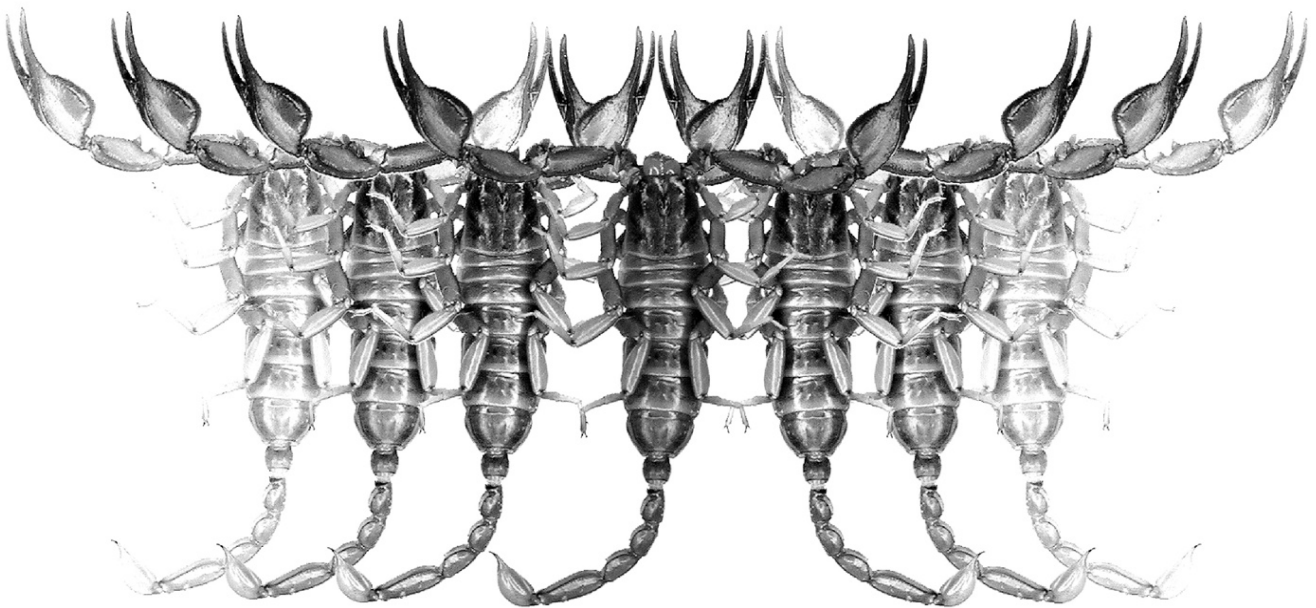


Euscorpius

Occasional Publications in Scorpiology



Scorpiops tangae sp. n.
(Scorpiones: Scorpiopidae)
from Laos.

František Kovařík, František Štáhlavský & Mark Stockmann

October 2024 — No. 399

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: 25 October 2024

<http://zoobank.org/urn:lsid:zoobank.org:pub:92220FF0-D158-4075-91F2-95AB6CF4C8AF>

Scorpiops tangae sp. n.
(Scorpiones: Scorpiopidae) from Laos.

František Kovařík¹, František Štáhlavský¹ & Mark Stockmann²

¹Department of Zoology, Charles University, Viničná 7, CZ-128 44 Praha 2, Czech Republic; www.scorpio.cz

²Im Hoek 20, D-48477 Hörstel-Riesenbeck, Germany; email: skorpionzuchtstockmann@gmail.com

<http://zoobank.org/urn:lsid:zoobank.org:pub:92220FF0-D158-4075-91F2-95AB6CF4C8AF>

Summary

A new species *Scorpiops tangae* sp. n. is described from Laos, fully illustrated with color photos showing its morphology and habitus. *Scorpiops tangae* sp. n. is the only species of the genus with a combination of the following five characters: chelal trichobothrium *Eb*₃ located in distal half of manus between trichobothria *Dt* and *Est*; patella of pedipalp with 11 ventral and 17 external trichobothria; fingers of pedipalps undulate in male; pedipalp movable finger with ca. 45 IAD; and chela length to width ratio 3.7 in male. In addition to morphology and hemispermaphore, we also present the information about the karyotype of *S. tangae* sp. n. (2n=105).

Introduction

Two recent studies by our research group (Kovařík et al., 2020; Štáhlavský et al., 2020) summarized known data, described 15 new species of the genus *Scorpiops* Peters, 1861, and defined/analysed taxonomic characters for 95 species. The following genera or subgenera were synonymized with *Scorpiops*: *Dasyscorpiops* Vachon, 1974; *Alloscorpiops* Vachon, 1980; *Euscorpiops* Vachon, 1980; *Neoscorpiops* Vachon, 1980; *Alloscorpiops* (*Laoscorpiops*) Lourenço, 2013; *Vietscorpiops* Lourenço & Pham, 2015; and *Plethoscorpiops* Lourenço, 2017.

In 2021–2023, 12 more species were described or redescribed from India (Sulakhe et al., 2021), China (Lv & Di, 2022, 2023; Lv et al., 2023, Tang, 2022a, 2022b, 2023) and Thailand (Nawaneti Wong et al., 2024). Here we describe another new species from Laos.

Methods, Material & Abbreviations

Nomenclature and measurements follow Stahnke (1971), Kovařík (2009), Kovařík & Ojanguren Affilastro (2013), and (Kovařík et al., 2020) except for trichobothriotaxy (Vachon, 1974), and sternum (Soleglad & Fet, 2003). Hemispermaphore terminology follows Kovařík et al. (2020).

Karyotype analyses were conducted on chromosome preparations prepared using the spreading technique already used in scorpiopid scorpions (e. g., Kovařík et al., 2015, 2020; Štáhlavský et al., 2021). The chromosomes were stained with a 5% Giemsa solution in Sörensen phosphate buffer for 20 min. Measurements were performed using Image J 1.45r software

(<http://rsbweb.nih.gov/ij>) with the Levan plugin (Sakamoto & Zacaro, 2009). The relative length of the chromosomes was calculated for 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

Scorpiopidae Kraepelin, 1905

Genus ***Scorpiops*** Peters, 1862

(Figures 1–45, Table 1)

Scorpiops Peters, 1862: 510; Vachon, 1980: 143–159, figs. 1–40; Tikader & Bastawade, 1983: 403–452, figs. 1129–1246; Fet, 2000: 491–495 (in part); Kovařík, 2000: 162–198, figs. 1–7, 14–22, 25, 28, 29, 31–72 (in part); Soleglad & Sissom, 2001: 93–97, figs. 3, 13–14, 86, 96, 101, 114, 147, 159, 183, 202, 220 (in part); Kovařík et al., 2020: 1–132, figs. 1–75, 77–81, 90–103, 105–127, 129–254, 257–815, tabs. 1–9 (complete references list until 2020).

= *Dasyscorpiops* Vachon, 1974: 952–953, figs. 142, 147, 160–162 (type species *Dasyscorpiops grandjeani* Vachon, 1974) (syn. by Kovařík et al., 2020: 32).

= *Scorpiops* (*Neoscorpiops*) Vachon, 1980: 150, 151, figs. 10–16 (type species *Scorpiops montanus satarensis* Pocock, 1900); Tikader & Bastawade, 1983: 382–483, figs. 1060–1128 (syn. by Kovařík et al., 2020: 32).

= *Scorpiops* (*Alloscorpiops*) Vachon, 1980: 151, figs. 18–25



Figure 1. Holotype male of *Scorpions tangae* sp. n. in vivo habitus.



Figures 2–3. *Scorpiops tangae* sp. n., male holotype in dorsal (2) and ventral (3) views. Scale bar: 10 mm.

- (type species *Scorpiops anthracinus* Simon, 1887) (syn. by Kovařík et al., 2020: 32).
- = *Scorpiops* (*Euscorpiops*) Vachon, 1980: 155, figs. 26–32 (type species *Scorpiops asthenurus* Pocock, 1900); Tikader & Bastawade, 1983: 452–476, figs. 1247–1305 (syn. by Kovařík, 2000: 164 and Kovařík et al., 2020: 32).
 - = *Alloscorpiops*: Stockwell, 1989: 120 (syn. by Kovařík et al., 2020: 32).
 - = *Alloscorpiops* (*Laoscorpiops*) Lourenço, 2013: 52–55, figs. 2–3 (type species *Alloscorpiops* (*Laoscorpiops*) *calmonti* Lourenço, 2013) (syn. by Kovařík et al., 2013: 1).
 - = *Scorpiops* (*Vietscorpiops*) Lourenço & Pham, 2015: 212–217, figs. 1–6 (type species *Scorpiops* (*Vietscorpiops*) *dentidactylus* Lourenço & Pham, 2015) (syn. by Kovařík et al., 2020: 32).
 - = *Plethoscorpiops* Lourenço, 2017: 352–357, figs. 6–10 (type species *Plethoscorpiops profusus* Lourenço, 2017) (syn. by Kovařík et al., 2020: 32).

Type species. *Scorpio hardwickii* Gervais, 1843.

DIAGNOSIS. Total length 24–75 mm. Carapace anterior margin with deep median notch. Inner accessory denticles present on pedipalp chelal fingers. Median eyes and median

ocular tubercle present. Lateral eyes with 2–3 larger ocelli, one small ocellus may also be present. Cheliceral movable finger with dorsal distal denticle slightly shorter than ventral distal denticle, dorsal margin with two large subdistal denticles, ventral margin with 4–7 smaller denticles or crenulations. Ventral aspect of cheliceral fixed finger smooth without denticles. Sternum pentagonal. Pectines short, with 4–14 teeth, fulcra present or absent. Hemispermatophore lamelliform, distal lamina long, slender, terminally curved and tapered, capsule conforming to 2-folds bauplan, truncal flexure absent, terminal membrane of sperm duct spiculate, trunk with mid-axial rib. Ovariuterus 6-celled, oocyte development apoikogenic. Pedipalp chela more or less compressed, flattened. Pedipalp fingers with median denticles aligned in linear row (or rows), outer denticles usually present and displaced externally, inner accessory denticles present. Trichobothrial pattern type C, with additive neobothriotaxy, trichobothrial counts: patella 16–75 external, 6–28 ventral, chela manus 4–16 ventral. External surface of chela with Eb_3 level with or distal to Db . Legs with two pedal spurs, tibial spurs absent. Tarsomere II with row of 3–11 stout spinules on ventral surface. Metasoma with paired ventrosubmedian carinae. Telson without subaculear tubercle, often with annular construction at base of aculeus.

Dimensions (mm)		<i>Scorpiops tangae</i> sp. n.
		♂ holotype
Carapace	L / W	5.27 / 5.53
Mesosoma	L	8.87
Tergite VII	L / W	2.00 / 3.59
Metasoma + telson	L	18.70
Segment I	L / W / D	1.87 / 1.91 / 1.75
Segment II	L / W / D	2.11 / 1.71 / 1.52
Segment III	L / W / D	2.31 / 1.62 / 1.57
Segment IV	L / W / D	2.71 / 1.57 / 1.43
Segment V	L / W / D	4.54 / 1.57 / 1.55
Telson	L / W / D	5.16 / 1.86 / 1.63
Pedipalp	L	23.28
Femur	L / W	6.18 / 2.22
Patella	L / W	6.04 / 2.19
Chela	L	11.06
Manus	W / D	2.99 / 2.33
Movable finger	L	5.58
Total	L	32.84

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

***Scorpiops tangae* sp. n.**
(Figures 1–45, Table 1)

<http://zoobank.org/urn:lsid:zoobank.org:act:03BA0A99-80B2-4831-B9F8-49EC978907A0>

TYPE LOCALITY AND TYPE REPOSITORY. **Laos**, ca. 6 km W Vang Vieng, 18.933833°N 102.386833°E; FKCP.

TYPE MATERIAL. **Laos**, ca. 6 km W Vang Vieng, 18.933833°N 102.386833°E, IX.2024, 1♂ (holotype), leg. Peter Kautt; FKCP.

ETYMOLOGY. The species epithet honors Victoria Tang for her dedication to understanding Chinese scorpions.

DIAGNOSIS (♂). Total length 33 mm. Base color reddish brown to black. Telson and legs yellowish brown. Pectine teeth number 7 in male, fulcra absent. Pectines with 2 marginal and 2–4 middle lamellae. Patella of pedipalp with 17 (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 4 *et*) external and 11 ventral trichobothria. Chela of pedipalp with 4 *V* series trichobothria located on ventral surface. Chelal trichobothrium *Eb*₃ located in distal half of manus between trichobothria *Dt* and *Est*. Fingers of pedipalps undulate in male. Chela length to width ratio 3.7 in male. Pedipalp movable finger with ca. 45 IAD which create a second row, parallel with MD (ca. 73 in number). There are also 4 ID and 11–13 OD present. Tarsomere II of legs with row of 5–8 stout median ventral spinules and two pairs of flanking setae. Metasoma I with 10 carinae and metasoma II–IV with 8

carinae. Telson elongate and smooth, length to depth ratio 2.8 in male; annular ring developed.

DESCRIPTION (♂ holotype). Total length 33 mm. Female unknown. Habitus as shown in Figs. 1–3. For position and distribution of trichobothria on pedipalps, see Figs. 15–21. Fingers of pedipalps undulate in male (Fig. 16).

Coloration (Fig. 1–3). Base color uniformly reddish brown to black. Telson and legs yellowish brown. Chelicerae grey and reticulate.

Carapace and mesosoma (Fig. 363). Entire carapace covered with both large and minute granules; carinae absent. Anterior margin of carapace with a deep median notch. Carapace with 3 pairs of lateral eyes. Mesosoma granulated, with one median carina. Tergite VII is pentacarinata. Sternites very finely granulated with two parallel furrows indicated except sternite VII, which has four completely developed granulate carinae. Pectine teeth number 7 in males, fulcra absent. Pectines with 2 marginal and 2–4 middle lamellae.

Metasoma and telson (Figs. 8–14). Metasoma very sparsely hirsute and granulated. Metasomal segment I with 10 carinae, II–IV with 8 carinae, and V with 5 carinae. Dorsolateral carinae of segments III–IV granulate with sharp granules, which terminate posteriorly with a barely pronounced tooth. Telson elongate and smooth with annular ring developed.

Pedipalps (Figs. 15–31). Pedipalps very sparsely hirsute. Patella with 17 (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 4 *et*) external trichobothria and 11 ventral trichobothria. Chela with 4 *V* series trichobothria which are located on the ventral surface. Femur and patella granulated. Femur with 5 granulate carinae



Figures 4–5: *Scorpiops tangae* sp. n., male holotype. **Figure 4.** Chelicera, carapace and tergites I–IV under white light. **Figure 5.** Coxosternal area and sternites under white light.

and patella with 5 complete carinae with dorsal and ventral patellar spurs pronounced. Manus dorsally with fine, rounded granules. External surface of chela covered by minute and larger sparse granules which indicate a external secondary carina. Movable fingers with ca. 45 IAD, which form a second row, parallel to MD (ca. 73 in number) and there are also 4 ID and 11–13 OD present.

Legs (Figs. 6–7, 32–35). Tibia and tarsomeres of legs with several setae not arranged into bristle combs on dorsal surfaces but with rows of spinules on dorsolateral and ventrolateral surfaces. Tarsomere II of legs I–IV with 5–8 stout median ventral spinules and two pairs of flanking setae. Femur with 3, and patella with 4 carinae; both femur and patella are finely granulated mainly on legs II–IV.

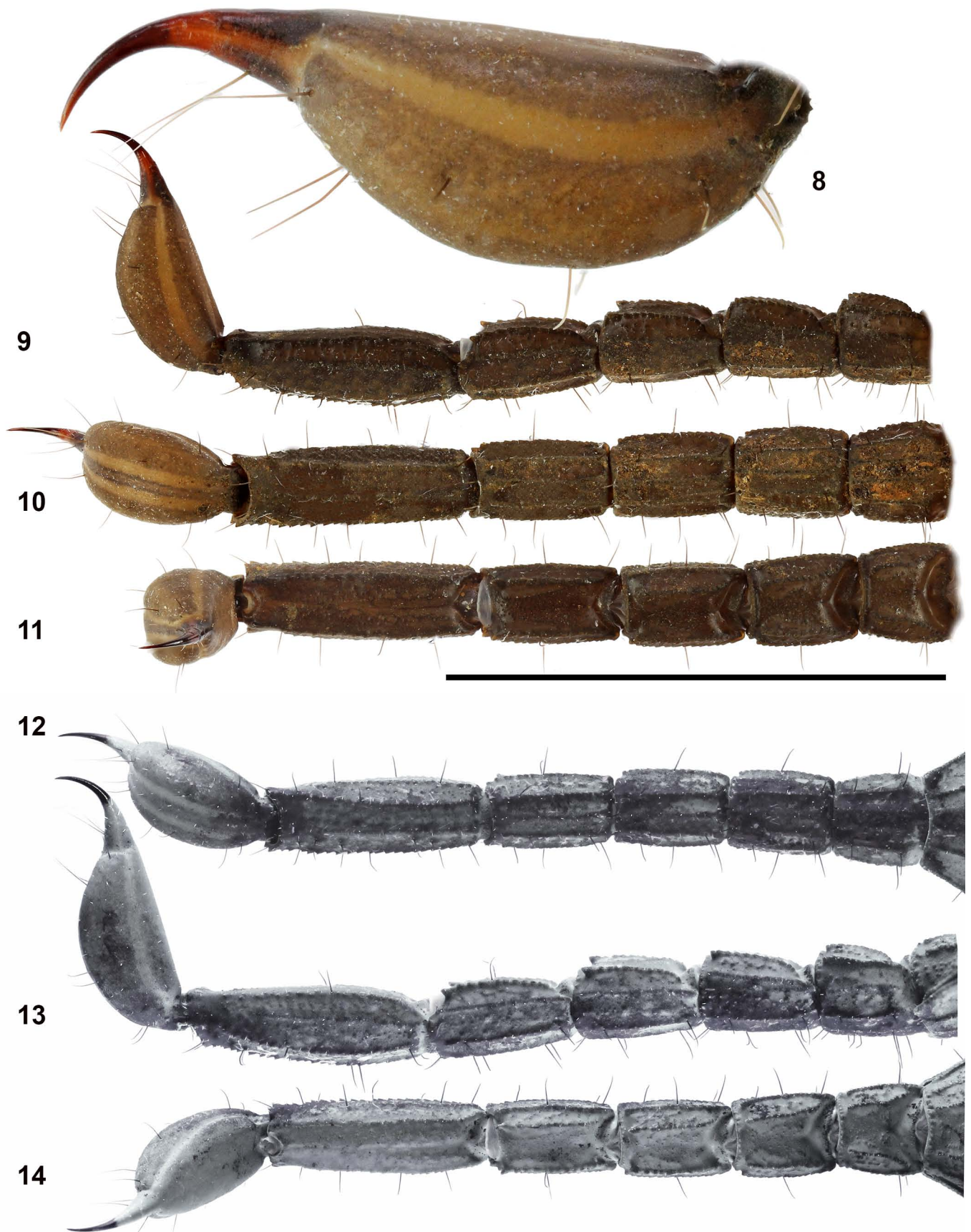


Figures 6–7: *Scorpiops tangae* sp. n., male holotype. **Figure 6.** Chelicera, carapace, tergites and part of right legs under UV fluorescence. **Figure 7.** Coxosternal area, sternites and part of right legs under UV fluorescence.

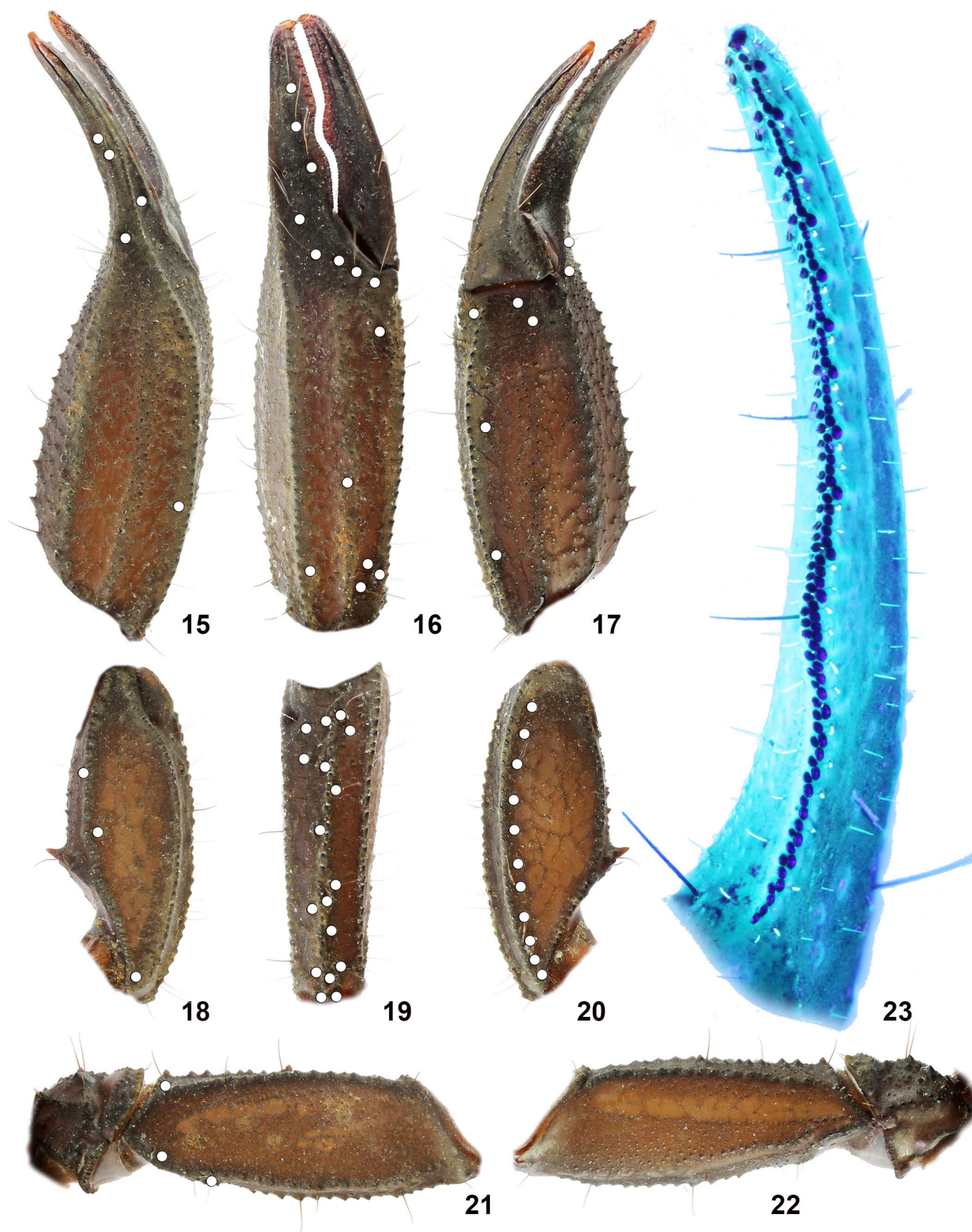
Karyotype (Figs. 40–43). We analyzed the karyotype of the male holotype, which consisted of 105 chromosomes exhibiting a typical monocentric organization (Figs. 42–43). Nearly all the chromosomes displayed acrocentric (one-armed) morphology, a feature that is common in other Scorpiopidae species with a high chromosome number (Kovářík et al., 2015, 2020; Šťáhlavský et al., 2021). The most distinct chromosome was a bi-armed chromosome, the largest in the karyotype, representing 2.38% of the diploid set. This chromosome, along with smaller acrocentric chromosomes, formed a conspicuous tetravalent during pachytene (Fig. 41) and postpachytene (Fig. 43). Unfortunately, the quality of the chromosomes did not permit a more precise determination of the number and size of additional bi-armed chromosomes, which were very small. At

least three such small bi-armed chromosomes were observed in metaphase II (Fig. 42).

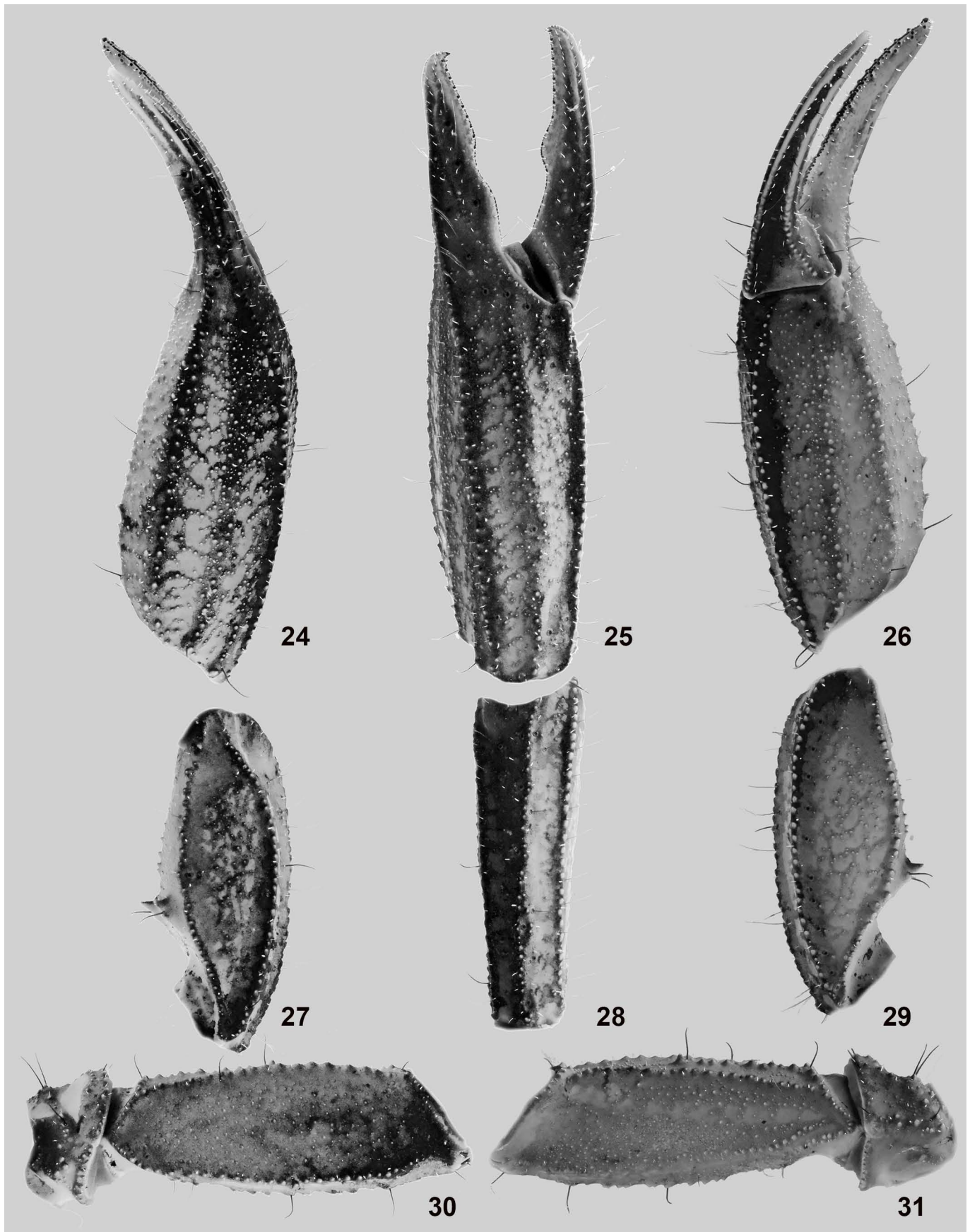
Aside from the largest chromosome that formed the trivalent, the remaining chromosomes decreased in size from 1.93% to 0.34% of the diploid set. The last chromosome pair was notably shorter (size of these chromosomes: 0.20% of the diploid set), being almost one-third smaller than the chromosomes of the preceding pair. The cytogenetic profile of *Scorpiops tangae* sp. n. correspond to the characteristics of other analyzed *Scorpiops* species, most of which have high chromosome counts ($2n=87$ – 109). Exceptions include *Scorpiops neradi* ($2n=48$), *Scorpiops schumacheri* ($2n=67$), and *Scorpiops thailandus* ($2n=147$), the latter having the highest diploid number within the family Scorpiopidae and one of the highest within the order Scorpiones



Figures 8–14: *Scorpiops tangae* sp. n., male holotype. **Figure 8.** Telson in lateral view under white light. **Figures 9–11.** Metasoma and telson lateral (9), ventral (10), and dorsal (11) views under white light. **Figures 12–14.** Metasoma and telson ventral (12), lateral (13), and dorsal (14) views under UV fluorescence. Scale bar: 10 mm (9–14).



Figures 15–23: *Scorpions tangae* sp. n., male holotype, pedipalp. **Figures 15–22.** Pedipalp segments under white light, chela dorsal (15), external (16), ventral (17) views, patella dorsal (18), external (19), and ventral (20) views, femur and trochanter dorsal (21), and ventral (22) views. **Figure 23.** Movable finger dentition under UV fluorescence. Trichobothrial pattern is indicated by white circles in Figures 15–21.



Figures 24–31. *Scorpiops tangae* sp. n., male holotype, pedipalp under UV fluorescence, chela dorsal (24), external (25), ventral (26) views, patella dorsal (27), external (28), and ventral (29) views, femur and trochanter dorsal (30), and ventral (31) views.



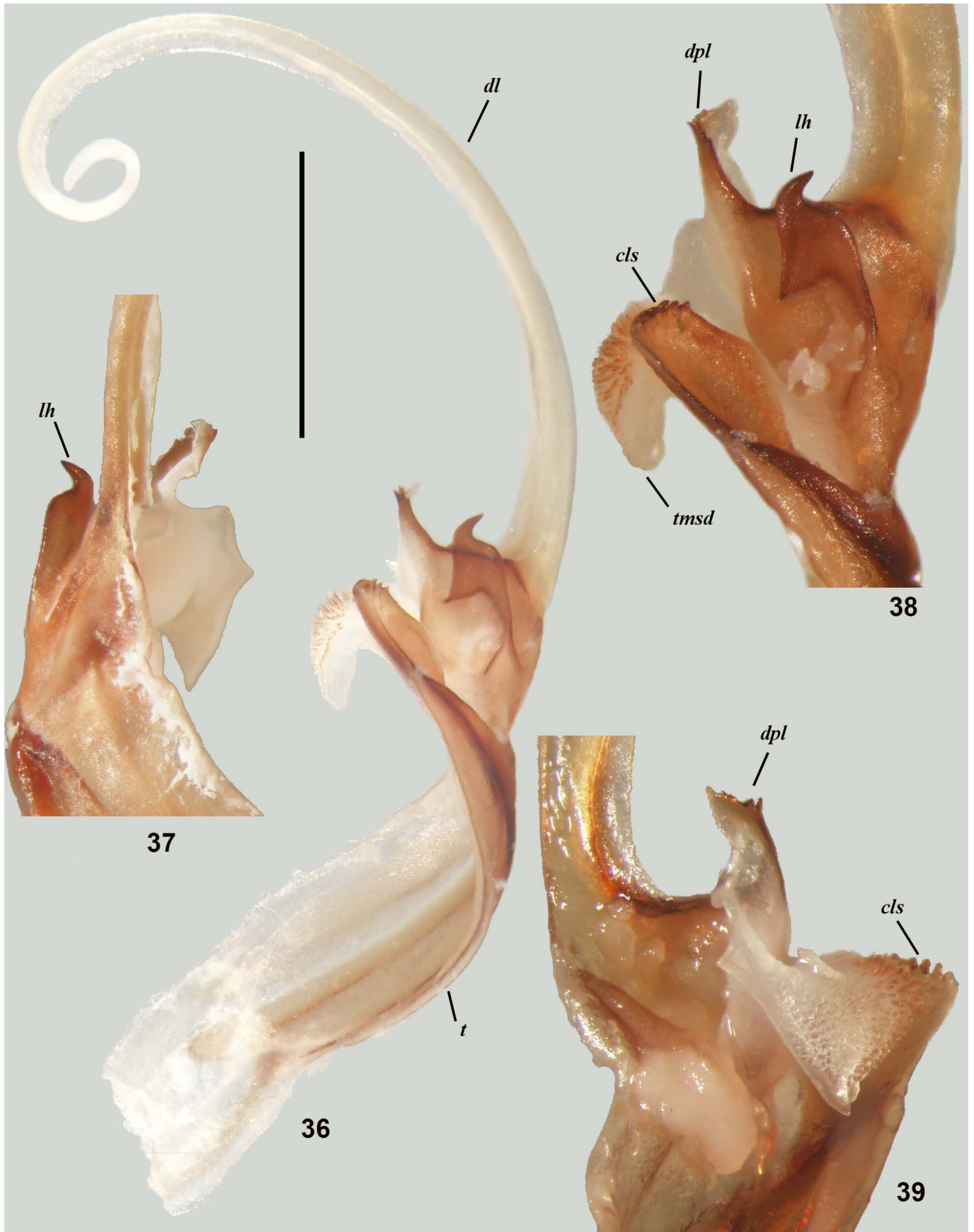
Figures 32–35. *Scorpiops tangae* sp. n., right legs I–IV in retrolateral aspect (respectively).

(Schneider et al., 2024). Trivalent associations are also common feature in this family, having been documented in 13 out of the 19 species analyzed (Kovářík et al., 2015, 2020; Šťáhlavský et al., 2021).

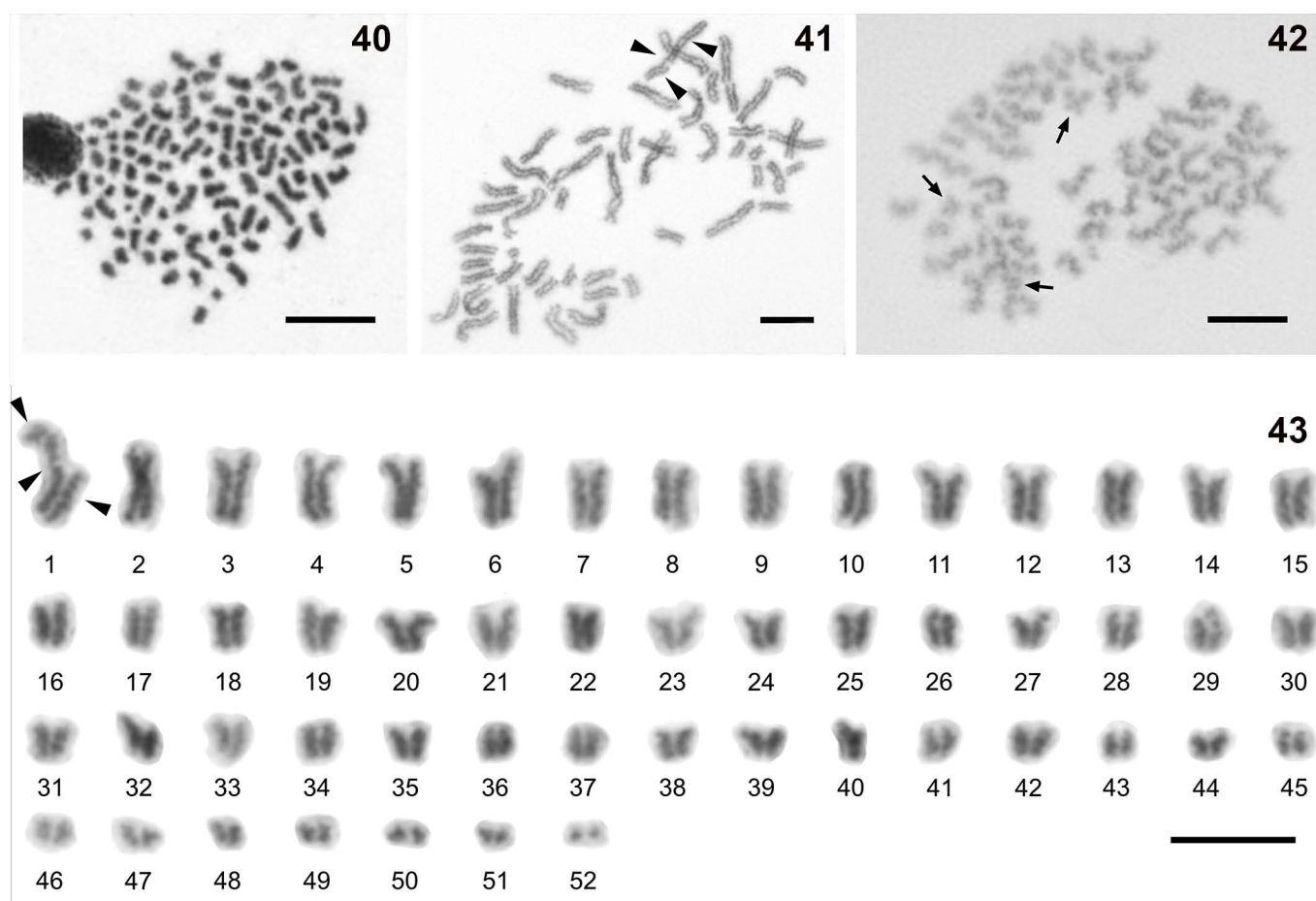
Hemispermaphore (Figs. 36–39). Lamelliform. Distal lamina (*dl*) long, narrow, apically coiled. Trunk (*t*) broader and shorter than distal lamina, with sclerotized mid-axial rib. Capsule large. Basal carina a wide sclerotized plate with posterior crest, apical margin forming crown-like structure (*cls*) bearing 5 evenly spaced denticles. Distal carina with both lateral hook (*lh*) and distal posterior lobe (*dpl*) strongly developed.

Lateral hook with wide base, terminating in robust spiniform process pointing distally outwards on convex surface of capsule. Distal posterior lobe prominent, apical margin with several denticulations. Distal carina connected to mid-axial rib of trunk by a narrow junction. Terminal membrane of sperm duct (*tmsd*) with numerous spicules. *Comments.* The hemispermaphore structure is typical for the genus (Kovářík et al., 2020). The low *cls* denticle count associates it with hemispermaphores of *S. oligotrichus*, *S. citadelle* and *S. sherwoodae*, i.e., Group 1 species (oligodentate) of Kovářík et al., 2020.

Measurements. See Table 1.



Figures 36–39. *Scorpiops tangae* sp. n., left hemispermatophore. **Figure 36.** Whole hemispermatophore. **Figures 37–39.** Capsule in posterior (37), antero-convex (38) and concave (39) views. Abbreviations: *cls*, crown-like structure; *dl*, distal lamina; *dpl*, distal posterior lobe; *lh*, lateral hook; *t*, trunk; *tmsd*, terminal membrane of sperm duct. Scale bar: 1 mm (Fig. 36).



Figures 40–43: The chromosomes of male holotype of *Scorpiops tangae* sp. n. ($2n=105$). (40) Spermatogonial metaphase, (41) pachytene, (42) metaphase II ($n=53$), the cell without large biarmed chromosome and (43) karyogram of analysed adult male based on postpachytene. Arrowheads show chromosomes in trivalent association; arrows show evident biarmed chromosomes in metaphase II. Scale bar: 10 μ m.

AFFINITIES. The combination of five characters (chelal trichobothrium Eb_3 located in distal half of manus between trichobothria Dt and Est ; patella of pedipalp with 11 ventral and 17 external trichobothria; fingers of pedipalps undulate in male; pedipalp movable finger with ca. 45 IAD; and chela length to width ratio 3.7 in male) is unique in the entire genus *Scorpiops*. The most similar species is *S. binghamii* Pocock, 1893 from Myanmar and Thailand which differs from *Scorpiops tangae* sp. n. by total length 50–65 mm; patella of pedipalp with 12–13 ventral and 20–21 external trichobothria; and fingers of pedipalps strongly undulate in male.

DISTRIBUTION. LAOS.

Acknowledgements

We are grateful to Peter Kautt who generously provided specimen for our studies and kindly giving permission to use his photographs herein as Figures 44 and 45. Special thanks to Graeme Lowe for his help with hemispermaphores descriptions. We thank two anonymous reviewers for their comments.

References

- FET, V. 2000. Family Scorpiopidae. Pp. 487–495 in: FET, V., W. D. SISSOM, G. LOWE & M. E. BRAUNWALDER. *Catalog of the Scorpions of the World* (1758–1998). New York, NY: The New York Entomological Society.
- KOVAŘÍK, F. 2000. Revision of family Scorpiopidae (Scorpiones), with descriptions of six new species. *Acta Societas Zoologicae Bohemicae*, 64: 153–201.
- KOVAŘÍK, F. 2009. *Illustrated catalog of scorpions. Part I. Introductory remarks; keys to families and genera; subfamily Scorpioninae with keys to Heterometrus and Pandinus species*. Prague: Clairon Production, 170 pp.
- KOVAŘÍK, F., O. KOŠULIČ, F. ŠTÁHLAVSKÝ, J. PLÍŠKOVÁ, W. DONGKHAMFU & P. WONGPROM. 2015. Two new species of *Euscorpiops* Vachon, 1980 from Thailand and Myanmar (Scorpiones: Euscorpiidae: Scorpiopinae). *Annales Zoologici (Warszawa)*. 65: 109–122.



Figures 44–45. *Scorpiops tangae* sp. n., type locality, habitat (44) and male holotype directly on the type locality (45).

- KOVAŘÍK, F., G. LOWE, M. STOCKMANN & F. ŠTÁHLAVSKÝ. 2020. Revision of genus-group taxa in the family Scorpidae Kraepelin, 1905, with description of 15 new species (Arachnida: Scorpiones). *Euscorpius*, 325: 1–140.
- KOVAŘÍK, F. & A. A. OJANGUREN AFFILASTRO. 2013. *Illustrated catalog of scorpions. Part II. Bothriuridae; Chaerilidae; Buthidae I., genera Compsobuthus, Hottentotta, Isometrus, Lychas, and Sassanidotus*. Prague: Clairon Production, 400 pp.
- KOVAŘÍK, F., M. E. SOLEGLAD & O. KOŠULIČ. 2013. *Alloscorpions wongpromi* sp. n. from Thailand and Laos (Scorpiones: Euscorpidae: Scorpinae). *Euscorpius*, 160: 1–12.
- LOURENÇO, W. R. 2013. A new subgenus and species of *Alloscorpions* Vachon, 1980 from Laos (Scorpiones, Euscorpidae, Scorpinae); implications for the taxonomy of the group. *Comptes Rendus Biologies*, 336: 51–55.
- LOURENÇO, W. R. 2017. A new genus and species of scorpion from Burma [Myanmar] (Scorpiones: Scorpidae): Implications for the taxonomy of the family. *Comptes Rendus Biologies*, 340(6–7): 349–357.
- LOURENÇO, W. R. & D. S. PHAM. 2015. An interesting new subgenus of *Scorpions* Peters, 1861 from North Vietnam (Scorpiones: Euscorpidae: Scorpinae). *Comptes Rendus Biologies*, 338 (3): 212–217.
- LV, H.Y. & Z. Y. DI. 2022a. *Scorpions lourencoi* sp. nov., the revalidation of *Scorpions atomatus* Qi, Zhu & Lourenço, 2005, and the redescription of *Scorpions tibetanus* Hirst, 1911 (Scorpiones, Scorpidae) from China. *ZooKeys*, 132: 189–214.
- LV, H.Y. & Z. Y. DI. 2022b. A new species of the genus *Scorpions* from Xizang, China (Scorpiones, Scorpidae). *Arthropoda Selecta*, 32(3): 323–332.
- LV, H. Y., W. R. LOURENÇO & Z. Y. DI. 2023. *Scorpions zhui* sp. n., a new species of *Scorpions* Peters, 1861 from Chongqing, China (Scorpiones: Scorpidae). *Zootaxa*, 5257 (1): 40–48.
- NEWANETIWONG, W., O. KOŠULIČ, N. WARRIT, W. R. LOURENÇO & E. YTHIER. 2024. A new species of the genus *Scorpions* Peters, 1861, subgenus *Euscorpions* Vachon, 1980 from Thailand (Scorpiones, Scorpidae). *ZooKeys*, 1193: 161–17.
- PETERS, W. 1861. Über eine neue Eintheilung der Skorpione und über die von ihm in Mossambique gesammelten Arten von Skorpionen. *Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin*, 1861: 507–516.
- SAKAMOTO, Y. & A. A. ZACARO. 2009. LEVAN, an ImageJ plugin for morphological cytogenetic analysis of mitotic and meiotic chromosomes. Available at: <http://rsbweb.nih.gov/ij/plugins/levan/levan.html>. Accessed 3rd June 2016.
- SCHNEIDER, M. C., V. F. MATTOS & D. M. CELLA. 2024. The Scorpion Cytogenetic Database. Current version: 12 (October, 2024) <https://arthropodacytogenetics.bio.br/scorpiondatabase/>
- SOLEGLAD, M. E. & V. FET. 2003. The scorpion sternum: structure and phylogeny (Scorpiones: Orthosterni). *Euscorpius*, 5: 1–34.
- SOLEGLAD, M. E. & W. D. SISSOM. 2001. Phylogeny of the family Euscorpidae Laurie, 1896 (Scorpiones): a major revision. 25–111 in: *Scorpions 2001 In Memoriam Gary A. Polis. Editorss Fet & Selden. British Arachnological Society, 2001*, 404 pp.
- ŠTÁHLAVSKÝ, F., F. KOVAŘÍK, M. STOCKMANN & V. OPATOVÁ. 2020. Karyotype evolution and preliminary molecular assessment of genera in the family Scorpidae (Arachnida: Scorpiones). *Zoology*, 144(2021) 125882: 1–10 and Supplementary Information. <https://doi.org/10.1016/j.zool.2020.125882>.
- STAHNKE, H. L. 1971. Scorpion nomenclature and mensuration. *Entomological News*, 81: 297–316.
- STOCKWELL, S. A. 1989. *Revision of the Phylogeny and Higher Classification of Scorpions (Chelicerata)*. Ph.D. Dissertation, Berkeley, California: University of Berkeley. 319 pp. (unpublished). Ann Arbor, Michigan: University Microfilms International.
- SULAKHE, S., S. DESHPANDE, N. DANDEKAR, A. PADHYE & D. BAWASKAR. 2021. Four new lithophilic species of *Scorpions* Peters, 1861 (Scorpiones: Scorpidae) from peninsular India. *Euscorpius*, 337: 1–49.
- TANG, V. 2022a. A new species of *Scorpions* Peters, 1861 from Yunnan Province, China, with a preliminary review of its congeners in Yunnan (Scorpiones: Buthidae). *Euscorpius*, 360: 1–45.
- TANG, V. 2022b. Reanalysis of the Yunnan population of *Scorpions kubani* with a description of a new species, *Scorpions lowei* sp.n. (Scorpiones: Scorpidae). *Euscorpius*, 361: 1–22.
- TANG, V. 2023. Description of the adult male *Scorpions tongtongi* Tang, 2022, with further comments on the genus *Scorpions* Peters, 1861 in China (Scorpiones: Scorpidae). *Euscorpius*, 377: 1–52.

- TIKADER, B. K. & D. B. BASTAWADE. 1983. Scorpions (Scorpionida: Arachnida). *The Fauna of India*, Vol. 3. (Edited by the Director). Calcutta: Zoological Survey of India, 671 pp.
- VACHON, M. 1974. Etude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en Arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les scorpions. *Bulletin du Muséum National d'Histoire Naturelle*, Paris, (3), 140 (Zool. 104), mai-juin 1973: 857–958.
- VACHON, M. 1980. Essai d'une classification sous-générique des scorpions du genre *Scorpiops* Peters, 1861 (Arachnida, Scorpionida, Vaejovidae). *Bulletin du Muséum National d'Histoire Naturelle*, 2(1): 143–160.