderately granulose), and the also completely fused central medians and posterior medians (finely and moderately granulose). Furrows: anterior median, median ocular, central median, posterior median and posterior marginal fused, narrow and very deep, posterior laterals long, trifurcate, narrow and moderately deep, lateral centrals narrow and moderately deep. Tegument very densely covered by fine but rough granulation, with abundant coarser granulation scattered, mostly over posterolateral areas. Median eyes large and separated by about one ocular diameter, lateral eyes much smaller but also relatively large and subequal.

Sternum (Fig. 76). Standard for the genus: type 1, medium-sized, longer than wide, and triangular in shape, with 3–4 pairs of long macrosetae. Tegument very finely and densely granulose.

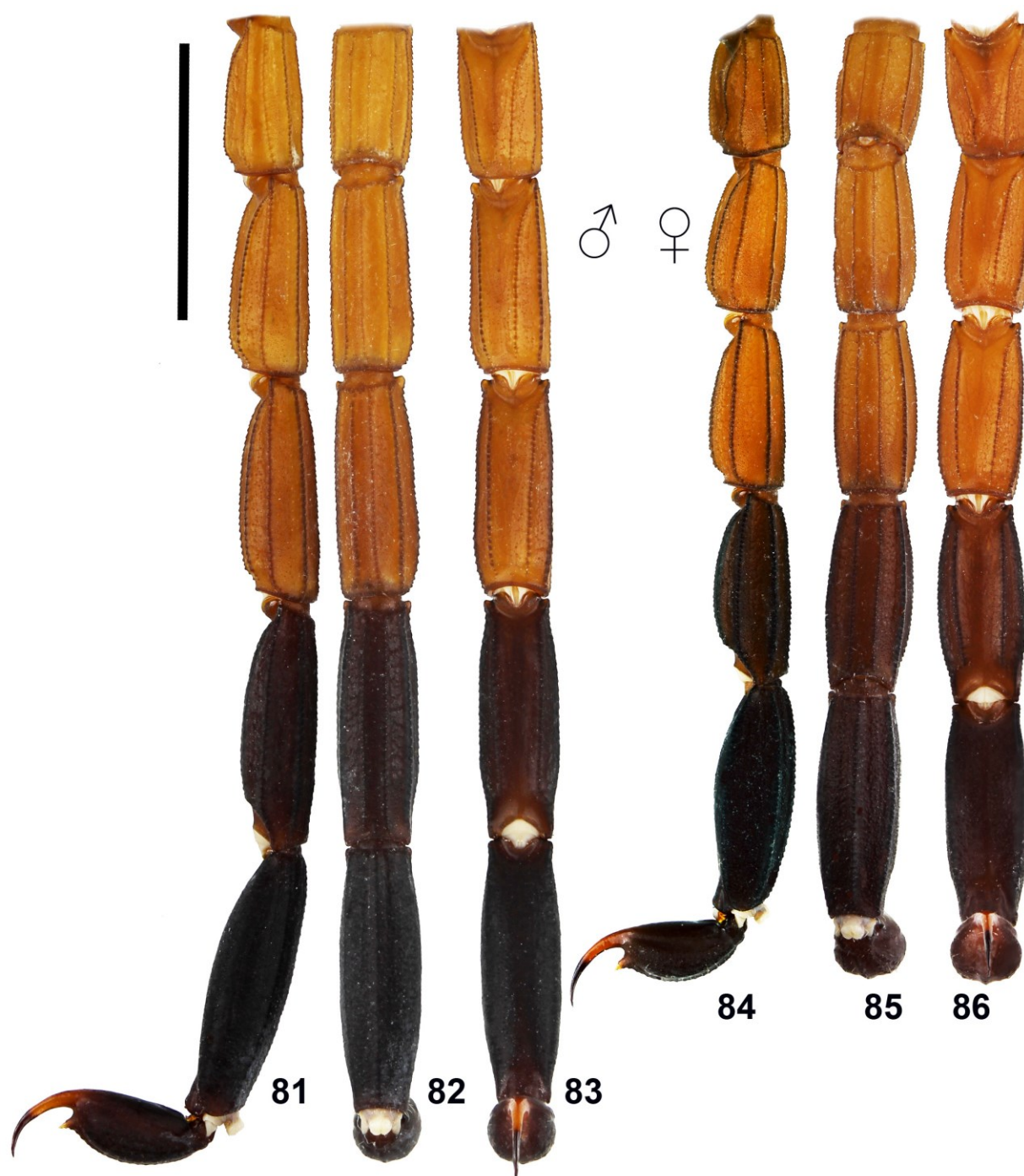
Genital operculum (Fig. 76). Medium-sized, halves widely separated and roundly subtriangular in shape, with 3–4 pairs of macrosetae; tegument coriaceous. Genital papillae large, conspicuously protruding. Pre-pectinal plate heavily sclerotized and widely V-shaped.

Pectines (Fig. 76). Size and shape standard for the group: almost reaching leg IV trochanter, subrectangular and moderately setose. Tooth count 19/19, teeth long and only slightly swollen. Basal middle lamella angulose and only vestigially enlarged. Basal plate highly sclerotized, wider than long; anterior margin with a narrow and deep linear anteromedian notch, posterior margin essentially straight; tegument coriaceous.

Hemispermaphore (Figs. 142–145). Trunk elongate, slender, tapering from foot to capsule; flagellum short, pars recta compressed, broad, very short, rudimentary, contracted apically; pars reflecta thin, uniform diameter, translucent, refractile; capsule region with 2 lobes; internal lobe rather narrow, long, with strong dorsal carina terminating in blunt vertex; basal lobe with low profile, robust, elongate, dorsally convex, hook-like, strongly overhanging internally; external lobe absent, either undeveloped or fused with basal margin of internal lobe (same condition in both left and right hemispermaphores).

Legs (Figs. 77–80). Very long and slender, with all carinae finely serrate, intercarinal tegument very finely and densely granulose. Prolateral and retrolateral pedal spurs long and thin. Ventral surface of telotarsi round and with less than 10 dark, thin spiniform setae not clearly arranged into rows. Claws very long and strongly curved.

Mesosoma (Figs. 73, 76). Tergites very densely covered by fine but rough granulation, with abundant coarser granulation scattered, mostly over posterolateral areas; I–VI with only one well-defined median longitudinal carina which is long, strong, granulose to crenulate, formed by medium-sized, glossy granules that do not project beyond posterior margin; VII with the



Figures 81–86: *Tityus panguana* sp. n. **Figures 81–83.** Holotype male, metasoma and telson, lateral (81), ventral (82), and dorsal (83) views. **Figures 84–86.** Paratype female, metasoma and telson, lateral (84), ventral (85), and dorsal (86) views. Scale bar: 10 mm.

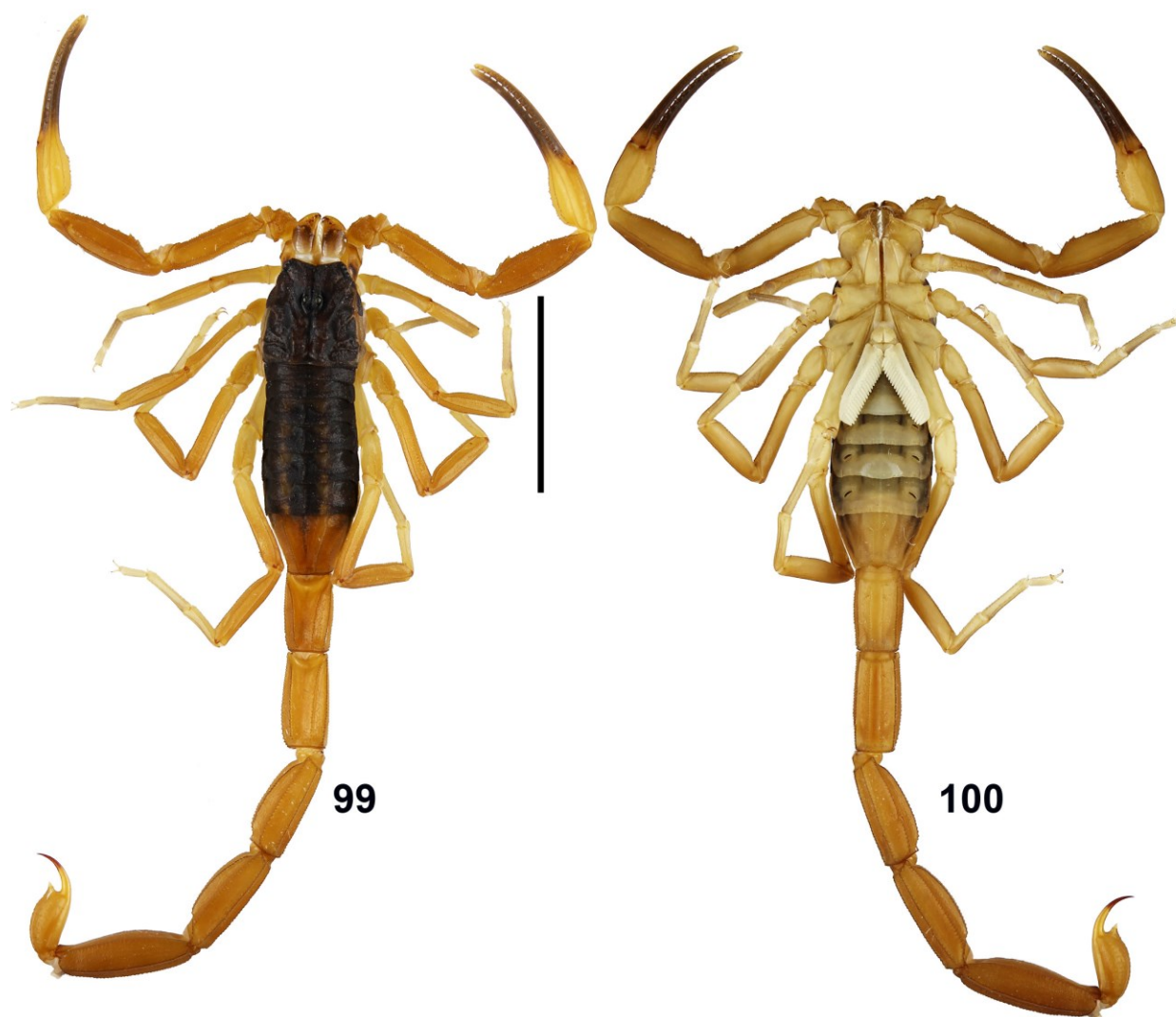
standard five carinae which are very long and finely serrate. Sternites very finely, densely and evenly granulate throughout; spiracles oblique, long and slit-like; posterior margin of III and V widely convex, IV essentially straight, VII narrowly concave; III with a posteromedian smooth patch, which is large, triangular,

longer than wide, flat, glossy, and translucent; smooth patch of V very large, ellipsoid, much wider than long, bulky, glossy, and whitish.

Metasoma (Figs. 81–83). Very long, slender and essentially parallel-sided and finely subserrate to subcrenulate on IV, absent on V, terminal denticle not en-



Figures 87–98: *Tityus panguana* sp. n. **Figures 87–94, 97.** Holotype male. Pedipalp chela, dorsal (87), external (88), and ventral (89) views. Pedipalp patella, dorsal (90) and external (91) views. Pedipalp femur and trochanter, internal (92) and dorsal (93) views. The trichobothrial pattern is indicated in Figures 88–93. Pedipalp movable finger (94). Telson lateral (97). **Figures 95–96, 98.** Paratype female. Pedipalp chela, dorsal (95) and external (96) views. Telson lateral (98).



Figures 99–100: *Tityus panguana* sp. n., paratype male subadult, dorsal (99) and ventral (100) views. Scale bar: 10 mm.

larged in any segment; lateral supramedians strong and finely serrate on I–III, weak and finely subserrate to subcrenulate on IV, absent on V (not distinguishable from surrounding granulation); lateral inframedians strong and finely serrate on I, absent on II–V (without slightest trace of remnants in any segment); ventral laterals strong and finely serrate on I–III, moderate and finely serrate on IV, weak and finely subcrenulate on V; ventral submedians strong and finely serrate on I–III, moderate and finely serrate on IV, absent on V (but indicated by aligned granules on basal third); ventral median absent on I–IV, weak and finely subserrate on V. Intercarinal tegument coriaceous, with abundant minute but rough granulation scattered on all surfaces but coarser and denser on IV–V, somewhat obscuring distinction of carinae; dorsal furrow complete, moderately narrow and shallow on all segments; setation sparse,

with 4–6 pairs of very short and thin, whitish ventrolateral macrosetae on I–V.

Telson (Figs. 81–83, 97). Vesicle oval (1.90 times longer than wide, 1.02 times wider than deep) and with several whitish setae scattered; tegument coriaceous, with vestigial granules scattered on all surfaces except dorsally; ventral median carina coarsely granulose, raised abruptly into the subaculear tubercle which is large, spiniform and ornate with two dorsal granules. Aculeus sharp, shorter than vesicle and shallowly curved.

FEMALE (paratype: Figs. 71–72, 74–75, 84–86, 95–96, 98; Table 2). Similar to male in coloration, but with evident sexual dimorphism: **1)** size slightly smaller; **2)** pedipalp manus much smaller, oval slender and with denticles of internal surface much smaller and sparser;



Figure 101: Panguana, type locality of *Tityus panguana* sp. n., the banks of a little jungle rivulet east of Panguana field station.

4) fingers longer, thinner and with lobe/notch combination much weaker; 5) genital papillae absent; 6) pectines shorter, with teeth much shorter and narrower and basal middle lamella oval and greatly enlarged; 7) mesosoma wider, with sides more convex; 8) smooth patch of sternite V somewhat smaller, almost flat and translucent; 9) metasomal segments and telson shorter.

VARIATION. The subadult paratype male differs from adult holotype in characters typical for the species group (Figs. 99–100): size smaller, coloration paler and more contrasting but with metasomal segments IV–V and telson not conspicuously darkened, tegument noticeably less sclerotized and with overall sculpturing less developed, and pedipalp manus very slender and narrower than patella.

Number of principal rows of denticles was always 14 on movable finger and predominantly also on fixed finger, where count of 13 was also observed.

Pectinal tooth counts among paratypes varied as follows: subadult male with 21/21, adult and juvenile females with 18–20 (1x18, 2x19, 3x20).

AFFINITIES. Across the entire "*bolivianus*" species-group, the unique combination of size (remarkably large), shape of pedipalps and metasoma (remarkably slender, more so in male), coloration (tergites with dark pattern confluent to uniform tergites), and shape of pectinal basal plate (slightly enlarged in male) presented by *T. panguana* sp. n. is shared only by two species: *Tityus footei* Chamberlin, 1916 (from Andean south-central Peru) and *Tityus horacioi* Lourenço et Leguin, 2011 (from Andean central Bolivia). Both taxa can be safely distinguished from *T. panguana* sp. n. by having: 1) metasoma remarkably less attenuated in both sexes; 2) pedipalp chelae comparatively smaller and more slender, with internal surface of manus much less denticulate and basal lobe/notch combination of fingers much weaker, with corresponding S-shaped gap vestigial to absent; 3) sternite V in male with smooth patch much smaller and flatter. In addition to these shared dissimilarities, the following diagnostic differences are also valid:

- *T. footei*: 1) coloration remarkably paler, with carapace and tergites irregularly patterned

DIMENSIONS (MM)		<i>T. wachteli</i> sp. n.		<i>A. ashaninka</i> sp. n.
		♂ holotype	♀ paratype	♀ holotype
Carapace	L / W	4.80 / 4.95	4.40 / 4.80	2.700 / 2.875
Mesosoma	L	11.20	12.00	8.250
Tergite VII	L / W	3.35 / 4.10	3.05 / 4.85	1.380 / 2.875
Metasoma + Telson	L	32.55	24.13	15.140
Segment I	L / W / H	4.10 / 2.30 / 2.25	2.90 / 2.25 / 2.05	1.500 / 1.725 / 1.425
Segment II	L / W / H	5.20 / 2.15 / 2.20	3.63 / 1.95 / 2.05	1.785 / 1.575 / 1.425
Segment III	L / W / H	5.70 / 2.13 / 2.25	4.05 / 1.95 / 2.10	2.050 / 1.550 / 1.425
Segment IV	L / W / H	6.25 / 2.25 / 2.40	4.40 / 1.90 / 2.15	2.550 / 1.530 / 1.500
Segment V	L / W / H	6.25 / 2.70 / 3.85	5.25 / 2.10 / 2.15	4.000 / 1.500 / 1.460
Telson	L / W / H	5.05 / 1.80 / 1.725	4.15 / 1.45 / 1.45	3.250 / 0.850 / 0.800
Vesicle	L	3.60	2.70	2.250
Aculeus	L	1.95	1.70	1.300
Pedipalp	L	12.80	16.65	9.775
Femur	L / W	5.20 / 1.30	4.10 / 1.15	2.750 / 0.700
Patela	L / W	5.85 / 2.00	4.75 / 1.75	2.950 / 0.950
Chela	L	9.30	7.80	4.075
Manus	L / W / H	3.40 / 3.33 / 2.30	2.70 / 1.45 / 1.40	0.975 / 0.625 / 0.675
Movable finger	L	5.90	5.10	3.100
Total	L	48.55	40.53	26.09

Table 3: Comparative measurements of adults of *Tityus wachteli* sp. n. and *Ananteris ashaninka* sp. n. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (H).

- with confluent, medium to light brown spots and pedipalp fingers only moderately to subtly infuscate; **2)** sternite V with posterior margin behind smooth patch medially projected into a narrowly convex lobe in both sexes; **3)** telson vesicle in male entirely smooth, in female only with few granules arranged into obsolete longitudinal carinae; **4)** subaculear tubercle much smaller and smoother.

- *T. horacioi*: **1)** pedipalp manus subrectangular in female; **2)** pectinal tooth count higher, 22–23 in male, 20–22 in female; **3)** sternite V with posterior margin essentially straight in male; **4)** telson with aculeus longer and not evenly curved, but angulate in both sexes, i.e., basally and distally curved, but with median third almost straight.

DISTRIBUTION. Known only from the type locality.

Tityus wachteli Kovářík, Teruel, Lowe et Friedrich, sp. n.

(Figures 102–132, 146–149; Table 3)

<http://zoobank.org/urn:lsid:zoobank.org:act:4CF07C17-A407-44F0-8440-25DE116CA2C9>

Tityus silvestris: Lourenço & Dastych, 2001: 55 (misidentification).

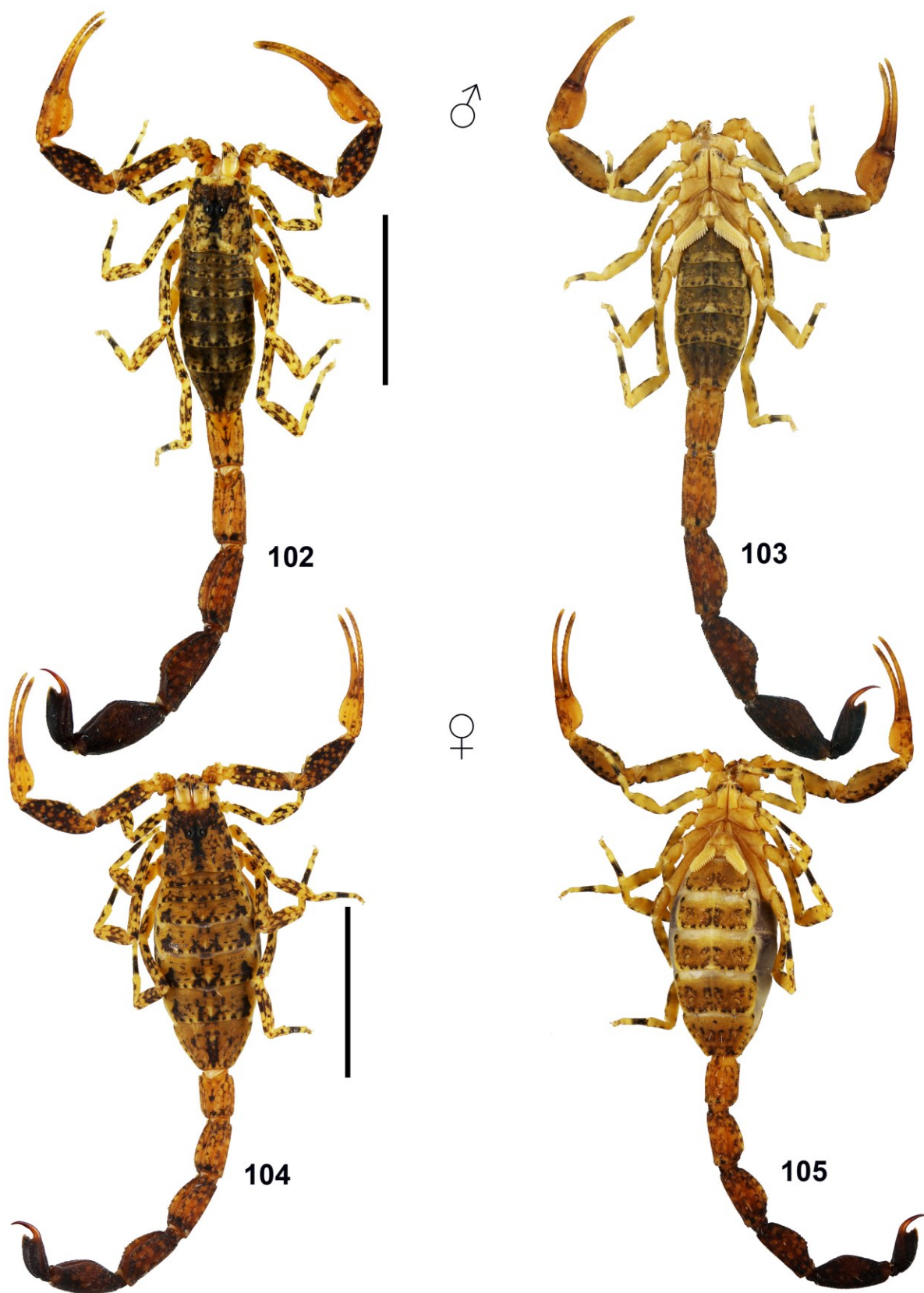
TYPE LOCALITY AND HOLOTYPE DEPOSITORY. Peru, [Huánuco Region], Huánuco Department, [Puerto Inca Province, Yuyapichis District], ACP Panguana, Río

Yuyapichis, 09°37'S - 74°56'W, 230–260 m a. s. l. (Fig. 132), MUSM.

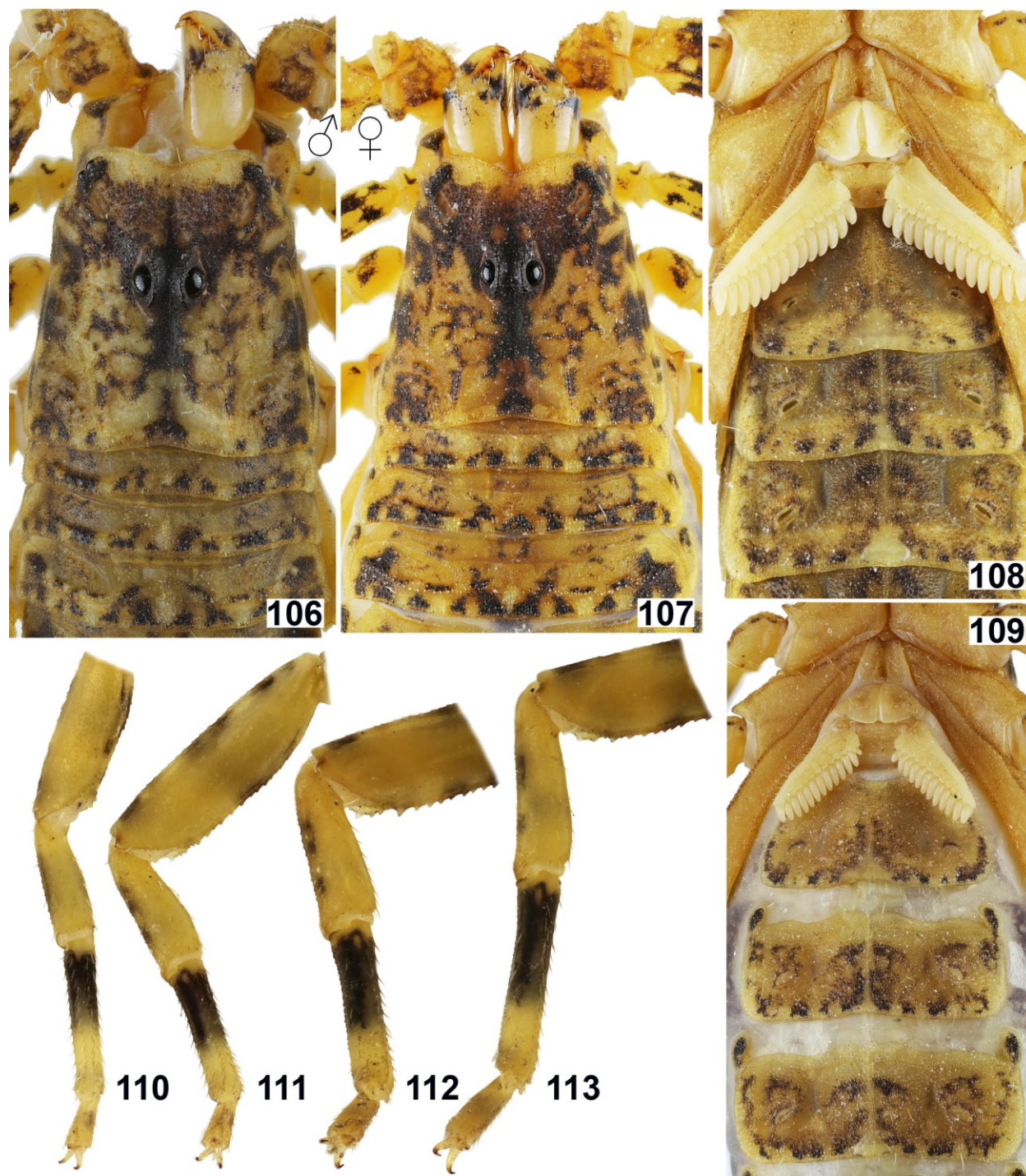
TYPE MATERIAL. Peru, [Huánuco Region], Huánuco Department, [Puerto Inca Province, Yuyapichis District], ACP Panguana, Río Yuyapichis, 09°37'S 74°56'W, 230–260 m a. s. l., 21.IX–4.X.2004, leg. K. Schönitzer, A. Segerer, T. Kothe, M. Breitsameter, O. Conle & F. Hennemann, 1♂ (holotype, MUSM, Figs. 102–103, 106, 108, 110–116, 120–127, 130), VII.1982, leg. E.-G. Burmeister, 1♀ with 8 juveniles after first ecdysis (paratypes, MUSM, labeled as *Tityus silvestris*), 20.IX–7.X.2013, leg. S. Friedrich, 1♂, 1♀ (paratypes, FKCP), 1.V–21.V.2015, leg. S. Friedrich, F. Wachtel & M. Steinherr, 1♂ (paratype, ZSMC No. ZSMA20157506), 6♀ (paratypes, MUSM, Figs. 104–105, 107, 109, 117–119, 128–129, 131), 4♀ (paratypes, ZSMC No. ZSM A20157507–10), 1♀ (paratype, FKCP), 2♀ (paratypes, RTOC), 1♀ (paratype, FWCG), 1 juvenile ♀ (paratype, ZSMC No. ZSMA20157511).

ETYMOLOGY. The selected epithet is a patronym honoring Franz Wachtel (Grünwald, Germany) for his companionship, expertise, and assistance in collecting soil arthropods during two field trips of one of us (SF) to ACP Panguana.

DIAGNOSIS. A member of the “*clathratus*” species-group. Adult size standard (male 45–49 mm, female 37–43 mm) for the group. Coloration basically light yel-



Figures 102–105: *Tityus wachteli* sp. n. **Figures 102–103:** holotype male, dorsal (102) and ventral (103) views. **Figures 104–105:** paratype female, dorsal (104) and ventral (105) views. Scale bar: 10 mm.



Figures 106–113: *Tityus wachteli* sp. n. **Figures 106, 108, 110–113:** holotype male, chelicerae, carapace and tergites I–III (106), sternopectinal region and sternites III–V (108), distal segments of legs I–IV (110–113), retroventral view. **Figures 107, 109:** paratype female, chelicerae, carapace and tergites I–III (107), sternopectinal region and sternites III–V (109).

lowish brown, very densely reticulated with blackish brown all over the body and appendages; tergites with three irregular longitudinal dark stripes; metasomal segment V and telson much darker, reddish-black; pedipalp

manus much paler and only sparsely spotted, fingers yellowish brown with irregular infuscation. Pedipalp chelae with manus small and strongly carinate in both sexes, subquadrate and wider than patella (ratio 1.67) in

male, oval and much narrower than patella (ratio 0.83) in female; fixed and movable fingers with 14–15 and 14–16 principal rows of denticles, respectively, basal lobe/notch combination vestigial in male, obsolete in female. Sternites and metasoma with some conspicuous, whitish macrosetae scattered. Pectines with 13–15 teeth in male, 11–14 in female (mode 13 in both sexes); basal middle lamella roundly trapezoidal and only slightly enlarged in both sexes. Sternite V with the smooth patch moderately small, widely teardrop-shaped and bulky in both sexes, larger in male; spiracles elongate oval. Metasoma long, slender, and remarkably swollen distally (more evident in male), with 10/8/8/8/5 complete to essentially complete, strongly serrate to serratocrenulate carinae; dorsal lateral carinae on segments II–IV with terminal denticle vestigially (male) to moderately (female) enlarged; all intercarinal spaces very coarsely and densely granulose. Telson elongate oval, vesicle weakly but coarsely granulose (stronger and denser in female), with subaculear tubercle very large, blade-like and with two dorsal plus 1–2 apical granules.

DESCRIPTION (adult male holotype). **Coloration** (Figs. 102–103) base light yellowish brown, very densely reticulated and spotted with blackish brown all over the body and appendages except on the ventral region of prosoma, which is spotted only on coxapophyses I–II. Chelicerae pale yellow; manus faintly spotted with blackish brown only distally, at fingers base; fingers only with basal half deeply infusate. Pedipalp femur very densely reticulated and spotted with blackish brown on all surfaces except ventral, which has only a single, large apical spot; patella even more densely reticulated and spotted with blackish brown on all surfaces except ventral, which is sparsely spotted, mostly along internal and external margins; chela with manus sparsely spotted with blackish brown, mostly on external and ventral surfaces, fingers only very faintly and irregularly infusate, mostly basally and subapically. Carapace symmetrically and densely reticulated and spotted with blackish brown, irregularly arranged into three longitudinal stripes, interocular triangle deeply infusate but with anterior margin immaculate pale as a broad, transverse yellow stripe; eyes and ocular tubercles black. Tergites symmetrically and densely reticulated and spotted with blackish brown, irregularly arranged into three longitudinal stripes continued to those on carapace. Pectines immaculate yellowish to whitish, with basal portion and basal plate progressively darker due to heavier sclerotization. Sternites symmetrically and densely reticulated and spotted with blackish brown, not arranged into stripes; V with the smooth patch conspicuously paler and immaculate, translucent yellowish. Legs densely spotted with blackish brown on all surfaces except internal, which it is essentially immaculate; basitarsi conspicuously annulated, with basal half blackish

and distal half pale; telotarsi similarly patterned, but much fainter. Metasoma with base color progressively darker distally, with segment V dark reddish; all surfaces very densely reticulated with blackish brown, with pattern becoming denser both basally and distally in every segment, especially on V which looks essentially blackish to unaided eye. Telson vesicle and subaculear tubercle dark reddish and densely reticulated with blackish brown, looking essentially blackish to unaided eye; aculeus with basal half yellowish brown and distal half reddish.

Chelicerae (Fig. 106). With dentition typical for the genus; teeth relatively small but sharp. Tegument glossy but with minute granulation scattered, dorsodistal portion of manus with coarse, glossy granules irregularly arranged transversally, defining a depressed area. Setation very dense ventrally, but essentially lacking dorsally, except for some five rigid, whitish macrosetae around depressed area of manus.

Pedipalps (Figs. 120–127). Moderately long and slender for the group, almost glabrous. Orthobothriotaxic A- α , but with chelal trichobothria *est-et-db-et* displaced towards apical third of finger and essentially with no "petite" trichobothria (basically all trichobothria with noticeably small, subequal areolae). Femur straight and essentially bare; all carinae strongly subdenticulate to subserrate; intercarinal tegument very densely and irregularly granulose; internal (*i*) trichobothria not surrounding a flat area (i.e., not a conspicuous spur). Patella straight and essentially bare; all carinae moderately granulose to subdenticulate; intercarinal tegument very densely and irregularly granulose, internally with two larger conical tubercles and many small denticles of similar size. Chela slender and sparsely setose; manus relatively small, subquadrate (1.02 times longer than wide), much wider than patella (ratio 1.67), and with the basal half only slightly widest, all carinae strongly granulose to crenulate, intercarinal tegument very densely and irregularly granulose on all surfaces and with abundant sharp, conical granules internally; fingers very long and slender (movable finger 1.74 times longer than underhand), evenly curved, sparsely setose, fixed finger with 14/14 principal rows of denticles, movable finger with 15/15 plus an apical subrow of three denticles and a large internal accessory denticle (large terminal denticle not included), basal lobe/notch combination vestigial.

Carapace (Fig. 106). Trapezoidal and slightly wider than long; anterior margin moderately bilobed, with two pairs of whitish macrosetae. Carination poorly developed: anterior medians widely separated and moderately granulose, superciliaries moderately granulose to subgranulose, lateral oculars moderately granulose, central laterals and posterior medians fused and moderately granulose, other carinae indistinct. Furrows: anterior median, median ocular, central median, posterior median and posterior marginal fused, wide and very deep, pos-



Figures 114–119: *Tityus wachteli* sp. n. **Figures 114–116.** Holotype male, metasoma and telson, lateral (114), ventral (115), and dorsal (116) views. **Figures 117–119.** Paratype female, metasoma and telson, lateral (117), ventral (118), and dorsal (119) views. Scale bar: 10 mm.

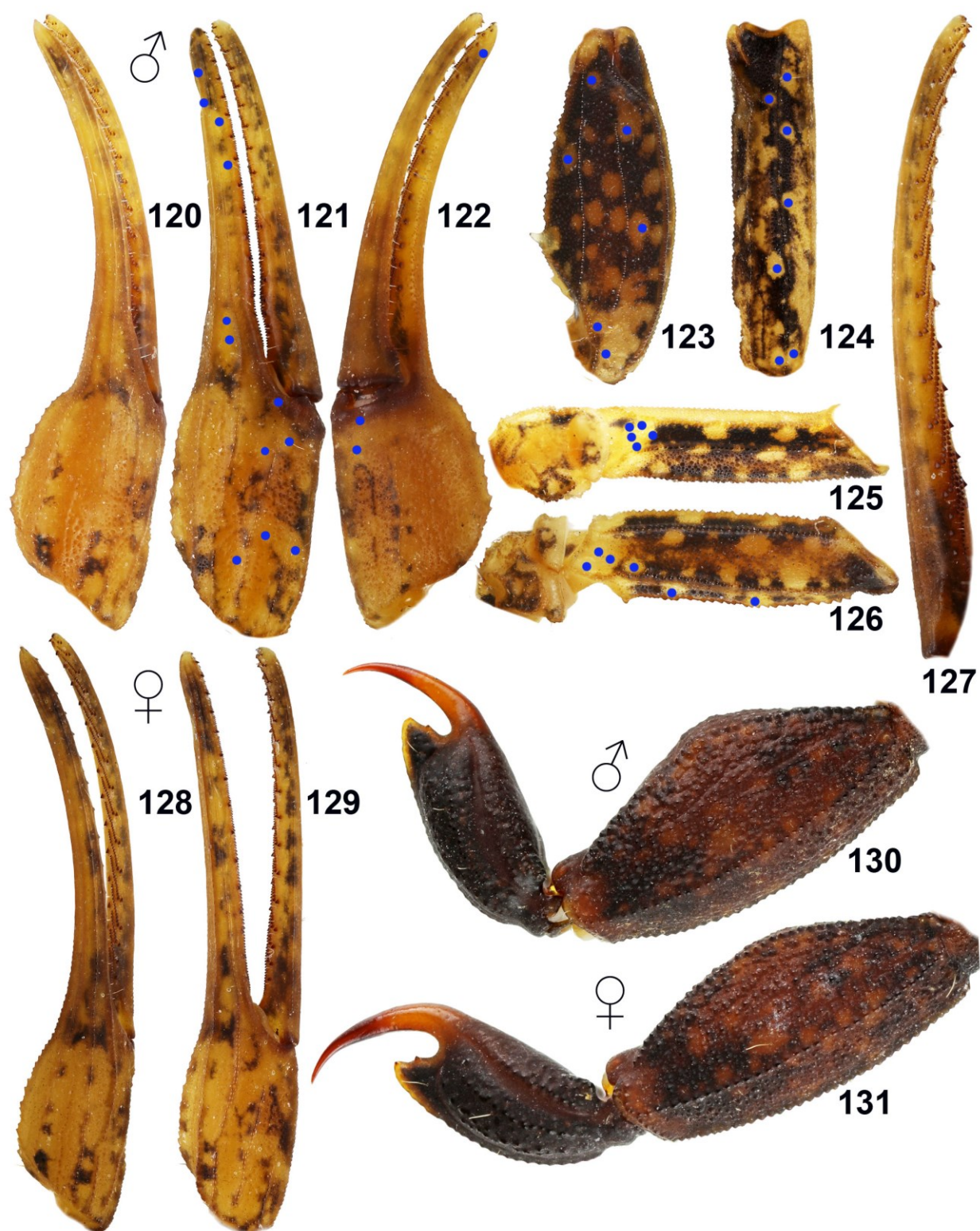
terior laterals long, wide and moderately deep, other furrows indistinct. Tegument very densely and irregularly granulose. Median eyes large and separated by more than one ocular diameter, lateral eyes much smaller.

Sternum (Fig. 108). Standard for the genus: type 1, medium-sized, longer than wide, and triangular in shape, with a pair of long macrosetae. Tegument very densely and irregularly granulose.

Genital operculum (Fig. 108). Medium-sized, halves moderately separated and cordiform in shape, with a few setae scattered. Genital papillae medium-sized, not protruding.

Pectines (Fig. 108). Size and shape standard for the group: small (far from reaching leg IV trochanter), sub-triangular and moderately setose. Tooth count 13/14, teeth conspicuously swollen. Basal middle lamella roundly trapezoidal and only slightly enlarged. Basal plate highly sclerotized, wider than long; anterior margin with a narrow V-shaped anteromedian notch, posterior margin very widely convex; tegument finely and densely granulose.

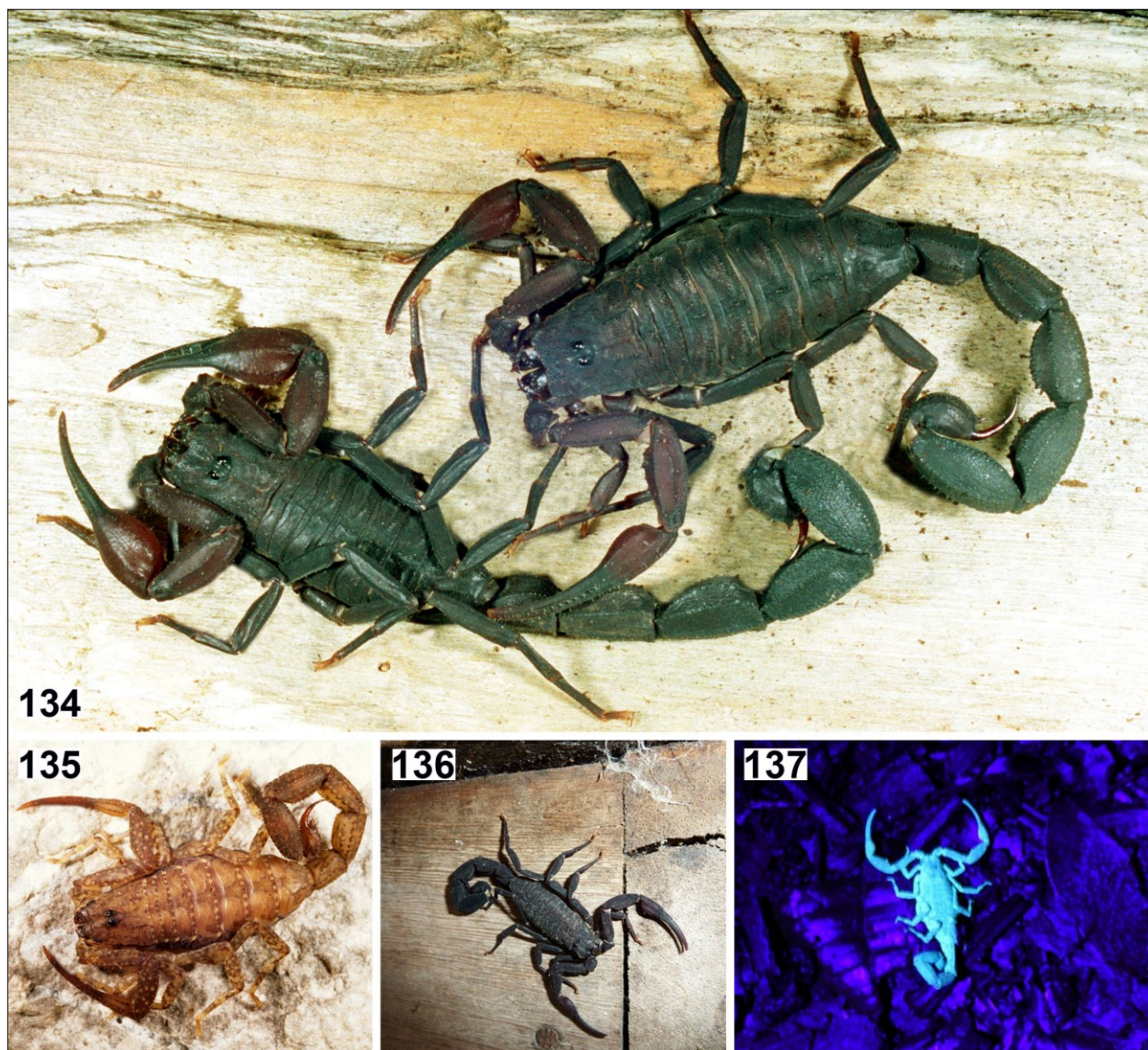
Legs (Figs. 110–113). Slender, with all carinae finely serrate to denticulate, intercarinal tegument finely and densely granulose. Prolateral and retrolateral pedal



Figures 120–131: *Tityus wachteli* sp. n. **Figures 120–127, 130.** Holotype male. Pedipalp chela, dorsal (120), external (121), and ventral (122) views. Pedipalp patella, dorsal (123) and external (124) views. Pedipalp femur and trochanter, internal (125) and dorsal (126) views. The trichobothrial pattern is indicated in Figures 121–126. Pedipalp movable finger (127). Telson and fifth metasomal segment lateral (130). **Figures 128–129, 131.** Paratype female. Pedipalp chela, dorsal (128) and external (129) views. Telson and fifth metasomal segment lateral (131).



Figures 132–133: Panguana. **Figure 132:** Type locality of *Ananteris ashaninka* sp. n. and *Tityus wachteli* sp. n., a jungle path east of the station near the Rio Yuyapichis. The two species were collected together with *Tityus metuendus* Pocock, 1897 from the jungle ground between and under leaf litter (except 2013: under dead wood). **Figure 133.** Rio Yuyapichis.



Figures 134–137: *Tityus* specimens alive. **Figure 134.** *Tityus metuendus*, a pair from Peru, Iquitos env. **Figure 135.** *Tityus metuendus*, juvenile. **Figure 136.** *Tityus metuendus*, female, Panguana field station. **Figure 137.** *Tityus wachteli* sp. n., female paratype at the type locality under UV.

spurs short and thick. Ventral surface of telotarsi round and with short, thin, dark setae irregularly arranged into two longitudinal, narrow, dense rows converging basally. Claws short and strongly curved.

Hemispermaphore (Figs. 146–149). Trunk elongate, slender, tapering from foot to capsule; flagellum short; pars recta and proximal portion of pars reflecta compressed, ribbon-like; pars reflecta strongly tapered, distal portion thin, uniform diameter, translucent, refractile; capsule region with 3 lobes; internal lobe rather narrow, with thin dorsal carina terminating in rounded apex; basal lobe a prominent, robust, dorso-externally convex, rounded hook-like process; external lobe moderately elongate, laminate, apically rounded.

Mesosoma (Figs. 106, 108). Tergites very densely and irregularly granulose; I–VI with only one well-

defined median longitudinal carina which is long, moderately strong, crenulate to subserrate, formed by partially anastomosed, medium-sized, glossy granules that do not project beyond posterior margin; VII with the standard five carinae which are long and crenulate to serrate. Sternites very densely and irregularly granulose, with some conspicuous whitish macrosetae scattered, spiracles oblique and elongate oval; posterior margin of III–IV widely bilobed, V–VI widely concave, VII straight; smooth patch of V moderately small, longer than wide, widely teardrop-shaped, bulky, and glossy.

Metasoma (Figs. 114–116, 130). Long, slender and remarkably swollen distally. Segment I with ten complete carinae, II–IV with eight, V with five: dorsal laterals strongly serrate to serratocrenulate and with vestigially enlarged terminal denticle on I–IV, absent on



Figures 138–141: *Tityus dillerorum* sp. n. Left hemispermatophore. **Figures 138–139.** Ventral (138) and dorsal (139) views of whole hemispermatophore (flagellum and foot were truncated). **Figures 140–141.** Enlarged ventral (140) and dorsal (141) views of capsule region. Scale bars: 1 mm, 500 μ m.

V; lateral supramedians strongly serrate to serratocrenulate on I–IV, strongly granulose but irregular on V; lateral inframedians strongly serrate to serratocrenulate on I, indicated by an incomplete row of coarser granules

on II (but not raised to form a true carina), absent on III–V; ventral laterals strongly serrate to serratocrenulate on I–IV, strongly granulose on V; ventral submedians strongly serrate to serratocrenulate on I–IV, absent on V;

ventral median absent on I–IV, strongly granulose to subcrenulate on V. Intercarinal tegument very coarsely and densely granulose; dorsal furrow complete, narrow and deep on all segments; setation sparse, with two pairs of whitish ventrolateral macrosetae.

Telson (Figs. 114–116, 130). Vesicle elongate oval (2.00 times longer than wide, 1.04 times wider than deep) and only with a few whitish macrosetae scattered; tegument coriaceous, with weak but coarse granules scattered on all surfaces except dorsally; ventral median carina coarsely granulose, continued into the subaculear tubercle which is very large, blade-like and ornate with two dorsal and two apical granules. Aculeus standard-sized, sharp, shorter than vesicle and shallowly curved.

FEMALE (paratype: Figs. 102–105, 107, 109, 117–119, 128–129, 131, Table 3). Similar to male in coloration, but with well-marked sexual dimorphism: **1)** size conspicuously smaller; **2)** pedipalp manus shorter, oval and much narrower than patella; **3)** fingers longer, thinner and with lobe/notch combination obsolete; **4)** genital papillae absent; **5)** pectines shorter, with teeth shorter and narrower; **6)** mesosoma wider, with sides more convex; **7)** smooth patch of sternite V smaller; **8)** metasomal segments and telson shorter and narrower.

VARIATION. Pectinal tooth count varied as follows: males 13–15 (3x13, 2x14, 1x15), females 11–14 (1x11, 11x12, 17x13, 5x14). The number of principal rows of denticles on the movable finger in both sexes was 14–16 (1x14, 16x15, 3x16).

AFFINITIES. Across the members of the “*clathratus*” species-group confirmed to occur from western Amazonia through the Pacific coast of South America (i.e., Colombia, Ecuador, Peru, Brazil, and Bolivia), the unique combination of coloration (metasoma distally blackish, pedipalp finger only very faintly and irregularly infuscate), shape of metasoma (slender in both sexes, laterally compressed and distally deeper in male), structure of metasomal dorsal lateral carinae (with terminal denticle not conspicuously enlarged), shape of pedipalps (slender, with manus small in both sexes and reduced basal lobe/notch combination) presented by *T. wachteli* **sp. n.** is shared only by two species: *Tityus betschi* Lourenço, 1992 (from Pacific Choco in western Colombia) and *Tityus kaderkai* Kovařík, 2005 (from Amazonian northwestern Bolivia, but see below). Both taxa can be safely distinguished by from *T. panguana* **sp. n.** by having: **1)** coloration sexually dimorphic, i.e., adult female with metasomal segment V and telson much paler than male; **2)** pedipalp manus in male comparatively longer and remarkably more slender; **3)** metasomal segments somewhat longer and less deep in male. In addition to these shared dissimilarities, the following diagnostic differences are also valid:

- *T. betschi*: **1)** adult female with metasomal segment V and telson yellowish, only with sparse and irregular infuscation; **2)** adult female with pedipalps and metasoma much more attenuate; **3)** telson with subaculear tubercle narrower and sharper in both sexes.

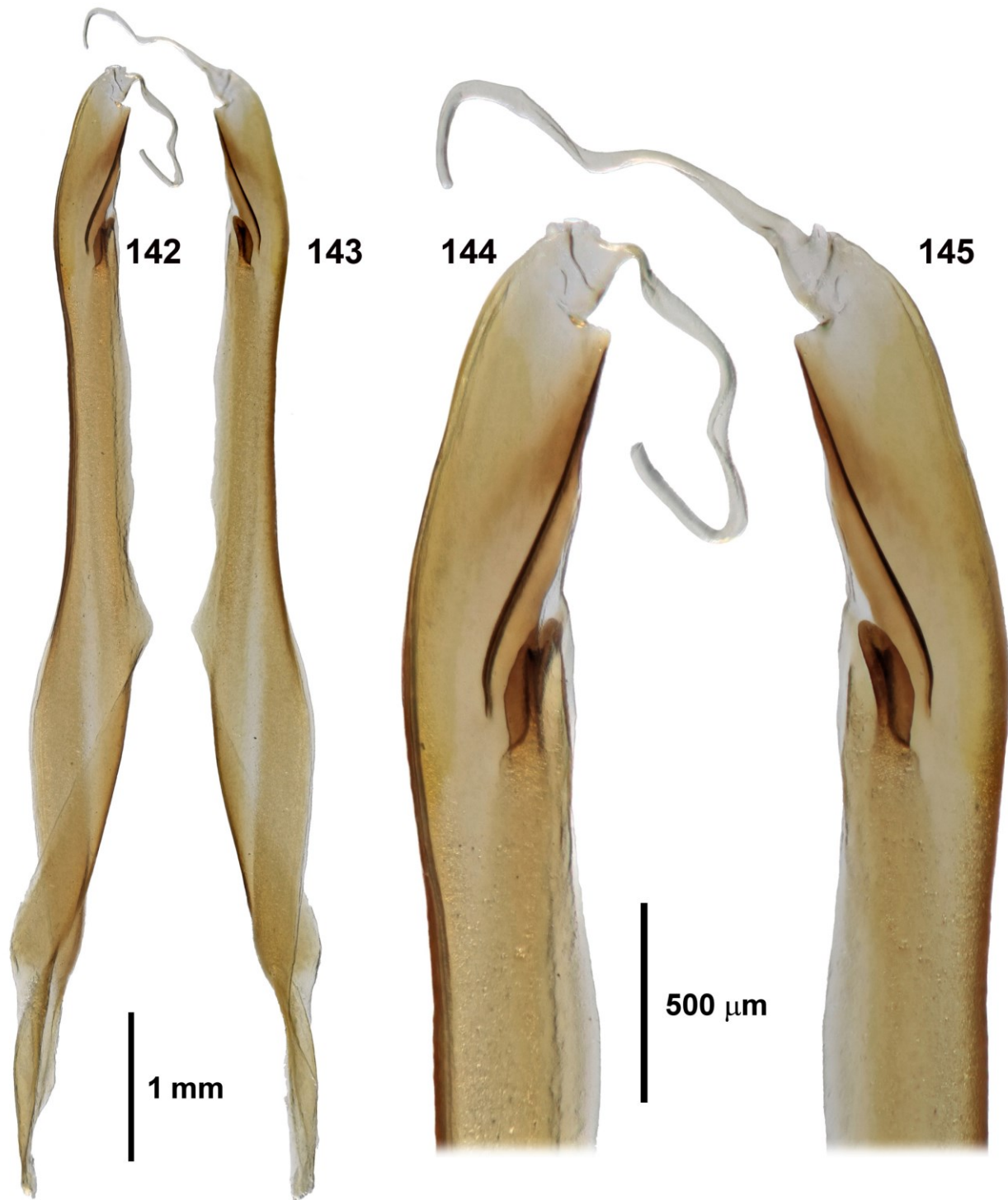
- *T. kaderkai*: **1)** adult male with metasomal segments IV–V and telson conspicuously deeper; **2)** adult female with pedipalps and metasoma less attenuate; **3)** smooth patch of sternite V in male wider than long, triangular and with a complete median longitudinal suture. It is worth mentioning here that Escobar et al. (2013) recorded this species from Madre de Dios Department in Amazonian southeastern Peru, but this record is erroneous: the color photographs of live adult male and female published by these authors (Escobar et al., 2013: 156; fig. 5) are clearly not referable to *T. kaderkai*, but a completely different and likely undescribed species instead, e.g., coloration is paler and less densely reticulated, male metasoma is shorter, not laterally compressed, and distally inflated but not darker, male pedipalp chelae are remarkably larger and more robust, and female has dorsal lateral carinae of metasomal segments I–III with terminal denticle enlarged.

Moreover, *T. wachteli* **sp. n.** has been previously misidentified as *Tityus silvestris* Pocock, 1897, but the two species are very distinct from each other and, as explained above, are not even the closest relatives inside the “*clathratus*” group (see below, in Remarks section).

DISTRIBUTION. Known only from the type locality.

REMARKS. Lourenço & Dastych (2001: 55) misidentified as *T. silvestris* one male and one juvenile from ZMUH, collected at the type locality of *T. wachteli* **sp. n.** By the way, the former author has repeatedly insisted in regarding *T. silvestris* as “polymorphic”, “polytypic” or “ochlopecies” and widespread over the entire Amazonian Basin from Guyana through Peru and Ecuador (e.g., Lourenço, 1986, 2002; Lourenço & Dastych, 2001), a situation that is clearly unrealistic:

1. Even that author himself (Lourenço, 1986, 2002; Lourenço & Dastych, 2001) has explicitly distinguished and illustrated “more than 25 morphs” based upon morphological characters such as shape and sculpture of pedipalps, metasoma, and telson. Such characters are just the same that have been repeatedly confirmed to be useful as species-level diagnostic in the “*clathratus*” group (e.g., Kovařík, 2005; Rojas-Runjaic & Armas, 2007; Teruel & García, 2008; Teruel & Roncallo, 2010; Teruel & Cozijn, 2011; Lourenço, 2008, 2012; Teruel & Kovařík, 2011).

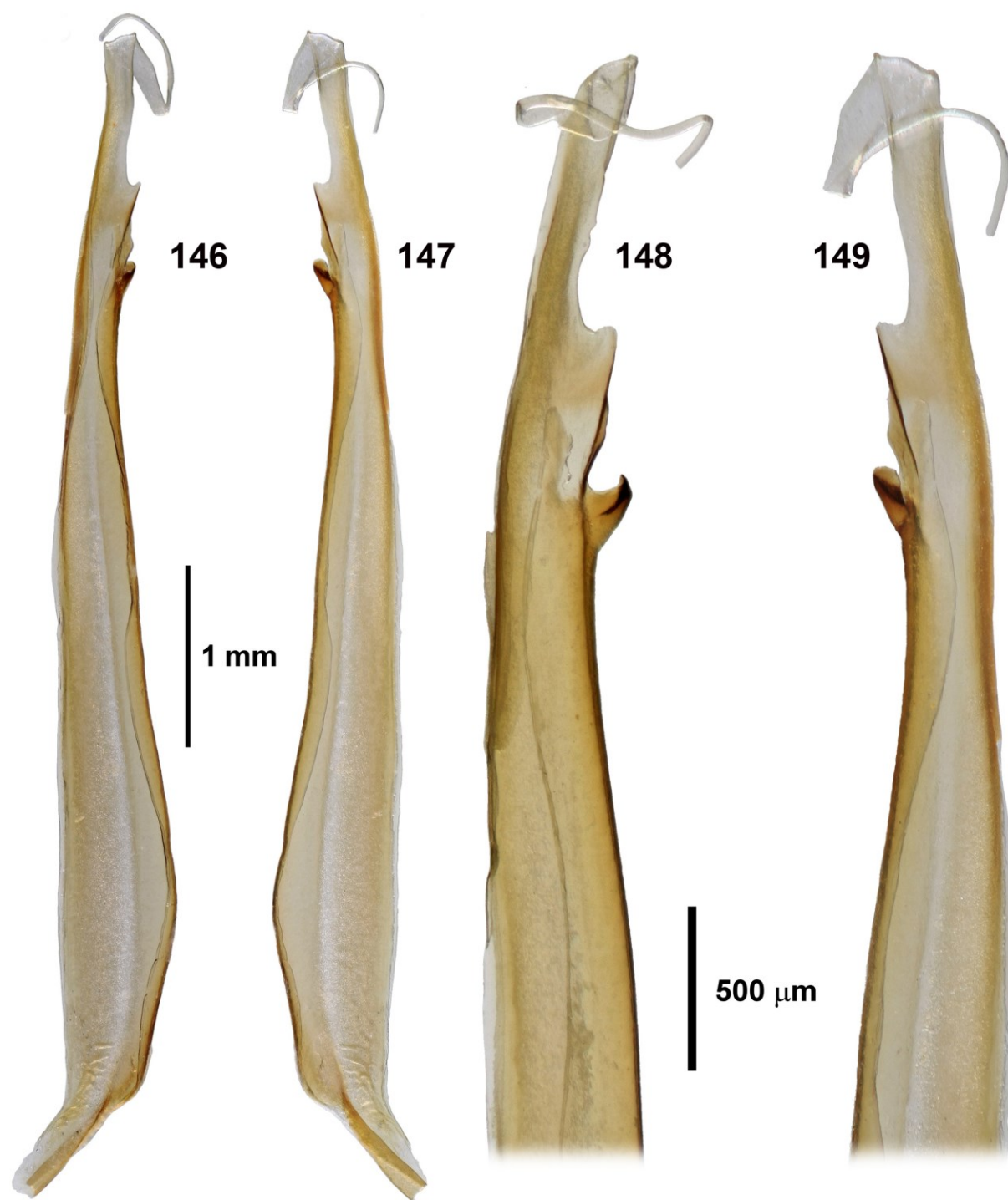


Figures 142–145: *Tityus panguana* sp. n. Left hemispermatophore. **Figures 142–143.** Ventral (142) and dorsal (143) views of whole hemispermatophore. **Figures 144–145.** Enlarged ventral (144) and dorsal (145) views of capsule region and flagellum. Scale bars: 1 mm, 500 µm.

2. The single reason declared to regard all those populations as conspecific has been the coloration pattern (“pigmentation”, e.g., Lourenço, 2002: 270). However, this is not a reliable character *per se* if its validity is not accurately tested,

i.e., clearly different species do have the same or very similar coloration, and vice versa.

3. Even though sometimes locally common, the species of the “*clathratus*” group whose identity has been clearly established, usually have a dis-



Figures 146–149: *Tityus wachteli* sp. n. Right hemispermatophore. **Figures 146–147.** Dorsal (146) and ventral (147) views of whole hemispermatophore. **Figures 148–149.** Enlarged dorsal (148) and ventral (149) views of capsule region and flagellum. Scale bars: 1 mm, 500 μm.

tribution restricted to continuous and mostly reduced habitats. Even in those species with confirmed wider geographical ranges such as *Tityus clathratus* C. L. Koch, 1844 and *Tityus tayrona*

Lourenço, 1991, it implies a single, continuous landscape and the morphological variation across the range is minor (Rojas-Runjaic & Armas, 2007; Teruel & Cozijn, 2011).

Because of the abovementioned reasons and until additional tools are incorporated (e.g., molecular genetics), we reject the polymorphic hypothesis for *T. silvestris* and recommend its taxonomic interpretation and geographical scope to be restricted to the type locality (Santarem, Pará State, Brazil) and those published descriptions and illustrations derived from the original types and topotypes only (e.g., Pocock, 1897; Lourenço, 1986: figs. 7–8; Lourenço, 2002: fig. 273). Following this, *T. wachteli* sp. n. is not even its closest relative, as it is evident from the completely different sexual secondary characters exhibited by the adult male *T. silvestris*: pedipalps and metasoma not conspicuously dimorphic, i.e., manus small and not wider than patella, and metasomal segments not longer, more slender and deeper than in female.

General remarks

At first sight, it could sound unusual that four new species of scorpion could be found together in a single Peruvian locality, but this is easy to understand when two main reasons are taken into account together.

The first is that the ACP Panguana is located deep inside the Río Pachitea river basin, which has a geographically privileged location for scorpion diversification: it is a long and narrow intramontane basin (ca. 400 x 100 km), perfectly oriented from south to north, and completely isolated by two impressive mountain ranges that rise above 2,000 m above sea level and more than 1,500 m above the locality itself: the Oriental Andes to the west, the Sira Mountains to the east, and their interconnecting foothills of the Gran Pajonal to the south; the basin is open only to its north, where it drains into the Río Ucayali.

The second reason is the misidentification of specimens previously available in collections: the three new species of the genus *Tityus* described herein had been previously misidentified as either *T. gasci* or *T. silvestris*, which are not even their closest relatives (see details above, under each species description).

Acknowledgments

We deeply thank our good friends Jan Ove Rein (Trondheim, Norway) and Antonio A. Melic (Sociedad Entomológica Aragonesa, Spain) for the pertinent literature supplied to the authors. We are also indebted to Julio Monzón and Franz Wachtel for kindly giving permission to use their photos herein as Figures 3, 68, 136, and 137. Further, we thank two anonymous reviewers for their comments to the manuscript.

And personally, Stefan Friedrich is deeply grateful to Juliane Diller and Erich Diller for the opportunity to

experience the unique place Panguana. Lots of thanks also to “Moro”, Nery, Hibrain and “Perico” for providing comfort and excellent food at the station. Thanks to Miriam Steinherr (Augsburg) for assistance with collecting, and to Ilse Tutter (Munich) for lending a UV torch. Ernst-Gerhard Burmeister and Klaus Schö-nitzer (both ZSMC) kindly donated valuable specimens of the new species they had collected in previous years. Last but not least, many thanks to Roland Melzer (ZSMC) and to the “Freunde der Zoologischen Staatssammlung München, e.V.” for providing grants for two field trips to Panguana.

References

- ACOSTA, L. E., D. M. CANDIDO, E. H. BUCKUP & A. D. BRESCOVIT. 2008. Description of *Zabius gaucho* (Scorpiones, Buthidae), a new species from southern Brazil, with an update about the generic diagnosis. *The Journal of Arachnology*, 36: 491–501.
- ARMAS, L. F. DE, R. TERUEL & F. KOVAŘÍK. 2011. Redescription of *Centruroides granosus* (Thorell, 1876) and identity of *Centruroides granosus simplex* Thorell, 1876 (Scorpiones: Buthidae). *Euscorpius*, 127: 1–11.
- ESCOBAR, E., R. TINCOPA & J. A. OCHOA. 2013. Estudio bioquímico del veneno de *Tityus kaderkai* (Scorpiones: Buthidae) con notassobre su distribución y hábitat en el Perú. *Revista Peruana de Biología*, 20(2): 151–158.
- 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 (eds.). *Catalog of the scorpions of the world (1758–1998)*. New York: The New York Entomological Society, v + 690 pp.
- FRANCKE, O. F. 1977. Scorpions of the genus *Diplocentrus* Peters from Oaxaca, Mexico. *The Journal of Arachnology*, 4: 145–200.
- KOVAŘÍK, F. 2005. Nový druh štíra *Tityus kaderkai* sp. n. v teráriu. *Akva Tera Fórum*, 11: 58–61.
- KOVAŘÍK, F. 2009. *Illustrated catalog of scorpions. Part I. Introductory remarks; keys to families and genera; subfamily Scorpioninae with keys to Heterometrus and Pandinus species*. Prague: Clairon Production, 170 pp.
- KOVARIK, F. & A. A. OJANGUREN AFFILASTRO. 2013. *Illustrated catalog of scorpions. Part II*.

- Bothriuridae; Chaerilidae; Buthidae* I. Genera *Compsobuthus, Hottentotta, Isometrus, Lychas, and Sassanidotus*. Prague: Clairon Production, 400 pp.
- LOURENÇO, W. R. 1986. Diversité de la faune scorpionique de la région amazonienne; centres d'endémisme; nouvel appui à la théorie des refuges forestiers du Pléistocène (Arachnida: Scorpiones). *Amazoniana*, 9(4): 559–580.
- LOURENÇO, W. R. 2002. *Scorpions of Brazil*. Paris: Les Édition de l'If, 307 pp.
- LOURENÇO, W. R. 2008. Nouvelles considérations sur le statut taxonomique de quelques espèces du genre *Tityus* C. L. Koch, 1836 (Scorpiones, Buthidae) décrites de la Colombie. *Acta Biológica Paraense*, Curitiba, 37(3–4): 195–209.
- LOURENÇO, W. R. 2012. Further considerations on *Tityus* (*Archaeotityus*) *clathratus* C. L. Koch, 1844 and description of two associated new species (Scorpiones, Buthidae). *Boletín de la Sociedad Entomológica Aragonesa*, 50: 277–283.
- LOURENÇO, W. R. & H. DASTYCH. 2001. A contribution to the scorpion fauna of Peru, with a description of *Chactas koepcke* sp. nov. (Arachnida: Scorpiones). *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, 98: 51–62.
- POCOCK, R. I. 1897. Report upon the Scorpiones and Pedipalpi obtained on the Lower Amazons by Messrs. E. E. Austen and F. Pickard Cambridge during the trip of Mr. Siemens's steamship "Fara-day". *The Annals and Magazine of Natural History*, 6(9): 357–368.
- 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. 1971. Scorpion nomenclature and mensuration. *Entomological News*, 81(1970): 297–316.
- STOCKWELL, S. A. 1989. *Revision of the Phylogeny and Higher Classification of Scorpions (Chelicerata)*. Ph.D. Thesis, University of Berkeley, Berkeley, California. 319 pp. (unpublished). University Microfilms International, Ann Arbor, Michigan.
- TERUEL, R. & M. A. C. COZIEN. 2011. A checklist of the scorpions (Arachnida: Scorpiones) of Panama, with two new records. *Euscorpius*, 133: 1–6.
- 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. KOVARÍK. 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.
- VACHON, M. 1974. Études des caractères utilisés pour classer les familles et les genres des scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum national d'Histoire naturelle*, 3e série, 140 (Zoologie, 104): 857–958.