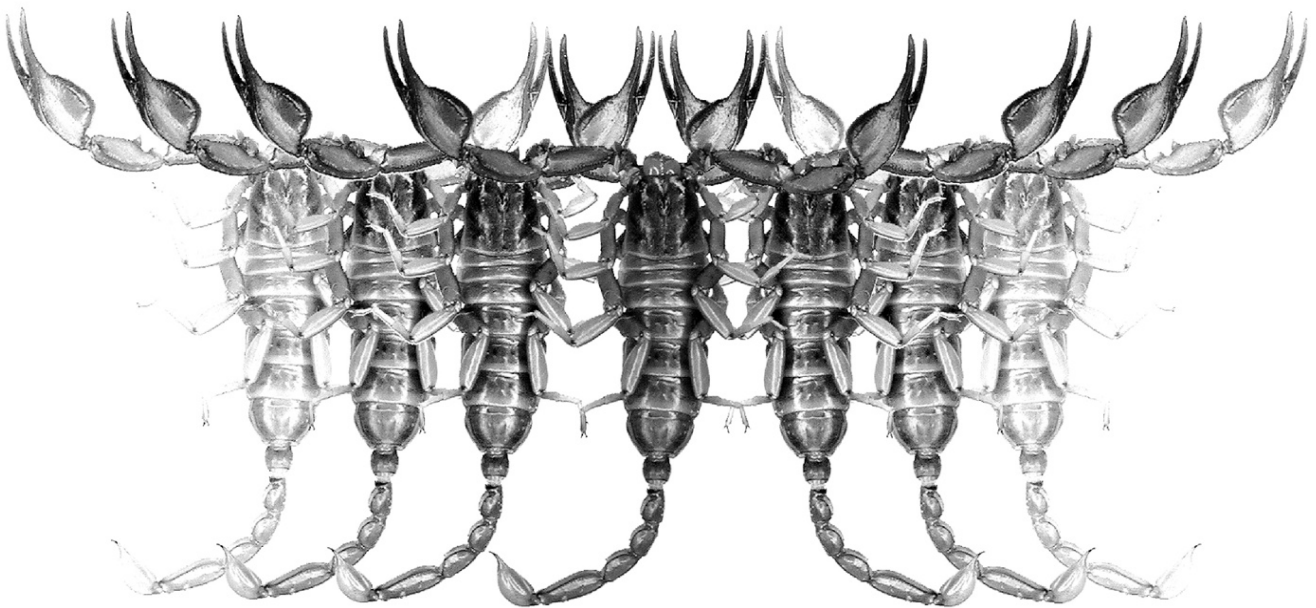


Euscorpius

Occasional Publications in Scorpiology



Tityopsis rolandoi sp. n.

(Scorpiones: Buthidae) from Cuba

František Kovařík, Mark Stockmann, František Štáhlavský & Sheyla Yong

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Euscorpius

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Tityopsis rolandoi sp. n. (Scorpiones: Buthidae) from Cuba

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Summary

A new species *Tityopsis rolandoi* sp. n. is described from Cuba, fully illustrated with color photos showing its morphology and habitus. *T. rolandoi* sp. n. is the only species of the genus with a combination of two characters: movable finger shorter than carapace and chela length/width ratio 3.6 in male. This species also has a characteristic shape of a median smooth patch of sternite V, which is almost oval in male. In addition to morphology, we present the information about the karyotype of *T. rolandoi* sp. n. (2n=20) and *T. sheylae* (2n=22).

Introduction

The genus *Tityopsis* was reviewed in detail by Teruel & Rodríguez-Cabrera (2022) who summarized the history of the study of this genus and described four new species. During the following corporate fieldtrip in 2022, Rolando found other specimens and discovered that they represented another new species. He planned to describe them before his death, but death was faster (Armas & Yong, 2023). We describe the new species in his honor here.

This publication marks the 400th issue of “*Euscorpius*”. Since its inception 24 years ago (December 2001), this online journal has welcomed publications by 254 zoologists from 53 countries; 427 new species and 30 new genera of scorpions were described in “*Euscorpius*”. The type specimens of new species described in the journal originate from 81 countries.

Rolando has been a loyal friend, author, and reviewer of this journal for many years, and the editors of “*Euscorpius*” are honored to dedicate this anniversary issue to his memory.

Methods, Material & Abbreviations

Nomenclature and measurements follow Stahnke (1971), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974).

Karyotype analyses were conducted on chromosome preparations following the methods of Kovařík et al. (2009). The chromosomes were stained with a 5% Giemsa solution in Sörensen phosphate buffer for 20 minutes. Chromosome measurements were obtained from five postpachytene nuclei using the Levan plugin (Sakamoto & Zacaro, 2009) in the Image J 1.45r software (<http://rsbweb.nih.gov/ij/>). The relative lengths of the chromosomes were calculated based on the diploid set.

Specimen Depositories: FKCP (František Kovařík, private collection, Prague, Czech Republic; will in future be merged with the collections of the National Museum of Natural History, Prague, Czech Republic)

Morphometrics: D, depth; L, length; W, width.

Systematics

Buthidae C. L. Koch, 1837

Tityopsis Armas, 1974

(Figures 1–58, Table 1)

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

Tityopsis: Armas, 1984: 29; tab. 3; Fet & Lowe, 2000: 58, 227–228; Teruel & Kovařík, 2012: 143–151, figs. 7, 30, 42–43, 49, 306–322, 570–577; Teruel & Rodríguez-Cabrera, 2022: 1–40, figs. 1–4 (complete references list until 2021).

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

DIAGNOSIS (after Teruel & Rodríguez-Cabrera, 2022). 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



Figure 1. Paratypes male (left) and female of *Tityopsis rolandoi* sp. n. in vivo habitus.

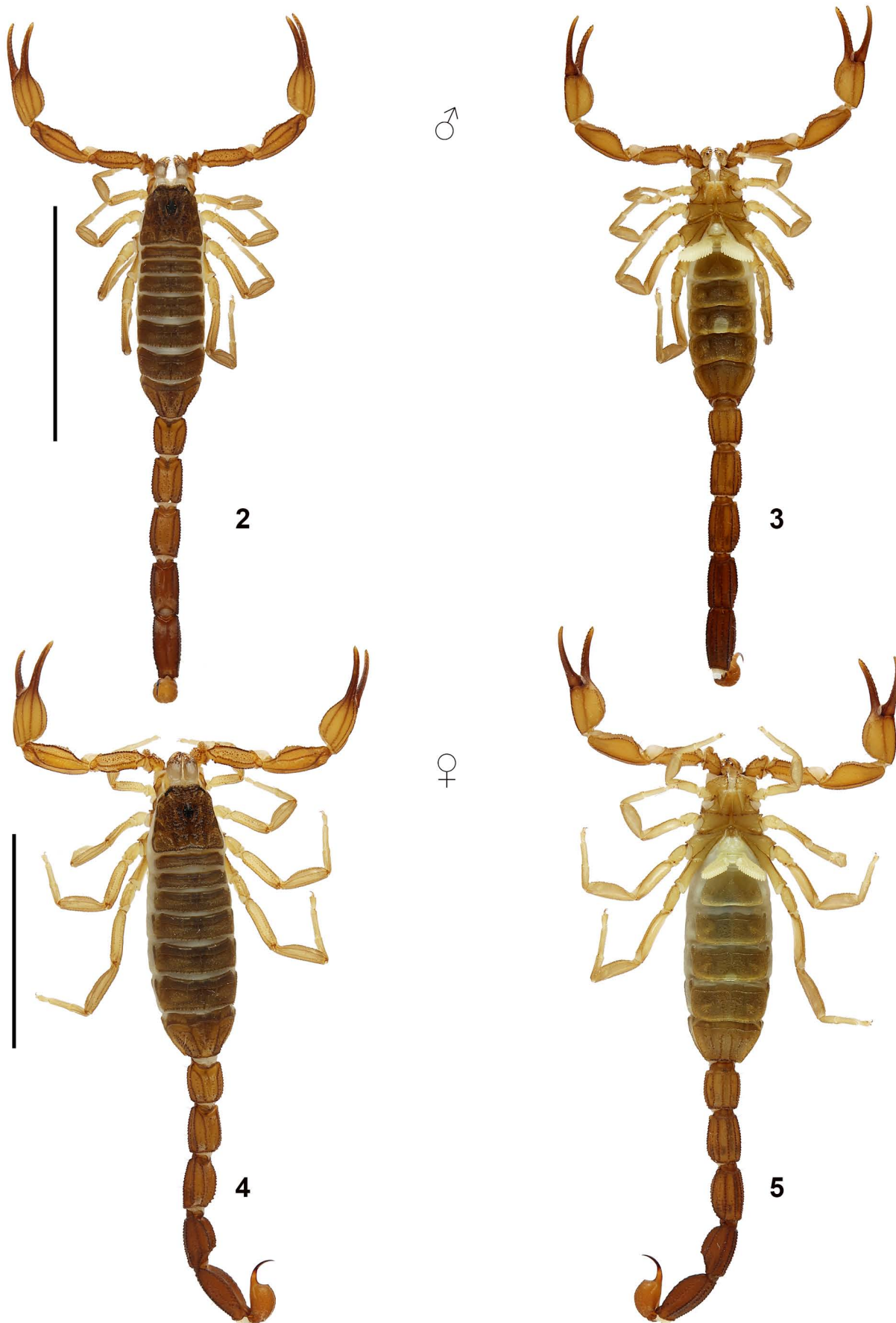
Dimensions (mm)		<i>Tityopsis rolandoi</i> sp. n. ♂ holotype	<i>Tityopsis rolandoi</i> sp. n. ♀ paratype
Carapace	L / W	2.62 / 2.65	3.13 / 3.45
Mesosoma	L	7.25	9.75
Tergite VII	L / W	1.83 / 2.62	2.27 / 3.62
Metasoma + telson	L	13.45	15.67
Segment I	L / W / D	1.64 / 1.47 / 1.33	1.96 / 1.71 / 1.63
Segment II	L / W / D	1.98 / 1.37 / 1.23	2.36 / 1.64 / 1.56
Segment III	L / W / D	2.21 / 1.36 / 1.22	2.46 / 1.59 / 1.53
Segment IV	L / W / D	2.33 / 1.28 / 1.19	2.66 / 1.56 / 1.43
Segment V	L / W / D	2.70 / 1.29 / 1.16	3.24 / 1.58 / 1.40
Telson	L / W / D	2.59 / 1.13 / 1.00	2.99 / 1.27 / 1.19
Pedipalp	L	9.59	11.29
Femur	L / W	2.34 / 0.81	2.73 / 1.06
Patella	L / W	2.82 / 1.05	3.30 / 1.31
Chela	L	4.43	5.26
Manus	W / D	1.23 / 1.11	1.55 / 1.50
Movable finger	L	2.56	3.04
Total	L	23.32	28.55

Table 1. Comparative measurements of holotype male of *Tityopsis rolandoi* sp. n. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

both sexes: not especially robust nor attenuate and strongly carinate; trichobothrial pattern A- α orthobothriotaxic, without clearly defined petite trichobothria (e. g., chela Eb_3 and Esb and fixed finger esb are somewhat smaller, but not as disproportionately reduced as a typical petite); femur with d_1 - d_3 - d_4 - d_5 regularly spaced along basal half, e_1 and e_2 located on subbasal and median position, respectively; patella with d_3 external to dorsal median carina and i slightly distal to midpoint; manus with V_2 clearly closer to ventroexternal carina than V_1 ; 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.

Karyotypes (Figs. 51–54). In total, we analyzed the chromosomes of one male *Tityopsis sheylae* (DNA 2826) from Cueva del Indio (GPS: 23.017507, -82.088714) and six paratype males of *T. rolandoi* sp. n. (DNA 2829–2834) from the type locality. The chromosomes of both species display typical characteristics for members of the family Buthidae, including holocentric organization, achiasmatic meiosis, and no differentiated sex chromosomes in males. Our initial findings on chromosomes within the genus *Tityopsis* also confirm the lower chromosome numbers commonly observed



Figures 2–5: *Tityopsis rolandoi* sp. n. **Figures 2–3.** Male holotype in dorsal (2) and ventral (3) views. **Figures 4–5.** Female paratype in dorsal (4) and ventral (5) views. Scale bar: 10 mm.

in Buthidae (see Schneider et al., 2024). The karyotype of *T. sheylae* consists of 22 chromosomes (Fig. 51), with chromosome lengths gradually decreasing from 6.98% to 2.32% of the diploid set (Fig. 52). The karyotype of *T. rolandoi* sp. n. includes 20 chromosomes (Fig. 53), where the first three pairs appear slightly longer than the remaining chromosomes (Fig. 54). We observed differences in the 2n and chromosome lengths between the two *Tityopsis* species analyzed, suggesting that cytogenetic data may be valuable for taxonomic purposes within this genus.

SUBORDINATE TAXA. *Tityopsis canizaresorum* Teruel & Rodríguez-Cabrera, 2022, *T. inaequalis* (Armas, 1974), *T. inexpectata* (Moreno, 1940), *T. mulata* Teruel & Rodríguez-Cabrera, 2022, *T. pumila* Teruel & Rodríguez-Cabrera, 2022, *T. rolandoi* sp. n., and *T. sheylae* Teruel & Rodríguez-Cabrera, 2022.

DISTRIBUTION. This genus is endemic to western Cuba.

***Tityopsis rolandoi* sp. n.**
(Figures 1–50, 53–58, Table 1)

<http://zoobank.org/urn:lsid:zoobank.org:act:3EC158A4-2DDC-4CE3-B40A-4D14F8690E8A>

TYPE LOCALITY AND TYPE DEPOSITORY. Cuba, Matanzas Province, Bacunayagua, 23.1307391°N 81.6650801°W; FKCP.

TYPE MATERIAL. Cuba, Matanzas Province, Bacunayagua, 23.1307391°N 81.6650801°W, 108 m a. s. l., 8.X.2022 and VI.2023, collected as juveniles during day by flipping rocks, bred in captivity by the second author, 1♂ (holotype) 6♂3♀ (paratypes), leg. Rolando Teruel, Mark & Britta Stockmann & Sheyla Yong, FKCP.

ETYMOLOGY. The species epithet honors the great Cuban arachnologist and our friend Rolando Teruel Ochoa (1974–2023; see also Introduction).

DIAGNOSIS. Adult size small (22–23.5 mm in males, 27–29 mm in females); adult coloration reddish brown; pedipalps chela length/width ratio 3.6 in male, 3.35–3.4 in females; movable and fixed fingers with 11 rows of denticles with one internal and one external denticles, and six (movable finger) or three (fixed finger) distal denticles; movable finger shorter than carapace; carapace and tergites with many medium-sized granules scattered; pectines with 11–14 teeth in male, 12–14 in female; basal middle lamella slightly enlarged and teardrop-shaped in male, moderately enlarged and oval in females; sternite V with median smooth patch widely almost oval; lateral smooth patches irregular in both sexes; metasoma I–II with 10 carinae, metasoma III–IV with 8 complete carinae; metasoma IV length/width ratio 1.82 in males and 1.70 in females; telson with vesicle bulbous, subaculear tubercle small and wide.

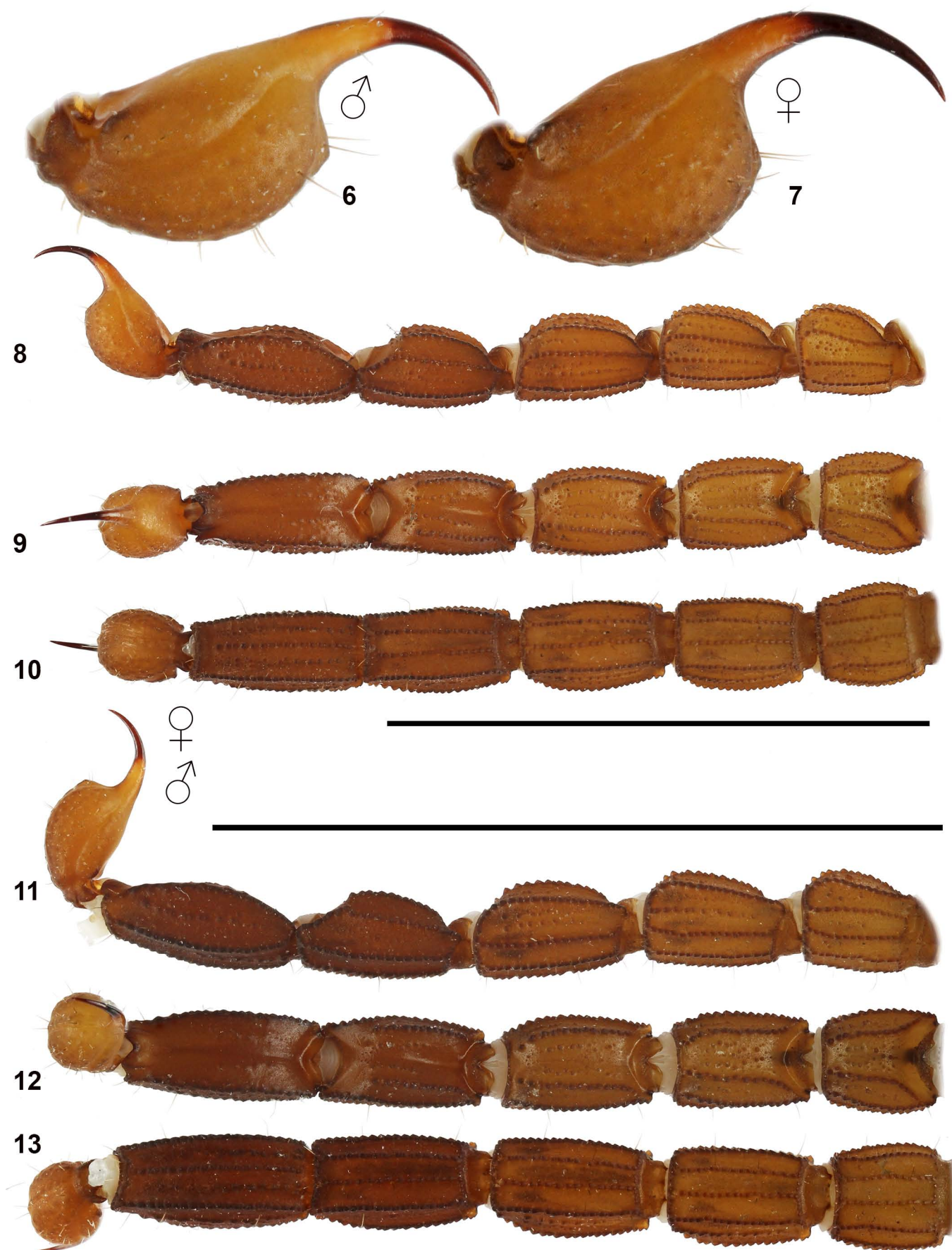
DESCRIPTION. Total length of adults 22–23.5 mm in males, 27–29 mm in females. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 1. For habitus, see Figures 1–5. *Sexual dimorphism:* tegument of carapace, tergites, sternites, metasoma and telson with a satin sheen in male vs. matt in females; females are conspicuously larger; other differences are cited below.

Coloration (Figs. 1–5). Base color reddish brown, conspicuously darker on carapace, very 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. Telson vesicle essentially immaculate; aculeus with distal half dark reddish brown.

Chelicerae (Figs. 18, 20). With dentition typical for the genus, teeth standard-sized and sharp. Cheliceral fixed finger with one ventral denticle, movable finger with two. Setation very dense ventrally, but essentially lacking dorsally.

Carapace and mesosoma (Figs. 14–21). Carapace densely coarsely granulated irregularly, without developed carinae; anterior margin of carapace acutely bilobed, with two pairs of dark macrosetae. Median eyes relatively large and separated by about one ocular diameter; three pairs of lateral eyes noticeably smaller and largely concealed below anterolateral margin. Mesosoma I–VI with median longitudinal strong granulated; tergite VII tricarinate. Tergites densely and irregularly but finely granulate, with many medium-sized, rough granules scattered. Sternites densely and irregularly but finely granulate, with some dark macrosetae scattered all over; sternites VI–VII with four carinae; sternite V with conspicuous median smooth patch large in posterior part widely almost oval in male and lanceolate in female; and with two lateral smaller symmetrical irregular smooth patch; spiracles small, narrowly oval to short slit-like. Sternum standard for the genus, with two pairs of dark macrosetae. Genital operculum standard for the genus, with two pairs of dark macrosetae. Pectines extending to around end of sternite III in male and half of sternite III in female; fulcra large and bulky, paraboloid to round; pectinal teeth number 11–14 (1 x 11, 4 x 12, 7 x 13, 2 x 14) in male and 12–14 (4 x 12, 1 x 13, 1 x 14) in female; basal middle lamella slightly enlarged and teardrop-shaped in male, moderately enlarged and oval in females.

Pedipalps (Figs. 26–50). Femur with five granulated carinae; patella and chela with seven granulated carinae. Femur intercarinal tegument densely and irregularly granulate. Patella with all carinae strong, coarsely granulate to serrato-crenulate; intercarinal tegument with a satin sheen, very finely and densely granulate, internally with conical denticles. Chela with carinae strong, coarsely serrate to serrato-crenulate, intercarinal tegument with a satin sheen, very finely and



Figures 6–13: *Tityopsis rolandai* sp. n. **Figures 6, 11–13.** Male holotype, telson in lateral view (6), metasoma and telson lateral (11), dorsal (12), and ventral (13) views. **Figures 7–10.** Female paratype, telson in lateral view (7), metasoma and telson lateral (8), dorsal (9), and ventral (10) views. Scale bar: 10 mm (8–10, 11–13).

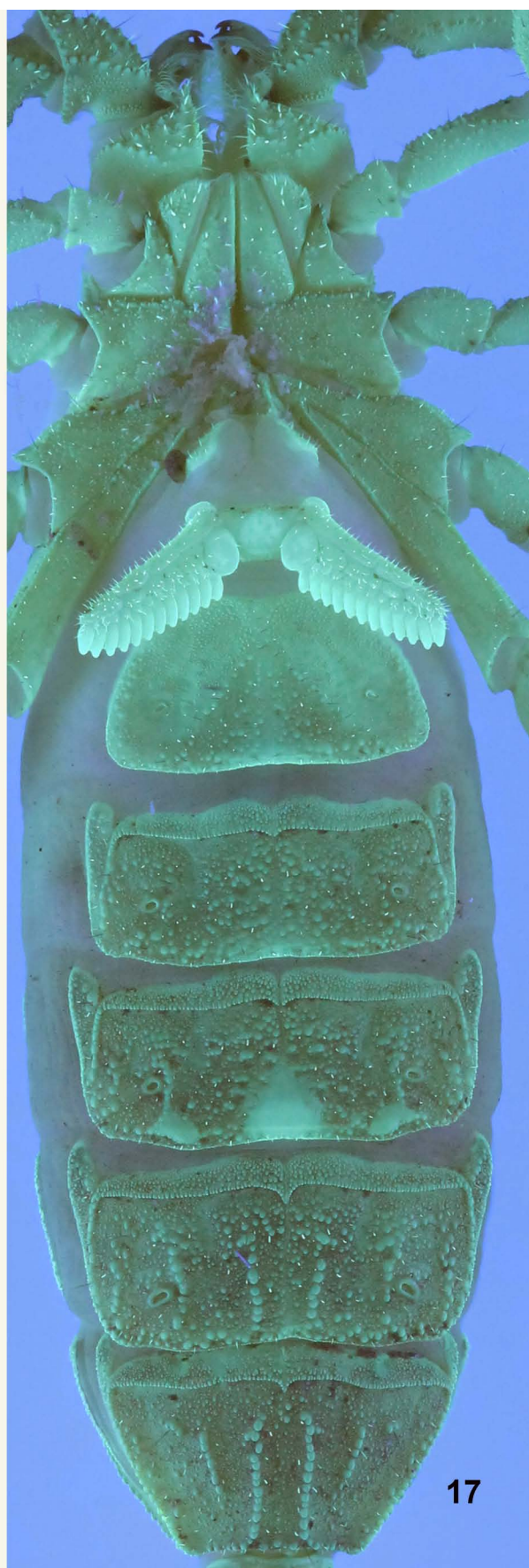


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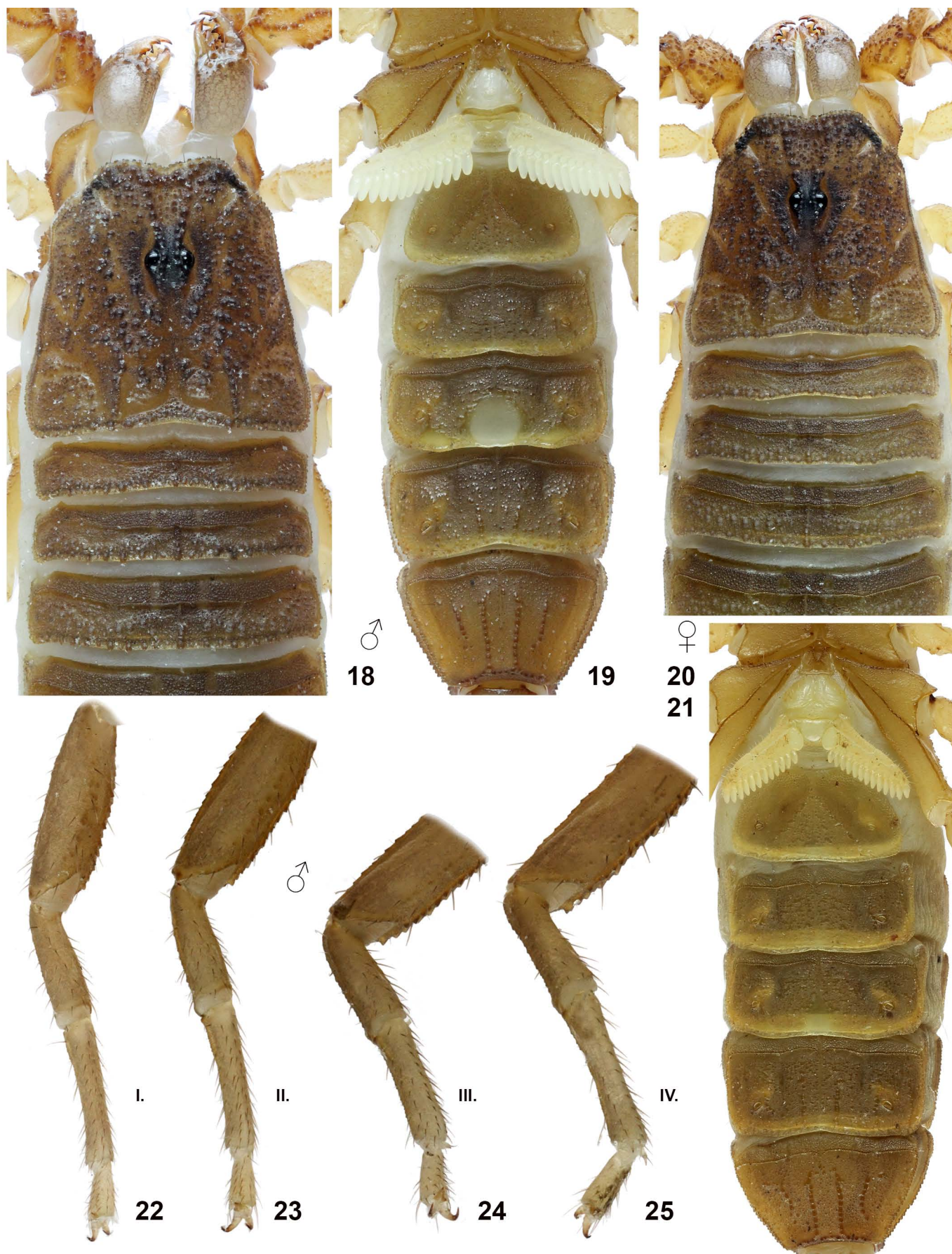


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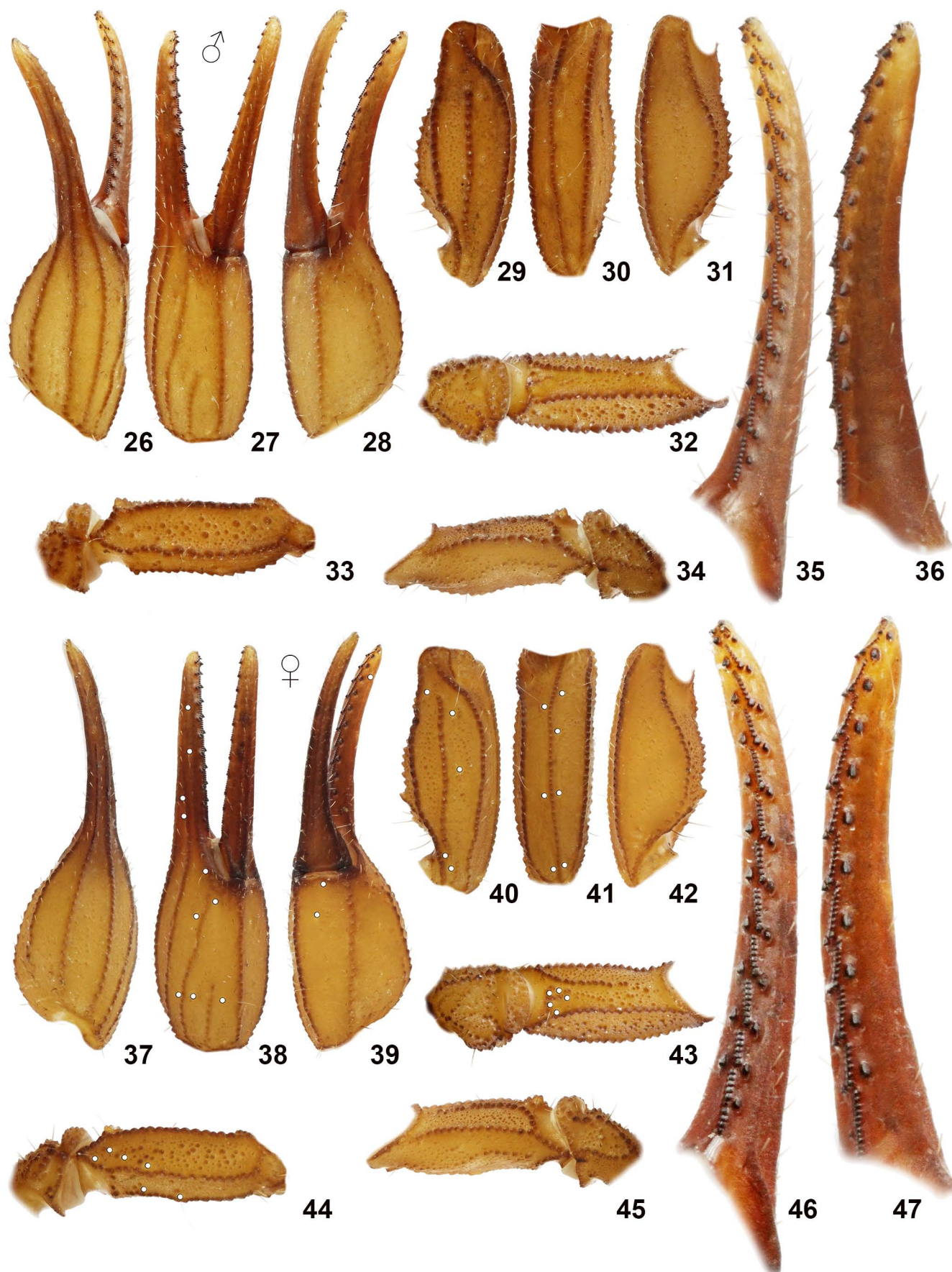
Figures 14–15: *Tityopsis rolandoi* sp. n., male holotype. **Figure 14.** Chelicera, carapace, tergites and part of right legs under UV fluorescence. **Figure 15.** Coxosternal area and sternites under UV fluorescence.



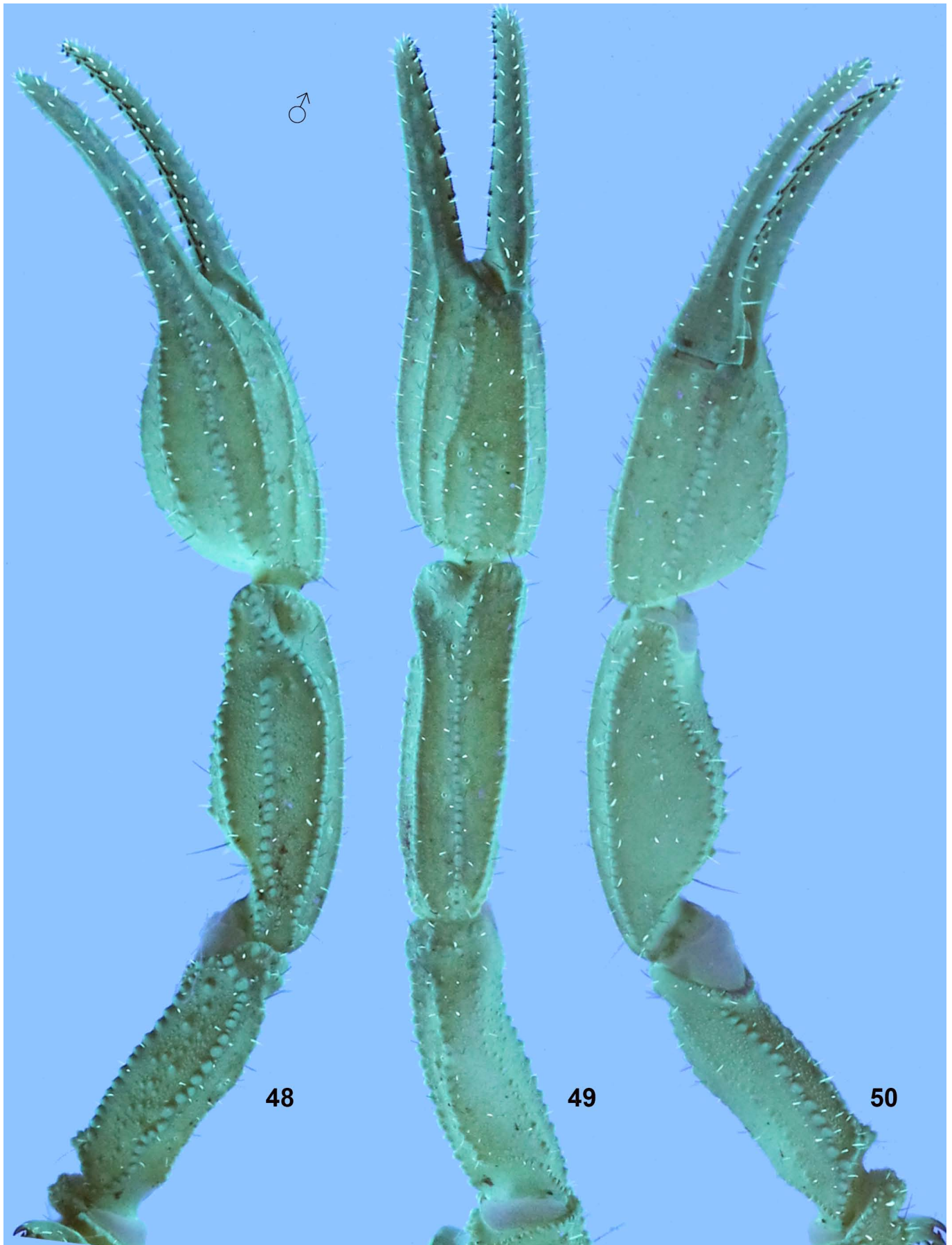
Figures 16–17: *Tityopsis rolandoi* sp. n., female paratype. **Figure 16.** Chelicera, carapace, tergites and part of right legs under UV fluorescence. **Figure 17.** Coxosternal area and sternites under UV fluorescence.



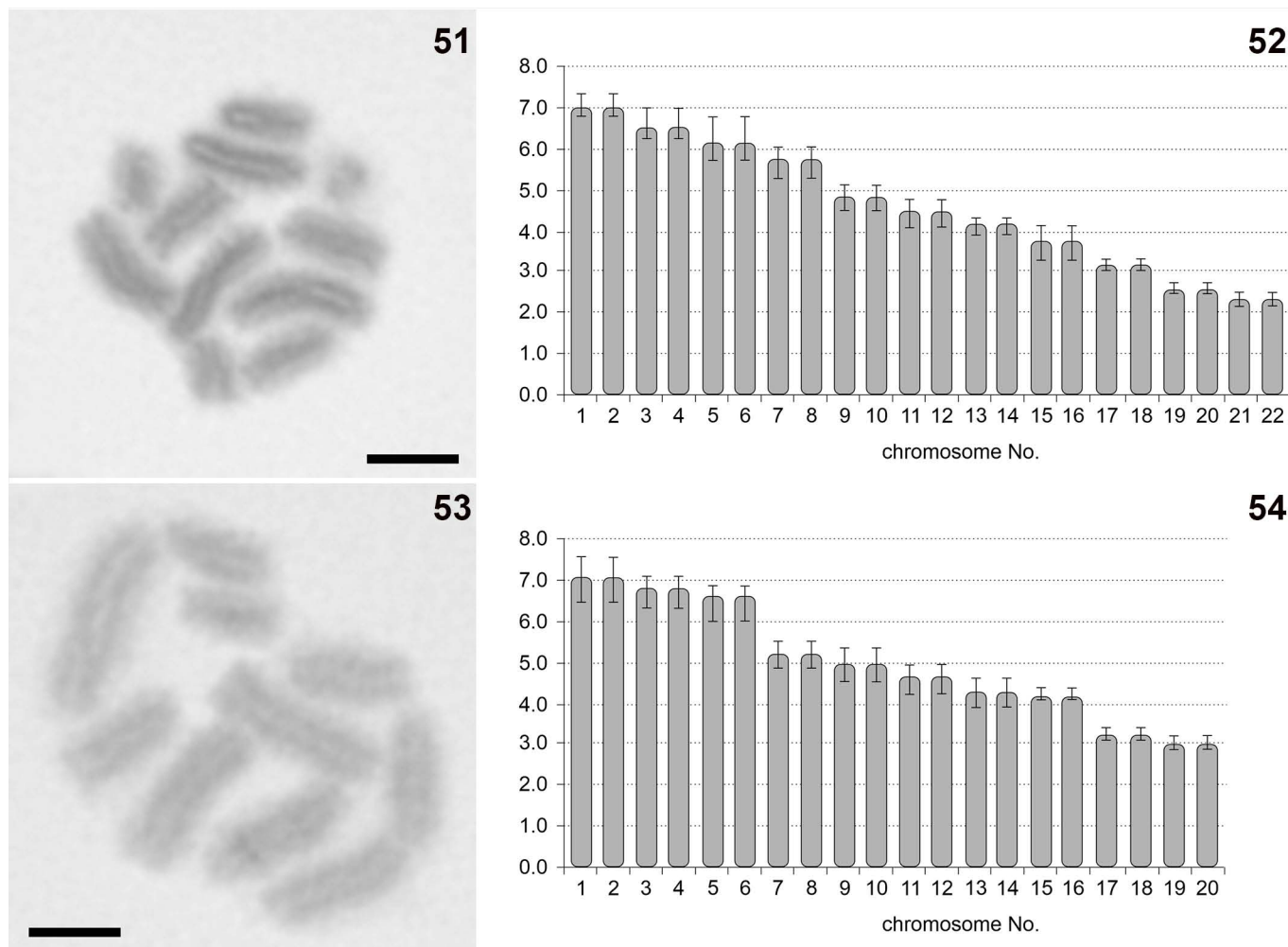
Figures 18–25: *Tityopsis rolandoi* sp. n. **Figures 18–19, 22–25.** Male holotype, chelicera, carapace, tergites I–III (18), coxosternal area and sternites (19), left legs I–IV in retrolateral aspect (respectively) (22–25). **Figures 20–21.** Female paratype, chelicera, carapace, tergites I–III (20), coxosternal area and sternites (21).



Figures 26–47: *Tityopsis rolandoi* sp. n., pedipalp segments under white light. **Figures 26–36.** Male holotype, chela dorsal (26), external (27), ventral (28) views, patella dorsal (29), external (30), and ventral (31) views, femur and trochanter external (32), dorsal (33), and ventral (34) views, movable (35) and fixed (36) finger dentition. **Figures 37–47.** Female paratype, chela dorsal (37), external (38), ventral (39) views, patella dorsal (40), external (41), and ventral (42) views, femur and trochanter external (43), dorsal (44), and ventral (45) views, movable (46) and fixed (47) finger dentition. Trichobothrial pattern is indicated by white circles in Figures 38–41, 43–44, 46–47.



Figures 48–50. *Tityopsis rolandoi* sp. n., male holotype, pedipalp under UV fluorescence, dorsal (48), external (49), and ventral (50).



Figures 51–54: The chromosomes of *Tityopsis sheylae* (2n=22) (51, 52) and *T. rolandoi* sp. n. (2n=20) (53, 54). Postpachytene (51, 53) and ideograms (52, 54) (y axis - % of the chromosome length of the diploid set, lines indicate min.-max. values). Scale bar: 5 µm.

densely granulose on all surfaces; movable finger shorter than carapace. Movable and fixed fingers with 11 rows of denticles with one internal and one external denticles, and six (movable finger) or three (fixed finger) distal denticles.

Metasoma and telson (Figs. 6–13). Entire metasoma and telson weakly hirsute; metasoma I–II with 10 complete carinae, III–IV with 8 complete and two incomplete carinae; metasoma V with 7 carinae; all carina strongly granulated; intercarinal tegument very finely and densely granulose, with some medium-sized granules scattered on dorsal surface of all segments and on lateral surfaces of V. Telson bulbous, with subaculear tubercle small and wide, not pointed. Aculeus shorter than vesicle and moderately curved.

Legs (Figs. 22–25). Slender, with all carinae strong, finely denticulate to granulose. Intercarinal tegument minutely granulose, with abundant slightly coarser granules scattered mostly over external surface. Claws short and strongly curved.

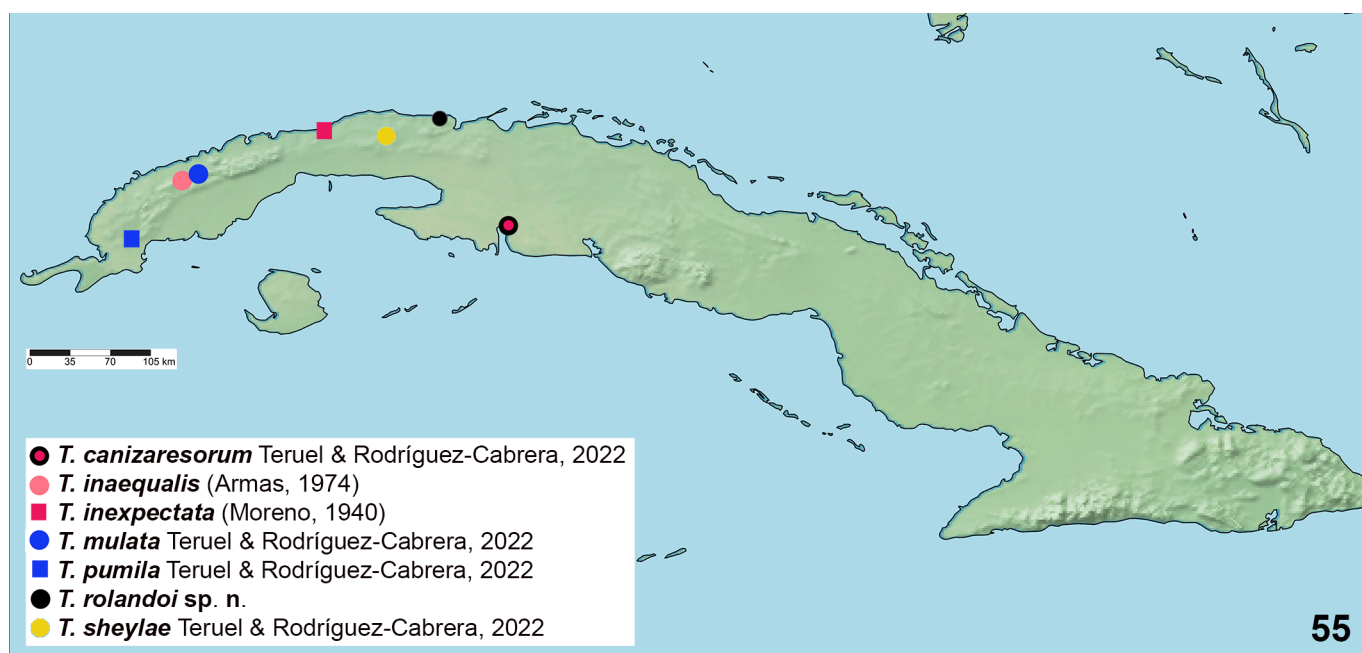
Measurements. See Table 1.

AFFINITIES. This species is the second in its genus that has the pedipalp movable finger shorter than carapace. All other species except *T. pumila* have the pedipalp movable finger

longer than carapace. Moreover, *Tityopsis rolandoi* sp. n. has unique shape of a median smooth patch of sternite V, which is almost oval in male while all other species including *T. pumila* have median smooth patch of sternite V cordiform or lanceolate in male. Male of *T. pumila* has chela length/width ratio 3.11 versus 3.6 in *Tityopsis rolandoi* sp. n.

COMMENTS ON LOCALITIES AND LIFE STRATEGY. The type locality is a primary rainforest close the the northern coast of western Cuba (Fig. 56). The forest ground is covered by a deep layer of humus with many rocks and loam on the ground. The forest itself is very dense, but without a lot undergrowth caused by a lack of light. The climate is tropical, affected by the north-east passat wind. Seasonal differences are small with a warmer rain season from May to October and a slightly cooler dry season from November to April. The humidity is high throughout the whole year with a little peak during the rain season.

All specimens of *Tityopsis rolandoi* sp. n. were found hiding directly under rocks or dead trees during daytime, where they were sitting directly on the soil without a notable burrow. They do not seem to burrow and prefer natural hideouts. Drier places were avoided, where moist places like dips were preferred.



55



56

Figures 55–56: Figure 55. Type localities of *Tityopsis* species. Figure 56. Type locality of *Tityopsis rolandoi* sp. n.



Figures 57–58. *Tityopsis rolandoi* sp. n., female paratype with newborns (57) and juveniles after the first ecdysis (58).

During night they did not seem to be very active in general (Rolando Teruel, personal communication), which indicates that they hunt and move under the rocks and deep in the leaf litter without coming to the surface a lot. The same behaviour can be observed during captive rearing.

All stages from Instar 2 to adult were found during the same time, so we assume this species reproduces during the whole year.

Other scorpions observed in type locality were *Heteroctenus junceus* (Herbst, 1800), found under loose bark of dead trees.

Captive bred specimen of *Tityopsis rolandoi* sp. n. reached adulthood in circa one year and give birth 4–6 months after mating. The females give birth to 11 to 18 juveniles.

CAPTIVE REARING AND BREEDING. For raising and breeding plastic boxes 11/11/6 cm with two perforated sides are used, where the specimens are housed solitary. Substrate is a thick layer of loam/clay mix and one half of the box is filled up with *Sphagnum* moss. A pieces of bark is placed in the other side to provide a hide. The soil and the moss is always kept wet by spraying water once a week. As prey, various insects (*Thermobia domestica*, *Shelfordella lateralis* and *Acheta domesticus*) of adequate sizes are offered.

Average temperatures during the year are 24–26°C (day) and 22–24°C (night). Dry and wet seasons are not simulated. For mating, the male is introduced to the well fed female for a few days until they are separated again.

Acknowledgments

Mark Stockmann wants to deeply thank the late Rolando Teruel for his invaluable mentorship and his close friendship to him and his wife Britta. Gratitude is also owed to Britta Stockmann for her irreplaceable help during the field trip; and to Carlos Turiel for having introduced Rolando to MS years ago and make this work possible at all.

Sheyla Yong also wants to acknowledge Rolando Teruel for „so much“: for being her best taxonomy advisor, colleague, friend, life partner and husband. Further, we thank two anonymous reviewers for their comments to the manuscript.

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