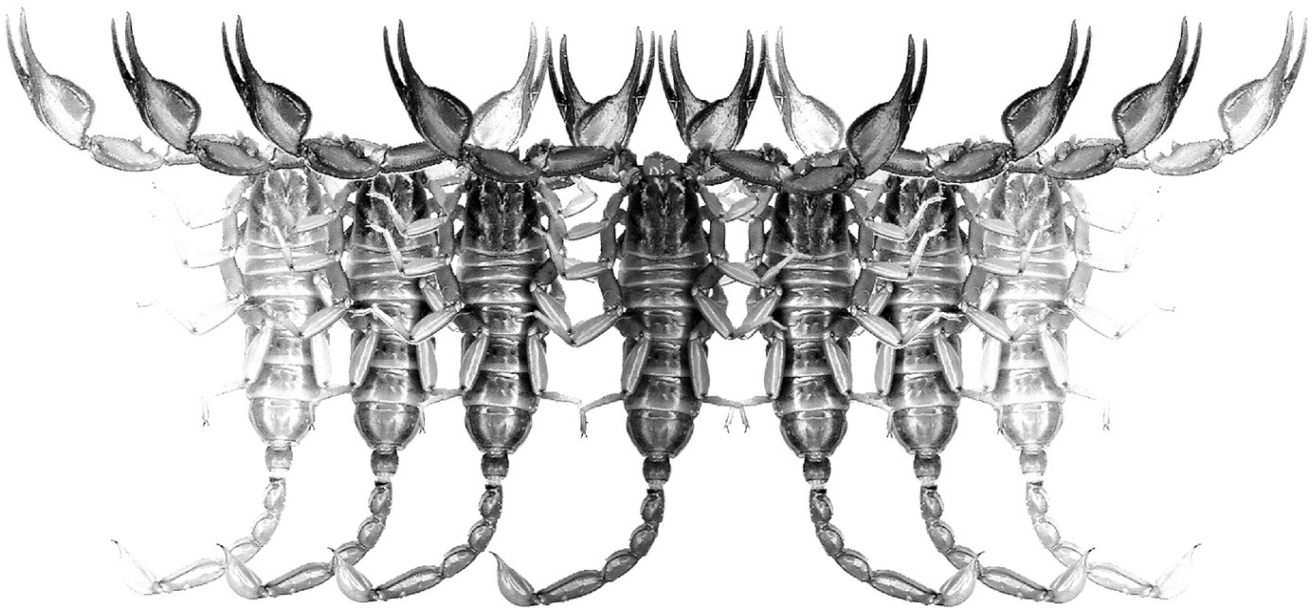


# ***Euscorpius***

**Occasional Publications in Scorpiology**



**Revision of the genus *Tityopsis* Armas, 1974  
(Scorpiones: Buthidae). Part 1.**

**General updates and description of four new species**

**Rolando Teruel & Tomás M. Rodríguez-Cabrera**

**March 2020 — No. 304**

# *Euscorpius*

## *Occasional Publications in Scorpiology*

EDITOR: Victor Fet, Marshall University, 'fet@marshall.edu'

ASSOCIATE EDITOR: Michael E. Soleglad, 'msoleglad@gmail.com'

TECHNICAL EDITOR: František Kovařík, 'kovarik.scorpio@gmail.com'

*Euscorpius* is the first research publication completely devoted to scorpions (Arachnida: Scorpiones). *Euscorpius* takes advantage of the rapidly evolving medium of quick online publication, at the same time maintaining high research standards for the burgeoning field of scorpion science (scorpiology). *Euscorpius* is an expedient and viable medium for the publication of serious papers in scorpiology, including (but not limited to): systematics, evolution, ecology, biogeography, and general biology of scorpions. Review papers, descriptions of new taxa, faunistic surveys, lists of museum collections, and book reviews are welcome.

### *Derivatio Nominis*

The name *Euscorpius* Thorell, 1876 refers to the most common genus of scorpions in the Mediterranean region and southern Europe (family Euscorpiidae).

*Euscorpius* is located at: <https://mds.marshall.edu/euscorpius/>

Archive of issues 1-270 see also at: <http://www.science.marshall.edu/fet/Euscorpius>

(Marshall University, Huntington, West Virginia 25755-2510, USA)

---

### ICZN COMPLIANCE OF ELECTRONIC PUBLICATIONS:

Electronic ("e-only") publications are fully compliant with ICZN (*International Code of Zoological Nomenclature*) (i.e. for the purposes of new names and new nomenclatural acts) when properly archived and registered. All *Euscorpius* issues starting from No. 156 (2013) are archived in two electronic archives:

- **Biotaxa**, <http://biotaxa.org/Euscorpius> (ICZN-approved and ZooBank-enabled)
- **Marshall Digital Scholar**, <http://mds.marshall.edu/euscorpius/>. (This website also archives all *Euscorpius* issues previously published on CD-ROMs.)

Between 2000 and 2013, ICZN *did not accept online texts* as "published work" (Article 9.8). At this time, *Euscorpius* was produced in two *identical* versions: online (ISSN 1536-9307) and CD-ROM (ISSN 1536-9293) (laser disk) in archive-quality, read-only format. Both versions had the identical date of publication, as well as identical page and figure numbers. *Only copies distributed on a CD-ROM* from *Euscorpius* in 2001-2012 represent published work in compliance with the ICZN, i.e. for the purposes of new names and new nomenclatural acts.

In September 2012, ICZN Article 8. What constitutes published work, has been amended and allowed for electronic publications, disallowing publication on optical discs. From January 2013, *Euscorpius* discontinued CD-ROM production; only online electronic version (ISSN 1536-9307) is published. For further details on the new ICZN amendment, see <http://www.pensoft.net/journals/zookeys/article/3944/>.

---

Publication date: 16 March 2020

<http://zoobank.org/urn:lsid:zoobank.org:pub:AC17B8E0-177D-48CD-8F24-878214033EAE>

# Revision of the genus *Tityopsis* Armas, 1974 (Scorpiones: Buthidae). Part 1. General updates and description of four new species

Rolando Teruel <sup>1,2</sup> & Tomás M. Rodríguez-Cabrera <sup>3</sup>

<sup>1</sup> Grupo de Sistemática y Ecología de Artrópodos Caribeños. Calle 200 # 3759, e/ 37 y 45, Reparto Versalles; La Lisa; La Habana 13500. CUBA. E-mail: [teruelrolando6@gmail.com](mailto:teruelrolando6@gmail.com)

<sup>2</sup> Instituto de Ecología y Sistemática (Subdirección de Colecciones Zoológicas), Carretera de Varona # 11835, e/ Oriente y Lindero, Reparto Calabazar, Boyeros, La Habana 11900, CUBA.

<sup>3</sup> Sociedad Cubana de Zoología, CUBA. E-mail: [tomasmichel.rodriguez@gmail.com](mailto:tomasmichel.rodriguez@gmail.com)

<http://zoobank.org/urn:lsid:zoobank.org:pub:AC17B8E0-177D-48CD-8F24-878214033EAE>

## Summary

The buthid scorpion genus *Tityopsis* Armas, 1974, endemic to western Cuba, is herein revised. In total, 428 specimens were examined from 127 localities, including the primary types of the two species currently recognized as valid; this led to realize that several populations actually represent taxa new to science. Four of them are described in the present paper: a presumed troglobite and three others from epigeal habitats. A thorough photographic complement and data on natural history are given for each species and for the genus in general, for which known geographical distribution is verified and updated. With this contribution, the scorpion fauna of Cuba reaches now 61 species, with 56 of them (92%) being endemic to this Caribbean archipelago.

## Introduction

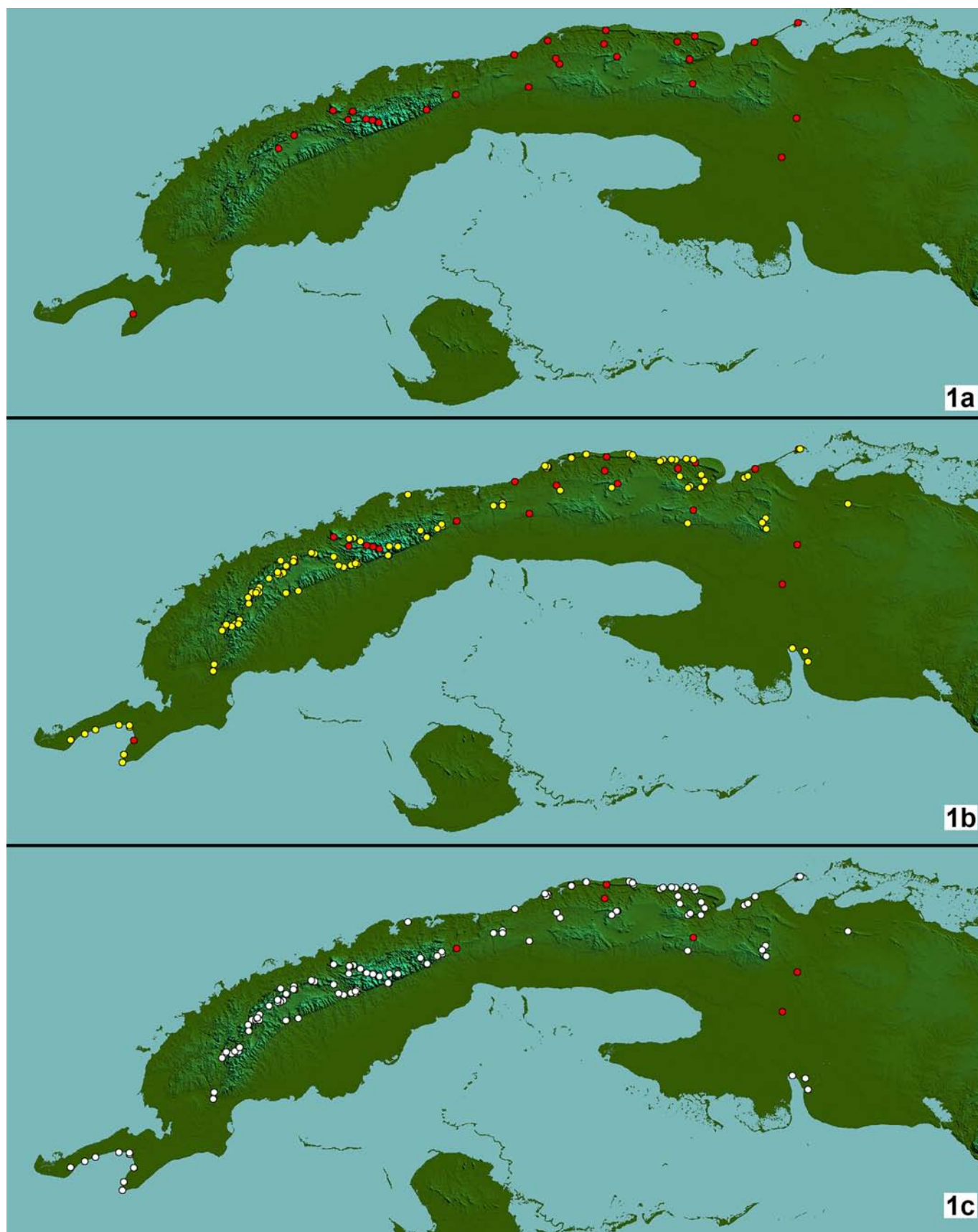
### HISTORY OF THE GENUS

In the first complete revision of the Cuban scorpion fauna, published almost 80 years ago and currently a classic reference for Cuban scorpiology, Moreno (1940a) described a very peculiar buthid scorpion he deemed the first record of the genus *Tityus* C. L. Koch, 1836 from Cuba: *Tityus inexpectatus* Moreno, 1940. The description was thorough and satisfactorily complemented with one black and white habitus photograph and several fine drawings. It was based upon three syntypes of unspecified sex, declared as two adults and a juvenile (Moreno, 1940a: 163–164). All were collected by himself in Playa de Baracoa, a coastal village located some 15 km west of Havana City (then in La Habana Province, but transferred to Artemisa Province with the political-administrative division introduced in 2010).

Mello-Leitão (1945) placed *T. inexpectatus* in his artificial “Group D” of the genus, together with other South American species, which even then clearly appeared not closely-related: *Tityus melanostictus* Pocock, 1893 (now in its own species-group) and *Tityus amazonicus* Giltay, 1928 (currently a junior synonym of *Tityus obscurus* (Gervais, 1843), which is currently placed in the subgenus *Tityus* (*Atreus*) Lourenço, 2006). Later, Jaime (1954) published a brief updated catalogue of the Cuban scorpion fauna and recorded *T. inexpectatus* from three new localities in Pinar del Río and La Habana Provinces (one of them now also in Artemisa).

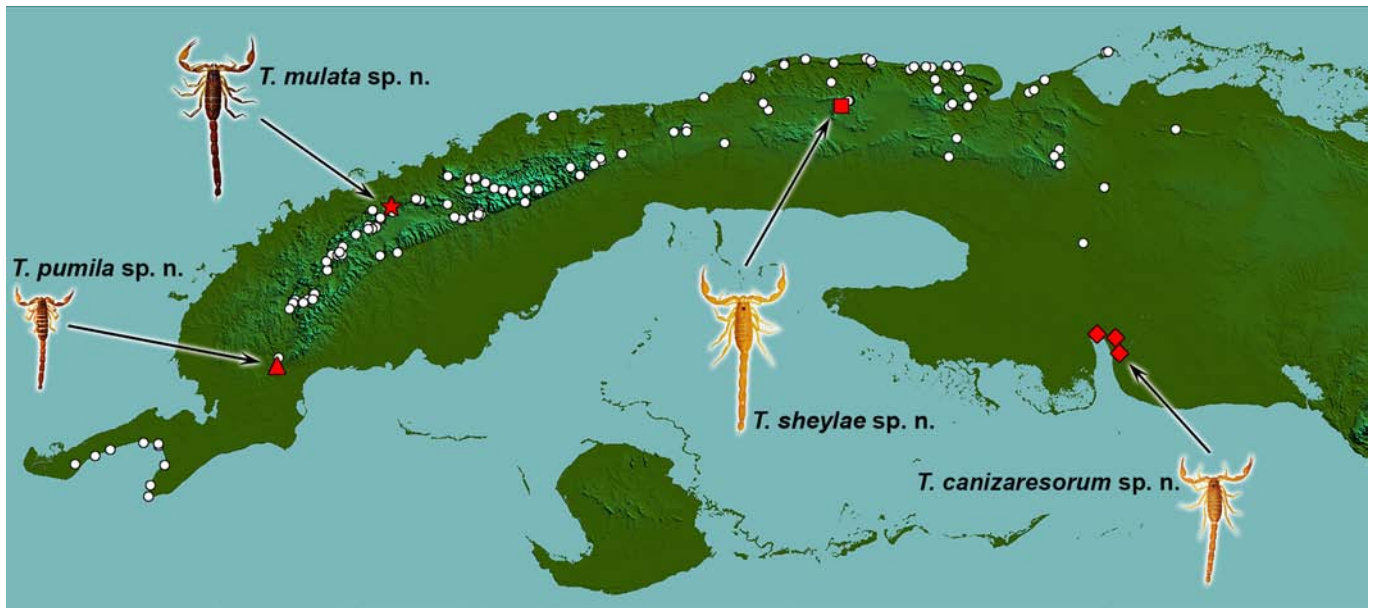
Armas (1973) gave measurements of one syntype of *T. inexpectatus*, but wrongly regarded it as a holotype. Armas (1974) revised the status of the species and introduced important changes: it was assigned to a new subgenus *Tityopsis* Armas, 1974, its geographical distribution was updated (including the first records from Matanzas Province), a new subspecies *Tityus* (*Tityopsis*) *inexpectatus inaequalis* Armas, 1974 was described to accommodate all populations from Pinar del Río Province, and some information on the taxonomy, natural history and biogeography of the genus were given. Unfortunately, the paper by Armas (1974) contains serious errors: the same specimen of Armas (1973) was still assumed to be the holotype and incorrectly classified as a subadult, moreover, the recognition of sexes and maturity instars was mostly wrong, i.e., adult females were mistaken as adult males, which were in turn regarded as subadults (we personally verified this by direct examination of the same voucher specimens).

Armas (1980) gave some supplementary information on the biology of both subspecies, including habitat, microhabitat and cataleptic behavior as a potential strategy to escape from predators. In the same paper, the two “adult males” previously described by himself (Armas, 1974) were both demonstrated to be adult females instead, but still the actual adult males remained unrecognized and by derivation, he wrongly deemed *T. inexpectatus* “apparently parthenogenetic” (Armas, 1980: 22). Simultaneously, Cruz & Armas (1980) recorded the presence of a specially modified sensory macrosetae on



**Figure 1.** Western Cuba, showing the updated geographical distribution of the genus *Tityopsis*: **a)** Previous locality records from literature (red symbols); **b)** Same “a” map, with new locality records obtained during the present study added (yellow symbols); **c)** Same “a” map, with locality records personally confirmed during the present study added (white symbols). Image frame size = 500 x 250 km.





**Figure 2.** Western Cuba, showing the complete geographical distribution of the genus *Tityopsis* (white symbols) and overlaid, that of the four species of *Tityopsis* treated herein (red symbols, complemented with habitus of their holotypes): *T. mulata* sp. n. (star), *T. canizaresorum* sp. n. (rhombs, the southernmost is the type locality), *T. pumila* sp. n. (triangle) and *T. sheylae* sp. n. (square). Image frame size, 500 x 250 km.

pedipalp fingers in *T. inexpectatus*, which they called “digital macrochaetae”.

Armas (1982) briefly introduced the first discussion on the biogeography of *Tityus* (*Tityopsis*). Two years later, Armas (1984a) raised *Tityopsis* to genus level, presented further taxonomic and biogeographical considerations, recorded some new localities and finally made a correct recognition of the adult males of both subspecies. Almost simultaneously, Armas (1984b) correctly designated as lectotype the same specimen assumed previously by himself as holotype (Armas, 1973, 1974), but completely avoided to make the slightest discussion on this crucial topic.

Armas & Alayón (1984) mentioned the presence of *T. i. inexpectatus* in two caves of Matanzas Province. Francke (1985) listed the genus and its bibliographic references in his complete catalog of scorpion genera. Armas (1988) compiled and updated most of the available information on the genus and its two subspecies. Shortly thereafter, Armas (1989a–b) recorded the litter sizes for five females of *T. i. inexpectata*, and described a case of gynandromorphism in *T. i. inaequalis*; in both papers the correct spelling “*inexpectata*” was used for the first time (the suffix “-opsis” is feminine in gender), again without any comments on the correction. Then, Sissom (1990) for the first time included this genus in a key to all genera of Buthidae.

Lourenço (in Lourenço & Vachon, 1996) raised *T. i. inaequalis* to species rank, depicted its trichobothrial pattern in detail and made a few brief biogeographic considerations, but unfortunately, the high-quality drawings included therein demonstrate that sex and maturity condition of their specimens were again wrongly established (the “male” depicted in their figs. 7–13 is clearly a juvenile female). Thereafter, the genus and its two species were accepted by essentially all later authors and listed in three scorpion

catalogs: two worldwide (Kovařík, 1998; Fet & Lowe, 2000) and one of the primary types housed at IES collection (Armas, 2006). However, within the same timeframe, Armas (2001, 2005) applied back the subspecies-level combination *T. inexpectata inaequalis*, but no explanatory arguments were presented to validate such nomenclatural act.

Within the same period, Armas (2003) recorded an enigmatic egg-like organism attached to the external body surface and setae of *T. inexpectata*. Later, in their recent book on Cuban scorpions, Teruel & Kovařík (2012) updated the diagnoses and distribution of the genus and its two species, and presented a thorough, high quality, full-color photographic complement of live and preserved individuals of both *T. inaequalis* and *T. inexpectata*, including the first images on their habitat, microhabitat, reproduction and cataleptic behavior. Last, Loria & Prendini (2014, 2018) illustrated a case of ocular anomaly in *T. inexpectata* and mentioned the presence of eyespots in *Tityopsis*.

It must be mentioned here the unexpected move by Armas & Martín-Frías (1998), who described as *Tityopsis aliciae* Armas & Martín-Frías, 1998 an enigmatic scorpion from southeastern Mexico (Tehuantepec, Oaxaca). This paper was burdened with flaws, e.g., the single available specimen was a poorly preserved immature (which led to observation errors detected elsewhere later, see below), it showed obvious discrepancies with the (then) current generic diagnosis of *Tityopsis*, but no pertinent amendments were introduced to accommodate the new taxon satisfactorily nor the slightest discussion was addressed on this situation (the standard procedure of its first author), *T. inexpectata* and *T. inaequalis* were implicitly regarded as conspecific and the few accompanying illustrations were sketchy drawings of very poor quality.

The *status quo* remained static for more than a decade, until Vidal-Acosta & Francke (2009) redescribed *T. aliciae* on the basis of a well-preserved, freshly collected adult female and pointed out most of the omissions and observation errors contained in the original description by Armas & Martín Frías (1998). Last, Francke et al. (2014) examined a larger sample that included the first adult males and applied a thorough morphological and phylogenetic analysis, which led to the description of the new genus *Chaneke* Francke, Teruel & Santibáñez-López, 2014 and the confirmation that *Tityopsis* is indeed endemic to western Cuba. By the way, *Chaneke* was actually found to be more diverse and currently includes four species, all endemic to southern Mexico (Francke et al., 2014; Kovařík et al., 2016).

#### ABOUT THE PRESENT REVISION

Since the first specimens of *Tityopsis* became available to us in the early 1990's, we immediately realized that a satisfactory species identification was not as easy as the published keys and diagnoses intended to present, and usually every attempt ended up in a forced assignment. Thus, looking for comparative material we started to visit the collection of the Instituto de Ecología y Sistemática (Havana), which then housed virtually all known specimens of *Tityopsis*, but we immediately met with additional problems. First, all samples were composed of one or a few specimens, in the latter case mostly juveniles and/or adults of the same sex, adult males were notoriously scarce and many specimens were in poor condition, including the types and all topotypes of *T. inexpectata*. Moreover, the localities of collection were so scattered that detecting any distribution patterns was impossible.

Thus, we decided to conduct a thorough taxonomic revision of the entire genus that overcame all these problems and allowed an accurate distinction of all subordinate taxa. To accomplish this task successfully, we designed and followed to the letter a very precise protocol. First, we retrieved all known records of *Tityopsis* from the literature and museum catalogues, and from 2006 on, we conducted field trips to as many of these sites as possible to collect in every one a representative sample of adults and juvenile males of both sexes. In parallel, we repeatedly visited the two Cuban public collections known to house specimens of this genus (Instituto de Ecología y Sistemática and Museo de Historia Natural "Felipe Poey", both at Havana), to either study *in situ* or to obtain them all on loan. Of course, we examined the type series of both species currently assigned to the genus and compared them to every sample in our hands, first to confirm we had conspecific fresh topotypes available for a better analysis and second to sort out how many morphospecies (presumably undescribed taxa) could be identified.

The results we had obtained by the end of 2019, after 14 years of continued hard work, were sound and plenty fulfilled our expectations:

1. We examined in total 597 specimens of *Tityopsis*: 93 adult males, 216 adult females and 288 juveniles of both sexes. We personally collected more than 91% of them, with adults and juveniles of both sexes represented in most individual samples.
2. We scored *Tityopsis* for 127 localities (Fig. 1c), which imply almost a five-fold increase of the 27 previously cited in the literature (Fig. 1a). This includes the first records of the genus for 11 municipalities (Fig. 1b), arranged by provinces as follows: Pinar del Río (3), Artemisa (2), La Habana (2), Mayabeque (2) and Matanzas (2).
3. We confirmed 21 (78%) of the 27 literature records, either by personal collecting efforts or direct examination of the voucher specimens (Fig. 1c). Only six remained unconfirmed, because the voucher specimens were missing from the declared repository (IES), the localities could not be visited by us, and additional samples were unavailable.
4. The known distribution of the genus was expanded towards the four cardinal points and all main gaps between isolate previous records or their clusters, were satisfactorily filled (Fig. 1b). Moreover, the range of both *T. inaequalis* and *T. inexpectata* was finally clarified, including numerous new records.
5. We identified not less than eight new taxa, which raise the diversity of this genus to at least 10 species. Several other populations are currently under study to define their precise identity and some of them may represent more undescribed taxa.
6. The morphological variability was satisfactorily assessed for *T. inaequalis* and *T. inexpectata*, as well as for most of the new taxa, based on adequate samples.
7. We obtained abundant data on the natural history, reproductive biology and behavior of all members of the genus. These include the first actual proof or strong factual evidences of occurrence of thelytokous parthenogenesis in three species (maybe four).
8. We compiled a thorough photographic complement of live and preserved specimens, habitat and microhabitat of every species.

We present here the first part of the results, which defines the complete taxonomic history and methodology in detail, and deals with the description of four new species. Further additions will follow soon, including the complete redescription and taxonomic update of the two species previously known in the genus.

#### Methods, Material & Abbreviations

Specimens were studied under a Motic SMZ-171-TP trinocular microscope, equipped with an ocular line scale calibrated to 20x for measuring and a Moticam 5 digital camera. First, a variable series of consecutive-plane shots was taken depending on the field depth, i.e., for a bulkier structure, more shots were necessary and vice versa. Then, all images of the same structure were assembled into a single, fully focused image using the CombineZP free image stacking software.

Dimensions (MM)		<i>T. mulata</i> sp. n. ♂ holotype	<i>T. mulata</i> sp. n. ♂ paratopotype	<i>T. mulata</i> sp. n. ♀ paratopotype	<i>T. mulata</i> sp. n. ♀ paratopotype
Carapace	L / W	2.97 / 3.05	2.95 / 3.05	3.68 / 4.12	4.00 / 4.30
Mesosoma	L	7.27	6.65	8.80	9.20
Tergite VII	L / W	2.00 / 5.85	2.00 / 5.80	2.50 / 4.30	2.70 / 4.60
Metasoma	L	12.87	12.60	15.30	16.15
Segment I	L / W / D	1.90 / 1.65 / 1.50	1.85 / 1.61 / 1.45	2.30 / 2.02 / 1.77	2.45 / 2.20 / 1.90
Segment II	L / W / D	2.30 / 1.55 / 1.40	2.25 / 1.50 / 1.35	2.80 / 1.90 / 1.77	3.00 / 2.03 / 1.72
Segment III	L / W / D	2.60 / 1.55 / 1.40	2.55 / 1.50 / 1.35	3.10 / 1.95 / 1.71	3.18 / 2.02 / 1.80
Segment IV	L / W / D	2.75 / 1.52 / 1.40	2.70 / 1.47 / 1.33	3.20 / 1.90 / 1.75	3.40 / 1.90 / 1.78
Segment V	L / W / D	3.32 / 1.42 / 1.35	3.25 / 1.36 / 1.30	3.90 / 1.80 / 1.70	4.12 / 1.90 / 1.72
Telson	L	3.19	3.08	4.04	4.40
Vesicle	L / W / D	1.77 / 1.27 / 1.27	1.70 / 1.25 / 1.25	2.22 / 1.55 / 2.00	2.50 / 1.79 / 1.70
Aculeus	L	1.42	1.38	1.82	1.90
Pedipalp	L	11.74	11.65	13.83	14.15
Femur	L / W	2.80 / 0.90	2.78 / 0.85	3.20 / 1.15	3.52 / 1.30
Patella	L / W	3.27 / 1.25	3.25 / 1.16	4.03 / 1.55	4.20 / 1.70
Chela	L	5.67	5.50	6.60	6.93
Manus	W / D	2.50 / 1.57 / 1.50	2.40 / 1.60 / 1.52	2.92 / 2.00 / 1.90	3.10 / 2.14 / 2.00
Movable finger	L	3.17	3.10	3.68	3.83
<b>Total</b>	<b>L</b>	<b>26.30</b>	<b>25.28</b>	<b>31.82</b>	<b>33.75</b>

**Table 1.** Measurements (mm) of four adult types of *Tityopsis mulata* sp. n. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

Last, all images were processed with Adobe Photoshop CS5, only for contrast and brightness optimization, removal of artifacts and/or unnecessary details from background and plate composition. Habitus and habitat photographs were taken with either a Nikon Coolpix B500 or a Nikon Coolpix S8100 digital camera.

Distribution maps were constructed in Mapinfo Professional ver.10, using precise locality coordinates taken *in situ* with a portable GPS device (Datum WGS 84) or extracted *a posteriori* from updated 1:25 000 cartographic maps. All localities were geo-referenced with precision, but we did not disclose coordinates here to protect those fragile, low-density populations from illegal collecting, which has become a real problem in Cuba during recent years. This information is available only upon direct, personal request to the authors.

Localities were ordered cardinally from west to east, to make geographical orientation and map interpretation easier to the reader. The name of each locality and the administrative entities where it belongs (e.g., province and municipality), were always updated according to the current political-administrative division of the country introduced in 2010. In all cases where labeling errors or inaccuracies were detected, the pertinent corrections and updates were explicitly introduced, but the complete original data of all labels were literally transcribed in the Remarks section as reference.

Nomenclature and measurements follow Stahnke (1971) except for trichobothriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977), pedipalp chela carinae (Acosta et

al., 2008, as interpreted by Armas et al., 2011), and sternum (Soleglad & Fet, 2003). Unless otherwise noted, all characters mentioned refer to adults of both sexes and total length includes telson. Pectinal tooth counts and number of principal rows of denticles were given as fractions for left/right pectines and fixed/movable pedipalp fingers, respectively.

Specimens studied herein are all preserved in ethanol 80% and housed in the following repositories: Instituto de Ecología y Sistemática, Havana, Cuba (IES), Museo “Felipe Poey” de la Universidad de La Habana, Cuba (MFP) and personal collections of the first author (RTO) and the late Miguel L. Jaume (MLJ, currently housed at IES).

Last, we discovered two important peculiarities for the taxonomic study of *Tityopsis* that need to be discussed in detail. First, the degree of species-level morphological differentiation is mostly determined by sex and maturity. In other words: **1)** juveniles of most species are virtually indistinguishable (except for coloration, when unique species-specific patterns are involved); **2)** in some closely related species, one sex is clearly distinct in morphology (usually male), but the other is either essentially identical or its variability largely overlaps; **3)** the secondary sexual dimorphism may differ sharply according to the species (e.g., the tegument is shiny in male but matt in female in one species, while the opposite condition occurs in another). Thus, the precise specific identity of any population can be safely established only when adults of both sexes are available for study.

Second, the coloration (both base color and superimposed dark pattern) is of great importance for the taxonomic recognition of most species of *Tityopsis*, because it is not strictly correlated to substrate coloration, e.g., in several localities, two species occur together and one is pale, while the other is dark. Nevertheless, coloration becomes rapidly altered with preservation process and tends to homogenize, i.e., reddish and orange shades turn yellowish to brown, bright yellow becomes darker and dull, and blackish fades to brown. As results, within few years most specimens become plain brownish or yellowish and this is why most museum samples cannot be trusted for coloration (the oldest the sample, the most unreliable the coloration). We are convinced this is a key reason why the true diversity of the genus remained so underestimated until now, with most published records of both *T. inaequalis* and *T. inexpectata* actually involving misidentifications.

We tried different strategies to overcome this (e.g., we used either ethanol or isopropanol at different concentrations, with or without some formaldehyde and/or acetic acid, we stored the specimens at low temperature over freezing point and even dry-pinned in a few cases), with varied results. In the end, we concluded that the best solution is to photograph in full-color and high-resolution live and just-sacrificed specimens (when base color and patterns are still intact), and then finally preserve them in ethanol or isopropanol 85% with a few drops of formaldehyde (for morphological study) or in absolute ethanol (for DNA extraction). The same methodology became standard for reptiles and orthopterans; e.g., see recent examples in Köhler & Hedges (2016) and Yong (2018), respectively. It was strictly followed here, unless otherwise noted.

## Systematics

### Family Buthidae C. L. Koch, 1837

#### Genus *Tityopsis* Armas, 1974

(Figures 1–40, Tables 1–4)

*Tityus* (*Tityopsis*) Armas, 1974: 8; Armas, 1982: 11, 13; Francke, 1985: 16, 19.

*Tityopsis*: Armas, 1984a: 29; tab. 3; Francke, 1985: 14; Armas, 1988: 10–12, 14, 17, 62, 71, 91, 95, figs. 2h, 2i; Sissom, 1990: 94, 102; Lourenço & Vachon, 1996: 33; fig. 2; Kovařík, 1998: 119; Fet & Lowe, 2000: 58, 227–228; Armas, 2001: 247–248, fig. 1 (in part, records from Cuba only); Armas, 2006: 1, 8; Vidal-Acosta & Francke, 2009: 333; Teruel & Kovařík, 2012: 143–151, figs. 7, 30, 42–43, 49, 306–322, 570–577; Francke et al., 2014: 220–224.

*Tityus*: Moreno, 1940a: 161–164; pls. 22–23, figs. 1–5 (misidentification); Moreno, 1940b: 108–110, pls. XXXVI–XXXVII (misidentification); Mello-Leitão, 1945: 300–309 (misidentification, references to *T. inexpectatus* [sic]); Jaume, 1954: 1092 (misidentification, references to *T. inexpectatus*); Armas, 1973: 7, 17–18; tab. 5 (misidentification, references to *T. inexpectatus*).

*Nec Tityopsis*: Armas & Martín Frías, 1998: 45–49 (misidentification); Armas, 2001: 247–248, fig. 1 (misidentification, record from Mexico).

TYPE SPECIES. *Tityus inexpectatus* Moreno, 1940 [currently *Tityopsis inexpectata* (Moreno, 1940)], by original designation (Armas, 1974: 8).

DIAGNOSIS (emended). Adult size small for the family (15–30 mm in males, 20–40 mm in females), with males slightly smaller than females within the same size-class. Coloration light yellowish to blackish, immaculate to densely patterned all over, especially on carapace, legs and metasoma. Entire body and appendages covered with modified macrosetae: brightly UV-fluorescent, short to medium-sized, thick, translucent, with tip truncate to crown-shaped. Cheliceral fixed finger with one ventral denticle, movable finger with two. Pedipalp very similar in both sexes: not especially robust nor attenuate and strongly carinate; trichobothrial pattern A- $\alpha$  orthobothriotaxic, without clearly defined petite trichobothria (e.g., chela *Eb*<sub>3</sub> and *Esb* and fixed finger *esb* are somewhat smaller, but not as disproportionately reduced as a typical petite); femur with *d*<sub>1</sub>-*d*<sub>3</sub>-*d*<sub>4</sub>-*d*<sub>5</sub> regularly spaced along basal half, *e*<sub>1</sub> and *e*<sub>2</sub> located on subbasal and median position, respectively; patella with *d*<sub>3</sub> external to dorsal median carina and *i* slightly distal to midpoint; manus with *V*<sub>2</sub> clearly closer to ventroexternal carina than *V*<sub>1</sub>; fixed finger with *est-db-et-dt-it* located on distal half, with *it* midway between *dt* and fingertip. Pedipalp chelae robust, wider than patella and strongly carinate; fixed and movable fingers with 11–13 principal rows of denticles which are short, oblique, subequal and flanked by very large internal and external accessory denticles, apical subrow oblique and composed of four denticles, basal lobe/notch combination absent. Carapace trapezoidal, essentially flat and with carinae distinct but variably fused and poorly defined from intercarinal granulation, which is variable but always well developed; 3–6 pairs of lateral eyes, not concealed below anterolateral margin. Legs without tibial spurs, both pedal spurs present; telotarsi ventrally with two well-defined, parallel, longitudinal rows of thin spiniform setae. Male genital papillae lip-like, not protruding from genital operculum and each with a distinct fleshy point, hardly visible by being located extremely basal and almost entirely concealed beneath pre-pectinal plate. Pre-pectinal plate well developed, heavily sclerotized and medially invaginate, not well visible by being largely concealed beneath genital operculum. Pectines with 11–16 teeth in males, 10–15 in females, fulcra well developed; basal middle lamella modified, slightly to moderately enlarged and angulose in males, moderately to remarkably enlarged and oval to round in females; basal plate unmodified, but in females with a large, whitish discal area of presumably glandular function. Tergites heavily granulose, monocarinate, with median carina and coarse granulation projecting over posterior margin. Sternites with small, round to short slit-like spiracles; III without stridulatory organ or deep furrows but with a raised, granulose, median triangular area flanked



by two lateral depressions that fit pectines for protection or rest, V–VII with paired submedian and lateral keels, V with three smooth patches (one median and two laterals, all conspicuously larger, bulkier and also usually paler in males). Metasoma very similar in both sexes: short, robust and very strongly carinate, segment V with lateral median carinae irregularly defined but clearly present. Telson vesicle globose; subaculear tubercle vestigial to moderate, blunt, irregular to conical and widely separate from aculeus, which is long, very sharp and strongly curved.

**SUBORDINATE TAXA.** After the present revision, the genus includes six nominal species: *Tityopsis canizaresorum* sp. n., *T. inaequalis* (Armas, 1974), *T. inexpectata* (Moreno, 1940), *T. mulata* sp. n., *T. pumila* sp. n., and *T. sheylae* sp. n.

**ECOLOGICAL NOTES.** All species of *Tityopsis* are forest scorpions that need shady, humid places with plenty of refuges to survive e.g., rocks, leaf litter and rotten logs, usually in karstic soil (Figs. 37–39). Nevertheless, at least one species occurs also in open vegetation (sparse pine forest with grass understorey, on shale sandy soil) and another has endured heavy, long-standing urbanization and still can be found in relict forested patches (from groves to tiny house gardens and courtyards) in Havana City. One species is a presumed troglobite known only from a single cave (Fig. 40), but others have been found sporadically or frequently in this subterranean habitat and are typical troglophiles. With a couple of noteworthy exceptions, population densities are extremely low and without a visible cause, individuals tend to concentrate (but never aggregate) in reduced spots within much larger, homogeneous areas.

It is important to note here that the most widely used standard technique to sample or study scorpions *in situ*, i.e., nocturnal search with ultraviolet light, is essentially useless for epigeal populations of *Tityopsis*. Except for three scattered successful exceptions, we found the vast majority of our specimens during diurnal searches under rocks, logs and leaf litter, in exactly the same spots that were intensively sampled in vain the night before (all moon phases attempted).

The adult sex ratio of the studied samples usually biased towards female, nevertheless, in juveniles it was more balanced. Males (either adult or juvenile) have been found in most populations, thus, sexual reproduction is assumed for them. Nevertheless, thelytokous parthenogenesis (all-female broods) was confirmed by us to occur in one species and suspected from strong factual evidence for at least two, maybe three others (R. Teruel and T. M. Rodríguez-Cabrera, unpublished data).

Pregnant females have been found all around the year, but more frequently during the warmer, rainy season (May through October). Litter size is small for bothids: 1–20 newborn (Fig. 36d). Sexually reproducing females give birth only once a year in captivity and apparently every parturition requires a mating, i.e., iteroparity does not seem to occur. In one species, captive females raised to adulthood in absolute isolation gave birth by parthenogenesis 7–10 weeks after

reaching maturity. Postembryonic development has never been studied by the direct method, but we raised to adulthood in captivity many wild-caught juveniles (indirect method) and found that maturity is attained in about one year at instars 5–7 (i.e., after four to six ecdyses), with larger species such as *T. inaequalis* being more prone to mature at different instars, than smaller ones.

The humidity requirements of all *Tityopsis* spp. are extremely high: all individuals dehydrate critically and die within less than 36 hours, if air humidity in their enclosure is not continuously kept above 85%. This is independent from the habitat where the scorpions lived in nature (humid, mesic or xeric), as well as from the origin of the individuals (wild-caught or captive-born).

**COMMENTS.** Despite intensive and extensive searches, *Tityopsis* remains undetected from any of the many islets adjacent to the main island and especially from the large Isla de Pinos, where its apparent absence is enigmatic and represents a subject of debate among scorpilogists. This question became even more interesting after we (Teruel & Rodríguez-Cabrera, 2017) finally accomplished ourselves the long-awaited discovery of another scorpion genus in Isla de Pinos: the diplocentrid *Heteronebo* Pocock, 1899.

**DISTRIBUTION** (Figs. 1–2). This genus is endemic to western Cuba (Pinar del Río, Artemisa, La Habana, Mayabeque and Matanzas Provinces), with widespread but scattered occurrences mostly across mountainous and hilly areas of the main island only. See further details below, in the Comments section.

***Tityopsis mulata* sp. n.**

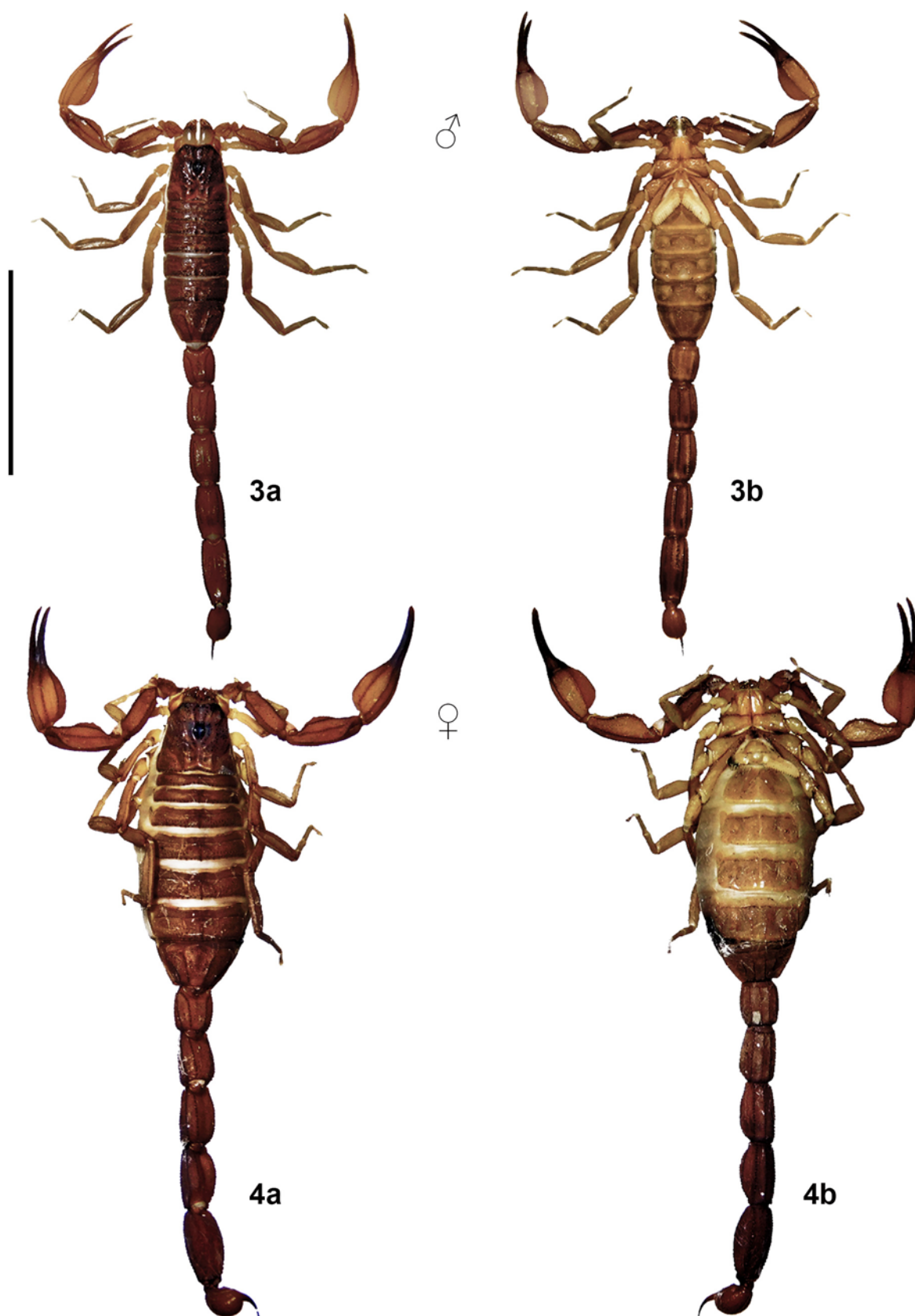
(Figures 2–12, 33, 37, Tables 1, 4)

<http://zoobank.org/urn:lsid:zoobank.org:act:CDA92F27-0CA8-45B1-9047-9EFC9489D160>

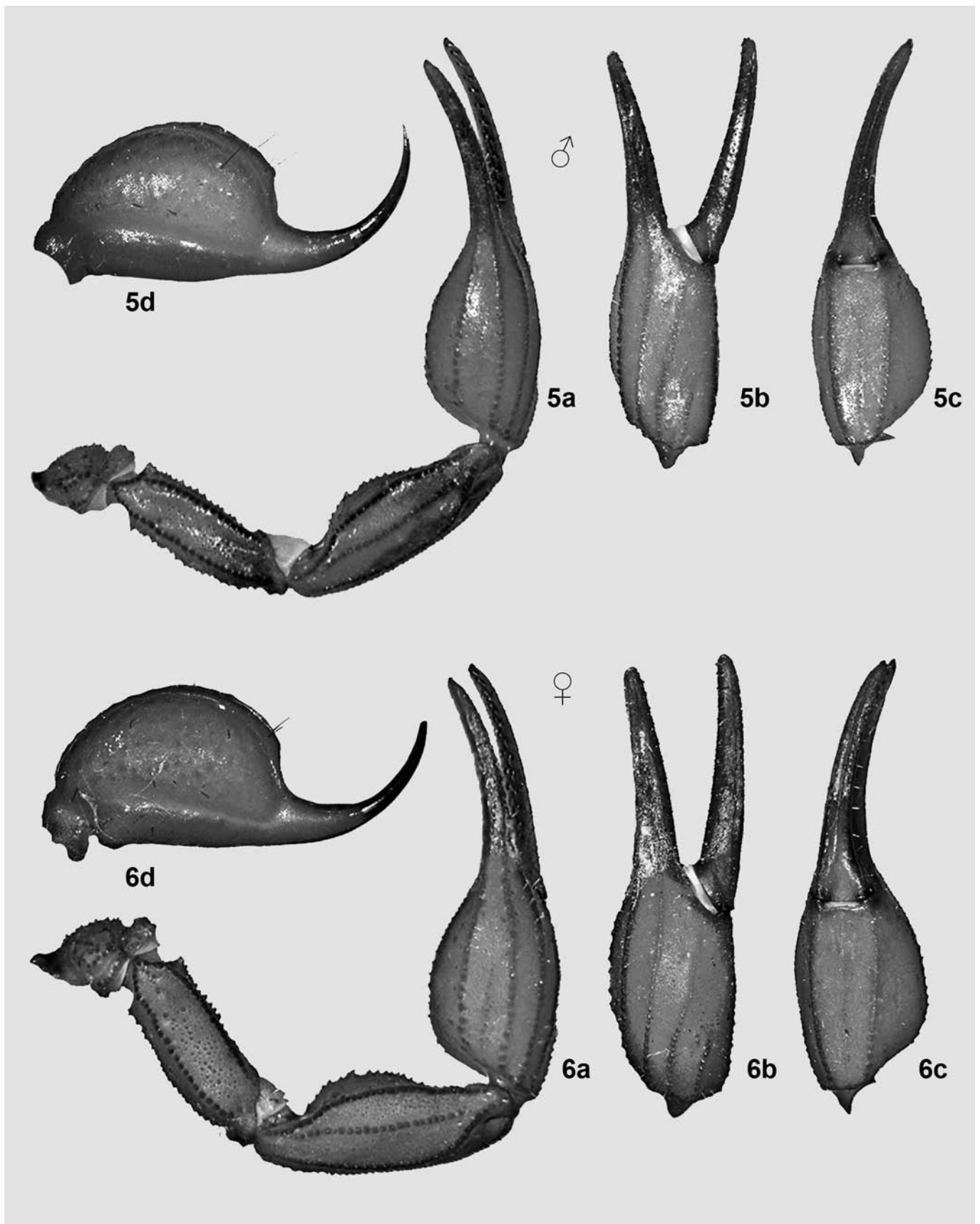
**TYPE LOCALITY AND TYPE DEPOSITORY.** Cuba, Pinar del Río Province, Viñales Municipality, Mogote La Mina, 120 m a. s. l.; RTO.

**TYPE SPECIMENS.** **Cuba**, Pinar del Río Province, Viñales Municipality, Mogote La Mina, 120 m a. s. l., 20 October 2019, leg. R. Teruel, 1♂ (holotype), 17 August 2016, leg. T. M. Rodríguez, A. Rodríguez & R. López, 1♂ (paratype, raised to adult in captivity), RTO, 23 October 2018, leg. T. M. Rodríguez & N. Navarro, 2♀1♀juv. (paratypes), RTO, 20 October 2019, leg. R. Teruel, 1♂3♀1♂juv.1♀juv. (paratypes), RTO.

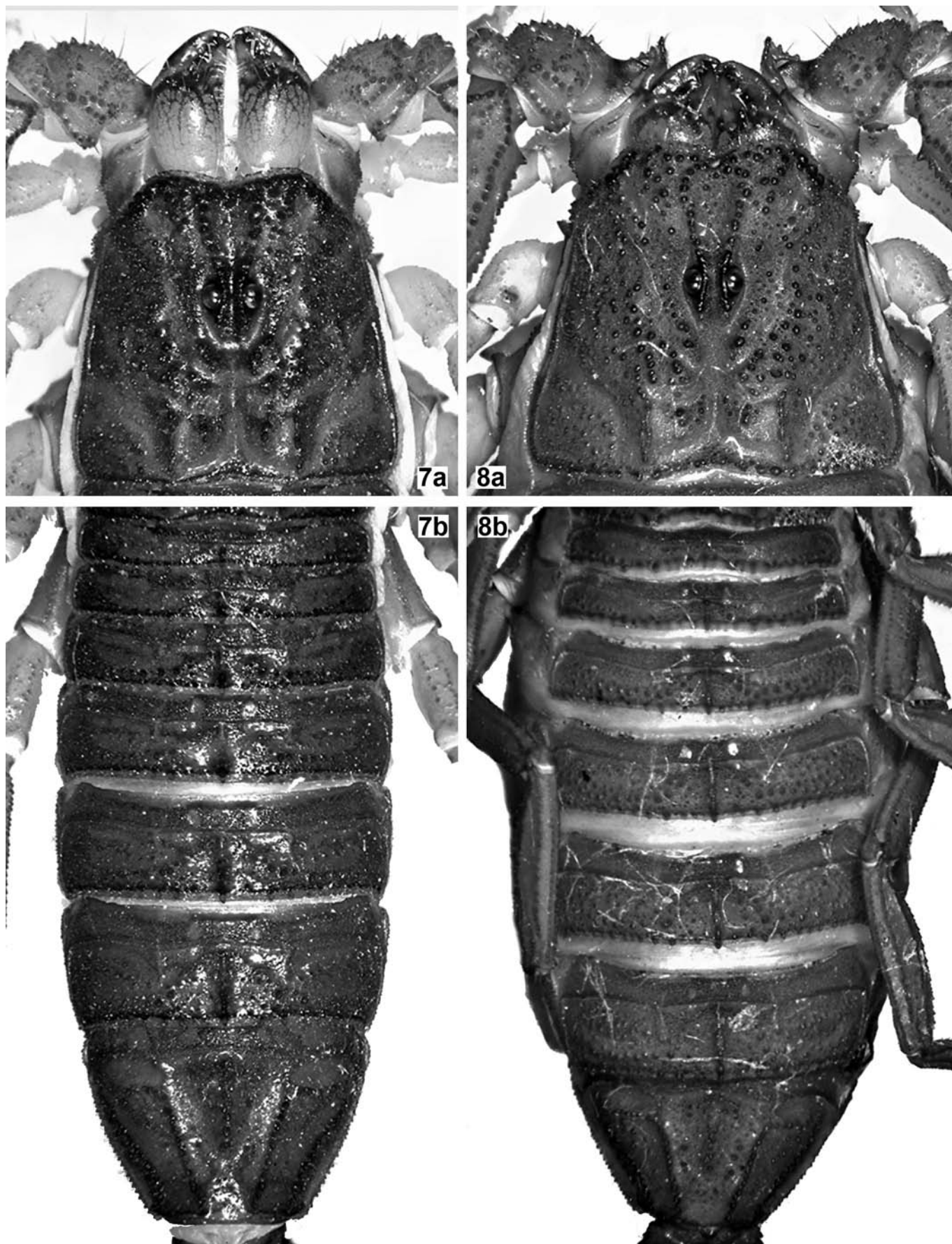
**ETYMOLOGY.** The selected epithet is a Spanish noun widely used in Cuba to call the brown-colored woman of mixed race, born from Caucasian and African parents. Especially the Cuban “mulata” is well reputed worldwide for her beauty and gracefulness. The word was selected both to allude to the most obvious character diagnostic of this species (the dark overall coloration) and to honor this spectacular kind of woman.



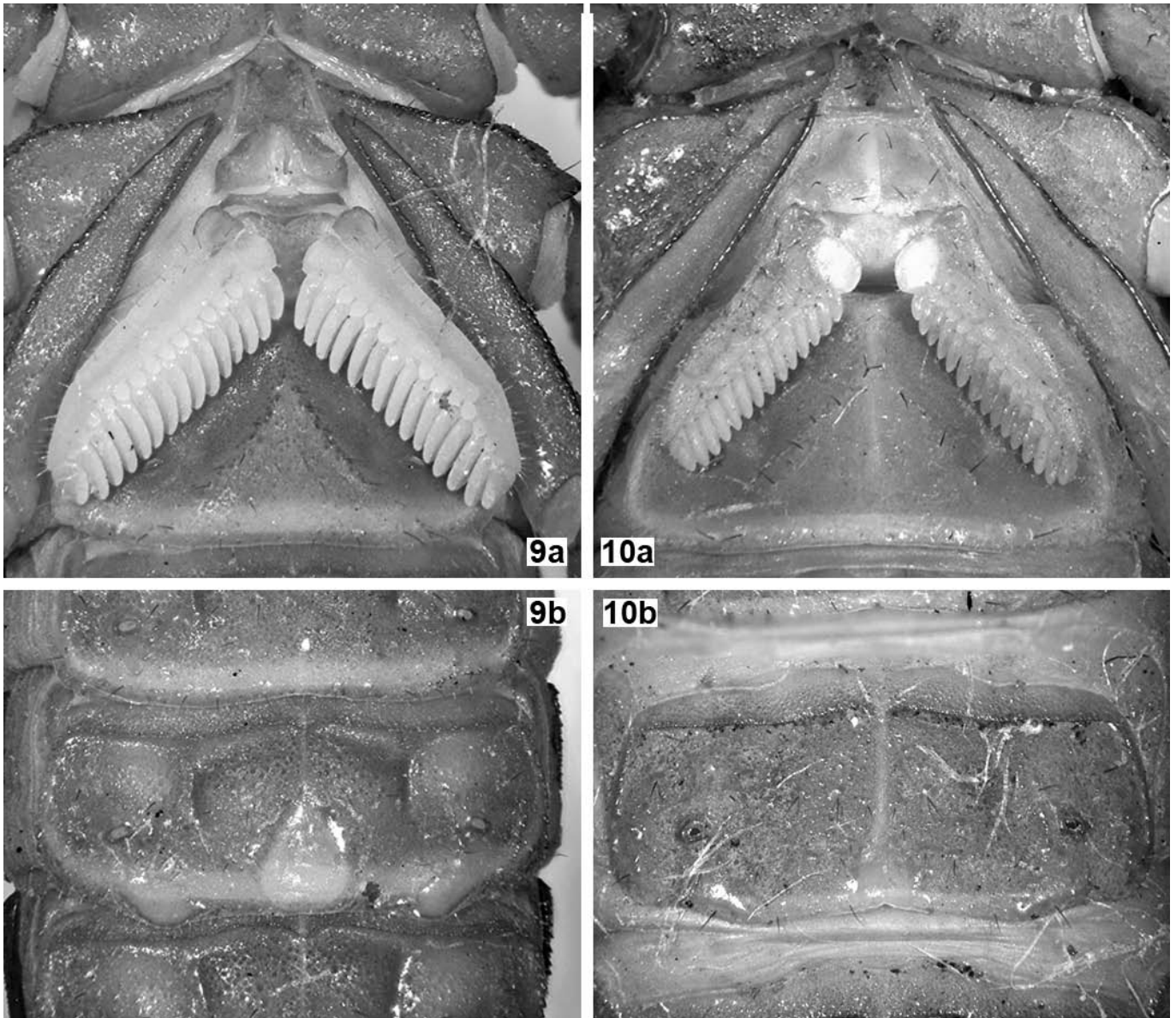
Figures 3–4. *Tityopsis mulata* sp. n., male holotype (3) and female paratopotype (4), habitus: a) dorsal; b) ventral. Scale bar = 10 mm.



**Figures 5–6.** *Tityopsis mulata* sp. n., male holotype (5) and female paratopotype (6): **a)** pedipalp, dorsal view; **b)** pedipalp chela, external view; **c)** pedipalp chela, ventral view; **d)** telson, lateral view.



**Figures 7–8.** *Tityopsis mulata* sp. n., male holotype (7) and female paratopotype (8): **a)** chelicerae and carapace; **b)** tergites.

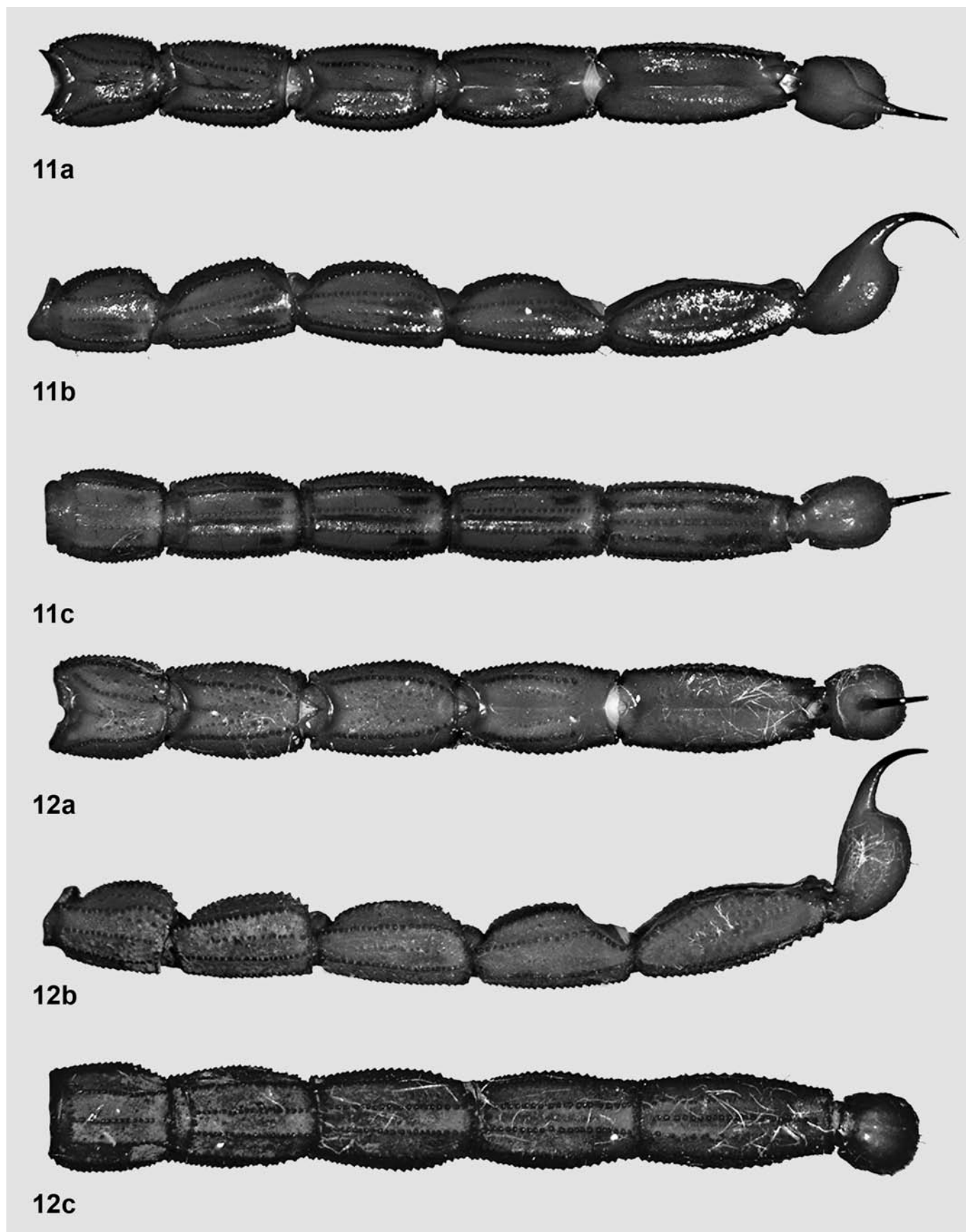


**Figures 9–10.** *Tityopsis mulata* sp. n., male holotype (9) and female paratopotype (10): **a)** sternopectinal region; **b)** sternite V.

**DIAGNOSIS.** Adult size moderately large for the genus (25–26 mm in males, 32–34 mm in females). Adult coloration: base olivaceous brown, very densely infuscate all over so the entire scorpion looks very dark to unaided eye; pedipalp chelae, legs and venter slightly paler; pedipalp fingers black. Juvenile coloration: base orange brown, slightly paler on legs, venter and telson; chelicerae and tergites almost entirely blackish (the latter with posterior margins translucent gray), pedipalp femur and patella, carapace, sternites and metasoma symmetrically patterned with blackish brown; pedipalp chelae with manus whitish and fingers blackish. Pedipalps moderately elongate for the genus (length/width ratio of femur, patella and chela: 3.11–3.27, 2.62–2.80 and 3.44–3.61 in male, 2.71–2.78, 2.47–2.60 and 3.24–3.30 in females); chelae with manus oval and slightly longer in male (length/width ratio: 1.50–1.59 in male, 1.45–1.46 in females) and with fingers moderately long (movable finger/manus length ratio: 1.27–1.29 in male, 1.24–1.26 in females), fixed/movable fingers with 12/12

principal rows of denticles (exceptionally 11/11). Tegument of carapace, tergites, sternites, metasoma and telson sexually dimorphic between adults: with a satin sheen in male vs. matt in females. Carapace and tergites with many medium-sized granules scattered (much coarser and denser in female). Pectines with 14–16 teeth in male, 12–15 in female; basal middle lamella slightly enlarged and teardrop-shaped in male, moderately enlarged and oval in females. Sternite V with median smooth patch large and longer than wide in both sexes, lanceolate in male and narrowly cordiform in females; lateral smooth patches moderately large, oblique and bulky in both sexes. Metasoma slightly elongate in male vs. not elongate in females (length/width ratio of segments I–V: 1.15, 1.48–1.50, 1.68–1.70, 1.81–1.84 and 2.34–2.39 vs. 1.11–1.14, 1.47–1.48, 1.57–1.59, 1.78–1.79 and 2.16–2.17), with 10/10/8/8/7 complete to almost complete, coarsely serrate to serrato-denticulate carinae; lateral inframedians on II obsolete only on basal one-fifth (male) to one-quarter (females); intercarinal





**Figures 11–12.** *Tityopsis mulata* sp. n., male holotype (11) and female paratopotype (12), metasoma and telson: **a)** dorsal, **b)** lateral, and **c)** ventral views.

tegument of segment V with many small (male) to medium-sized (females) conical granules. Telson with vesicle globular, subaculear tubercle small.

**DESCRIPTION** (♂ holotype; Figs. 2–3, 5, 7, 9, 11, 33a; Tabs. 1, 4).

**Coloration** (Figs. 3, 33a). Base medium olivaceous-brown, conspicuously darker on carapace, slightly paler on pedipalp chelae, legs and venter. Chelicerae manus very densely reticulate with blackish brown distally; fingers deeply infusate. Pedipalps heavily and irregularly infusate on all segments except chela manus, with carinae darker and fingers blackish. Carapace symmetrically and densely spotted with blackish brown, mostly below coarser granulate areas; all margins black; eyes and ocular tubercles black. Tergites symmetrically and densely spotted with blackish brown, mostly below coarser granulate areas and median keel; posterior margin black. Pectines immaculate yellowish brown, with basal portion and basal plate progressively darker due to heavier sclerotization. Sternites III–VI essentially immaculate, VII faintly infusate laterally; V with median smooth patch bright white and lateral smooth patches translucent yellowish to whitish. Legs heavily and irregularly infusate on all segments except coxa, trochanter and basal portion of femur, with all carinae darker. Metasoma concolor all along (i.e., distal segments not darker), with carinae faintly to moderately infusate and distal portion of each segment infusate into an irregularly annulated pattern; dorsal surface of I–IV with an irregular arrowhead-shaped blackish spot along midline; lateral surfaces with large, elongate blackish spots between carinae all over distal half of all segments; ventral surface with a thick but interrupted blackish stripe between ventral submedian carinae, plus a pair of large, elongate blackish spots between ventral submedian and ventrolateral carinae over distal half of segments I–IV and all along V. Telson vesicle essentially immaculate; aculeus with distal half dark reddish brown.

**Chelicerae** (Fig. 7a). With dentition typical for the genus, teeth standard-sized and sharp. Tegument glossy but with minute granulation scattered, dorsodistal portion of manus with coarse, glossy granules irregularly arranged transversally around dorsodistal depression. Setation very dense ventrally, but essentially lacking dorsally, except for six rigid macrosetae around dorsodistal depression of manus.

**Pedipalps** (Fig. 5a–c). Somewhat enlarged for the genus, i.e., moderately longer and with chelae longer and heavier than standard. Femur essentially straight (very slightly bent inwards distally), with all carinae very strong, coarsely denticulate to serrate; intercarinal tegument with a satin sheen, very densely and irregularly granulose; internal (*i*) trichobothria surrounding a large, irregularly triangular spur. Patella straight, with all carinae very strong, coarsely granulose to serrato-crenulate; intercarinal tegument with a satin sheen, very finely and densely granulose, internally with many conical denticles. Chela with manus oval (1.59 times longer than wide), much wider than patella (ratio 1.26) and with the basal half slightly widest, all carinae strong, coarsely

serrate to serrato-crenulate, intercarinal tegument with a satin sheen, very finely and densely granulose on all surfaces; fingers long for the genus (movable finger 1.27 times longer than underhand) and evenly curved, fixed finger with 12/12 principal rows of denticles, movable finger with 12/12 plus an apical subrow of four denticles and a large internal accessory denticle (large terminal denticle not included), basal lobe/notch combination absent.

**Carapace** (Fig. 7a). Slightly wider than long (length/width ratio = 0.97). Anterior margin acutely bilobed, with three pairs of dark macrosetae. Carinae: anterior medians anteriorly divergent and formed by coarse, isolated granules and irregularly fused to the superciliaries, which are composed of much smaller and closer granules; posterior medians straight, parallel and formed by medium-sized granules; other carinae absent or indistinct from general granulation. Furrows: anterior marginal, anterior median, median ocular, lateral oculars, central transverse, central median, posterior median and posterior marginal all fused, wide and moderately deep; posterior laterals very long, oblique, wide and moderately deep, almost fused to posterior marginal; lateral centrals very long, oblique (essentially parallel to posterior laterals), wide and moderately deep, almost fused to central transverse. Tegument with a satin sheen, very densely and irregularly but finely granulose, with many medium-sized, rough granules scattered. Median eyes relatively large and separated by about one ocular diameter; lateral eyes noticeably smaller and largely concealed below anterolateral margin.

**Sternum** (Fig. 9a). Standard for the genus, with two pairs of dark macrosetae. Tegument very densely and irregularly granulose.

**Genital operculum** (Fig. 9a). Standard for the genus, with two pairs of dark macrosetae. Valves roundly subtriangular and widely separated medially, each with a median depression; tegument minutely and densely granulose. Genital papillae large, thick and slightly protruding.

**Pectines** (Fig. 9a). Standard-sized for the genus (not reaching coxa-trochanter joint of leg IV). Tooth count 15/15, teeth straight and slightly swollen. Fulcra large and bulky, paraboloid to round. Basal middle lamella slightly enlarged and teardrop-shaped. Pre-pectinal plate well visible, heavily sclerotized, very wide and short; tegument minutely and densely granulose. Basal plate heavily sclerotized, about as long as wide; anterior margin with a very wide, V-shaped anteromedian notch, posterior margin convex; tegument minutely and densely granulose.

**Legs**. Slender, with all carinae strong, finely denticulate to granulose. Intercarinal tegument minutely and densely granulose, with abundant slightly coarser granules scattered mostly over external surface. Claws short and strongly curved.

**Mesosoma** (Figs. 7b, 9). Tergites with a satin sheen, very densely and irregularly but finely granulose, with many medium-sized, rough granules scattered; carinae: median longitudinal strong, serrato-crenulate to serrate and progressively longer from I–VII, submedians absent on I–VI, complete, straight and strongly serrate on VII, laterals absent on I–VI, complete, straight and strongly serrate on VII.

Sternites with a satin sheen, very densely and irregularly but finely granulose, with some dark macrosetae scattered all over; lateral margins of all sternites serrate to granulose; posterior margin of all sternites smooth to vestigially granulose, on III vestigially bilobed, on IV widely bilobed, on V narrowly bilobed (due to protuberance of lateral smooth patches), on VI widely bilobed, on VII essentially straight; carinae: III–V acarinate, VI–VII with paired laterals and submedians which are long, straight and finely crenulate; spiracles small, narrowly oval to short slit-like; sternite V with median smooth patch large, lanceolate (remarkably longer than wide), bulky and glossy, not protruding from posterior margin; lateral smooth patches moderately large, oblique, elongate-oval to teardrop-shaped, bulky and glossy, conspicuously protruding from posterior margin.

**Metasoma** (Fig. 11). Slightly longer than standard for the genus (4.33 times longer than carapace) and slightly narrower distally. Segments I–II with ten complete to almost complete carinae, III–IV with eight, V with seven: dorsal laterals strong, coarsely serrate to serrato-denticulate on I–IV, absent on V but indicated by an incomplete row of conical granules; lateral supramedians strong, coarsely serrate to serrato-denticulate on I–V; lateral inframedians strong, coarsely serrato-crenulate on I–II (obsolete on basal one-fifth of the latter), absent on III–V (but indicated in each segment by an incomplete row of coarse granules that never form a true, raised carina); ventral laterals strong, coarsely serrate to serrato-denticulate on I–V; ventral submedians strong, coarsely serrate to serrato-denticulate on I–IV, indicated by an incomplete but raised row of coarse granules on more than basal half of V; ventral median absent on I–IV, strong, coarsely serrate to serrato-denticulate on V. Intercarinal tegument with a satin sheen, very finely and densely granulose, with some medium-sized granules scattered on dorsal surface of all segments and on lateral surfaces of V; dorsal furrow complete, narrow and moderately deep on all segments; setation sparse, with two pairs of dark macrosetae on essentially all carinae.

**Telson** (Fig. 5d). Vesicle globose (1.39 times longer than wide, exactly as wide as deep) and with several dark and whitish setae scattered; tegument coriaceous but with a satin sheen, with some medium-sized granules scattered mostly ventrally; ventral median carina weak but coarsely subgranulose, continued into the subaculear tubercle that is small, broadly conical and unarmed (i.e., without any granules). Aculeus standard-sized, sharp, shorter than vesicle and moderately curved.

**FEMALE** (adult paratopotypes; Figs. 4, 6, 8, 10, 12, 33b–e; Tabs. 1, 4). Sexual dimorphism well-marked, differing from described male by: **1**) size conspicuously larger (31.8–33.8 mm); **2**) tegument of carapace, tergites, sternites, metasoma and telson matt, with scattered granulation coarser; **3**) pedipalps relatively shorter, more robust (especially chela manus) and with carinae coarser; **4**) carapace remarkably wider posteriorly; **5**) mesosoma relatively wider, with lateral sides markedly convex; **6**) pre-pectinal plate absent; **7**) genital operculum with valves not separated medially and lacking genital papillae; **8**) pectines relatively smaller, with teeth

shorter, narrower and slightly fewer in number (12–15, mode 13–14), and with basal middle lamella moderately enlarged, oval in shape and whitish; **9**) sternite V with median and lateral smooth patches smaller and less bulky, the former narrowly cordiform in shape and translucent; **10**) metasoma relatively shorter, more robust and with carinae coarser.

**VARIATION.** The type series is remarkably homogeneous in all morphological characters that are diagnostic for *T. mulata* sp. n. The coloration varies only subtly in shade in both adults and juveniles, with some individuals being slightly lighter or darker (Figs. 33a–e). Interestingly, while keeping individuals alive in captivity we unexpectedly discovered that this variation is at least sometimes directly related to moisture degree: if the breeding cage is kept under drier conditions for several days the scorpions gradually become slightly lighter, but they start to darken back after humidity is raised again.

Adult size varied as follows: 25.3–26.3 mm in males, 31.8–33.8 mm in females (Tab. 1). All adult paratopotypes seem to belong to a single size-class.

Number of principal rows of denticles was essentially fixed at 12/12 on both fixed and movable fingers of all specimens but one. The latter is an adult female with 11/11 rows on right pedipalp chela.

Pectinal tooth counts (Tab. 4) varied from 14–16 in males and 12–15 in females, with modes of 14–15 in the former sex and 14 in the latter. Single-tooth asymmetry was a very common occurrence: 2 out of 4 males and 3 out of 5 females (two adults of this sex had a pecten too damaged for counting); there were no specimens with two or more teeth asymmetry.

**AFFINITIES.** This species is very easy to distinguish at first sight from the other two described species of the genus by its very dark coloration all over. Adults of *T. inaequalis* are light to pale yellowish brown, only with faint infuscation in carapace and metasomal segments II–IV (even absent in many specimens, mostly males) and pedipalp fingers, while juveniles are pale orange to yellowish brown, usually with a reduced, sparse pattern of grayish-brown spots on carapace, tergites, legs and metasoma (absent altogether in some individuals) and with pedipalps always immaculate. On the other hand, adults of *T. inexpectata* are reddish brown, with only the carapace and metasoma densely patterned with dark brown (sometimes also the tergites); juveniles are light orange to pale reddish brown, with the carapace and tergites remarkably less densely spotted with dark to grayish brown.

Apart from coloration, these two species can be distinguished from *T. mulata* sp. n. as follows:

***T. inaequalis*:** **1**) size slightly but consistently larger (26–29 mm in males, 33–36 mm in females); **2**) pedipalps with remarkably heavier chela manus; **3**) entire habitus markedly slenderer, especially in males; **4**) tegument of carapace, tergites, sternites, metasoma and telson with a satin sheen in adult females; **5**) pectines relatively larger and with slightly but consistently higher tooth counts (16/16 in males, 14–16 in females); **6**) carapace and tergites with granulation finer; **7**) pedipalps and metasoma with carinae weaker and finer.

*T. inexpectata*: **1)** size smaller (23–25 mm in males, 27–29 mm in females); **2)** entire habitus markedly stockier, especially pedipalps and metasoma; **3)** pectines with lower tooth counts (13–14 in males, 12–13 in females); **4)** sternite V with median smooth patch much wider and widely cordiform in shape; **5)** pedipalps and metasoma with carinae weaker and finer.

**ECOLOGICAL NOTES.** This species lives in mesophyllous semicaducifolious forest on limestone karstic soil (Fig. 37). All specimens were collected in the slopes of the mogote, under rocks semi-buried in leaf litter and organic soil, usually hanging to the underside of the rocks, as well as directly on the soil. Two other buthid scorpions live in this site as well: *Centruroides guanensis* Franganillo, 1931 and *Heteroctenus junceus* (Herbst, 1800); the former is arboreal and the latter occurs both in ground and in the vegetation.

An adult female paratopotype collected on 20/October/2019 gave birth in captivity to 18 pulli on 25 February 2020; the birth process was witnessed and documented by one of us (RT, see Figs. 33d–e). It lasted for about two hours, i.e., the first pulli was detected at 10:24 hrs when it had one-third out and all pulli finished to accommodate on mother's back at 12:29 hrs. The female remained all the time hanging from substratum completely horizontal in a “belly-up” position, with the “birth basket” formed by legs I–II (each pair evenly arched and closed by loosely touching the opposite telotarsi). All pulli emerged “head-first” and nine unfertilized eggs (large, round and uniformly pale yellowish) were delivered and eaten by the female after birth. The first ecdysis was accomplished on 2 March 2020.

**COMMENTS.** All eight specimens found on August 2016 were juveniles. Four of them were kept alive in captivity, where they readily accepted as prey small insects such as beetle larvae (*Tenebrio molitor* L., 1758) and cockroach nymphs (*Blattella germanica* (Linné, 1758) and *Periplaneta americana* (Linné, 1767)). They did very well in captivity and molted repeatedly until December 2016, when the breeding room became infested with an extremely aggressive, undetermined parasitic fly (*Chloropidae*?); the parasite larvae completely destroyed all individuals but one: the male herein designated as a paratopotype, which had already been preserved after having reached maturity (last ecdysis on November 13, 2016).

**DISTRIBUTION** (Fig. 2). This species is known only from the type locality. Mogote La Mina is a minute, isolated, karstic limestone plateau near the eastern end of Sierra de los Órganos mountain range. Actually, it represents the westernmost tip of Sierra de Guacamaya, cut off the main massif by erosion.

***Tityopsis pumila* sp. n.**

(Figures 2, 13, 15, 17, 19, 21, 34, 38, Tables 2, 4)

<http://zoobank.org/urn:lsid:zoobank.org:act:806A095B-3AFE-4D3F-B0B9-5C333A064BBA>

**TYPE LOCALITY AND TYPE DEPOSITORY.** Cuba, Pinar del Río Province, Guane Municipality, Sierra de Paso Real, 1.5 km northwest of Molina, 50 m a. s. l.; RTO.

**TYPE SPECIMEN.** Cuba, Pinar del Río Province, Guane Municipality, Sierra de Paso Real, 1.5 km northwest of Molina, 50 m a. s. l., 24 August 2016, leg. T. M. Rodríguez, A. Rodríguez & R. López, ♂ (holotype), RTO.

**ETYMOLOGY.** The selected epithet is a Latin adjective that literally means “dwarf”. It alludes to one the most obvious diagnostic character for this species, i.e., the very small adult size.

**DIAGNOSIS** (male only). Adult size small for the genus (21 mm). Coloration: base orange-brown, slightly darker on metasomal segments IV–V, slightly paler on pedipalp chelae and venter, and much paler on legs; pedipalp femur and patella, carapace, tergites and metasoma symmetrically patterned with dark brown; metasoma with carinae conspicuously darker; pedipalp fingers dark brown. Pedipalps short for the genus (length/width ratio of femur, patella and chela: 2.65, 2.45 and 3.11); chela with manus short oval (length/width ratio: 1.43) and with fingers very short (movable finger/manus length ratio: 1.17), fixed/movable fingers with 11/11 principal rows of denticles. Tegument of carapace, tergites, and metasoma matt, of pedipalp manus, sternites and telson with a subtle satin sheen. Carapace and tergites with many coarse granules scattered. Pectines with 14/14 teeth; basal middle lamella slightly enlarged and teardrop-shaped. Sternite V with median smooth patch large, longer than wide and lanceolate; lateral smooth patches moderately large, oblique and bulky. Metasoma very short and robust (length/width ratio of segments I–V: 1.03, 1.34, 1.45, 1.61 and 2.11), with 10/8/8/8/7 complete to almost complete, coarsely serrate to serrato-denticulate carinae; lateral inframedians on II obsolete on basal half; intercarinal tegument of segment V with many small conical granules. Telson with vesicle globular; subaculear tubercle small.

**DESCRIPTION** (♂ holotype; Figs. 2, 13, 15, 17, 19, 21, 34; Tabs. 2, 4).

**Coloration** (Figs. 13, 34). Base medium orange-brown, slightly darker on metasomal segment V, slightly paler on pedipalp chelae and venter, and much paler on legs (which are pale yellowish brown). Chelicerae manus moderately reticulate with dark brown distally; fingers moderately infusate. Pedipalps faintly and irregularly infusate on all segments except chela manus, with carinae darker and fingers dark brown. Carapace symmetrically and densely spotted with dark brown, mostly below coarser granulate areas; all margins black; eyes and ocular tubercles black. Tergites symmetrically and densely spotted with dark brown, mostly below coarser granulate areas and median keel; posterior margin dark brown. Pectines immaculate yellowish, with basal portion and basal plate progressively darker due to heavier sclerotization. Sternites III–VI immaculate, VII only with posterior margin deeply infusate; V with median and lateral smooth patches bright white. Legs essentially immaculate, only with external surface of patella and tibia very faintly and irregularly infusate. Metasoma with segments IV–V slightly darker (reddish), with carinae deeply infusate and with distal portion of each

		<i>T. pumila</i> sp. n.	<i>T. canizaresorum</i> sp. n.		
		♂ holotype	♀ holotype	♀ paratopotype Los Hondones	♀ paratype Pálpite
Dimensions (MM)					
Carapace	L / W	2.60 / 2.67	3.40 / 3.65	3.15 / 3.40	3.50 / 3.75
Mesosoma	L	5.60	7.60	7.00	8.00
Tergite VII	L / W	1.65 / 2.67	2.20 / 3.40	2.00 / 3.20	2.17 / 3.52
Metasoma	L	10.62	13.50	12.35	13.72
Segment I	L / W / D	1.57 / 1.52 / 1.35	2.05 / 1.80 / 1.62	1.85 / 1.70 / 1.50	2.15 / 1.85 / 1.65
Segment II	L / W / D	1.95 / 1.45 / 1.30	2.45 / 1.75 / 1.50	2.20 / 1.50 / 1.40	2.50 / 1.77 / 1.55
Segment III	L / W / D	2.10 / 1.45 / 1.30	2.65 / 1.70 / 1.50	2.45 / 1.55 / 1.40	2.62 / 1.72 / 1.55
Segment IV	L / W / D	2.25 / 1.40 / 1.25	2.85 / 1.62 / 1.50	2.60 / 1.52 / 1.35	2.90 / 1.65 / 1.50
Segment V	L / W / D	2.75 / 1.30 / 1.20	3.50 / 1.52 / 1.42	3.25 / 1.40 / 1.35	3.55 / 1.57 / 1.47
Telson	L	2.70	3.75	3.45	3.80
Vesicle	L / W / D	1.50 / 1.10 / 1.10	2.15 / 1.35 / 1.35	1.95 / 1.25 / 1.25	2.10 / 1.37 / 1.37
Aculeus	L	1.20	1.60	1.50	1.70
Pedipalp	L	9.30	12.65	11.85	12.95
Femur	L / W	2.25 / 0.85	3.00 / 1.10	2.75 / 1.02	3.00 / 1.07
Patella	L / W	2.70 / 1.10	3.55 / 1.40	3.30 / 1.30	3.70 / 1.42
Chela	L	4.35	6.10	5.80	6.25
Manus	W / D	2.00 / 1.40 / 1.30	2.55 / 1.67 / 1.57	2.50 / 1.55 / 1.47	2.70 / 1.70 / 1.57
Movable finger	L	2.35	3.55	3.30	3.55
<b>Total</b>	<b>L</b>	<b>21.52</b>	<b>28.25</b>	<b>25.95</b>	<b>29.02</b>

**Table 2.** Measurements (mm) of the adult types of *Tityopsis pumila* sp. n. and *T. canizaresorum* sp. n. Abbreviations: length (L), width (W), in carapace it corresponds to posterior width), depth (D).

segment faintly infuscate into an irregularly annulated pattern; dorsal surface of I–IV immaculate; lateral surfaces with large but faint, elongate dark brown spots between carinae all over distal third of all segments; ventral surface with a thick but interrupted dark brown stripe between ventral submedian carinae, plus a pair of large but faint, elongate dark brown spots between ventral submedian and ventrolateral carinae over distal half of segments I–IV and all along V. Telson vesicle ventrally with faint, irregular infuscation; aculeus with distal half dark reddish brown.

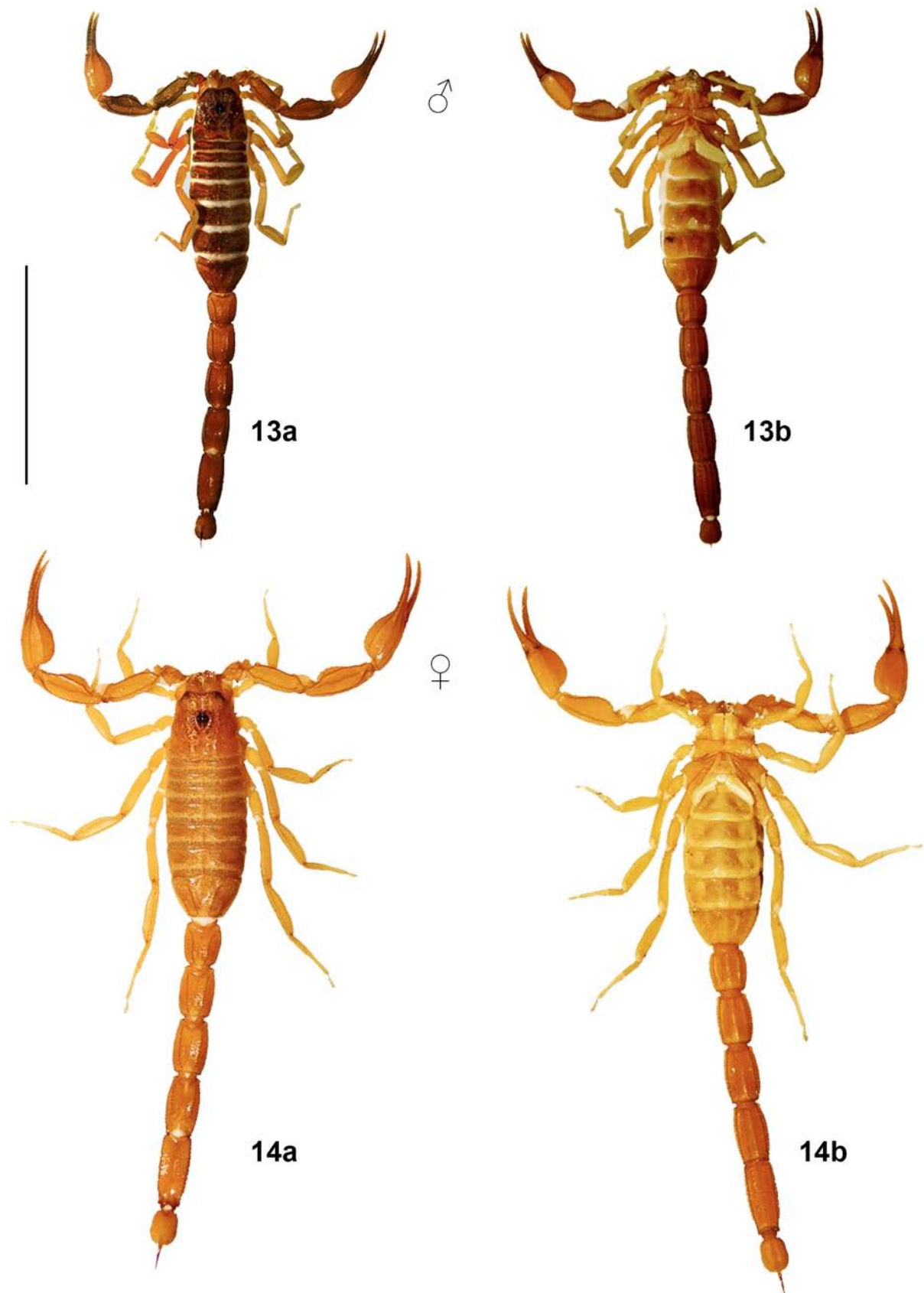
**Chelicerae** (Fig. 17a). With dentition typical for the genus, teeth standard-sized and sharp. Tegument glossy but with minute granulation scattered, dorsodistal portion of manus with coarse, glossy granules irregularly arranged transversally around dorsodistal depression. Setation very dense ventrally, but essentially lacking dorsally, except for six rigid macrosetae around dorsodistal depression of manus.

**Pedipalps** (Fig. 15a–c). Short for the genus, with chelae shorter and heavier than standard. Femur essentially straight (very slightly bent inwards distally), with all carinae very strong, coarsely denticulate to serrate; intercarinal tegument matt, very densely and irregularly granulose; internal (*i*) trichobothria surrounding a large, irregularly triangular spur. Patella straight, with all carinae very strong, coarsely granulose to serrato-crenulate; intercarinal tegument matt,

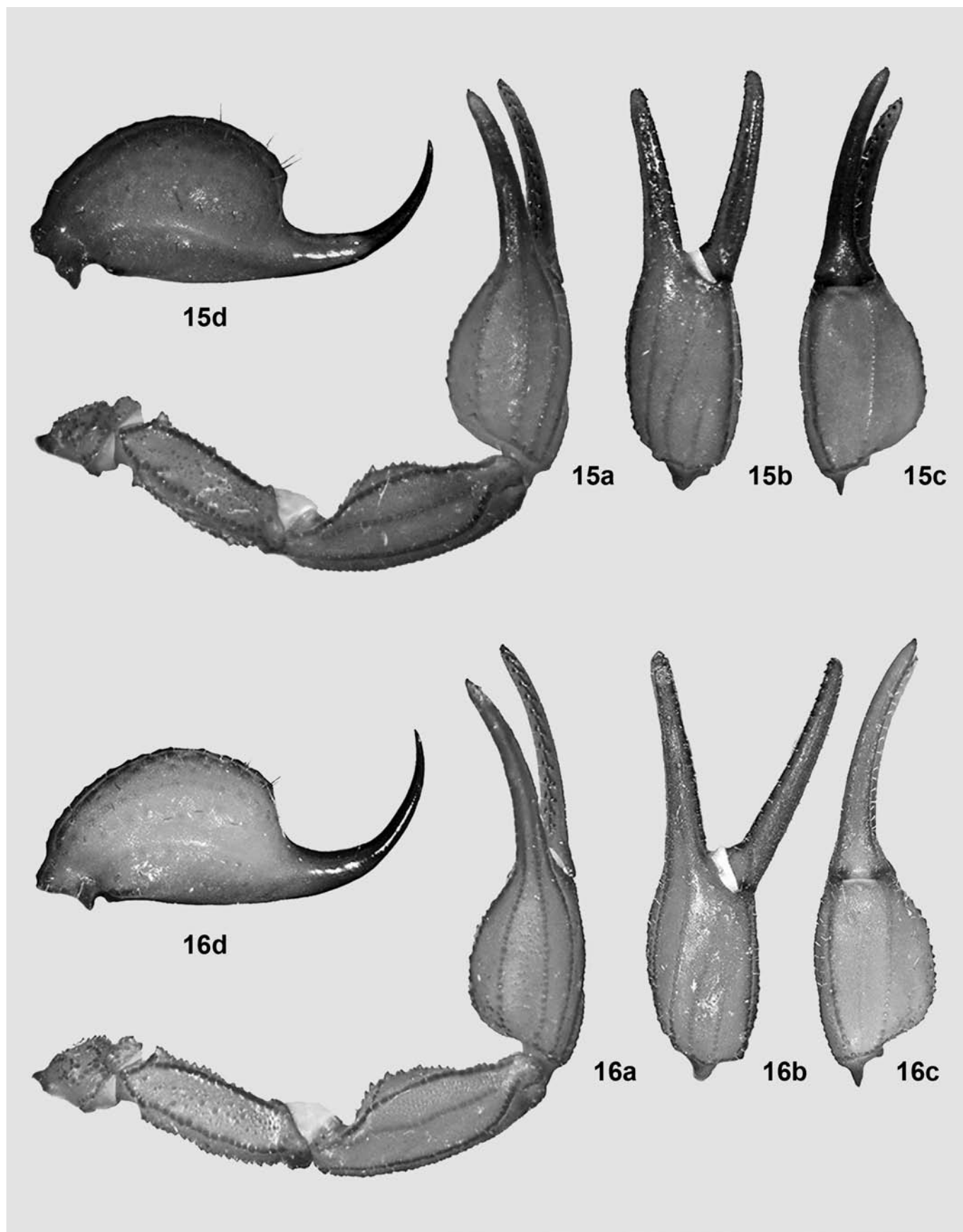
very finely and densely granulose, internally with many large, conical denticles. Chela with manus short-oval (1.43 times longer than wide), much wider than patella (ratio 1.27) and with the basal half slightly widest, all carinae strong, coarsely serrate to serrato-crenulate, intercarinal tegument with a subtle satin sheen, very finely and densely granulose on all surfaces; fingers very short for the genus (movable finger 1.17 times longer than underhand) and evenly curved, fixed finger with 11/11 principal rows of denticles, movable finger with 11/11 plus an apical subrow of four denticles and a large internal accessory denticle (large terminal denticle not included), basal lobe/notch combination absent.

**Carapace** (Fig. 17a). Slightly wider than long (length/width ratio = 0.97). Anterior margin roundly bilobed, with two pairs of dark macrosetae. Carinae: anterior medians anteriorly divergent and formed by very coarse, isolated granules and irregularly fused to the superciliaries, which are composed of much smaller and closer granules; posterior medians straight, parallel and formed by coarse granules; other carinae absent or indistinct from general granulation. Furrows: anterior marginal, anterior median, median ocular, lateral oculars, central transverse, central median, posterior median and posterior marginal all fused, wide and moderately deep; posterior laterals very long, oblique, wide and moderately deep, almost fused to posterior marginal; lateral centrals very long,

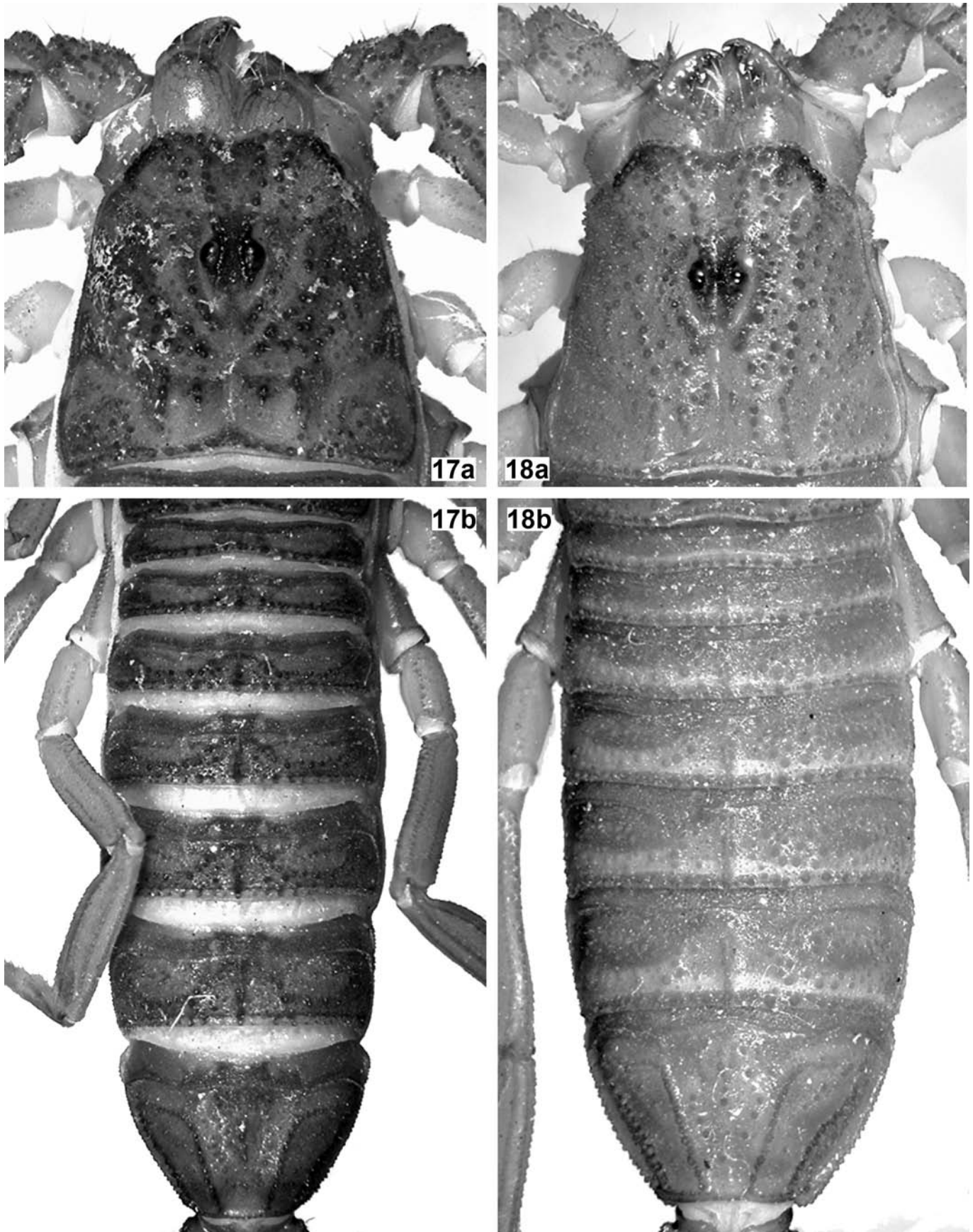




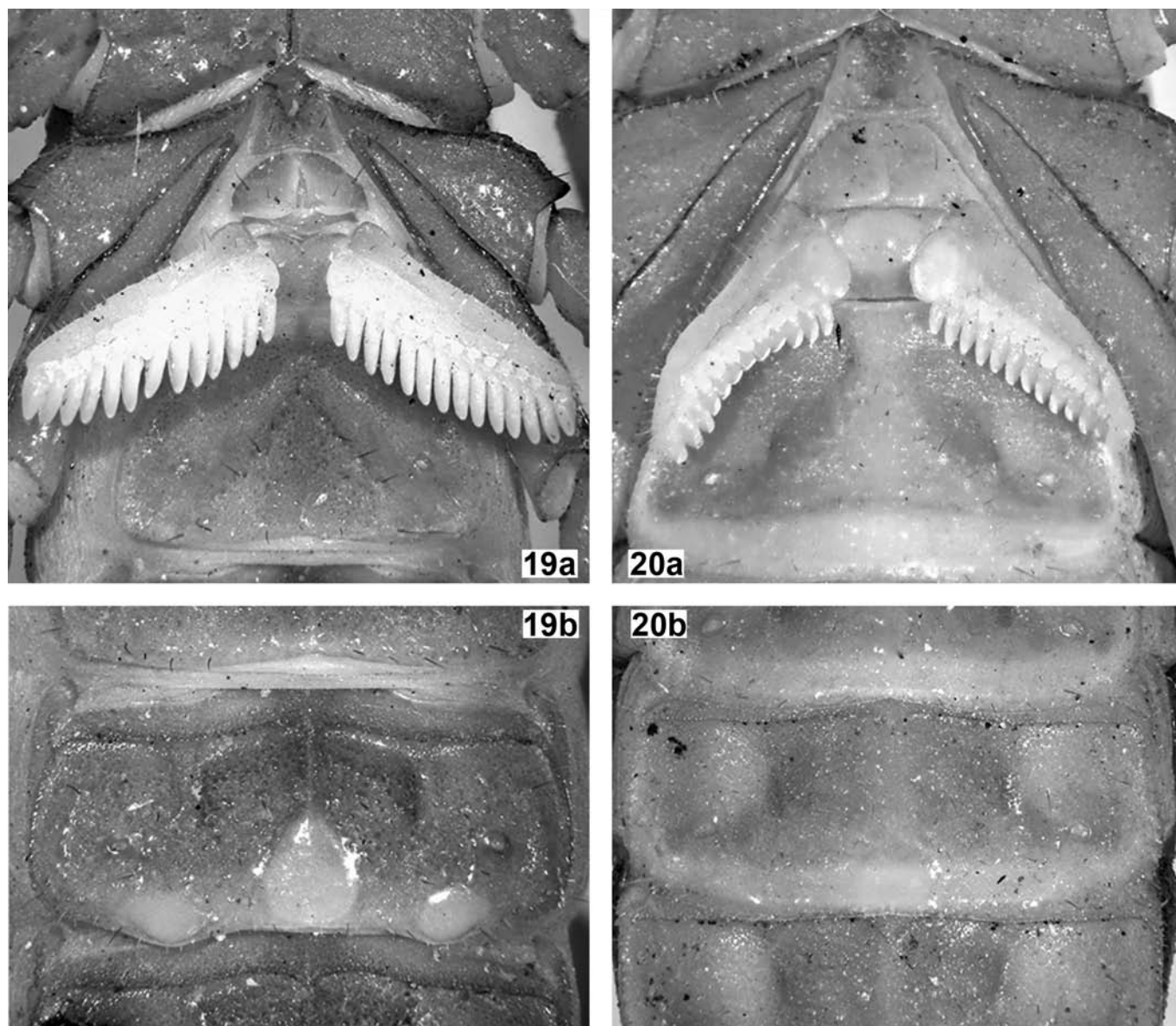
**Figures 13– 14.** *Tityopsis pumila* sp. n., male holotype (13) and *T. canizaresorum* sp. n., female holotype (14), habitus: **a)** dorsal; **b)** ventral. Scale bar = 10 mm.



**Figures 15–16.** *Tityopsis pumila* sp. n., male holotype (15) and *T. canizaresorum* sp. n., female holotype (16): **a)** pedipalp, dorsal view; **b)** pedipalp chela, external view; **c)** pedipalp chela, ventral view; **d)** telson, lateral view.



**Figures 17–18.** *Tityopsis pumila* sp. n., male holotype (17) and *T. canizaresorum* sp. n., female holotype (18): **a)** chelicerae and carapace; **b)** tergites.



**Figures 19–20.** *Tityopsis pumila* sp. n., male holotype (19) and *T. canizaresorum* sp. n., female holotype (20): **a)** sternopectinal region; **b)** sternite V.

oblique (essentially parallel to posterior laterals), wide and moderately deep, almost fused to central transverse. Tegument matt, very densely and irregularly but finely granulose, with many coarse, rough granules scattered. Median eyes relatively large and separated by about one ocular diameter; lateral eyes noticeably smaller and largely concealed below anterolateral margin.

**Sternum** (Fig. 19a). Standard for the genus, with two pairs of dark macrosetae. Tegument very densely and irregularly granulose.

**Genital operculum** (Fig. 19a). Standard for the genus, with three pairs of dark macrosetae. Valves roundly subtriangular and widely separated medially, each with a median depression; tegument minutely and densely granulose. Genital papillae large, thick and slightly protruding.

**Pectines** (Fig. 19a). Standard-sized for the genus (not reaching coxa-trochanter joint of leg IV). Tooth count 14/14

(right pecten with tooth eight abnormally short), teeth straight and slightly swollen. Fulcra medium-sized to small, bulky and round. Basal middle lamella slightly enlarged and teardrop-shaped. Pre-pectinal plate well visible, heavily sclerotized, very wide and short; tegument minutely and densely granulose. Basal plate heavily sclerotized, about as long as wide; anterior margin with a very wide, V-shaped anteromedian notch, posterior margin convex; tegument minutely and densely granulose.

**Legs.** Somewhat less slender than standard, with all carinae strong, finely denticulate to granulose. Intercarinal tegument finely and very densely granulose, with abundant slightly coarser granules scattered mostly over external surface, even defining an additional carina (externomedian) on lateral surface of femur of all legs. Claws short and strongly curved.

**Mesosoma** (Figs. 17b, 19). Tergites largely matt, very densely and irregularly but finely granulose, with many

medium-sized to coarse, rough granules scattered; carinae: median longitudinal strong, serrato-crenulate to serrate and progressively longer from I–VII, submedians absent on I–VI, complete, straight and strongly serrate on VII, laterals absent on I–VI, complete, straight and strongly serrate on VII. Sternites with a subtle satin sheen, very densely and irregularly but finely granulose, with some dark macrosetae scattered all over; lateral margins of all sternites serrate to granulose; posterior margin of all sternites smooth to vestigially granulose, on III vestigially bilobed, on IV widely bilobed, on V narrowly bilobed (due to protuberance of lateral smooth patches), on VI widely bilobed, on VII concave; carinae: III–V acarinate, VI–VII with paired laterals and submedians which are long, straight and coarsely crenulate; spiracles small, round to short-oval; sternite V with median smooth patch large, lanceolate (remarkably longer than wide), bulky and glossy, not protruding from posterior margin; lateral smooth patches moderately large, oblique, oval, bulky and glossy, protruding well from posterior margin.

**Metasoma** (Fig. 21). Shorter than standard for the genus (4.08 times longer than carapace), very robust and slightly narrower distally. Segment I with ten complete carinae, II–IV with eight, V with seven: dorsal laterals strong, coarsely serrate to serrato-denticulate on I–IV, absent on V but subtly indicated by an incomplete row of conical granules; lateral supramedians strong, coarsely serrate to serrato-denticulate on I–V; lateral inframedians strong, coarsely serrato-crenulate on I, present only on distal half of II, absent on III–V (but indicated in III–IV by a few coarser, irregularly arranged granules and on V by a well-defined row of coarse granules that almost define true carinae); ventral laterals strong, coarsely serrate to serrato-denticulate on I–V; ventral submedians strong, coarsely serrate to serrato-denticulate on I–IV, indicated by an incomplete but raised row of coarse granules on basal half of V; ventral median absent on I–IV, strong, coarsely serrate to serrato-denticulate on V. Intercarinal tegument matt, very finely and densely granulose, with some medium-sized granules scattered on dorsal surface of all segments and on lateral surfaces of V; dorsal furrow poorly defined, wide and shallow, but distally narrower and deeper; setation sparse, with two pairs of dark macrosetae on essentially all carinae.

**Telson** (Fig. 15d). Vesicle globose (1.36 times longer than wide, exactly as wide as deep) and with many dark and whitish setae scattered; tegument coriaceous but with a subtle satin sheen, with vestiges of coarse granules scattered mostly ventrally; ventral median carina weak but coarsely subgranulose, continued into the subaculear tubercle that is small, broadly conical and unarmed (i.e., without any granules). Aculeus standard-sized, sharp, shorter than vesicle and moderately curved.

FEMALE. Unknown.

VARIATION. Unknown.

**AFFINITIES** (adult males only). This species is very easy to distinguish at first sight from the other three described species of the genus by having the pedipalp movable finger shorter than carapace. Moreover, by the unique combination of a median smooth patch of sternite V lanceolate (longer than wide), coupled to a tiny size (21 mm) and very robust habitus (e.g., pedipalp only 3.58 times longer than carapace and with movable finger shorter than carapace, metasoma only 4.08 times longer than carapace and with segment I essentially as long as wide).

These characters compare to the three other *Tityopsis* as follows, enhanced by additional diagnostic features:

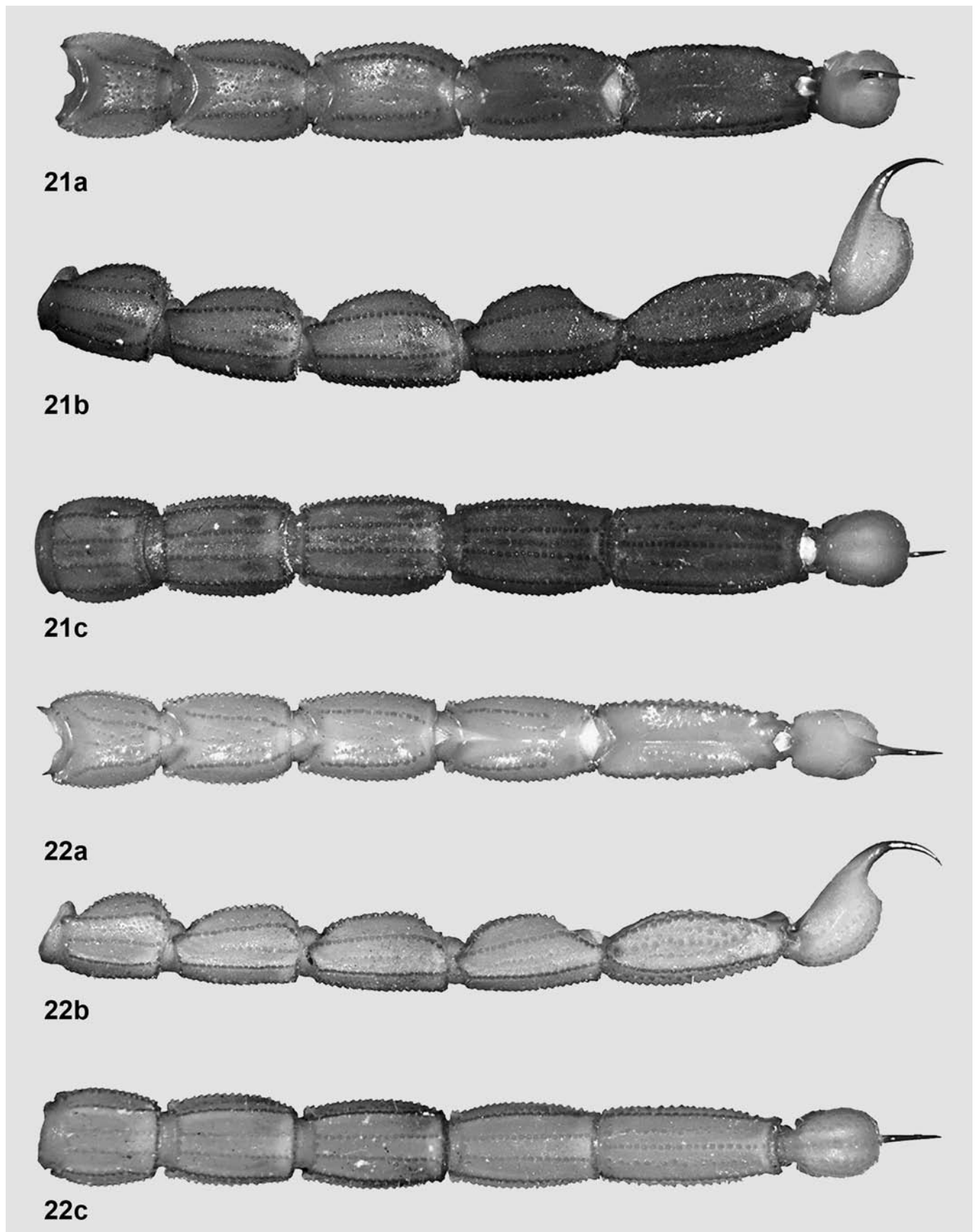
***T. mulata* sp. n. 1)** size larger (25–26 mm); **2)** coloration much darker (basically olivaceous brown) and very densely spotted all over with blackish brown; **3)** pedipalps more elongate (3.95 times longer than carapace), with movable finger longer than carapace; **4)** metasoma more elongate (4.27–4.33 times longer than carapace, with segment I 1.15 times longer than wide); **5)** tegument of carapace, tergites, sternites, metasoma and telson with a satin sheen; **6)** pectines with slightly higher tooth count (14–15); **7)** carapace and tergites with granulation finer; **8)** metasoma with carinae weaker and finer.

***T. inaequalis*: 1)** size much larger (26–29 mm); **2)** coloration much paler (basically light to pale yellowish brown) and only with faint infuscation in carapace and metasomal segments II–IV (even absent in many specimens, mostly males); **3)** pedipalps much more elongate (4.00–4.02 times longer than carapace), with movable finger longer than carapace; **4)** metasoma more elongate (4.26–4.44 times longer than carapace, with segment I 1.21–1.31 times longer than wide); **5)** tegument of carapace, tergites, sternites, metasoma and telson with a satin sheen; **6)** pectines with higher tooth count (16/16); **7)** carapace and tergites with granulation finer; **8)** metasoma with carinae weaker and finer.

***T. inexpectata*: 1)** size larger (23–25 mm); **2)** coloration basically reddish brown, with carapace remarkably darker (heavily spotted with dark brown); **3)** pedipalps more elongate (3.74–3.88 times longer than carapace), with movable finger longer than carapace; **4)** metasoma more elongate (4.16–4.25 times longer than carapace, with segment I 1.12–1.14 times longer than wide); **5)** sternite V with median smooth patch widely cordiform and about as long as wide; **6)** pedipalps and metasoma with carinae weaker and finer; **7)** telson with subaculear tubercle variable, but almost always markedly larger.

**ECOLOGICAL NOTES.** This species lives in mesophyllous semicaducifolious forest on limestone karstic soil (Fig. 38). All specimens were collected in the slopes of the mogote, under rocks semi-buried in leaf litter and organic soil, usually hanging to the underside of the rocks, as well as directly on the soil. It lives syntopically with a very different *Tityopsis* sp. (much larger, paler and slenderer) and with *C. guanensis* and *H. junceus*, both of which also occur sympatrically on the vegetation.





**Figures 21–22.** *Tityopsis pumila* sp. n., male holotype (21) and *T. canizaresorum* sp. n., female holotype (22), metasoma and telson: **a)** dorsal, **b)** lateral, and **c)** ventral views.

COMMENTS. Three juveniles of *T. pumila* sp. n. (one male, two females) were collected together with the holotype. Two of them (male and female) were kept alive in captivity, where they readily accepted small beetle larvae (*Tenebrio molitor* Linnaeus, 1758) as prey. They did very well in captivity and molted once each until December 2016, when the breeding room became infested with an extremely aggressive, undetermined parasitic fly (Chloropidae?), whose larvae destroyed both juveniles.

This represents the first record of the genus from the Guane Municipality, as well as the first documented finding of two species of *Tityopsis* occurring together in the same locality.

DISTRIBUTION (Fig. 2). This species is known only from the type locality. Sierra de Paso Real is a minute, isolated, karstic limestone plateau at the southern end of Cordillera de Guaniguanico mountain range. Actually, it represents the westernmost tip of Sierra de Guane, cut off the main massif by erosion.

***Tityopsis canizaresorum* sp. n.**

(Figures 2, 14, 16, 18, 20, 22, 35, 39, Tables 2, 4)

<http://zoobank.org/urn:lsid:zoobank.org:act:AC88BB73-DE45-4045-890D-74C4D6E2A98B>

TYPE LOCALITY AND TYPE DEPOSITORY. Cuba, Matanzas Province, Ciénaga de Zapata Municipality, Los Hondones, 2–3 m a. s. l., RTO.

TYPE SPECIMENS. **Cuba**, Matanzas Province, Ciénaga de Zapata Municipality, Los Hondones, 2–3 m a. s. l., 22–25/January/2013, leg. R. Teruel & T. M. Rodríguez, 1♀ (holotype), RTO; Matanzas Province, Ciénaga de Zapata Municipality, Playa Larga, 1 m a. s. l., 20 June 2011, leg. L. A. Casanella, F. Cala, 1♀juv. (paratype), RTO; 3.5 km southeast of Soplillar, 3 m a. s. l., 25 January 2013, leg. R. Teruel & T. M. Rodríguez, 2♀ (paratypes), RTO; Los Hondones, 2–3 m a. s. l., June 1985, leg. J. Novo & L. V. Moreno, 1♀juv. (paratype), IES, 1 February 2001, leg. R. Teruel, 2♀1♀juv. (paratypes), RTO, 28 November–4 December 2012, leg. T. M. Rodríguez, 5♀1♀juv. (paratypes), RTO, 22–25/January 2013, leg. R. Teruel & T. M. Rodríguez, 12♀9♀juvs. (paratypes), RTO, 16 August 2014, leg. T. M. Rodríguez, 4♀2♀juvs. (paratypes), RTO.

ETYMOLOGY. The selected epithet is a Latinized patronym honoring two good friends of us: the Cañizares brothers (Maikel and Maydiel), who greatly helped us during our repeated collecting trips to the type locality.

DIAGNOSIS (females only). Adult size medium for the genus (25–29 mm). Adult coloration: base yellowish brown, slightly darker on metasomal segments IV–V and slightly paler on legs, venter and telson; dark patterns essentially absent, except for faint brown reticulation in chelicera manus and faint infuscation in carapace (along anterior margin and around eyes) and metasomal segments II–IV (on ventral surface).

Juvenile coloration: base pale orange to yellowish brown, slightly paler on pedipalps, legs, venter and telson; dark patterns essentially absent, except for faint gray reticulation in chelicera manus and faint infuscation in carapace (along anterior margin and around eyes) and metasomal segments II–V (mostly on posterior part and around carinae); tergites with posterior margins translucent whitish; pedipalps fingers not infusate. Pedipalps remarkably elongate for the genus (length/width ratio of femur, patella and chela: 2.70–2.80, 2.54–2.61 and 3.65–3.74); chela with manus elongate-oval (length/width ratio: 1.53–1.61) and with fingers long (movable finger/manus length ratio: 1.31–1.39), fixed/movable fingers with 11–12/11–12 principal rows of denticles (mode 12/12). Tegument of carapace, tergites, sternites, metasoma and telson with a satin sheen. Carapace and tergites with many coarse granules scattered. Pectines with 11–14 teeth (mode 12–13); basal middle lamella greatly enlarged and oval. Sternite V with median smooth medium-sized, as long as wide and cordiform; lateral smooth patches small, oblique and slightly bulky. Metasoma slightly elongate (length/width ratio of segments I–V: 1.09–1.16, 1.40–1.47, 1.52–1.58, 1.71–1.88 and 2.26–2.32), with 10/8/8/8/7 complete to almost complete, coarsely denticulate to serrato-denticulate carinae; lateral inframedians on II obsolete on basal half; intercarinal tegument of segment V with many large, conical granules. Telson with vesicle less globose than standard for the genus; subaculear tubercle small.

DESCRIPTION (♀ holotype; Figs. 2, 14, 16, 18, 20, 22, 35a; Tabs. 2, 4).

**Coloration** (Figs. 14, 35a). Base light yellowish brown, slightly darker on metasomal segments IV–V (medium brown) and slightly paler on legs, venter and telson. Chelicerae manus very sparsely reticulate with brown (more densely distally); fingers faintly and irregularly infusate. Pedipalps immaculate, with carinae and fingers slightly darker due to heavier sclerotization. Carapace largely immaculate, with faint symmetrical infuscation along anterior margin and around all three eye groups; eyes and ocular tubercles black. Tergites immaculate, with carinae of VII slightly darker due to heavier sclerotization. Pectines immaculate pale yellowish brown, with basal portion and basal plate progressively darker due to heavier sclerotization. Sternites immaculate; V with median and lateral smooth patches translucent. Legs immaculate, with carinae slightly darker due to heavier sclerotization. Metasoma with segments IV–V slightly darker (medium brown), with carinae darker due to heavier sclerotization and without any annulated pattern; all surfaces immaculate, except for ventral surface with a pair of very faint, elongate brownish spots between ventral submedian and ventrolateral carinae over distal half of segments II–IV. Telson immaculate, with distal half of aculeus dark reddish brown.

**Chelicerae** (Fig. 18a). With dentition typical for the genus, teeth standard-sized and sharp. Tegument glossy but with minute granulation scattered, dorsodistal portion of manus

with coarse, glossy granules irregularly arranged transversally around dorsodistal depression. Setation very dense ventrally, but essentially lacking dorsally, except for five rigid macrosetae around dorsodistal depression of manus.

**Pedipalps** (Fig. 16a–c). Remarkably elongate for the genus, i.e., moderately longer and with chelae slenderer than standard. Femur essentially straight (very slightly bent inwards distally), with all carinae very strong, coarsely denticulate to serrate; intercarinal tegument with a satin sheen, very densely and irregularly granulose; internal (*i*) trichobothria surrounding a large, irregularly triangular spur. Patella straight, with all carinae strong, coarsely granulose to serrato-crenulate; intercarinal tegument with a satin sheen, very finely and densely granulose, internally with many conical denticles. Chela with manus elongate-oval (1.53 times longer than wide), wider than patella (ratio 1.19) and with the basal half slightly widest, all carinae strong, coarsely serrate to serrato-crenulate, intercarinal tegument with a satin sheen, very finely and densely granulose on all surfaces; fingers long for the genus (movable finger 1.39 times longer than underhand) and evenly curved, fixed finger with 12/12 principal rows of denticles, movable finger with 12/12 plus an apical subrow of four denticles and a large internal accessory denticle (large terminal denticle not included), basal lobe/notch combination absent.

**Carapace** (Fig. 18a). Wider than long (length/width ratio = 0.93). Anterior margin widely V-shaped, with two pairs of dark macrosetae. Carinae: anterior medians almost parallel (very slightly divergent anteriorly) and formed by very coarse, isolated granules and irregularly fused to the superciliaries, which are composed of much smaller and closer granules; posterior medians almost parallel (very slightly divergent posteriorly) and formed by coarse, isolated granules and irregularly fused to the central laterals and lateral oculars which are equally formed by coarse, isolated granules; other carinae absent or indistinct from general granulation. Furrows: anterior marginal, anterior median, median ocular, lateral oculars, central median, posterior median and posterior marginal all fused, wide and moderately deep; posterior laterals very long, oblique, wide and moderately deep, almost fused to posterior marginal; other furrows absent or indistinct. Tegument with a satin sheen, very densely and irregularly but finely granulose, with many coarse, rough granules scattered. Median eyes relatively large and separated by about one ocular diameter; lateral eyes noticeably smaller and largely concealed below anterolateral margin.

**Sternum** (Fig. 20a). Standard for the genus, although more pentagonal in shape, with two pairs of dark macrosetae. Tegument minutely and densely granulose.

**Genital operculum** (Fig. 20a). Standard for the genus, with three pairs of dark macrosetae. Valves roundly subtriangular and not separated medially; tegument coriaceous. Genital papillae absent.

**Pectines** (Fig. 20a). Smaller than standard for the genus (barely reaching sternite III spiracles). Tooth count 13/12, teeth very short, straight and not swollen. Fulcra large and

bulky, paraboloid to round. Basal middle lamella greatly enlarged and oval in shape. Pre-pectinal plate vestigial, poorly sclerotized, very wide and short; tegument smooth. Basal plate normally sclerotized, about as long as wide; anterior margin with only a subtle indication of anteromedian notch, posterior margin paraboloid; tegument smooth.

**Legs**. Slenderer than standard for the genus, with all carinae strong, finely denticulate to granulose. Intercarinal tegument finely and very densely granulose, with abundant slightly coarser granules scattered mostly over external surface, even defining an additional carina (externomedian) on lateral surface of femur of all legs. Claws short and strongly curved.

**Mesosoma** (Figs. 18b, 20). Tergites with a satin sheen, very densely and irregularly but finely granulose, with many coarse, rough granules scattered; carinae: median longitudinal strong, serrato-crenulate to serrate and progressively longer from I–VII, submedians absent on I–VI, complete, straight and strongly serrate on VII, laterals absent on I–VI, complete, straight and strongly serrate on VII. Sternites with a satin sheen, very densely and irregularly but finely granulose, with some dark macrosetae scattered all over; lateral margins of all sternites subserrate to subgranulose; posterior margin of all sternites essentially smooth, on III–IV widely bilobed, on V vestigially and widely bilobed (lacking any protuberance of lateral smooth patches), on VI essentially straight, on VII shallowly concave; carinae: III–V acarinate, VI–VII with paired laterals and submedians which are long, straight and finely crenulate; spiracles small, narrowly oval to short-oval; sternite V with median smooth patch medium-sized, cordiform (as long as wide), moderately bulky and glossy, not protruding from posterior margin; lateral smooth patches small, oblique, oval, slightly bulky and glossy, not protruding from posterior margin.

**Metasoma** (Fig. 22). Length standard for the genus (3.97 times longer than carapace) and slightly narrower distally. Segment I with ten complete to almost complete carinae, II–IV with eight, V with seven: dorsal laterals very strong, coarsely denticulate to serrato-denticulate on I–IV, absent on V but subtly indicated by an incomplete row of conical granules; lateral supramedians very strong, coarsely denticulate to serrato-denticulate on I–V; lateral inframedians very strong, coarsely serrato-denticulate on I, present only on distal half of II, absent on III–V (but indicated in III–IV by a few coarser, irregularly arranged granules and on V by a well-defined row of very coarse granules that almost define true carinae); ventral laterals very strong, coarsely serrate to serrato-denticulate on I–V; ventral submedians very strong, coarsely serrate to serrato-denticulate on I–IV, indicated by an incomplete but raised row of coarse granules on more than basal half of V; ventral median absent on I–IV, very strong, coarsely denticulate to serrato-denticulate on V. Intercarinal tegument with a satin sheen, very finely and densely granulose, with some medium-sized granules scattered on dorsal surface of all segments and with many large, conical granules on lateral surfaces of V; dorsal furrow complete, narrow and moderately deep on all segments; setation sparse, with two pairs of macrosetae on essentially all carinae.

**Telson** (Fig. 16d). Vesicle less globose than standard for the genus (1.59 times longer than wide, exactly as wide as deep) and with several dark and whitish setae scattered; tegument coriaceous but with a satin sheen, with many medium-sized granules scattered ventrally and ventrolaterally; ventral median carina weak but coarsely subgranulose, continued into the subaculear tubercle that is obsolete. Aculeus standardized, sharp, shorter than vesicle and moderately curved.

**MALE.** Unknown. This is apparently a female-only species that reproduces asexually by thelytokous parthenogenesis (see below, in Comments section).

**VARIATION.** The 40 paratypes are remarkably homogeneous for most morphological characters such as coloration, tegument sculpture, carination, setation and morphometric ratios, where variation was only minor and mostly due to eval differences, e.g., older adults have slightly darker coloration and setation, granulation and claws worn-out to different degrees. The only noteworthy exceptions are discussed as follows.

Adult size (Tab. 2) varied from 24.9–29.0 mm. The maximum gap observed between two specimens was 4.07 mm (a 14% absolute difference), which suggests the existence of at least two distinct size-classes; on the contrary, within each putative size class specimens differed by not more than 1.2 mm (4%). Number of principal rows of denticles varied from 11–12 on both fixed and movable fingers, with a clearly defined mode of 12 in each case. Fixed finger was slightly more variable, with five fingers out of 66 (7.6%) having 11 rows; on movable finger, only two fingers out of 65 (3.1%) had 11 rows. All cases of fixed and movable fingers with 11 rows were single-finger occurrences (most frequently on right pedipalp), i.e., the specimen had the three other fingers with 12 rows. An adult female paratopotype had right movable finger with seven rows only, but it was a teratology: about half of the denticles were irregularly aligned into a single, poorly defined row.

Pectinal tooth counts (Tab. 4) varied from 11–14, with a clearly defined mode of 12–13. Occurrence of symmetric counts between left/right pectines was essentially as common as one-tooth asymmetry (20 vs. 16 individuals, respectively, two specimens excluded from analysis due to having one pecten either missing or too damaged for reliable counting); the only two naturally deviant specimens (i.e., not showing any evidences of teratology), had 11/13 and 14/12.

**AFFINITIES** (adult females only). This species is very easy to distinguish at first sight from the three other described species of the genus where this sex is known, by two unique characters: the metasomal segment V with intercarinal tegument very coarsely denticulate (especially on lateral surfaces) and the pedipalp chela remarkably more elongate and slender (3.65–3.83 times longer than wide).

In the remaining species, metasomal segment V always has much weaker and sparser intercarinal granulation. Besides, pedipalp chela length/width ratio is much lower and compares as follows, enhanced by additional diagnostic features:

*T. mulata* sp. n.: **1)** size larger (32–34 mm); **2)** coloration much darker (basically olivaceous brown) and very densely spotted all over with blackish brown; **3)** pedipalp chela shorter and more robust (length/width ratio: 3.24–3.30); **4)** tegument of carapace, tergites, sternites, metasoma and telson matt; **5)** pectines with slightly but consistently higher tooth counts (12–15) and with basal middle lamella slightly smaller and more oval in shape; **6)** sternite V with median smooth patch markedly narrower; **7)** metasoma more robust, especially segment V (length/width ratio: 2.16–2.17); **8)** telson vesicle more globose.

*T. inaequalis*: **1)** size much larger (33–36 mm); **2)** pedipalp chela shorter and more robust (length/width ratio: 3.43–3.51); **3)** carapace and tergites with granulation finer; **4)** pectines larger, with higher tooth counts (14–16) and with basal middle lamella slightly smaller and more oval in shape; **5)** sternite V with median smooth patch smaller, longer than wide and narrowly cordiform in shape; **6)** metasoma with carinae weaker and finer; **7)** telson vesicle more globose.

*T. inexpectata*: **1)** coloration basically light reddish brown, with carapace darker and pedipalp fingers deeply infuscate; **2)** pedipalp chela shorter and more robust (length/width ratio: 3.31–3.48); **3)** sternite V with median smooth patch shorter and wider than long; **4)** metasoma markedly more robust (length/width ratio of segments I–V: 1.01–1.08, 1.31–1.35, 1.49–1.53, 1.63–1.70 and 2.01–2.06); **5)** telson vesicle more globose.

The females of *T. pumila* sp. n. are still unknown, but it can be distinguished from *T. canizaresorum* sp. n. based on a non-sexually dimorphic character: the coloration remarkably darker (base orange-brown) and symmetrically patterned with dark brown on pedipalps (femur and patella), carapace, tergites and metasoma. Moreover, *T. pumila* sp. n. and *T. canizaresorum* sp. n. are two of the most widely allopatric members of *Tityopsis*, by occurring near the opposite longitudinal tips of the genus range (Fig. 2).

**ECOLOGICAL NOTES.** This species lives exclusively in mesophyllous semicaducifolious forest on karstic soil (Fig. 39). Almost all specimens were collected during diurnal searches, under rocks of various sizes semi-buried in the leaf litter, usually hanging to the underside of the rock, as well as directly on the soil. In the type locality, *T. canizaresorum* sp. n. is more common inside the small collapsed depressions (dolines) that are locally called “hondones” and give the place its name.

Repeated nocturnal searches by the authors with UV light at Los Hondones, Playa Larga and other sites scattered all over Zapata Swamp, were completely unsuccessful to yield any specimens of this elusive species. Nevertheless, two juveniles were unintentionally found at night inside human-inhabited rooms: one walking on the floor at the type locality at about 22:30 hrs, the other on a hotel bed at Playa Larga at about 2:15 hrs. The latter stung one of the collectors in his back while sleeping and caused him excruciating pain for about two hours (Luis A. Casanella, personal communication).

In the three known localities, *T. canizaresorum* **sp. n.** lives syntopically with the buthids *C. guanensis* and *H. junceus* (which are also commonly found on the vegetation, especially the former), as well as with the diplocentrid *Heteronebo morenoi* (Armas, 1973), which is largely restricted to the seashore.

All collecting events listed above included pregnant females, thus, this species reproduces all year round. Five captive females gave birth to litters of 6–17 newborn, which underwent the first ecdysis 4–6 days later.

**COMMENTS.** Although not proved yet, there is strong factual evidence that *T. canizaresorum* **sp. n.** reproduces by obligate thelytokous parthenogenesis. Most adult females were collected pregnant, but not a single male is present in the entire sample (41 specimens, 26 of them adults) and the five females that gave birth in captivity, produced all-female broods.

We tried to get a direct, positive confirmation of parthenogenesis from all juveniles collected on 22–25 January 2013, by rearing them in captive isolation to maturity and then expect for any virgin parturition. They readily accepted as prey small beetle larvae (*T. molitor*) and cockroach nymphs (*B. germanica* and *P. americana*), but unfortunately a month later there was a massive, long-term anti-dengue fumigation campaign all over the city and despite all efforts, the entire breeding group was killed by envenomation, either directly or via contaminated prey.

To overcome this fatality, we turned to check the sex ratio in all our 179 samples of *Tityopsis* spp. from populations where both sexes have been found, following Francke (2007). We found that despite the species, at least one male (either adult or juvenile) was present in: **1)** all populations with a minimum cumulative sample size of five specimens; **2)** all individual samples composed of five or more specimens; **3)** 84% of the individual samples composed of two to four specimens. There is no need for a statistical analysis to discard sampling error as the potential cause of the observed absolute absence of males in *T. canizaresorum* **sp. n.** Last, collecting events of this species span all along the year (January, February, June, August and November) and represent both dry and rainy seasons, thus, environmental sex determination and male birth/survival seasonality can also be safely disregarded as alternate hypotheses.

**DISTRIBUTION** (Fig. 2). This species is known only from three nearby localities enclaved in the karstic limestone coastal plain of southern Zapata Swamp. This coastal stripe is completely isolated from inland by extensive marshlands and permanently flooded areas.

The presence of *T. canizaresorum* **sp. n.** in adjacent areas of Cienfuegos Province (e.g., Aguada de Pasajeros and Abreus Municipalities) seems likely, as these areas are geographically very close to those where it is confirmed to occur (less than 25 km air-distance at the nearest point) and have the same types of vegetation and soil. A few scattered attempts to find it there by the present authors and some collaborators were all unsuccessful, but these searches were not intensive nor extensive enough to be conclusive.

***Tityopsis sheylae* sp. n.**

(Figures 2, 23–32, 36, 40, Tables 3–4)

<http://zoobank.org/urn:lsid:zoobank.org:act:7DD2D5D2-87BC-49B5-A268-D6C2FB94746E>

**TYPE LOCALITY AND TYPE DEPOSITORY.** Cuba, Mayabeque Province, border between San José de Las Lajas and Jaruco Municipalities, Tapaste, Escaleras de Jaruco, Mogote La Jaula, Cueva del Indio, 190 m a. s. l.; RTO.

**TYPE SPECIMENS.** **Cuba**, Mayabeque Province, border between San José de Las Lajas and Jaruco Municipalities, Tapaste, Escaleras de Jaruco, Mogote La Jaula, Cueva del Indio, 190 m a. s. l., 3 April 2019, leg. R. Teruel, S. Yong & T. M. Rodríguez, 1♂ (holotype), RTO, 13 December 2014, leg. T. M. Rodríguez & A. Longueira, 3♂7♀2♂juvs.3♀juvs. (paratypes), RTO, 12 May 2017, leg. S. Yong & L. Forcelledo, 1♀1♂juv. (paratypes), RTO, 5 January 2018, leg. R. Teruel, S. Yong & L. Forcelledo, 5♂9♀2♂juvs.3♀juvs. (paratypes), RTO, 3 April 2019, leg. R. Teruel, S. Yong & T. M. Rodríguez, 2♂6♀ (paratypes), RTO.

**OTHER MATERIAL EXAMINED.** **Cuba**, Mayabeque Province, border between San José de Las Lajas and Jaruco Municipalities, Tapaste, Escaleras de Jaruco, La Jaula, Cueva del Indio, 190 m a. s. l., 23 December 1995, leg. A. Pérez, 1♂ (topotype), IES, 27 September 1999, leg. E. Fonseca, 1♀ (topotype), IES.

**Note.** Both specimens were repeatedly seen by one of us (RT) between 2005 and 2011, but are currently missing from IES collection. As their whereabouts is unknown (there is no official record of a loan, destruction or loss in the collection log), both were excluded from the type series.

**ETYMOLOGY.** The selected epithet is a Latinized matronym honoring the senior author's wife Sheyla Yong, who enthusiastically assisted us all along the present revision, both in the field (she actually collected several of the type specimens) and in the lab (part of the data gathering and processing, as well as photographic work).

**DIAGNOSIS.** Adult size moderately large for the genus (24–27 mm in males, 32–34 mm in females). Adult coloration: base light yellowish brown, slightly darker on metasomal segments IV–V and slightly paler on legs, venter and telson; dark patterns essentially absent, except for faint infuscation in carapace (mostly around eyes) and metasomal segments II–IV (in some specimens only, mostly females). Juvenile coloration: base pale yellowish brown, paler on pedipalp chelae, legs, venter and telson; dark patterns essentially absent, except for diffuse gray to dark brown reticulation in chelicerae, carapace (along anterior margin and around eyes) and metasomal segments II–V (mostly on posterior part and around carinae); tergites with posterior margins translucent whitish; pedipalps fingers infuscate. Pedipalps



Dimensions (MM)		<i>T. sheylae</i> sp. n. ♂ holotype	<i>T. sheylae</i> sp. n. ♂ paratopotype	<i>T. sheylae</i> sp. n. ♀ paratopotype	<i>T. sheylae</i> sp. n. ♀ paratopotype
Carapace	L / W	3.15 / 3.40	2.90 / 3.10	3.87 / 4.10	4.07 / 4.25
Mesosoma	L	6.90	5.65	8.70	9.75
Tergite VII	L / W	2.05 / 3.20	1.80 / 2.85	2.70 / 4.32	2.67 / 4.40
Metasoma	L	13.31	12.08	15.44	15.94
Segment I	L / W / D	2.05 / 1.77 / 1.60	1.80 / 1.61 / 1.45	2.35 / 2.05 / 1.75	2.52 / 2.20 / 1.87
Segment II	L / W / D	2.45 / 1.70 / 1.50	2.25 / 1.58 / 1.40	2.82 / 1.95 / 1.70	2.95 / 2.07 / 1.77
Segment III	L / W / D	2.62 / 1.70 / 1.47	2.45 / 1.55 / 1.40	3.15 / 1.92 / 1.70	3.15 / 2.05 / 1.75
Segment IV	L / W / D	2.82 / 1.60 / 1.42	2.58 / 1.45 / 1.35	3.20 / 1.87 / 1.65	3.32 / 1.95 / 1.75
Segment V	L / W / D	3.37 / 1.50 / 1.45	3.00 / 1.35 / 1.30	3.92 / 1.75 / 1.62	4.00 / 1.80 / 1.70
Telson	L	3.40	2.99	4.10	4.24
Vesicle	L / W / D	1.95 / 1.32 / 1.30	1.65 / 1.16 / 1.16	2.35 / 1.60 / 1.57	2.37 / 1.65 / 1.62
Aculeus	L	1.45	1.34	1.75	1.87
Pedipalp	L	12.17	11.00	14.64	14.95
Femur	L / W	2.95 / 0.95	2.65 / 0.90	3.40 / 1.22	3.55 / 1.20
Patella	L / W	3.37 / 1.27	3.10 / 1.20	4.10 / 1.55	4.20 / 1.55
Chela	L	5.85	5.25	7.14	7.20
Manus	W / D	2.50 / 1.60 / 1.52	2.25 / 1.50 / 1.44	3.07 / 2.00 / 1.87	3.00 / 2.05 / 1.80
Movable finger	L	3.35	3.00	4.07	4.20
<b>Total</b>	<b>L</b>	<b>26.76</b>	<b>23.62</b>	<b>32.11</b>	<b>34.00</b>

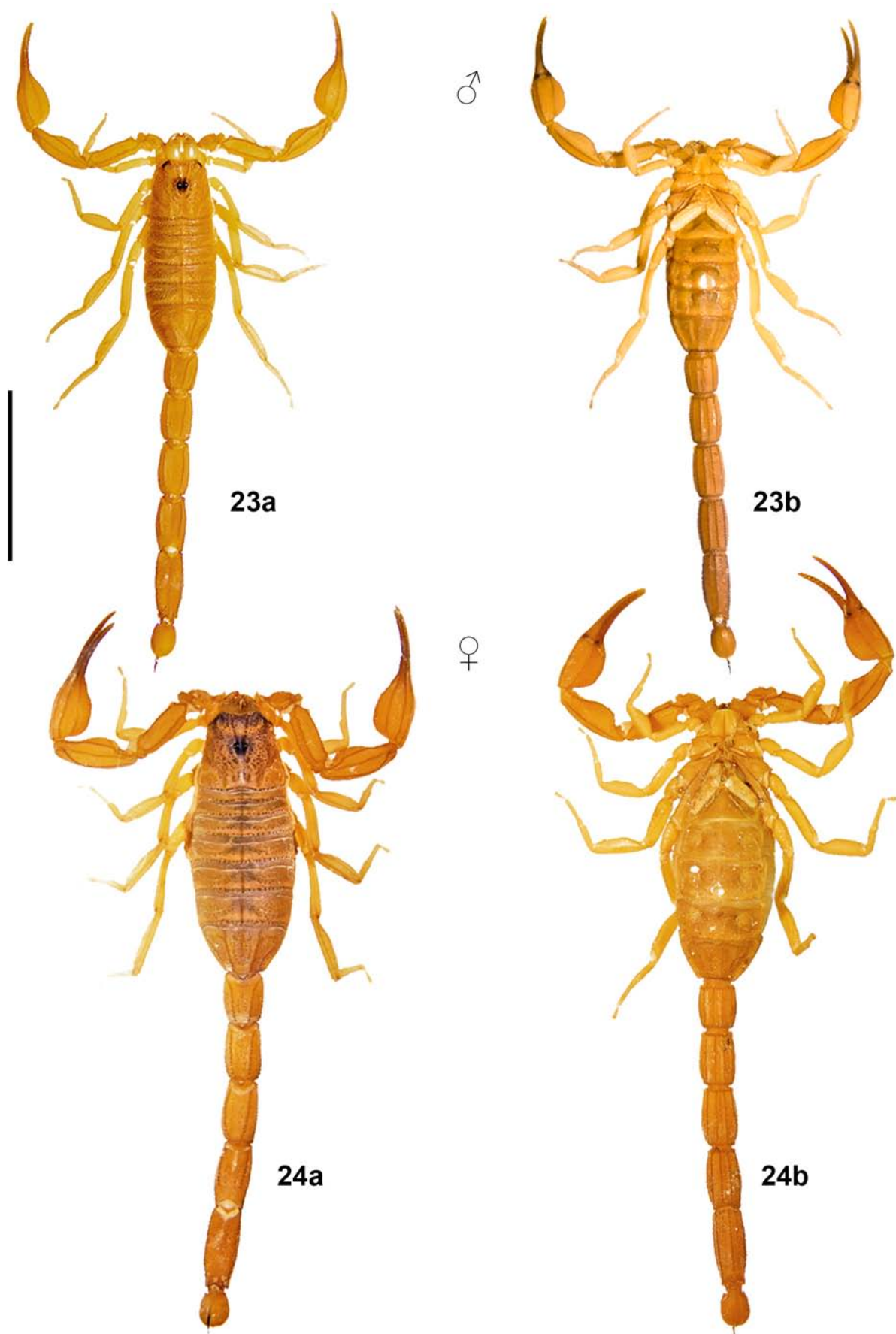
**Table 3.** Measurements (mm) of four adult types of *Tityopsis sheylae* sp. n. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

remarkably elongate and robust for the genus (length/width ratio of femur, patella and chela: 2.94–3.11, 2.58–2.65 and 3.50–3.66 in males, 2.79–2.96, 2.64–2.71 and 3.51–3.57 in females); chelae with manus incassate oval and very slightly longer in males (length/width ratio: 1.50–1.56 in males, 1.46–1.53 in females) and with fingers very long (movable finger/manus length ratio: 1.33–1.34 in males, 1.33–1.40 in females), fixed/movable fingers with 12–13/12–13 principal rows of denticles (mode 12/12). Tegument of carapace, tergites, sternites, metasoma and telson sexually dimorphic between adults: matt in male vs. with a satin sheen in females. Carapace and tergites with many medium-sized to coarse granules scattered (similar in both sexes). Pectines with 13–16 teeth in males, 13–15 in females (mode 14 and 13–14, respectively); basal middle lamella slightly enlarged and teardrop-shaped in males, greatly enlarged and widely oval in females. Sternite V with median smooth patch widely cordiform and about as long as wide in both sexes, very large in males and moderately large in females; lateral smooth patches oval, oblique and bulky in both sexes, moderately large in males and small in females. Metasoma slightly elongate in both sexes (length/width ratio of segments I–V: 1.12–1.16, 1.42–1.44, 1.54–1.58, 1.76–1.78 and 2.22–2.25 in males vs. 1.14–1.15, 1.43–1.45, 1.54–1.64, 1.70–1.71 and 2.22–2.24 in females), with 10/10/8/8/7 complete to almost complete, coarsely serrate to serrato-crenulate carinae; lateral inframedians on II obsolete only on basal one-sixth (males)

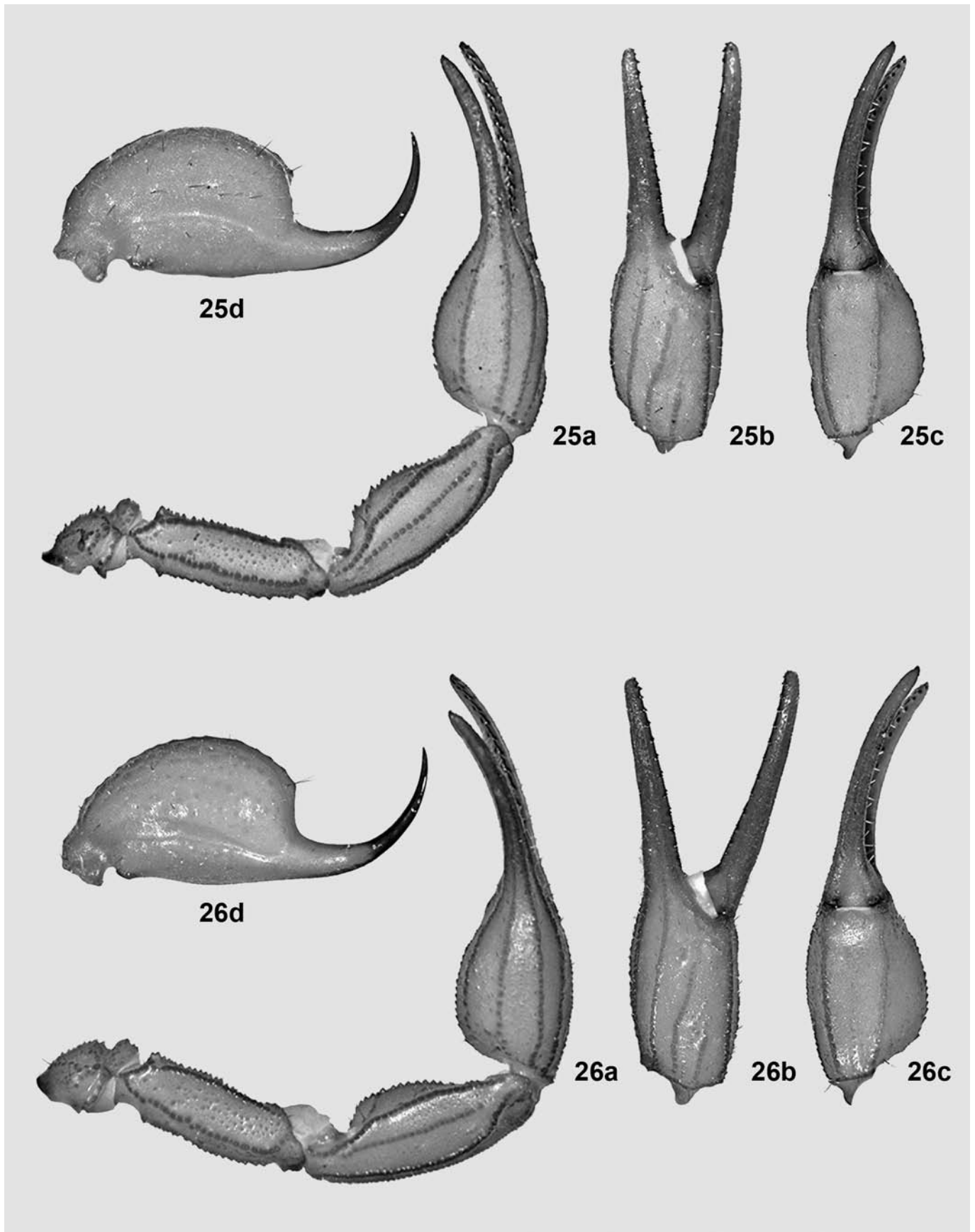
to one-fifth (females); intercarinal tegument of segment V with many small (males) to medium-sized (females) conical granules. Telson with vesicle less globose than standard for the genus, subaculear tubercle small.

**DESCRIPTION** (adult male holotype; Figs. 2, 23, 25, 27, 29, 31, 36a; Tabs. 3–4).

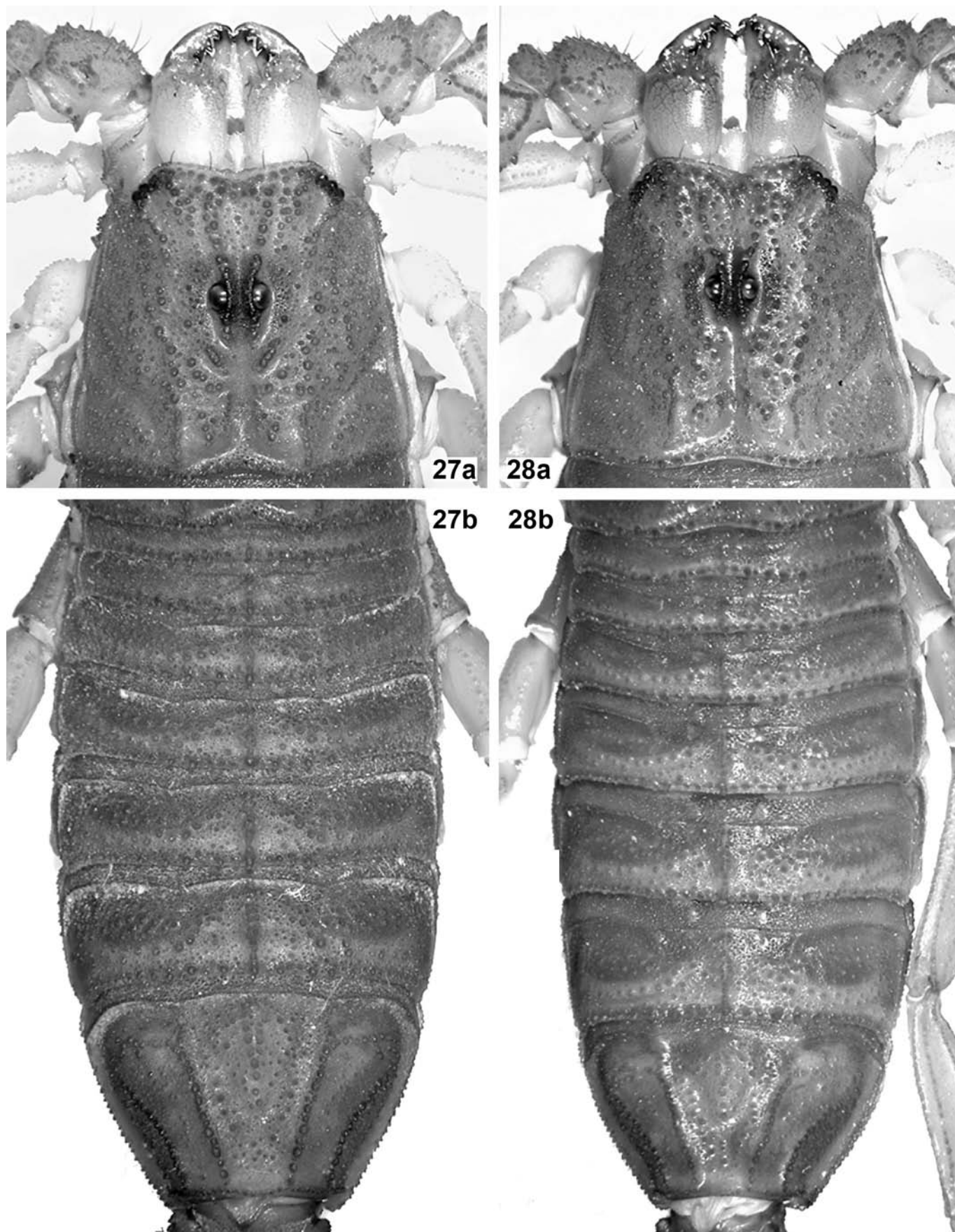
**Coloration** (Figs. 23, 36a) base light yellowish brown, slightly darker on metasomal segments IV–V (medium brown) and slightly paler on legs and venter. Chelicerae manus very sparsely reticulate with brown (more densely distally); fingers very faintly and irregularly infusate. Pedipalps immaculate, with carinae and fingers slightly darker due to heavier sclerotization; fingers infusate. Carapace largely immaculate, with faint symmetrical infuscation around all three eye groups; eyes and ocular tubercles black. Tergites immaculate, with carinae of VII slightly darker due to heavier sclerotization. Pectines immaculate pale yellowish brown, with basal portion and basal plate progressively darker due to heavier sclerotization. Sternites immaculate; V with median and lateral smooth patches bright white. Legs immaculate, with carinae slightly darker due to heavier sclerotization. Metasoma with segments IV–V slightly darker (medium brown), with carinae darker due to heavier sclerotization and without any annulated pattern; all surfaces immaculate. Telson immaculate, with distal half of aculeus dark reddish brown.



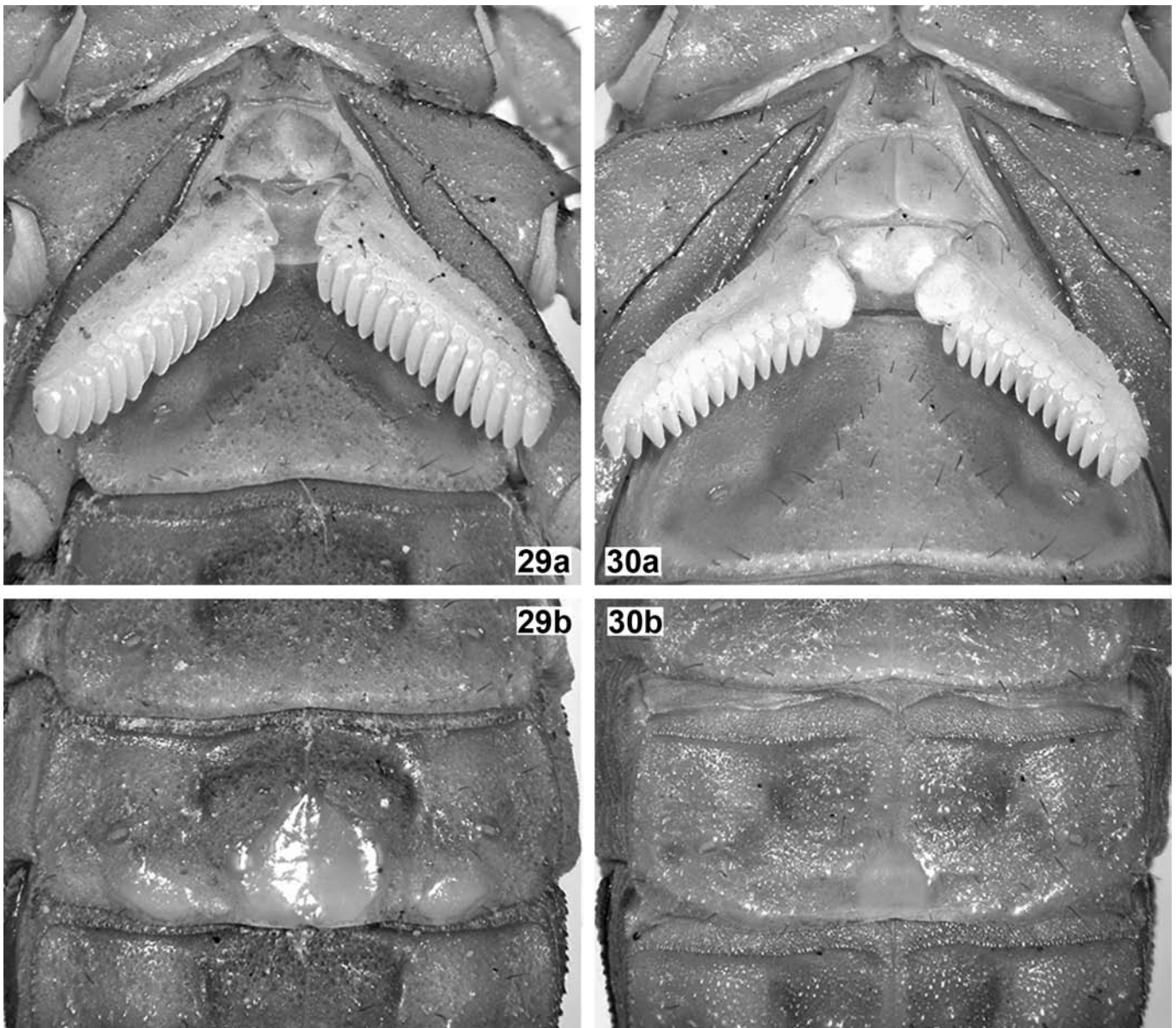
Figures 23–24. *Tityopsis sheylae* sp. n., male holotype (23) and female paratopotype (24), habitus: **a**) dorsal; **b**) ventral. Scale bar = 10 mm.



**Figures 25–26.** *Tityopsis sheylae* sp. n., male holotype (25) and female paratopotype (26): **a)** pedipalp, dorsal view; **b)** pedipalp chela, external view; **c)** pedipalp chela, ventral view; **d)** telson, lateral view.



**Figures 27–28.** *Tityopsis sheylae* sp. n., male holotype (27) and female paratopotype (28): **a)** chelicerae and carapace; **b)** tergites.



Figures 29–30. *Tityopsis sheylae* sp. n., male holotype (29) and female paratopotype (30): a) sternopectinal region; b) sternite V.

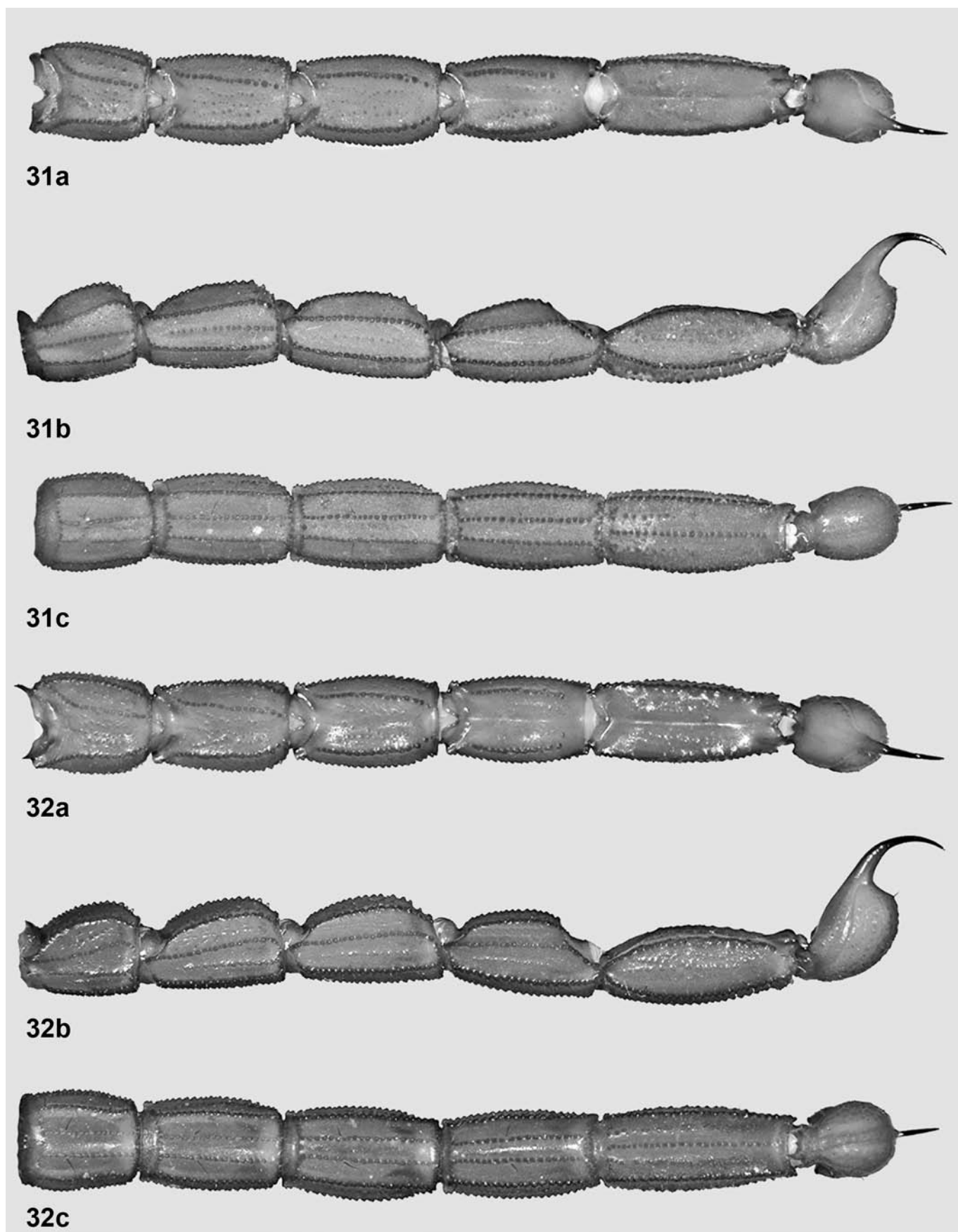
**Chelicerae** (Fig. 27a). With dentition typical for the genus, teeth standard-sized and sharp. Tegument glossy but with minute granulation scattered, dorsodistal portion of manus with coarse, glossy granules irregularly arranged transversally around dorsodistal depression. Setation very dense ventrally, but essentially lacking dorsally, except for five rigid macrosetae around dorsodistal depression of manus.

**Pedipalps** (Fig. 25a–c). Remarkably enlarged for the genus, i.e., all segments longer and chelae also heavier than standard. Femur essentially straight (very slightly bent inwards distally), with all carinae very strong, coarsely denticulate to serrate; intercarinal tegument matt, very densely and irregularly granulose; internal (*i*) trichobothria surrounding a large, irregularly triangular spur. Patella straight, with all carinae very strong, coarsely granulose to serrato-crenulate; intercarinal tegument matt, very finely and densely granulose, internally with many conical denticles. Chela with manus incrassate oval (1.56 times longer than wide), much wider

than patella (ratio 1.26) and with the basal half slightly widest, all carinae strong, coarsely serrate to serrato-crenulate, intercarinal tegument matt, very finely and densely granulose on all surfaces; fingers very long for the genus (movable finger 1.34 times longer than underhand) and evenly curved, fixed finger with 12/12 principal rows of denticles, movable finger with 12/12 plus an apical subrow of four denticles and a large internal accessory denticle (large terminal denticle not included), basal lobe/notch combination absent.

**Carapace** (Fig. 27a). Wider than long (length/width ratio = 0.93). Anterior margin widely V-shaped, with two pairs of dark macrosetae. Carinae: anterior medians anteriorly divergent and formed by coarse, isolated granules and irregularly fused to the superciliaries, which are composed of smaller and much closer granules; posterior medians straight, parallel and formed by medium-sized granules; other carinae absent or indistinct from general granulation. Furrows: anterior marginal, anterior median, median ocular, lateral oculars, central transverse,





**Figures 31–32.** *Tityopsis sheylae* sp. n., male holotype (31) and female paratopotype (32), metasoma and telson: **a)** dorsal, **b)** lateral, and **c)** ventral views.

Species	Sex	N	Pectinal tooth count						Ave.	SD
			11	12	13	14	15	16		
<i>Tityopsis mulata</i> sp. n.	♂	8				3	4	1	14.75	± 0.66
	♀	12		1	3	5	3		13.83	± 0.90
<i>Tityopsis pumila</i> sp. n.	♂	2				2			14.00	± 0.00
<i>Tityopsis canizaresorum</i> sp. n.	♀	76	2	33	39	2			12.54	± 0.59
<i>Tityopsis sheylae</i> sp. n.	♂	30			2	21	5	2	14.23	± 0.67
	♀	52			27	24	1		13.50	± 0.54

**Table 4.** Pectinal tooth count variation in the four species of the genus *Tityopsis* treated in this paper. Abbreviations: number of pectines (N), average (Ave.), standard deviation (SD).

central median, posterior median and posterior marginal all fused, wide and moderately deep; posterior laterals long, oblique, wide and moderately deep, almost fused to posterior marginal; posterior transverse narrow and moderately deep; other furrows absent or indistinct. Tegument matt, very densely and irregularly but finely granulose, with many medium-sized, rough granules scattered. Median eyes relatively large and separated by about one ocular diameter; lateral eyes noticeably smaller and moderately exposed beyond anterolateral margin. **Sternum** (Fig. 29a). Standard for the genus, although more pentagonal in shape, with three pairs of dark macrosetae. Tegument very densely and irregularly granulose.

**Genital operculum** (Fig. 29a). Standard for the genus, with three pairs of dark macrosetae. Valves roundly subtriangular and not separated medially; tegument minutely and densely granulose. Genital papillae large, thick and not protruding.

**Pectines** (Fig. 29a). Moderately large for the genus (but not reaching coxa-trochanter joint of leg IV). Tooth count 14/15, teeth straight and slightly swollen. Fulcra large and bulky, paraboloid to round. Basal middle lamella slightly enlarged and teardrop-shaped. Pre-pectinal plate well visible, heavily sclerotized, very wide and short; tegument coriaceous to smooth. Basal plate normally sclerotized, about as long as wide; anterior margin with a very wide, V-shaped anteromedian notch, posterior margin convex; tegument smooth.

**Legs.** Slender, with all carinae strong, finely denticulate to granulose. Intercarinal tegument minutely and densely granulose, with a row of slightly coarser granules defining an additional carina (externomedian) on lateral surface of femur of all legs. Claws short and strongly curved.

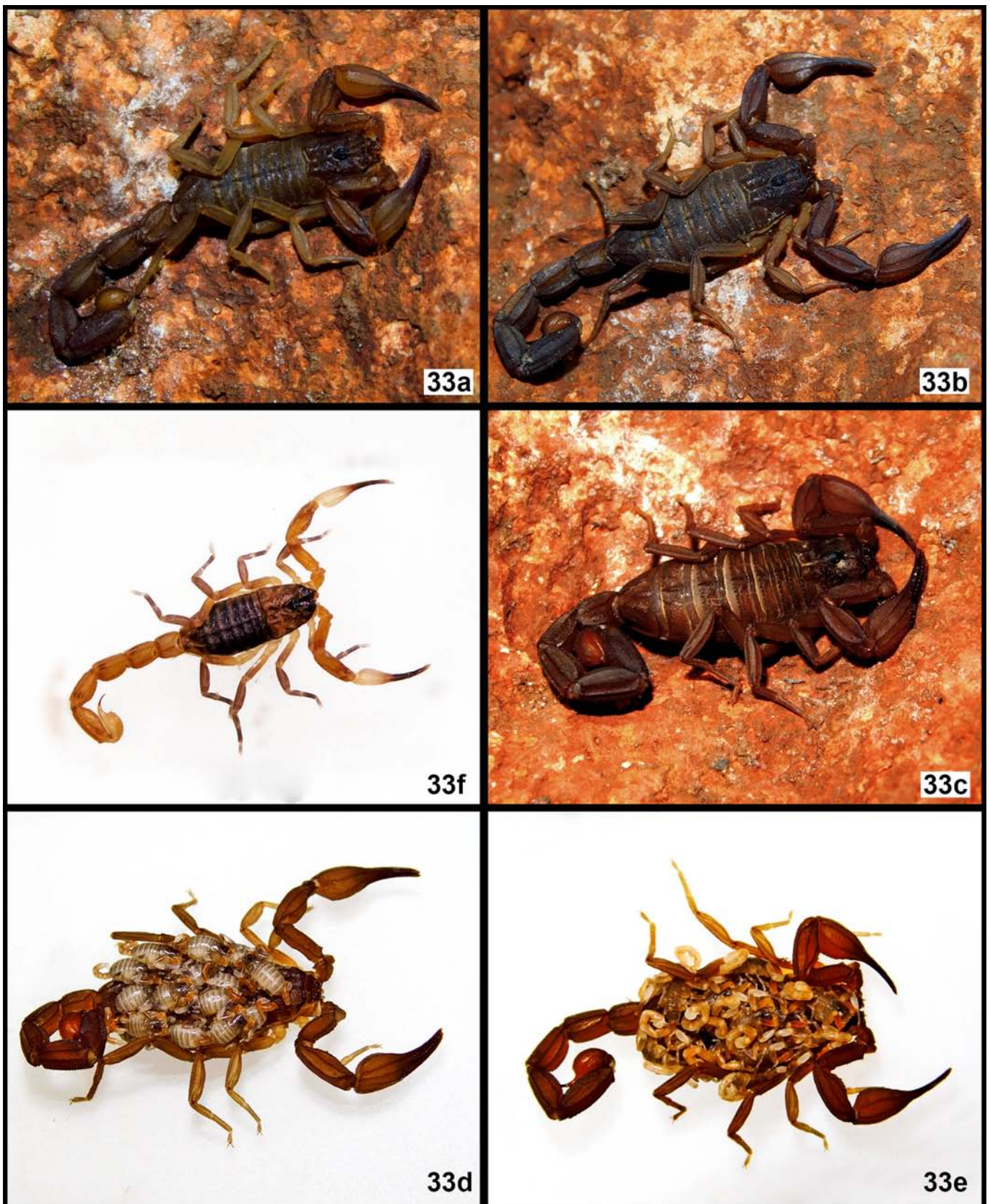
**Mesosoma** (Figs. 27b, 29). Tergites matt, very densely and irregularly but finely granulose, with many medium-sized to coarse, rough granules scattered; carinae: median longitudinal strong, serrato-crenulate to serrate and progressively longer from I–VII, submedians absent on I–VI, complete, straight and strongly serrato-denticulate on VII, laterals absent on I–VI, complete, straight and strongly serrato-denticulate on VII. Sternites matt, very densely and irregularly but finely granulose, with some dark macrosetae scattered all over; lateral margins of all sternites subgranulose to granulose; posterior margin of all sternites smooth to vestigially granulose, on III–IV vestigially bilobed, on V bilobed (due to protuberance of lateral smooth patches), on VI essentially

straight, on VII widely concave; carinae: III–V acarinate, VI–VII with paired laterals and submedians which are long, straight and finely crenulate; spiracles small, narrowly oval to short slit-like; sternite V with median smooth patch very large, widely cordiform (about as long as wide), bulky and glossy, not protruding from posterior margin; lateral smooth patches moderately large, oblique, oval, bulky and glossy, moderately protruding from posterior margin.

**Metasoma** (Fig. 31). Slightly longer than standard for the genus (4.23 times longer than carapace) and slightly narrower distally. Segments I–II with ten complete to almost complete carinae, III–IV with eight, V with seven: dorsal laterals strong, coarsely serrate to serrato-denticulate on I–III, coarsely crenulate-denticulate on IV, absent on V but subtly indicated by a few granules; lateral supramedians strong, coarsely serrate to serrato-crenulate on I–V; lateral inframedians strong, coarsely serrato-crenulate on I–II (obsolete on basal one-sixth of the latter), absent on III–V (but indicated in each segment by an incomplete row of granules that never form a true, raised carina); ventral laterals strong, coarsely crenulate to serrato-crenulate on I–V; ventral submedians strong, coarsely serrate to serrato-crenulate on I–IV, indicated by an incomplete but raised row of coarse granules on less than basal half of V; ventral median absent on I–IV, strong, coarsely serrato-crenulate on V. Intercarinal tegument matt, very finely and densely granulose, with many medium-sized granules scattered on dorsal surface of all segments and many small, conical granules on lateral surfaces of V; dorsal furrow absent or indistinct on segments I–III, complete, narrow and moderately deep on IV–V; setation sparse, with two pairs of dark macrosetae on essentially all carinae.

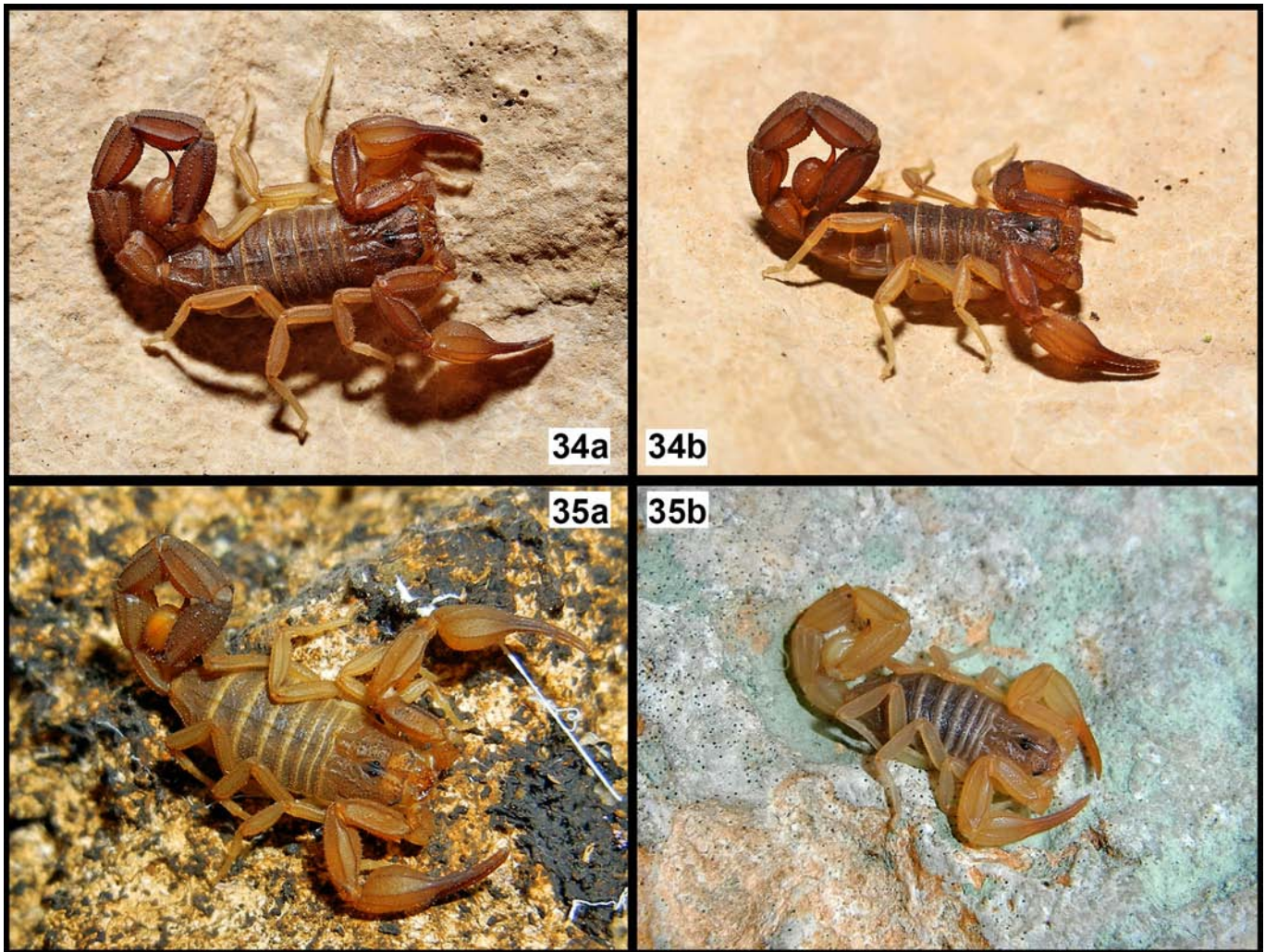
**Telson** (Fig. 25d). Vesicle less globose than standard for the genus (1.48 times longer than wide, 1.02 times wider than deep) and with several dark and whitish setae scattered; tegument coriaceous and matt, smooth even ventrally; ventral median carina very weak but coarsely subgranulose, continued into the subaculear tubercle that is small, broadly conical and unarmed (i.e., without any granules). Aculeus standard-sized, sharp, shorter than vesicle and moderately curved.

**FEMALE** (adult paratopotypes; Figs. 24, 26, 28, 30, 32, 36c–d; Tabs. 3–4). Sexual dimorphism well-marked, differing from described male by: **1)** size conspicuously larger (32.1–34.0



**Figure 33.** *Tityopsis mulata* sp. n., photographed alive in its natural habitat unless otherwise noted: **a)** male holotype; **b–c)** female paratopotypes; **d–e)** captive female paratopotype, with litter of instars 1 (d) and 2 (e); **f)** captive juvenile male paratopotype.





**Figures 34–35:** **Figure 34.** *T. pumila* sp. n., male holotype photographed alive in its natural habitat (two different shots, photos courtesy Raimundo López-Silvero). **Figure 35.** *T. canizaresorum* sp. n., photographed alive in its natural habitat: **a)** female holotype; **b)** juvenile female paratopotype.

mm); **2)** tegument of carapace, tergites, sternites, metasoma and telson with a satin sheen; **3)** pedipalps relatively shorter, slightly more robust (especially chela manus) and with carinae finer; **4)** carapace slightly wider posteriorly; **5)** mesosoma relatively wider, with lateral sides markedly convex; **6)** pre-pectinal plate absent; **7)** genital papillae absent; **8)** pectines relatively smaller, with teeth shorter, narrower and slightly fewer in number (13–15, mode 13–14), and with basal middle lamella greatly enlarged, widely oval in shape and whitish; **9)** sternite V with median and lateral smooth patches much smaller, less bulky and translucent; **10)** metasoma with carinae slightly stronger; **11)** telson vesicle with many medium-sized granules scattered ventrally and ventrolaterally, and ventral median carina stronger.

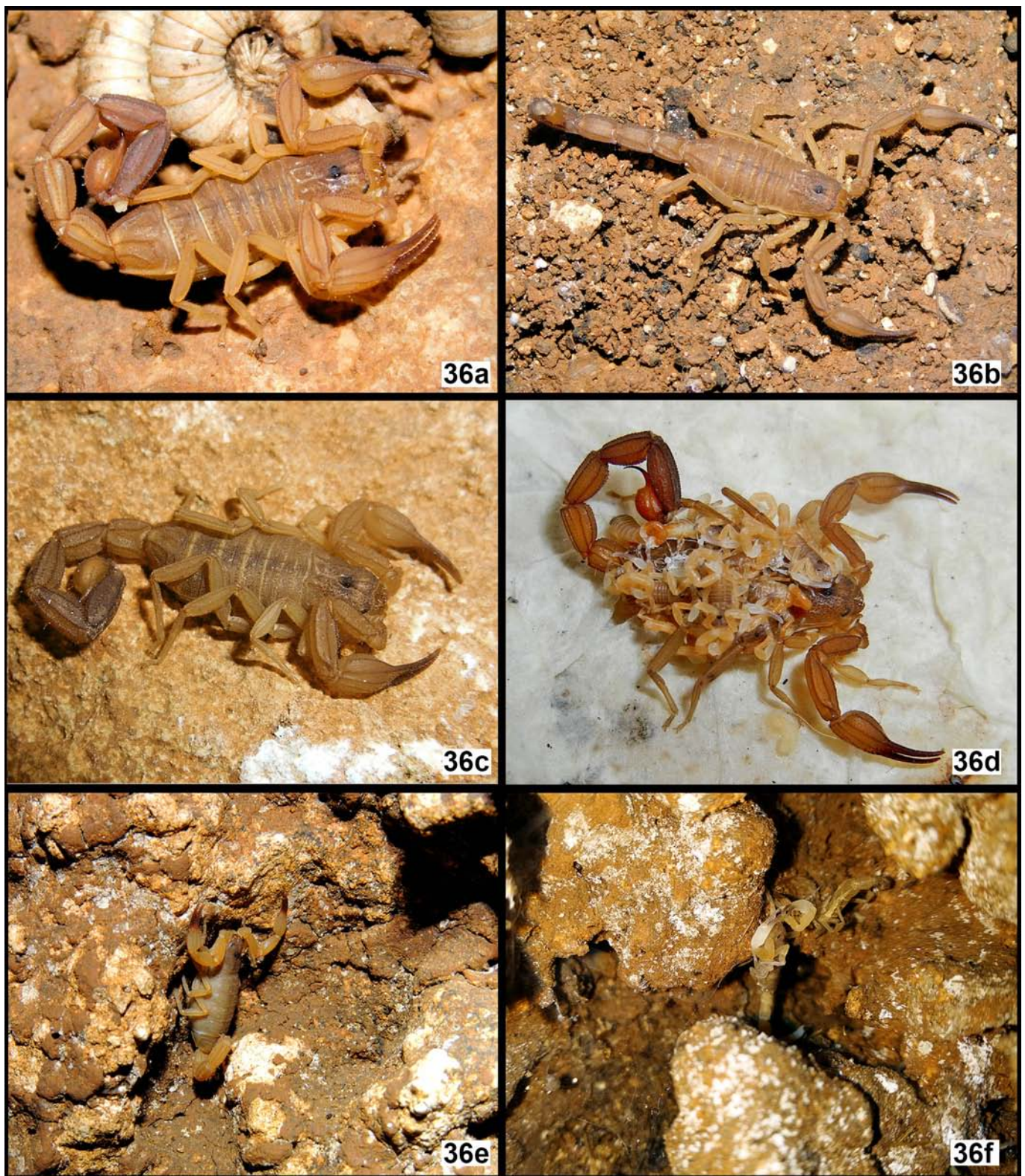
**VARIATION.** The 44 paratopotypes are remarkably homogeneous for most morphological characters such as coloration, tegument sculpture, carination, setation and morphometric ratios, where variation was only minor and mostly due to eval differences (Fig. 36), e. g., older adults have slightly darker coloration and setation, granulation and claws worn-out to different degrees. The only noteworthy exceptions are discussed as follows. Adult size (Tab. 3) varied from 23.6–26.8 mm in males and

32.1–34.0 mm in females. There are two size classes even distinguishable to unaided eye in adult males (separated by a maximum gap of 3.14 mm, i.e., a 12% size difference), but only one in females (5% maximum size difference).

Number of principal rows of denticles varied from 12–13 on both fixed and movable fingers, with a clearly defined mode of 12 in each case. Fixed, symmetrical counts for both pedipalps (i.e., same number of rows in all four fingers of the same individual), were the dominant occurrence by far: of 35 specimens analyzed (10 paratopotypes excluded due to having at least one finger broken or too damaged for reliable counting), 25 had 12/12 rows (including the holotype) and one had 13/13 rows (an adult female). The cases of asymmetry did not show any bias towards a defined finger, i.e., they occur in similar frequencies on fixed and movable fingers, and on left and right pedipalps.

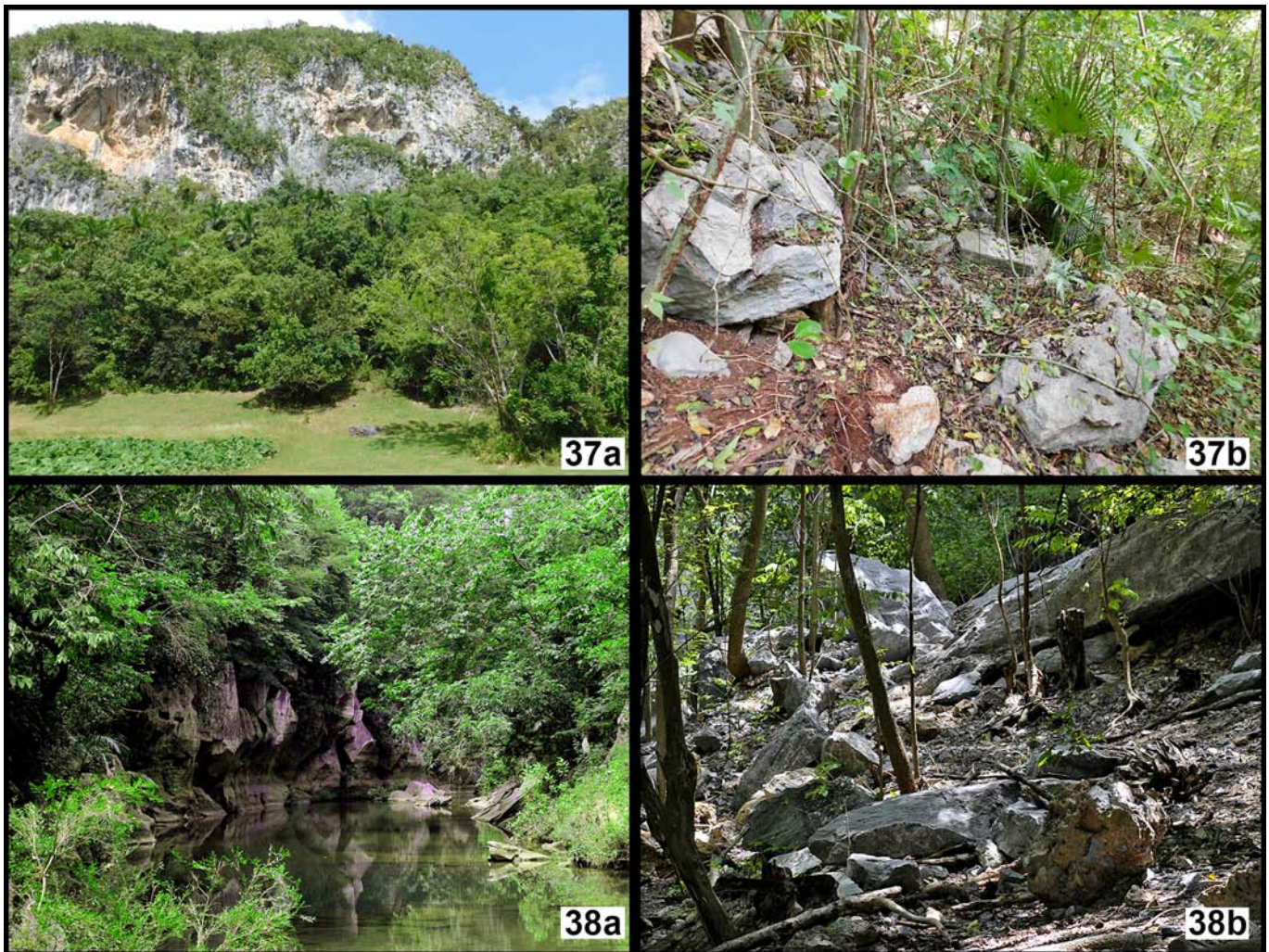
Pectinal tooth counts (Tab. 4) varied from 13–16 in males and 13–15 in females, with clearly defined modes of 14 and 13–14, respectively. Single-tooth asymmetry was a very common occurrence: 7 out of 15 males and 11 out of 25 females (two adults of this sex had a pecten either missing or too damaged for counting); there were no specimens with two or more teeth asymmetry.





**Figure 36.** *Tityopsis sheylae* sp. n., photographed alive in its natural habitat unless otherwise noted: **a)** male holotype; **b)** small-sized male paratopotype; **c)** female paratopotype; **d)** captive female paratopotype, with mixed litter of instars 1–2; **e)** juvenile female paratopotype; **f)** just-molted, small-sized adult male paratopotype, being predated upon by the pholcid *Ciboneya nuriae* (the spider is not visible because while taking the photographs, it fled from the camera's flash and hid in the crevice behind the scorpion). Photos courtesy Sheyla Yong (a–b).





Figures 37–38: Type localities of *Tityopsis mulata* sp. n. (37) and *T. pumila* sp. n. (38), a) habitat, b) microhabitat.

**AFFINITIES.** By adults exhibiting the unusual combination of a size large for the genus (over 23 mm in males and 32 mm in females) with a light yellowish, essentially immaculate coloration, this species resembles only *T. inaequalis*. All other congeners (either described or not) are combined conversely, i.e., if coloration is pale, then size is small and vice versa (actually, most of them are medium-sized and reddish-colored with well-defined darker patterns).

Adults of *T. inaequalis* can be easily separated from those of *T. sheylae* sp. n. by the following characters: **1)** size slightly but consistently larger (26–29 mm in males, 33–36 mm in females); **2)** female pedipalp chela slightly shorter and more robust (length/width ratio: 3.43–3.51 in females); **3)** female pectines with basal middle lamella slightly smaller and more oval in shape; **4)** male sternite V with median smooth patch narrower, longer than wide and lanceolate in shape.

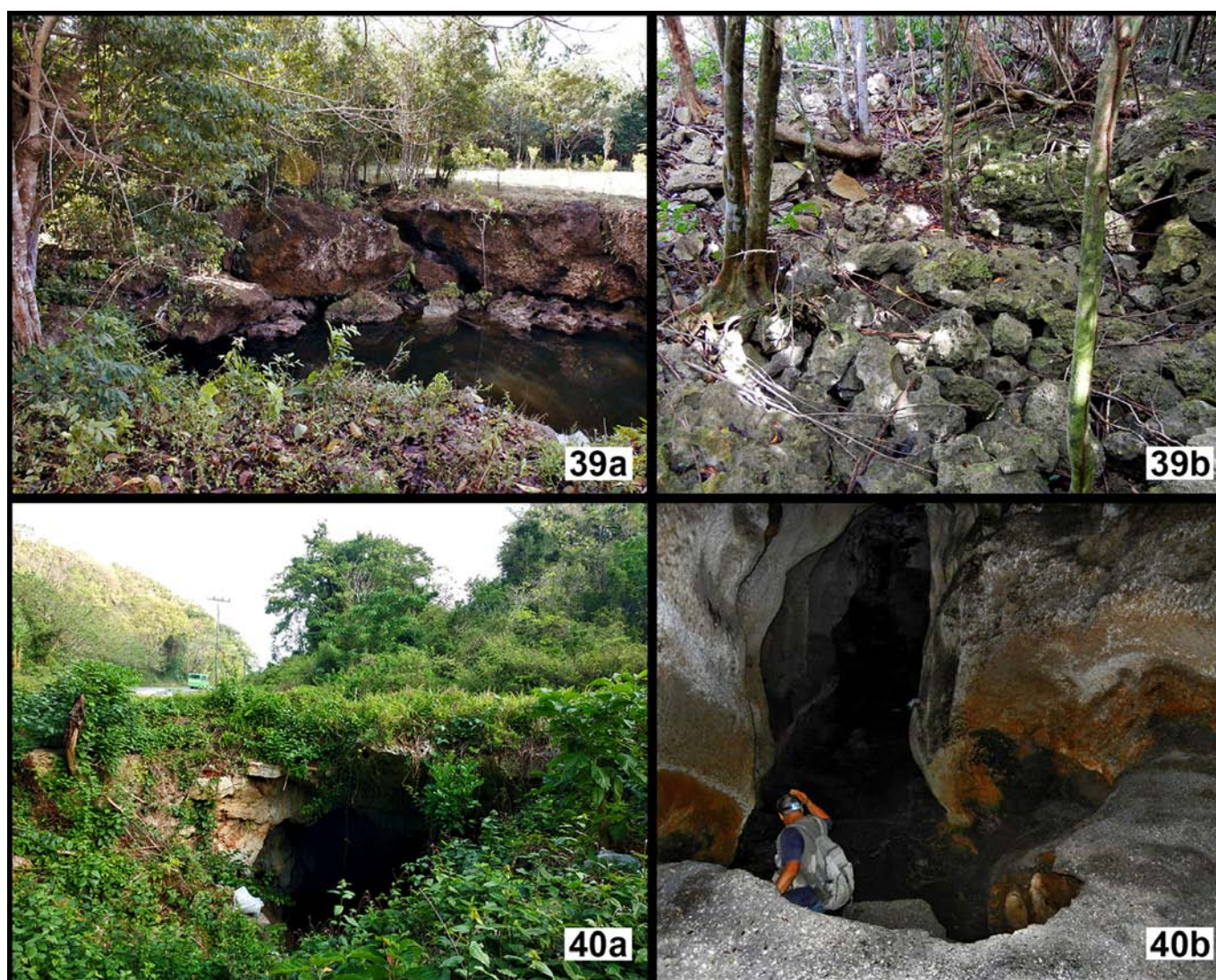
Besides, both species are widely allopatric in isolated orographic systems: *T. inaequalis* in Sierra de Los Órganos (Pinar del Río Province) and *T. sheylae* sp. n. in Escaleras de Jaruco (Mayabeque Province), with their nearest occurrences separated by 170 km air-distance.

**ECOLOGICAL NOTES.** *T. sheylae* sp. n. has been found so far only inside a single cave (Fig. 40). It occurs scattered all along it, from the first chamber right beyond the entrance (not completely dark, relatively cold, less humid and essentially devoid of bat guano), through the deepest corridors (in absolute darkness, very hot, with water-saturated air and densely covered by bat guano).

We always used the UV-detection technique to find it and were able to notice that apparently because of the different microclimatic conditions, the scorpions changed their behavior accordingly: those from the first chamber were mostly found hidden under rocks (only one adult of each sex was found walking between the rocks, in separate collecting events), while all those living in the deep were totally or partially exposed on the walls and floor, either walking slowly or sit-and-wait hunting.

It lives syntopically with the buthid *Centruroides gracilis* (Latreille, 1804), but one species always outnumbers the other depending on the cave site. In the hottest chamber *T. sheylae* sp. n. is rare (only three specimens found so far), while hundreds of *C. gracilis* virtually cover all available surfaces. Conversely, in the colder chambers and corridors we have found less than 15 individuals of *C. gracilis* in total, against 42 of *T. sheylae* sp. n.





**Figures 39–40:** Type localities of *Tityopsis canizaresorum* sp. n. (39) and *T. sheylae* sp. n. (40), **a)** habitat, **b)** microhabitat (photo courtesy Sheyla Yong).

Interestingly, no cases of mutual predation have been observed yet, in spite of the coexistence and abundance of both scorpion species all along the cave.

On 3 April 2019, we found a small-sized adult male that was being predated upon by an adult female of the spider *Ciboneya nuriae* Huber & Pérez, 2001 (Pholcidae). The scorpion had just molted (its exoskeleton was still soft and not completely stretched yet, see Fig. 36f) and was already dead about 1 cm away from its exuvium, while the spider sucked it somewhere between the chelicerae and pedipalp coxae. We deduce the scorpion anchored to molt beside the web and once it came out of the exuvium, it became entangled and was then killed by the spider.

According to its collecting label, the male collected on 1995 (see above in Other Material Examined section) was also found dead, entangled in a spider's web. Unfortunately, this sample is currently missing from its repository and the identity of the spider cannot be established, but this second finding evidences that spiders are a routine predator of this scorpion.

**COMMENTS.** The habitat outside the cave is mesophyllous semicaducifolious forest on limestone karstic soil (Fig. 40a), typical for most members of the genus. Nevertheless, repeated intensive searches conducted by us and some collaborators there and in other mogotes of this plateau, never yielded any evidences of an epigeal occurrence of *T. sheylae* sp. n. (e.g., live specimens or remains of carcasses and exuvia). Only two females tentatively referable to *T. inexpectata* were found, one of them from IES collection and which vouchers the Escaleras de Jaruco record by Armas (1974: 5). Thus, we classify *T. sheylae* sp. n. herein as a true troglobite.

**DISTRIBUTION** (Fig. 2). This species is apparently a troglobite, known only from the type locality. Cueva del Indio is located in the southern mogotes of Escaleras de Jaruco, which is a medium-sized (15 x 5 km), roughly east-west oriented, karstic limestone plateau, isolated in the middle of the Habana-Matanzas Plain.

## Acknowledgments

Such a complete taxonomic revision could not be possible without the assistance and support of many person, who donated or loaned specimens and literature, provided field assistance and accommodation, gave logistic support and warranted access to collections. Most of them took part in most of these steps, so we thank all of them at once in random order: Alejandro M. Rodríguez (Fomento, Sancti Spíritus), Raimundo López-Silvero and Rosario Domínguez (who also took some of the excellent photographs presented herein), Sheyla Yong, Sheila Rodríguez, Nayla García (IES), Alejandro Barro (MFP), Dayron Breto (San Diego de los Baños, Pinar del Río), Elier Fonseca, Armando R. Longueira, Javier Torres, Rubén Marrero, Lázaro J. Forcelledo, Samuel Hernández, and Diego Salas (Havana), as well as Tomás García and family; we are deeply indebted to all of them. The present study was partially funded to the senior author by the IES project "Colecciones zoológicas, su conservación y manejo III". The Rufford Foundation provided financial support to the junior author for field expeditions and equipment (Projects 15393-1 and 19261-2: "Ecology and conservation of the endemic scorpion genus *Tityopsis* in native forests of western Cuba, I-II"). Further, we thank two anonymous reviewers for their comments to the manuscript.

## References

- ACOSTA, L. E., D. M. CANDIDO, E. H. BUCKUP & A. D. BRESOVIT. 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. 1973. Tipos de las colecciones escorpionológicas P. Franganillo y Universidad de la Habana (Arachnida, Scorpionida). *Poeyana*, 101: 1–18.
- ARMAS, L. F. DE. 1974. Escorpiones del archipiélago cubano. 3. Género *Tityus* C. L. Koch, 1836 (Scorpionida: Buthidae). *Poeyana*, 135: 1–15.
- ARMAS, L. F. DE. 1980. Aspectos de la biología de algunos escorpiones cubanos. *Poeyana*, 211: 1–28.
- ARMAS, L. F. DE. 1982. Algunos aspectos zoogeográficos de la escorpiofauna antillana. *Poeyana*, 238: 1–17.
- ARMAS, L. F. DE. 1984a. Escorpiones del archipiélago cubano. VIII. Adiciones y enmiendas (Scorpiones, Buthidae, Diplocentridae). *Poeyana*, 275: 1–37.
- ARMAS, L. F. DE. 1984b. Tipos de Arachnida depositados en el Instituto de Zoología de la Academia de Ciencias de Cuba. I. Amblypygi, Opiliones, Ricinulei, Scorpiones, Schizomida y Uropygi. *Poeyana*, 284: 1–11.
- ARMAS, L. F. DE. 1988. *Sinopsis de los escorpiones antillanos*. Editorial Científico-Técnica, Havana, 102 pp.
- ARMAS, L. F. DE. 1989a. Cantidad de hijos por parto en escorpiones cubanos (Scorpiones: Buthidae, Diplocentridae). *Ciencias Biológicas*, 18: 119–122.
- ARMAS, L. F. DE. 1989b. Dos casos de anomalía sexual en escorpiones cubanos (Scorpiones: Buthidae, Diplocentridae). *Ciencias Biológicas*, 21–22: 173–175.
- ARMAS, L. F. DE. 2001. Scorpions of the Greater Antilles, with the description of a new troglobitic species (Scorpiones: Diplocentridae). Pp. 245–253 in Fet, V. & P. A. Selden (eds.). *Scorpions 2001. In Memoriam Gary A. Polis*. Bucks: British Arachnological Society, xi + 690 pp.
- ARMAS, L. F. DE. 2003. On two enigmatic organisms associated with some Antillean and Mexican scorpions (Arachnida: Scorpiones). *Revista Ibérica de Aracnología*, 7: 239–240.
- ARMAS, L. F. DE. 2005. Antillean scorpions deposited at the Montana State University (Arachnida: Scorpiones). *Euscorpius*, 18: 1–4.
- ARMAS, L. F. DE. 2006. Name-bearing types of scorpions deposited at the Institute of Ecology and Systematics, Havana, Cuba (Arachnida: Scorpiones). *Euscorpius*, 33: 1–14.
- ARMAS, L. F. DE & G. ALAYÓN. 1984. Sinopsis de los arácnidos cavernícolas de Cuba (excepto ácaros). *Poeyana*, 276: 1–25.
- ARMAS, L. F. DE & E. MARTÍN-FRÍAS. 1998. Presencia del género *Tityopsis* en México y descripción de una especie nueva (Scorpiones: Buthidae). *Anales de la Escuela Nacional de Ciencias Biológicas*, México, 43: 45–49.
- 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.
- COMISIÓN INTERNACIONAL DE NOMENCLATURA ZOOLOGICA [CINZ]. 1999. *Código Internacional de Nomenclatura Zoológica*. 4ª edición. The International Trust for Zoological Nomenclature, xxix + 156 pp.
- CRUZ, J. DE LA & L. F. DE ARMAS. 1980. Macroquetas digitotermiales en Buthidae (Arachnida: Scorpionida). *Poeyana*, 199: 1–10.

- FET, V. & G. LOWE. 2000. Family Buthidae C. L. Koch, 1837. Pp. 54-286, in “*Catalog of the scorpions of the world (1758-1998)*” (V. Fet, W. D. Sissom, G. Lowe & M. E. Braunwalder, eds.). 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.
- FRANCKE, O. F. 1985. *Conspectus genericus scorpionorum* 1758–1982 (Arachnida: Scorpiones). *Occasional Papers of the Museum*, Texas Tech University, 98: 1–32.
- FRANCKE, O. F. 2007. A critical review of reports of parthenogenesis in scorpions (Arachnida). *Revista Ibérica de Aracnología*, 16: 93–104.
- FRANCKE, O. F., R. TERUEL & C. E. SANTIBÁÑEZ-LÓPEZ. 2014. A new genus and a new species of scorpions (Scorpiones: Buthidae) from southeastern Mexico. *The Journal of Arachnology*, 42: 220–232.
- JAUME, M. L. 1954. Catálogo de la fauna cubana. IV. Catálogo de los Scorpionida de Cuba. *Circulares del Museo y Biblioteca de Zoología de La Habana*, pp. 1085–1092.
- KOVAŘÍK, F. 1998. *Štíři* [Scorpions]. Madagaskar, Jihlava, 175 pp. [In Czech].
- KOVAŘÍK, F., R. TERUEL & G. LOWE. 2016. Two new scorpions of the genus *Chaneke* Francke, Teruel & Santibáñez-López, 2014 (Scorpiones: Buthidae) from southern Mexico. *Euscorpius*, 218: 1–20.
- KÖHLER, G. & S. B. HEDGES. 2016. A revision of the green anoles of Hispaniola with description of eight new species (Reptilia, Squamata, Dactyloidae). *Novitates Caribaeae*, 9, 1–135.
- LORIA, S. F. & L. PRENDINI. 2018. Ultrastructural comparison of the eyespot and ocelli of scorpions, and implications for the systematics of Chaerilidae Pocock, 1893. *Zoologischer Anzeiger* 273: 183–191.
- LOURENÇO, W. R. & M. VACHON. 1996. Compléments à la phylogénie et à la biogéographie des genres *Alayotityus* Armas et *Tityopsis* Armas (Scorpiones: Buthidae). *Biogeographica*, 72(1): 33–39.
- MELLO-LEITÃO, C. DE. 1945. Escorpiões sul-americanos. *Arquivos do Museu Nacional*, Rio de Janeiro, 40: 1–468.
- MORENO, A. 1940a. Contribución el estudio de los escorpiónidos cubanos. Parte III-Familia “Buthidae”, Addendus. *Memorias de la Sociedad Cubana de Historia Natural “Felipe Poey”*, 14(2): 161–164.
- MORENO, A. 1940b. Scorpilogía cubana. *Revista “Universidad de La Habana”*, 23, 26–27: 1–75.
- SISSOM, W. D. 1990. Systematics, biogeography and paleontology. Pp. 64–160, in Polis, G. A. (ed.), *The Biology of Scorpions*. Stanford University Press, California, xxiii + 567 pp.
- 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: 297–316.
- TERUEL, R., L. F. DE ARMAS & F. KOVAŘÍK. 2015a. A new species of *Centruroides* Marx, 1890 (Scorpiones: Buthidae) from southern Hispaniola, Greater Antilles. *Euscorpius*, 198: 1–18.
- TERUEL, R. & F. KOVAŘÍK. 2012. Scorpions of Cuba. *Clairon Production*, 232 pp.
- TERUEL, R. & T. M. RODRÍGUEZ-CABRERA. 2017. The missing piece of the puzzle solved: *Heteronebo* Pocock, 1899 (Scorpiones: Scorpionidae) occurs at Isla de Pinos, Cuba. *Euscorpius*, 240: 1–4.
- 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.
- VIDAL-ACOSTA, V. & O. F. FRANCKE. 2009. Redescrípción de *Tityopsis aliciae* (Scorpiones: Buthidae). *Revista Mexicana de Biodiversidad*, 80: 333–339.
- YONG, S. 2018. Revision of the genus *Dellia* Stål, 1878 (Orthoptera: Acrididae). Part 1. Two redescríptions and seven new species from Cuba. *Ecologica Montenegrina*, 16: 58–107.