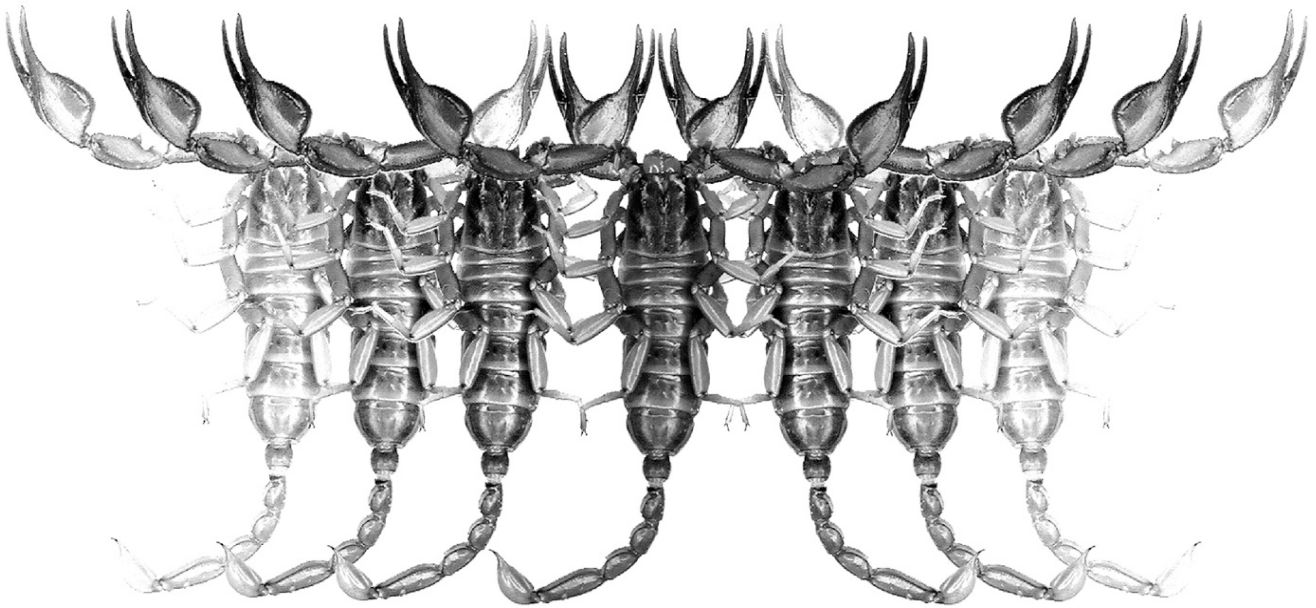


# *Euscorpius*

Occasional Publications in Scorpiology



**The genus *Barbaracurus* in Saudi Arabia  
(Scorpiones: Buthidae), with description  
of a new species.**

**František Kovařík, Graeme Lowe, František Štáhlavský & Pavel Just**

**December 2022 — No. 365**

# *Euscorpius*

## *Occasional Publications in Scorpiology*

EDITOR: **Victor Fet**, Marshall University, '[fet@marshall.edu](mailto:fet@marshall.edu)'

ASSOCIATE EDITOR: **Michael E. Soleglad**, '[msoleglad@gmail.com](mailto:msoleglad@gmail.com)'

TECHNICAL EDITOR: **František Kovařík**, '[kovarik.scorpio@gmail.com](mailto: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 December 2022**

<http://zoobank.org/urn:lsid:zoobank.org:pub:D51F871E-1BF6-409B-B211-76C9A61BB005>

# The genus *Barbaracurus* in Saudi Arabia (Scorpiones: Buthidae), with description of a new species.

František Kovařík<sup>1</sup>, Graeme Lowe<sup>2</sup>, František Štáhlavský<sup>1</sup> & Pavel Just<sup>1</sup>

<sup>1</sup> Department of Zoology, Charles University, Viničná 7, CZ-128 44 Praha 2, Czech Republic; <http://www.scorpio.cz>

<sup>2</sup> Monell Chemical Senses Center, 3500 Market St., Philadelphia, PA 19104-3308, USA

<http://zoobank.org/urn:lsid:zoobank.org:pub:D51F871E-1BF6-409B-B211-76C9A61BB005>

## Summary

The genus *Barbaracurus* (Scorpiones: Buthidae) is recorded for the first time from Saudi Arabia. *Barbaracurus yemenensis* Kovařík et al., 2018 was found in the extreme southwest of the country, near its border with Yemen. The diagnosis of the species is emended based on the finding of adult males and a large adult female. The proximal margins of the pedipalp fingers of male *B. yemenensis* are strongly undulate, leaving a gap with the fingers closed. This character differentiates it from all other species of *Barbaracurus* in the Arabian Peninsula. A second species, *B. kabateki* sp. n. from Saudi Arabia is described as new. In addition to external morphological characters, we also describe the karyotypes of *B. yemenensis* (2n = 26), and the hemispermatophores of both species. A key to the species of *Barbaracurus*, and a map of the distribution of the genus in the Arabian Peninsula and Horn of Africa are provided.

## Introduction

The genus *Barbaracurus* Kovařík, Lowe et Štáhlavský, 2018 with type species *Babycurus sofomarensis* Kovařík et al., 2015, was recently defined and compared to the genus *Babycurus* Karsch, 1886, by Kovařík et al. (2018b). To date, nine allopatric species have been recognized in the Horn of Africa and Arabian Peninsula. The latter region includes three species: *B. exquisitus* (Lowe, 2001) and *B. winklerorum* Kovařík, Lowe & Štáhlavský, 2018 from Oman; and *B. yemenensis* from Yemen (a species known only from females). Here, we report the results of recent fieldwork in Saudi Arabia which revealed for the first time the presence of *Barbaracurus* in that country. Males of *B. yemenensis* were discovered, further elucidating the taxonomic position of this species. A second member of the genus was also found in Saudi Arabia, and is herein described as a new species.

## Methods, Material & Abbreviations

Nomenclature and measurements follow Stahnke (1971), Sissom (1990), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974, 1975), and morphology of sternum (Soleglad & Fet, 2003) and hemispermatophore (Kovařík et al., 2018a). Karyotypes were analyzed using standard cytogenetic methods (e.g., Kovařík et al., 2009).

Specimens studied herein are preserved in 80% ethanol in the first authors collection (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).

## Systematics

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

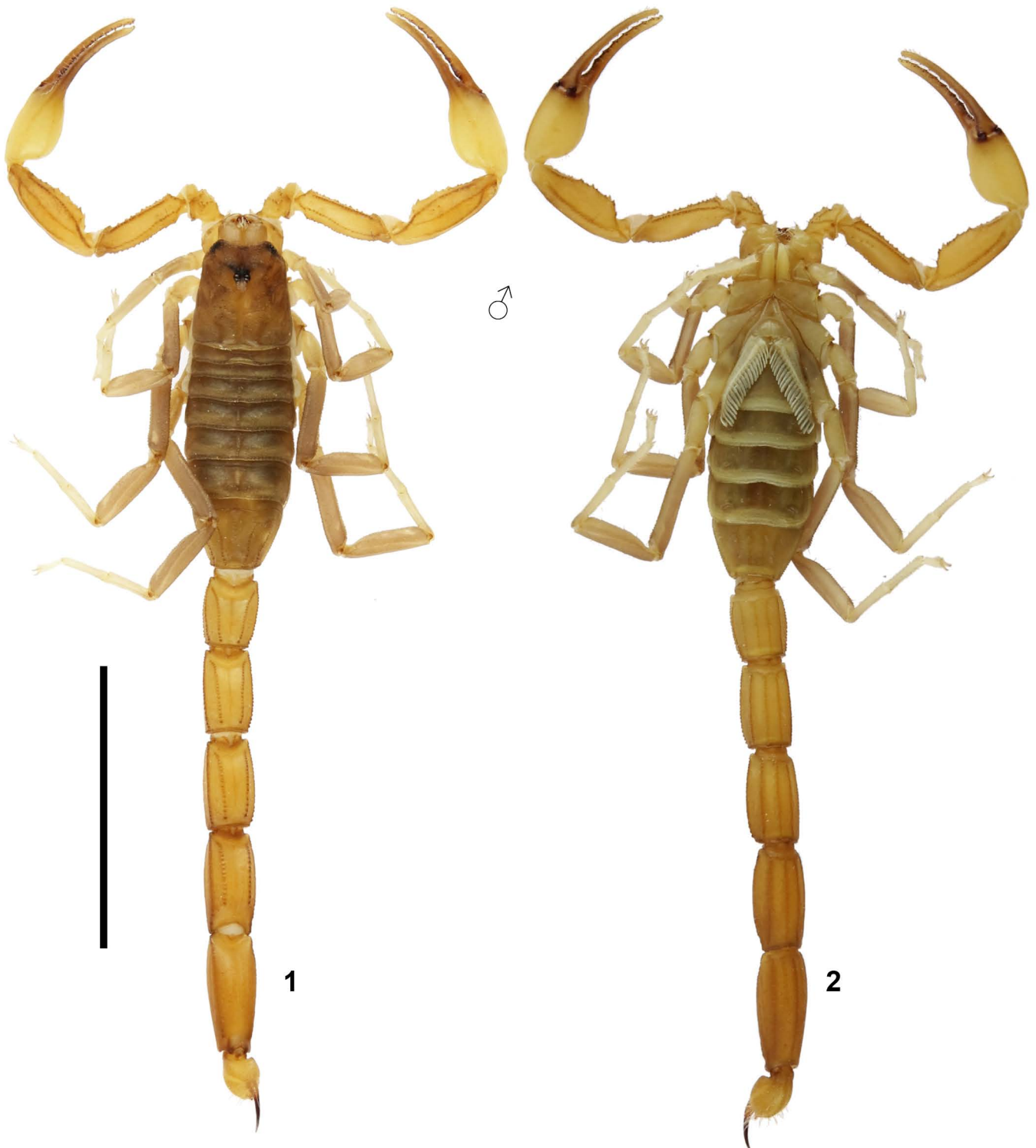
#### *Barbaracurus* Kovařík, Lowe et Štáhlavský, 2018 (Figs. 1–107, Table 1)

*Babycurus*: Kraepelin, 1913: 179–183 (in part); Fet & Lowe, 2000: 76–80 (in part); Kovařík, 2000: 244–245, 255–256, 260–262, figs. 10, 13, 21–22, 26, 38–40, tables 1–3 (in part); Kovařík, 2009: 30 (in part); Kovařík et al., 2015: 1–31 (in part), figs. 46–123.

*Barbaracurus* Kovařík, Lowe et Štáhlavský, 2018b: 4–41, figs. 1–10, 24–28, 32–36, 50–251, 258–262, tabs. 1–2; Kovařík et al., 2019: 1–11, figs. 1–46, table 1.

TYPE SPECIES. *Babycurus sofomarensis* Kovařík, Lowe, Seiter, Plíšková et Štáhlavský, 2015.

DIAGNOSIS. Small to medium-sized buthids, adult total length 20–60 mm. Carapace granular, lacking distinct carinae; flat, subrectangular with concave anterior margin. Median eyes on low ocular tubercle located at 1/3 of carapace length from anterior margin. Carapace usually bearing 4, or sometimes 5 pairs of lateral eyes (3 major ocelli, 1–2 minor ocelli). Anterior, central and posterior median furrows distinct, connected by median groove over ocular tubercle. Sternum type 1, triangular in shape. Tergites I–VI granular, with single median carina which may be obsolete on I–II, tergite VII with 5 carinae. Metasoma elongate, segment I with 10 carinae; segments II–IV with 8 carinae, lacking lateral median carina.



Figures 1–2. *Barbaracurus kabateki* sp. n., paratype male, dorsal (1) and ventral (2) views. Scale bar: 10 mm.

Metasoma V convex, may be dilated, with carinae either present or obsolete. Telson ellipsoidal, pyriform or slightly bulbous, with a distinct subaculear tooth. Pectines with fulcra. Hemispermatophore capsule with 2-lobed sperm hemiduct and oblique carinate or scoop-like basal lobe, which may be obsolete. Chelicerae with typical buthid dentition (Vachon, 1963), fixed finger with two accessory denticles on ventral surface. Pedipalps orthobothriotaxic, type A $\beta$ ; femur with 'trichobothrium'  $d_2$  internal; patella with trichobothrium  $d_3$  external to dorsomedian carina,  $esb_2$  close to  $esb_1$ ; chela with trichobothrium  $Eb_2$  distal to  $Eb_1$ ,  $db$  in distal half of fixed finger. Chela manus smooth, with carinae reduced or obsolete; dentate margins of chela movable finger with 6–7 non-imbricated, almost linear or contiguous rows of granules, each row terminated proximally by an enlarged granule flanked by single adjacent internal and external accessory granules. Most proximal granule row without internal accessory denticle, and either with (in species from the Horn of Africa and Arabian Peninsula) or without (in species from Cameroon and Nigeria) a single isolated external accessory granule midway along its length. Chela fixed and movable fingers bearing numerous short macrosetae with blunt, micropapillate tips. Pedipalp chelae sexually dimorphic, males typically with manus dilated and dentate margins of fingers proximally undulate; denticles of undulate subproximal granule rows in males are bicuspid. Tibial spurs absent on leg III, present on leg IV, tibia and tarsus I–IV without bristle combs, ventral surfaces of tarsi equipped with two rows of setae, ungues stout.

SUBORDINATE TAXA. *B. exquisitus* (Lowe, 2000) (Oman), *B. feti* Kovařík et al., 2019 (Somaliland), *B. kabateki* sp. n. (Saudi Arabia), *B. prudenti* (Lourenço, 2013) (Cameroon), *B. sofomarensis* (Kovařík et al., 2015) (Ethiopia), *B. somalicus* (Hirst, 1907) (Somaliland), *B. subpunctatus* (Borelli, 1925) (Ethiopia, Somalia), *B. ugartei* (Kovařík, 2000) (Nigeria), *B. winklerorum* Kovařík et al., 2018 (Oman), *B. yemenensis* Kovařík et al., 2018 (Saudi Arabia, Yemen), *B. zambonellii* (Borelli, 1902) (Eritrea).

*Barbaracurus kabateki* sp. n.  
(Figures 1–33, 101–103, 107, Table 1)

<http://zoobank.org/urn:lsid:zoobank.org:act:B8A2A455-E0B9-48E6-820F-662F34B4E412>

TYPE LOCALITY AND TYPE DEPOSITORY. Saudi Arabia, Rijal Almaa District, Ragal Almaa env., 18°12'54"N 42°17'47"E, 1900 m a. s. l.; FKCP.

TYPE MATERIAL EXAMINED. Saudi Arabia, Rijal Almaa District, Ragal Almaa env., 18°12'54"N 42°17'47"E, 1900 m a. s. l., 18.–19.X.2022 (Locality No. 22SL, Fig. 33), 2♂ (holotype and paratype, DNA Nos. 2390, 2430), leg. F. Kovařík & P. Just, FKCP.

ETYMOLOGY. The specific epithet honors Petr Kabátek (Czech Republic) for his friendship and help with the Saudi Arabian expedition.

DIAGNOSIS (♂). Total length of adult male 35 mm, female unknown. Coloration yellowish brown to orange, chelicerae yellow with weak reticulation. Pedipalp chela length/ width ratio 4.07 in male; proximal margins of pedipalp fingers of male weakly undulate without gap with fingers closed; dentate margin of movable finger armed with 7 rows of granules, and a short subapical row of 4 denticles; most proximal granule row with one external accessory granule. Pectines with 20 teeth in males. Hemispermatophore basal lobe reduced to a broad, weak oblique ridge. Metasoma narrow, metasoma V length/ width ratio 2.71 in male; metasoma I with 10 carinae, II–IV with 8 carinae. Telson setose, bearing numerous long macrosetae and a short, spiniform subaculear tubercle; vesicle smooth, elongate, ellipsoidal in lateral profile, telson length/ depth ratio 2.91; aculeus slender, curved, shorter than vesicle.

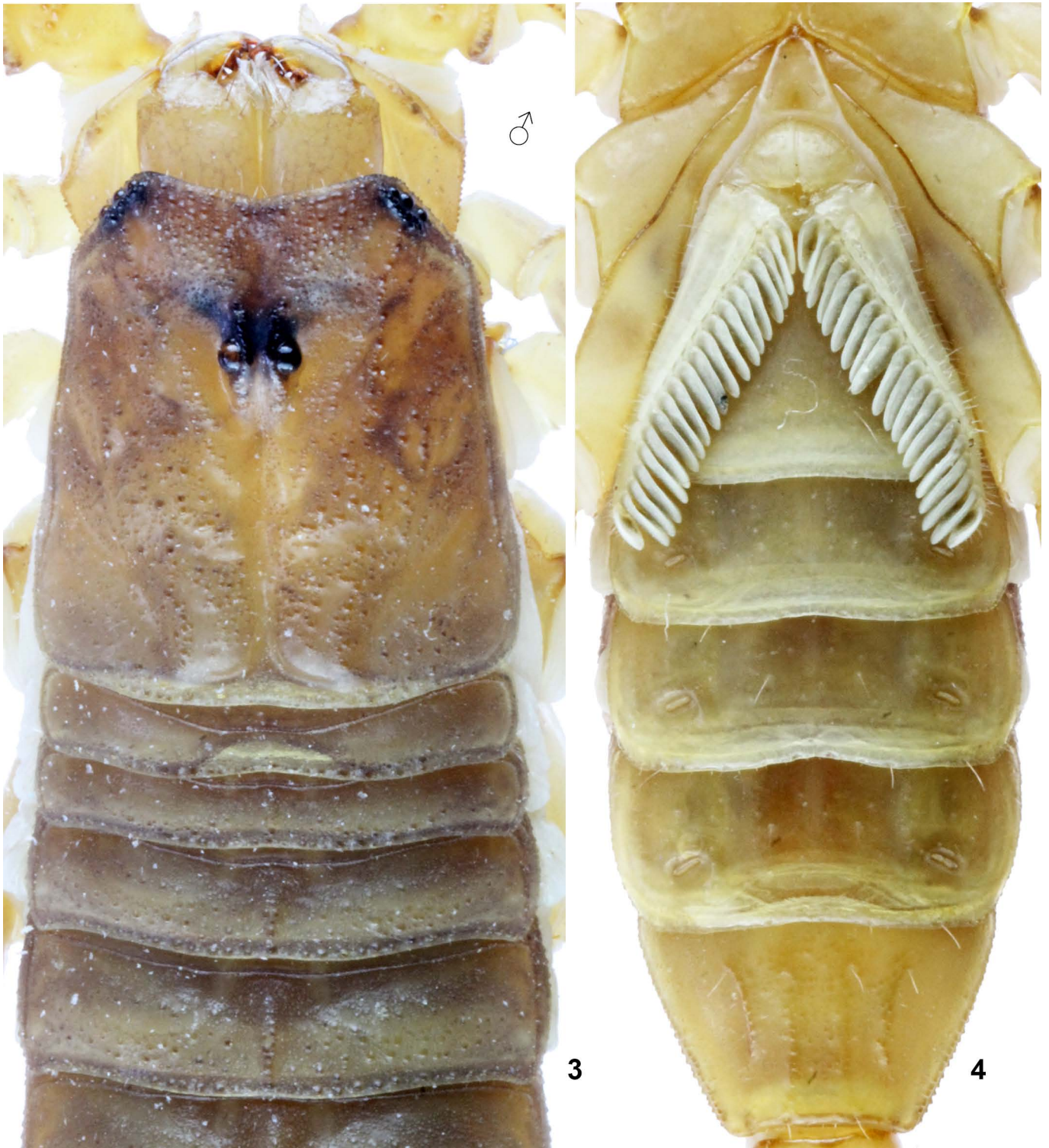
DESCRIPTION (♂). Total length of adult male 35 mm, female unknown. Measurements of the carapace, telson, segments of the metasoma and pedipalps are given in Table 1. Base color is pale yellowish brown to orange (Figs. 1–2). Chelicerae are yellow with weak reticulation (Fig. 3). *Sexual dimorphism* unknown, adult male with pedipalp chela length/ width ratio 4.07; the fingers of males are weakly undulate proximally without a gap with fingers closed.

**Pedipalp** (Figs. 7–17, 22–25). Pedipalp mostly very sparsely hirsute, but more densely so on ventral surface of movable finger. Femur dorsally granulated, with five granulose carinae. Patella smooth with seven granulose carinae developed, only median carina on external patella smooth. Chela smooth with traces of carinae visible; fingers long, curved; movable finger with 7 granule rows and short apical row of 4 denticles on dentate margins, the most proximal row with one external and no internal accessory granule; fixed finger with 8 granule rows. Fixed and movable fingers bearing pale, fluorescent setae of various lengths, as well as short, dark, non-fluorescent macrosetae of almost constant length with blunt tips.

**Carapace** (Figs. 3, 5). Slightly trapezoidal (narrower anteriorly) and slightly longer than wide; anterior margin concave, with some short microsetae. Carinae absent. Median and posterior lateral furrows wide and deep, others vestigial to absent. Tegument densely and coarsely granulose. Median eyes large and raised; four or five pairs of lateral eyes: three major ocelli aligned along each anterolateral corner, plus two minor ocelli that may be vestigial or absent.

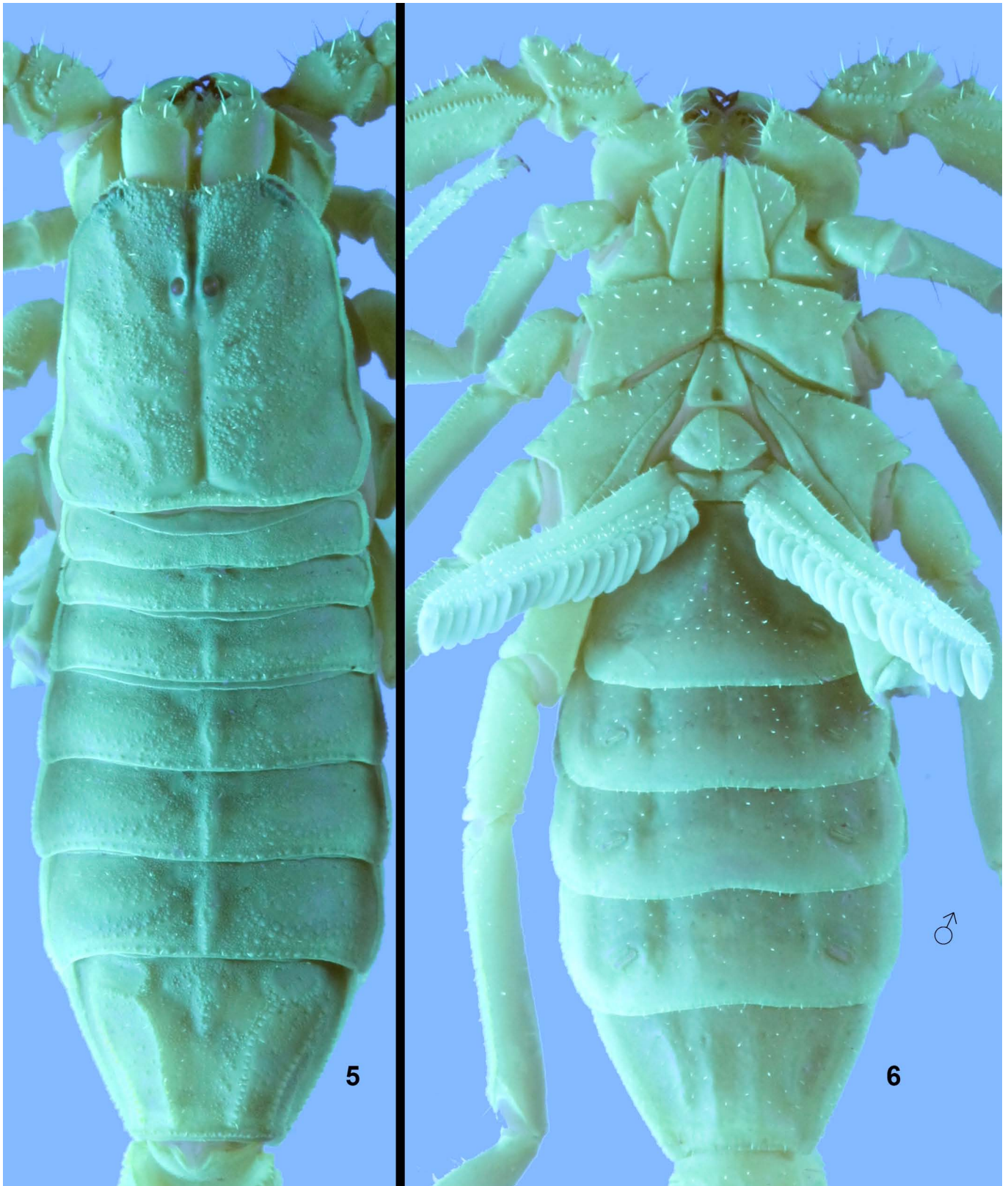
**Mesosoma** (Figs. 3–6). Tergites I–VI bear a single conspicuous median carina; tergite VII bears five well-defined carinae (median, submedians and laterals); median carina granulate, submedian and lateral carinae long and serrate to crenulate. All tergites densely and coarsely granulose, bearing small granules on anterior surfaces and larger granules mainly on posterior surfaces. Sternum type 1, triangular in shape; medial depression large. Pectines extending to around a third or a quarter of sternite IV in male. Pectinal tooth count 20 in males. Pectines with 3 marginal lamellae and 7–8 middle lamellae. Sternites III–VI lacking carinae, surfaces smooth and sparsely setose. Posterior margin of sternite V without smooth median patch, weakly concave. Sternite VII with four well-defined carinae, which are long and serrate to crenulate.



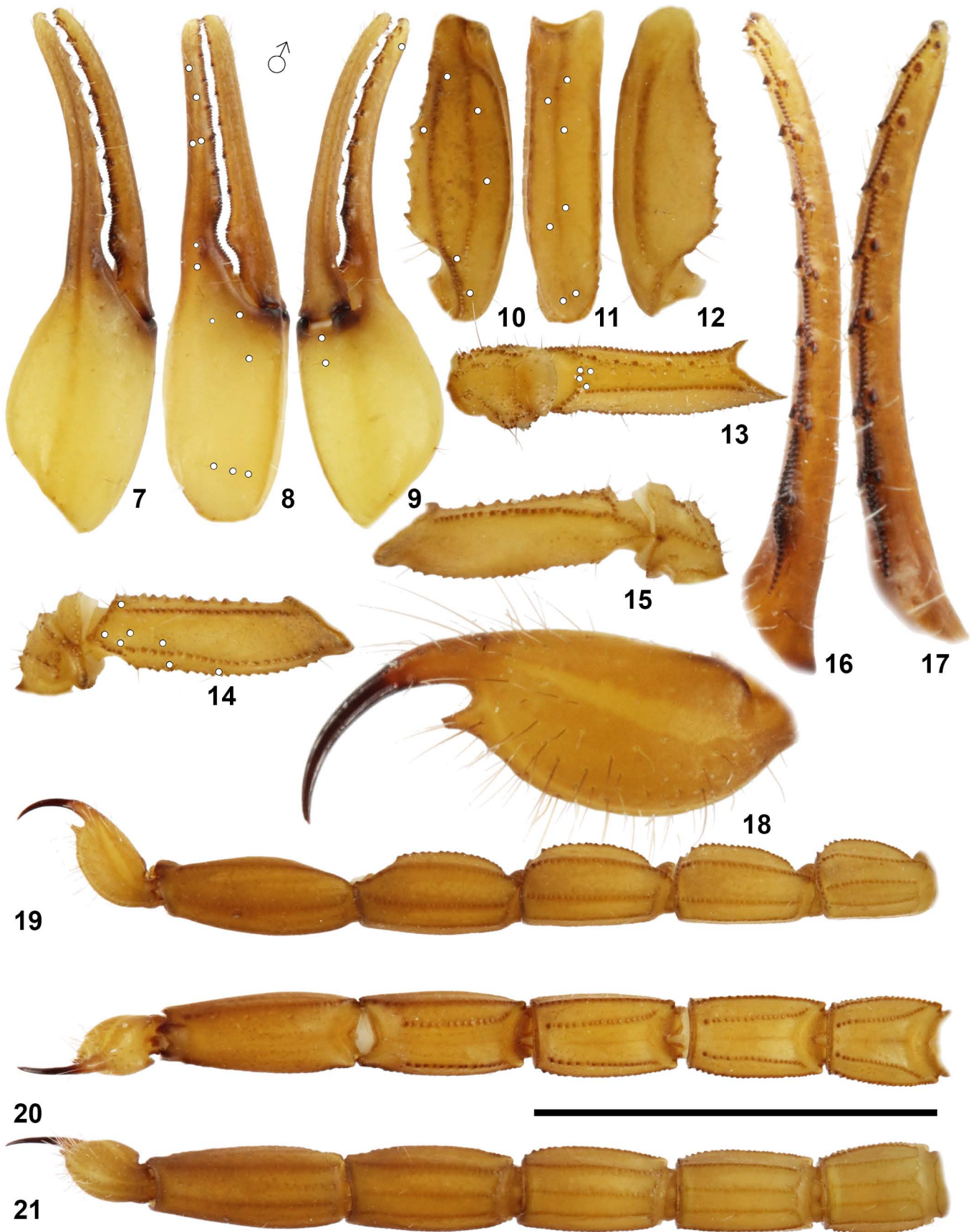


Figures 3–4. *Barbaracurus kabateki* sp. n., paratype male, carapace and tergites I–IV (3) and sternoplectinal region and sternites (4).



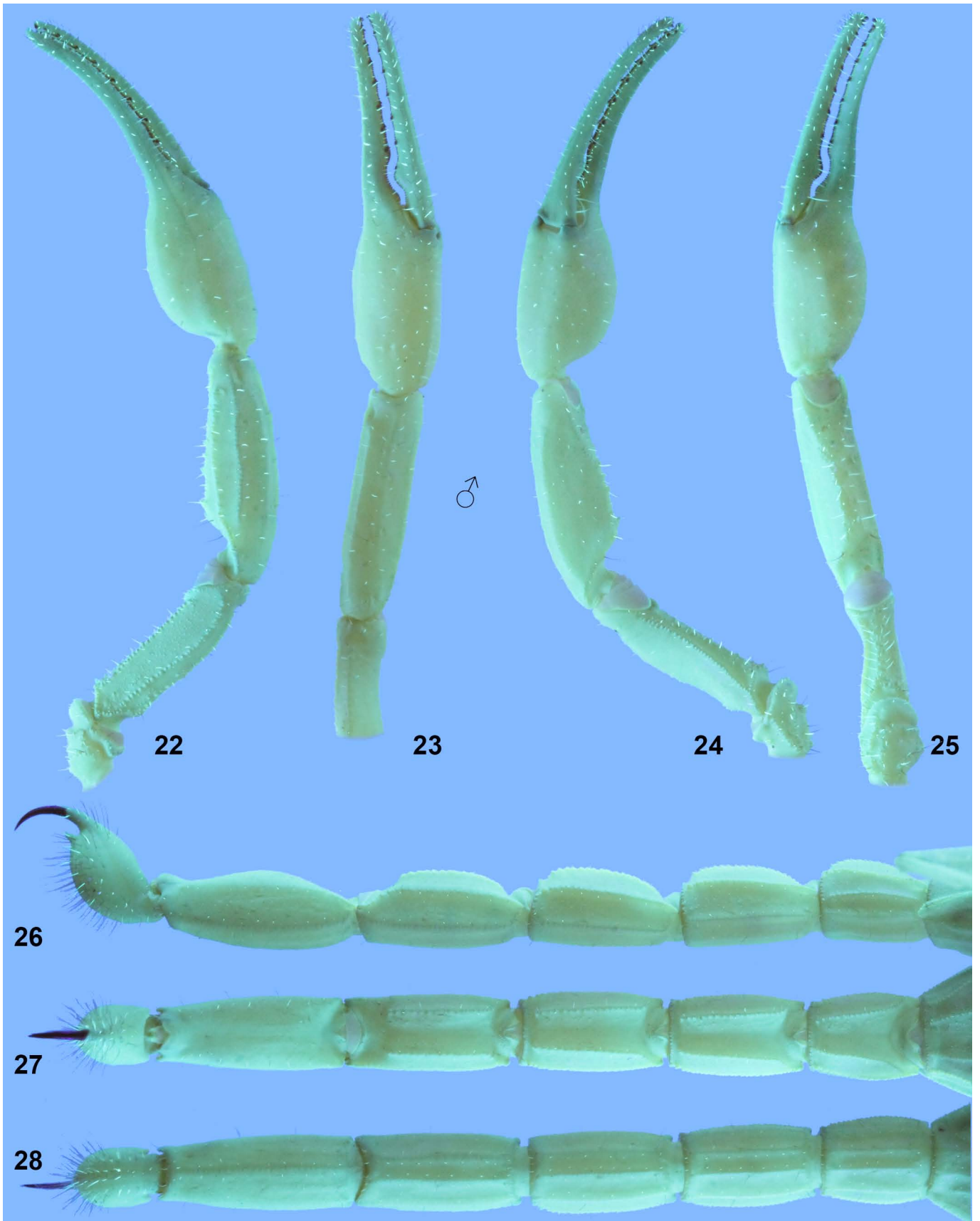


**Figures 5–6.** *Barbaracurus kabateki* sp. n., holotype male, carapace and tergites (5) and coxal region, sternoplectinal region and sternites (6) under UV fluorescence.



**Figures 7–21:** *Barbaracurus kabateki* sp. n., paratype male. **Figures 7–17.** Right pedipalp. Chela, dorsal (7), external (8) and ventrointernal (9) views; patella, dorsal (10), external (11), and ventral (12); femur and trochanter, internal (13), dorsal (14) and ventral (15) views. Chela, movable (16) and fixed (17) finger dentate margins. Trichobothrial pattern indicated in Figures 8–11, 13–14 (white circles). **Figures 18–21.** Telson lateral view (18), metasoma and telson, lateral (19), dorsal (20) and ventral (21) views. Scale bar: 10 mm (19–21).





**Figures 22–28:** *Barbaracurus kabateki* sp. n., holotype male. **Figures 22–25.** Right pedipalp in dorsal (22), external (23), ventral (24) and internal (25) views under UV fluorescence. **Figures 26–28.** Metasoma and telson in lateral (26), dorsal (27) and ventral (28) views under UV fluorescence.



Figures 29–32. *Barbaracurus kabateki* sp. n., paratype male, distal segments of left legs I–IV, ventral views.





**Figures 33–34:** Saudi Arabian localities of *Barbaracurus* species. **Figure 33.** Type locality of *Barbaracurus kabateki* sp. n. **Figure 34.** Locality of *Barbaracurus yemenensis*.



Dimensions (mm)		<i>B. kabateki</i> sp. n.	<i>B. yemenensis</i>	<i>B. yemenensis</i>	<i>B. yemenensis</i>
		♂ holotype	♂	♀	♀
Carapace	L / W	4.21 / 3.94	5.28 / 5.00	4.92 / 4.50	6.57 / 6.22
Mesosoma	L	8.24	12.65	12.06	17.60
Tergite VII	L / W	2.40 / 3.61	3.22 / 4.52	3.00 / 4.50	4.34 / 6.10
Metasoma + telson	L	22.19	28.52	25.07	33.20
Segment I	L / W / D	2.76 / 2.20 / 1.92	3.45 / 3.02 / 2.53	3.10 / 2.51 / 2.09	4.11 / 3.34 / 3.04
Segment II	L / W / D	3.29 / 2.00 / 1.82	4.21 / 2.78 / 2.54	3.77 / 2.27 / 2.04	5.02 / 3.02 / 2.98
Segment III	L / W / D	3.51 / 2.00 / 1.96	4.58 / 2.68 / 2.48	3.88 / 2.18 / 2.14	5.18 / 3.04 / 2.95
Segment IV	L / W / D	3.93 / 1.88 / 1.85	5.07 / 2.65 / 2.55	4.39 / 2.13 / 2.07	5.78 / 2.99 / 2.87
Segment V	L / W / D	4.83 / 1.78 / 1.90	6.31 / 2.52 / 2.54	5.30 / 2.03 / 2.04	7.29 / 2.96 / 3.07
Telson	L / W / D	3.87 / 1.33 / 1.64	4.90 / 1.84 / 1.96	4.63 / 1.70 / 1.73	5.82 / 2.34 / 2.34
Pedipalp	L	16.44	20.17	18.53	24.24
Femur	L / W	4.04 / 1.06	5.00 / 1.38	4.63 / 1.29	6.00 / 1.45
Patella	L / W	4.66 / 1.52	5.80 / 1.97	5.54 / 1.63	7.08 / 2.30
Chela	L	7.74	9.37	8.36	11.16
Manus	W / D	1.90 / 1.83	2.88 / 2.70	1.54 / 1.60	2.33 / 2.37
Movable finger	L	4.77	5.60	5.78	7.44
<b>Total</b>	<b>L</b>	<b>34.64</b>	<b>46.45</b>	<b>42.05</b>	<b>57.37</b>

**Table 1.** Comparative measurements of male holotype of *Barbaracurus kabateki* sp. n. and male and two females of *Barbaracurus yemenensis* from Saudi Arabia. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

**Hemispermatorphore** (Figs. 101–103). Flagelliform, trunk long and narrow, widening basally. Capsule region short, length measured from basal lobe is 10% of trunk length. Flagellum folded, pars recta thicker, 3.3 times length of capsule, pars reflecta tapering to thin filament 1.7 times length of pars recta. Sperm hemiduct with two elongated lobes, posterior lobe broad, spatulate, with distinct fold or carina extending along its length, anterior lobe narrower, tapered. Basal lobe obsolete, reduced to a broad, weak oblique ridge (Figs. 102–103).

**Legs** (Figs. 29–32). Tarsomeres bearing two rows of macrosetae on their ventral surface and numerous macrosetae on other surfaces; bristle combs absent. Femur bearing only solitary macrosetae. Femur surface coarsely granulose, femur and patella with carinae developed. Reduced tibial spurs present on leg IV.

**Metasoma and telson** (Figs. 19–21, 26–28). Metasomal segments I–IV with granulate, completely developed carinae, segment V with carinae indicated. Carinae composed of minute, rounded, equal-sized, evenly spaced granules. First metasomal segment with a total of 10 carinae, the second through fourth segments with eight carinae, and the fifth segment with five indicated carinae. All metasomal segments very sparsely granulated. Metasoma very sparsely hirsute. Telson smooth with a dense cover of long setae. Subaculear tubercle short and spiniform. Vesicle elongate, ellipsoidal, telson length/ depth ratio 2.91. Aculeus slender, curved, shorter than vesicle.

**COMMENTS ON LOCALITIES AND LIFE STRATEGY.** The type locality, 22SL is a rocky mountain area (Fig. 33). The types of *Barbaracurus kabateki* sp. n. were recorded at night during UV collecting together with *Compsobuthus manzonii* (Borelli, 1915) and *Nebo* sp. Two of the authors (F.K. and P.J.) visited the locality on 18–19 October 2022 and recorded a minimum nighttime temperature of 8 °C. The recorded humidity was between 20% and 50%.

*Barbaracurus yemenensis* Kovařík, Lowe & Štáhlavský, 2018

(Figures 34–100, 104–107, Table 2)

*Babycurus zambonellii* (in part, Yemen): Sissom, 1994: 5–6, figs. 1–7; Fet & Lowe, 2000: 80; Kovařík, 2000: 260–261, figs. 13, 26; Lowe, 2000: 185–191; Kovařík & Whitman, 2005: 106.

*Barbaracurus yemenensis* Kovařík et al., 2018b: 30–33, figs. 9, 78, 87, 103–106, 206–218, 245–247, 262, table 2; Kovařík et al., 2019: 9.

= *Babycurus borellii* Rossi, 2018(2019): 41 (syn. by Kovařík et al., 2019: 1).

**TYPE LOCALITY AND TYPE DEPOSITORY.** Yemen, Wadi Dawan NW Al Mukalla, 15°09'N 48°26'E, 946 m a. s. l.; FKCP.

**TYPE MATERIAL EXAMINED.** Yemen, Wadi Dawan NW Al Mukalla, 15°09'N 48°26'E, 946 m a. s. l., 3.IV.2007, 1♀

(holotype), leg. P. Kabátek, FKCP; Jabal Bura NEE Al Hudaydah, 14°53'N 43°26'E, 557 m a. s. l. (fig. 146 in Kovařík et al., 2018b: 19), 19.–21.III.2007, 1♀ (paratype), leg. P. Kabátek, FKCP; Hajjah gov., 2.–3. XI.2007, Halhal vill. env., NE Hajjah by road, 15°43'42"N 43°37'25"E, 998 m a. s. l., (Locality No. 14), 1juv. (paratype), leg. D. Král, FKCP.

SAUDI ARABIAN MATERIAL EXAMINED. **Saudi Arabia**, 10 km W of Faifa, 17°15'37"N 43°04'07"E, 652 m a. s. l. (Locality No. 22SF2, Fig. 34), 20.–22.X.2022, 3♂ (DNA Nos. 2419, 2420, 2421) 6♀2♂juvs., leg. F. Kovařík & P. Just, FKCP.

EMENDED DIAGNOSIS (♂♀). Total length of adults 36–47 mm (males) and 40–57 mm (females). Coloration pale yellow to light orange, chelicerae yellow without reticulation in females, with reticulation at least in anterior part in males. Pedipalp chela length/ width ratio 3.2–3.3 in males, 3.4–5.4 in females; pedipalp fingers of females straight; proximal margins of pedipalp fingers of male strongly undulate, leaving gap with fingers closed; dentate margin of movable finger armed with 7 rows of granules, and a short subapical row of 4 denticles; most proximal granule row with one external accessory granule. Pectines with 22–25 (males) and 19–23 (females) teeth. Hemispermatophore basal lobe a weak oblique carina. Metasoma very narrow, metasoma V length/ width ratio 2.30–2.61 in both sexes; metasoma I with 10 carinae, II–IV with 8 carinae. Telson setose, bearing numerous long macrosetae and a short, spiniform subaculear tubercle; vesicle smooth, ellipsoidal, slightly bulbous, telson length/ depth ratio 2.48–2.70; aculeus slender, curved, shorter than vesicle.

**Hemispermatophore** (Figs. 104–106). Flagelliform. Trunk long, narrow, widening basally. Capsule region short, length measured from basal lobe is 9 % of trunk length. Flagellum folded, pars recta thicker, 4 times length of capsule, pars reflecta tapering to thin filament about same length as pars recta. Sperm hemiduct with two elongated lobes, posterior lobe broad, spatulate, with distinct fold or carina extending along its length, anterior lobe narrower, distally tapered. Basal lobe a weak oblique carina (Figs. 105–106). Left and right hemispermatophores from two examined males had similar basal lobes. The terminally coiled flagellum in Fig. 104 was atypical, others were folded.

**Sensory setae** (Figs. 97–98). Pedipalp chela with at least six types of sensory setae (Figs. 97–97a): (i) trichobothria, with very long, non-fluorescent shafts and large diameter areolae; (ii) petite 'trichobothria', with very short, curved fluorescent shafts, and intermediate diameter areolae; (iii) long, pale setae with straight or distally curved fluorescent shafts, and small areolae (cf. Fig. 97a, right seta); (iv) short, pale setae with straight or curved fluorescent shafts, and very small areolae; (v) macrosetae with tips tapered to fine points, moderately long, almost straight non-fluorescent shafts, and small areolae; and (vi) macrosetae with blunt tips, shorter straight non-fluorescent shafts of almost constant length,

and small areolae (cf. Fig. 97a, left seta). The latter type of macrosetae is present on the fixed and movable fingers, and their blunt tips are ramified and bear several micropapillate processes. We also observed these specialized (type vi) blunt-tipped macrosetae on the pedipalp fingers of *B. exquisitus*, *B. feti*, *B. kabateki* sp. n., *B. sofomarensis*, *B. somalicus*, *B. subpunctatus*, *B. ugartei*, *B. winklerorum* and *B. zambonellii*. Their confirmed presence in 10/11 species of *Barbaracurus* suggests a potential synapomorphy for the genus.

Truncate macrosetae with diverse tip structures have been reported in a number of other buthids. San Martín (1968) first described short, truncate macrosetae with hollow shafts, some with coronate or micropapillate tips, on the pedipalps, sternites, metasoma and telson of *Microtityus rickyi*. Short, thick, truncate macrosetae were also found on the pedipalp chelae of *Tityopsis inexpectatus*, *Alayotityus delacruzii* and *Rhopalurus laticauda* (Armas, 1973, 1974; Cruz & Armas, 1980). Lamoral (1976) described short, apically perforated macrosetae, some with truncate or papillate tips, on the pedipalp segments (except chela fingers), carapace, legs, pectines, sternites and metasoma of *Akentrobuthus leleupi*. The presence of thick macrosetae with truncate or crown-shaped tips on the body and appendages is a diagnostic character for the genera *Chaneke* and *Tityopsis* (Kovařík et al., 2016; Teruel & Rodríguez-Cabrera, 2020). We have also observed short, truncate macrosetae on the pedipalp fingers of *Somalicharmus* and *Karasbergia*.

Telson vesicle and basal aculeus with at least three types of sensory setae (Fig. 98): (i) macrosetae with very long, non-fluorescent shafts and intermediate diameter areolae; (ii) long, pale setae with straight or curved fluorescent shafts, and small areolae; (iii) short, pale setae with straight or distally curved fluorescent shafts, and very small areolae. Some of the first type of setae were not as long and their tips were truncated. However, these truncated tips appeared flush without micropapillate structure, and the lengths of the setae were variable. We interpreted this as random breakage of longer setae, not evidence for other specialized types of macrosetae.

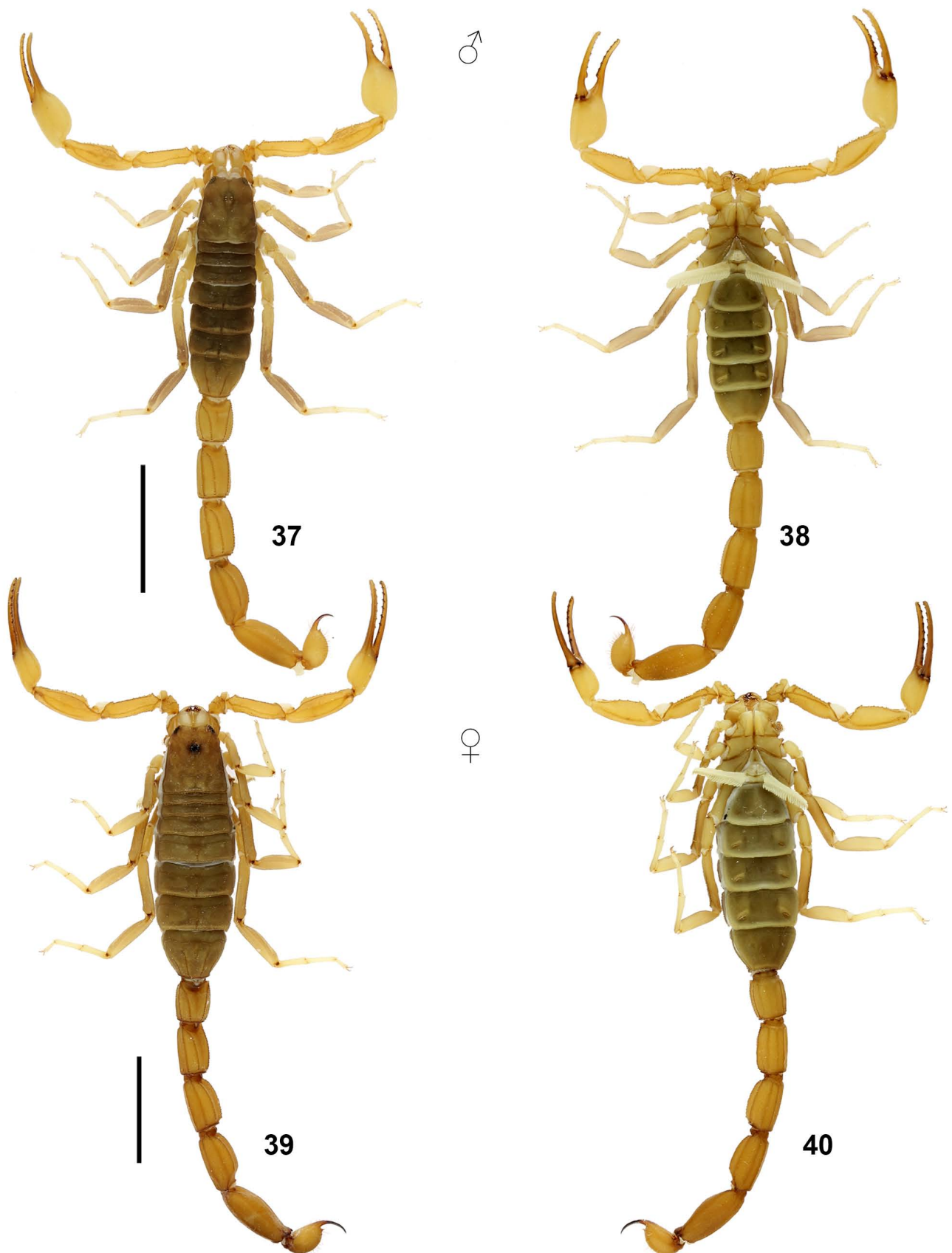
**Karyotype** (Figs. 99–100). We analyzed two males of *B. yemenensis* (specimens Nos. 2420–2421). The diploid number of this specimen was 26 chromosomes (Figs. 99–100). This chromosome number corresponds to the range of 2n known in the genus *Barbaracurus* (2n = 22–36) (Kovařík et al., 2015; 2018b). The same 2n = 26 was previously identified also in *B. zambonellii* from Eritrea (Kovařík et al., 2018b). However, there are differences in chromosome length between *B. zambonellii* and *B. yemenensis*. Only the first pair of the chromosomes is a slightly longer whereas all the following chromosomes gradually decrease in length in *B. yemenensis*. In contrast, the first two pairs of chromosomes are slightly longer than the following chromosomes in *B. zambonellii* (Kovařík et al., 2018b). Our results confirmed the existence of interspecific variability among *Barbaracurus* species and support the utility of cytogenetic characters in the taxonomy of this group.





Figures 35–36: *Barbaracurus yemenensis* from Saudi Arabia, in vivo habitus. Male (35) and female (36).





**Figures 37–40:** *Barbaracurus yemenensis* from Saudi Arabia. **Figures 37–38.** Male, dorsal (37) and ventral (38) views. **Figures 39–40.** Female, dorsal (39) and ventral (40) views. Scale bars: 10 mm (37–38), 10 mm (39–40).



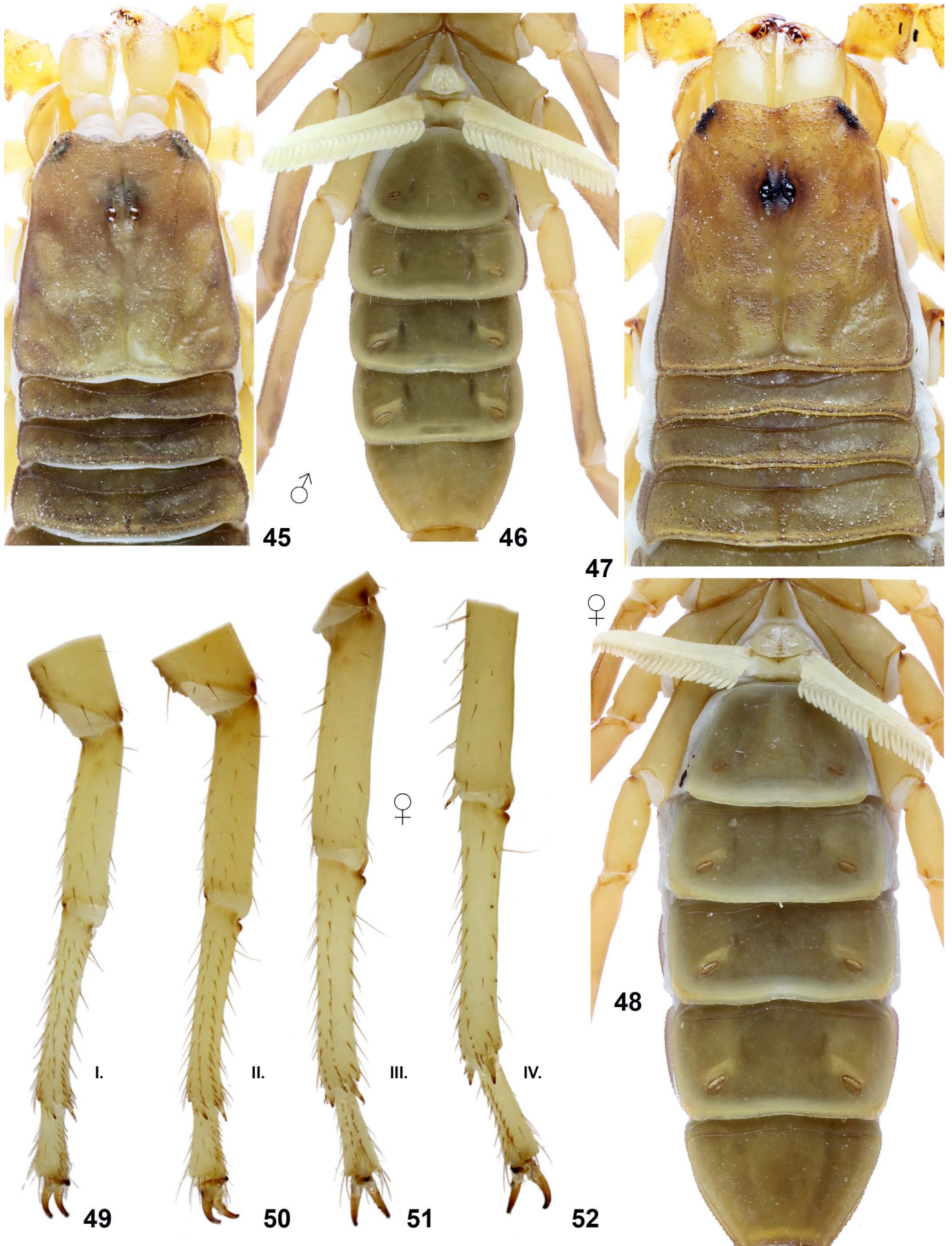
**Figures 41–42.** *Barbaracurus yemenensis*, male from Saudi Arabia, carapace and tergites (41) and coxal region, sternoplectinal region and sternites (42) under UV fluorescence.





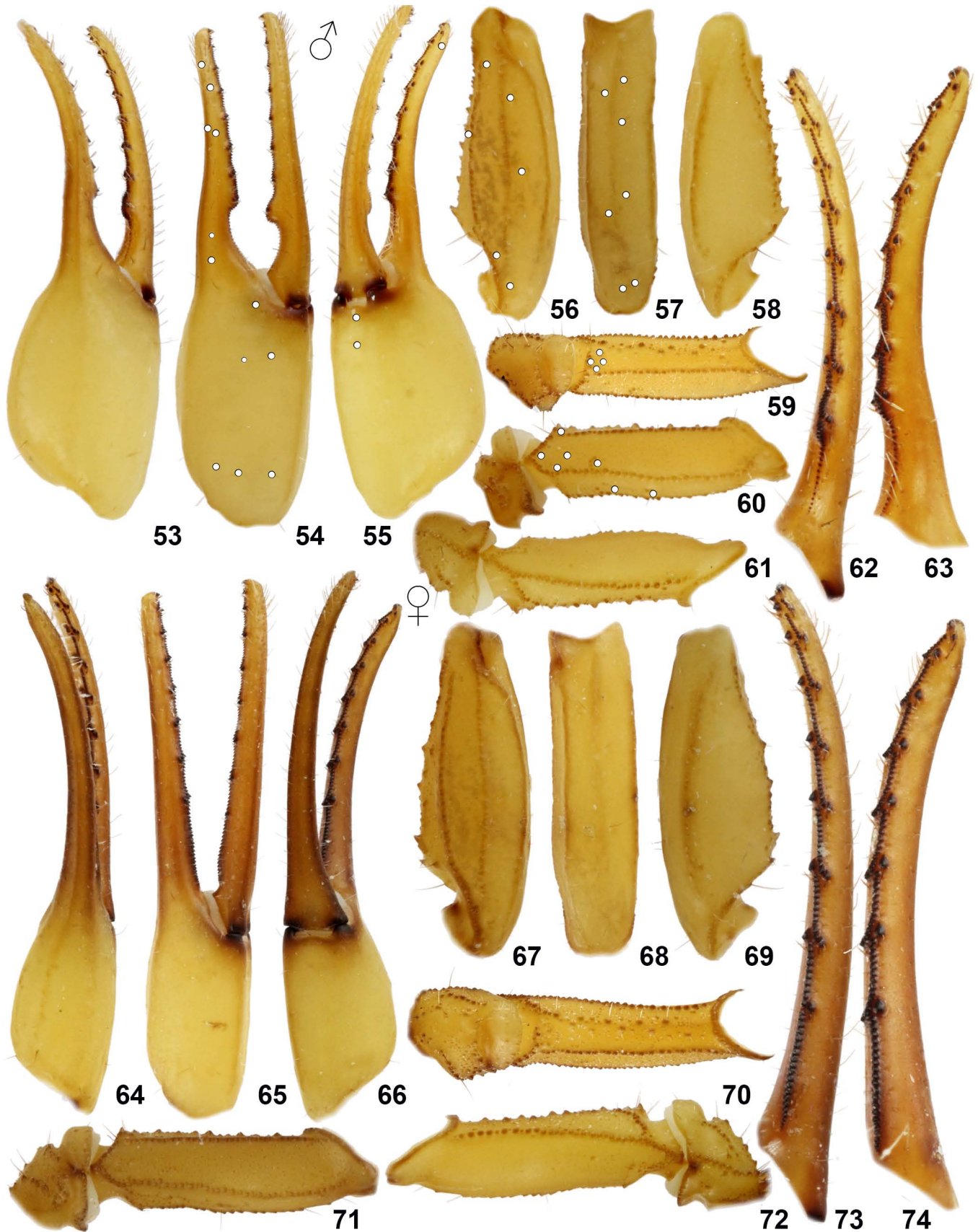
**Figures 43–44.** *Barbaracurus yemenensis*, female from Saudi Arabia, carapace and tergites (43) and coxal region, sternoplectinal region and sternites (44) under UV fluorescence.





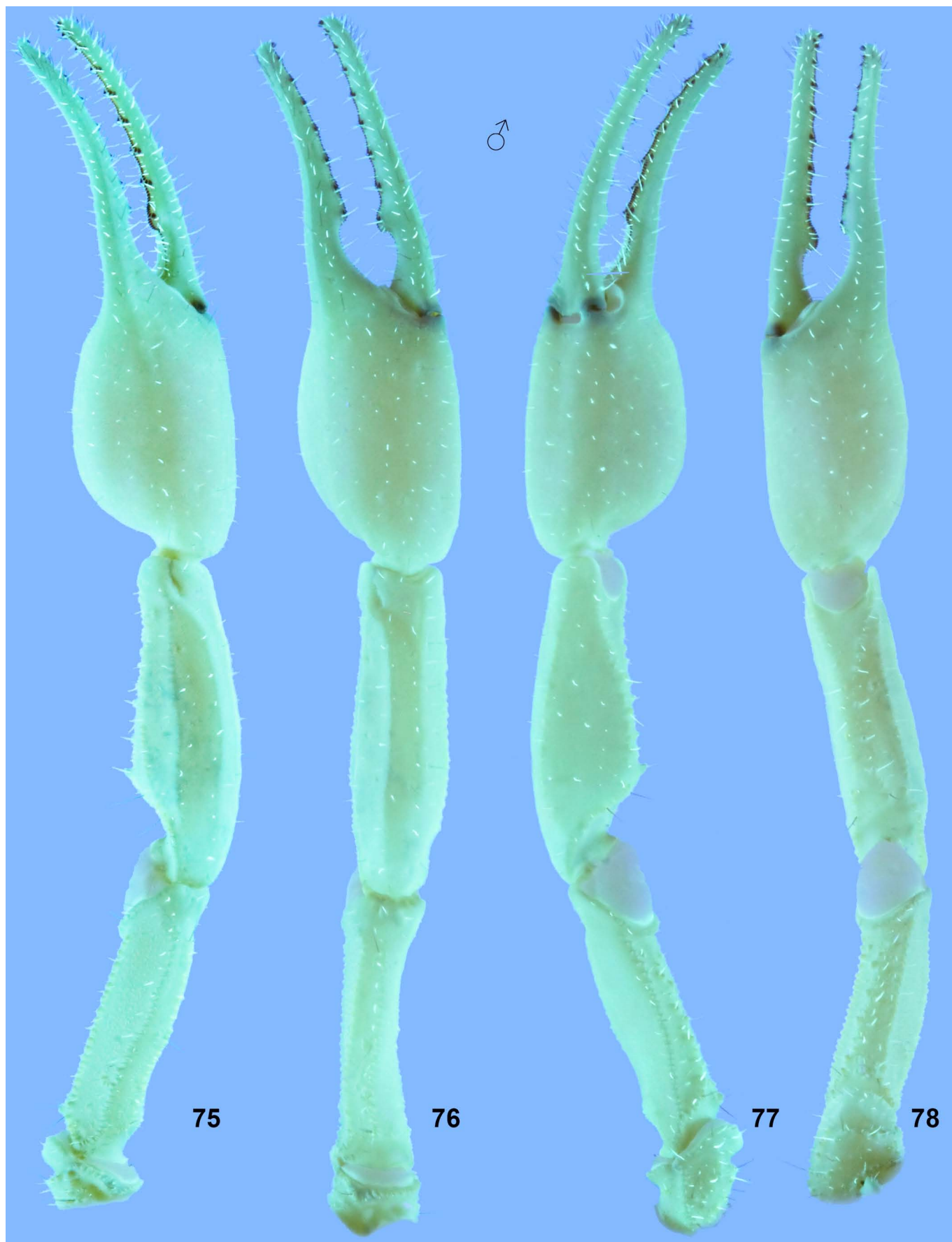
**Figures 45–52:** *Barbaracurus yemenensis* from Saudi Arabia. **Figures 45–46.** Male, carapace and tergites I–III (45) and sternopleural region and sternites (46). **Figures 47–52.** Female, carapace and tergites I–III (47), sternopleural region and sternites (48), distal segments of right legs I–IV, prolateral (49–50), ventral (51) and retrolateral (52) views.



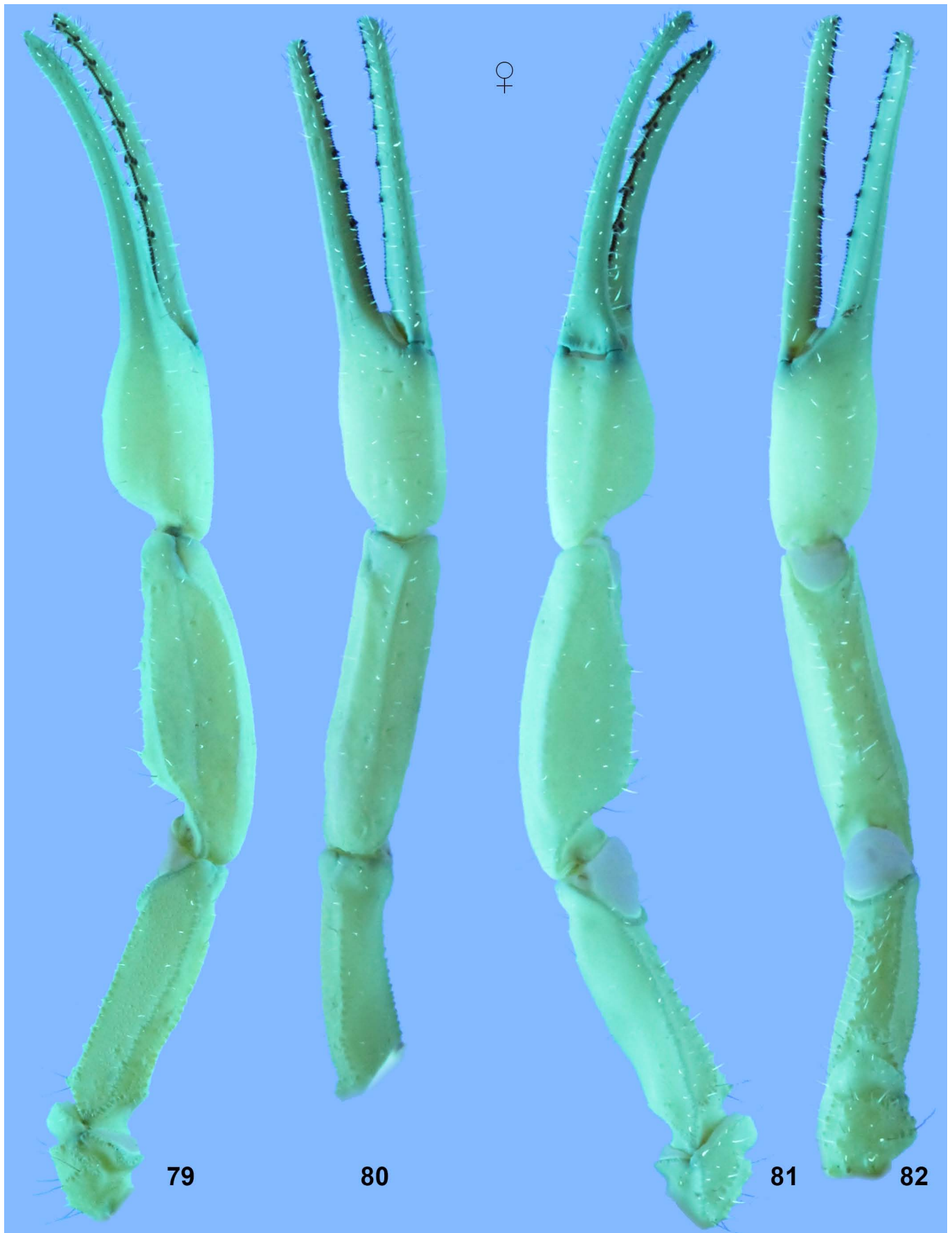


**Figures 53–74:** *Barbaracurus yemenensis* from Saudi Arabia. **Figures 53–63.** Male, right pedipalp. Chela, dorsal (53), external (54), and ventrointernal (55) views; patella, dorsal (56), external (57), and ventral (58) views; femur and trochanter, internal (59), dorsal (60) and ventral (61) views; chela, movable (62) and fixed (63) finger dentate margins. Trichobothrial pattern indicated in Figures 54–57, 59–60 (white circles). **Figures 64–74.** Female, right pedipalp. Chela, dorsal (64), external (65), and ventrointernal (66) views; patella, dorsal (67), external (68), and ventral (69) views; femur and trochanter, internal (70), dorsal (71) and ventral (72) views; chela, movable (73) and fixed (74) finger dentate margins.



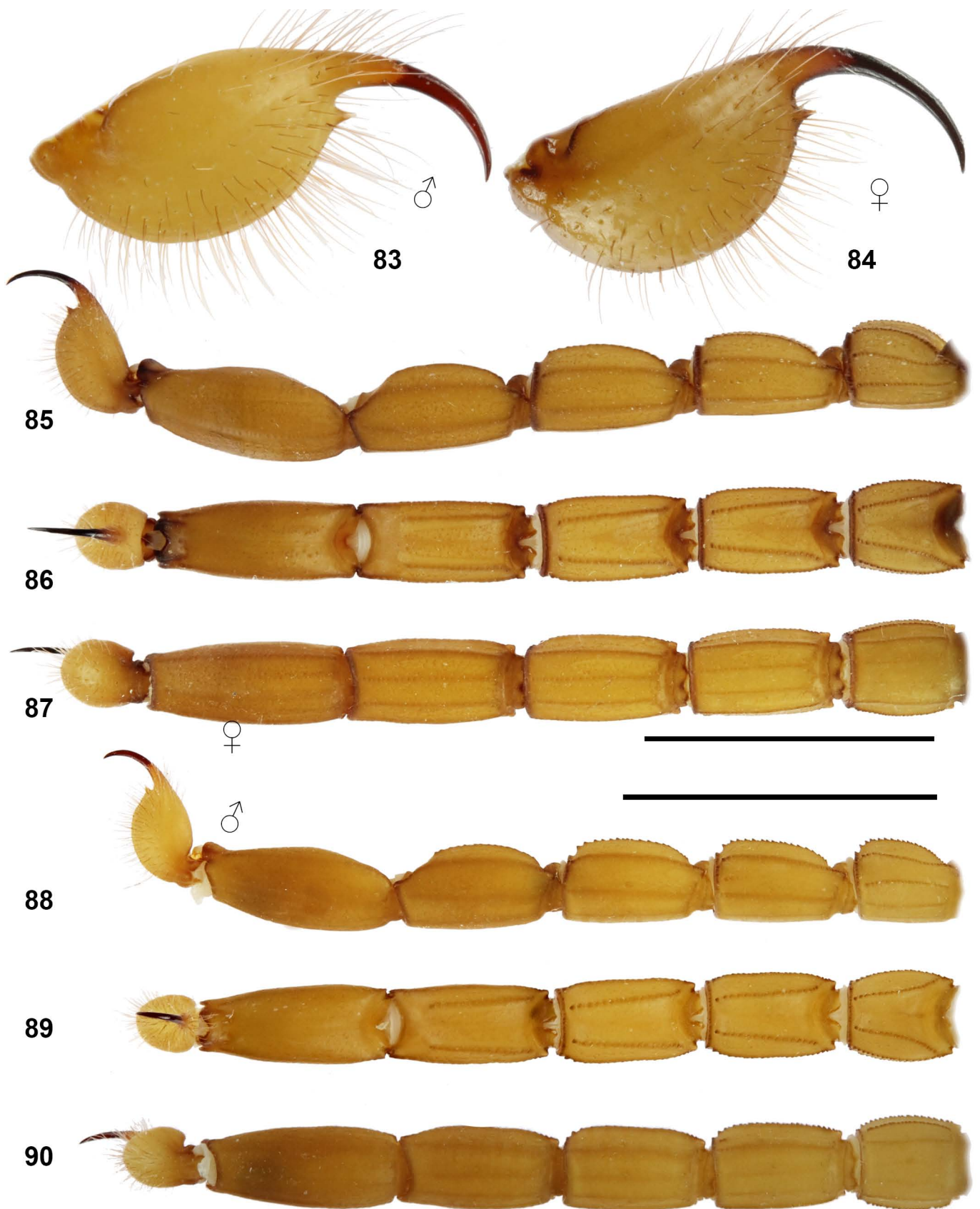


Figures 75–78. *Barbaracurus yemenensis*, male from Saudi Arabia, pedipalp in dorsal (75), external (76), ventral (77) and internal (78) views under UV fluorescence.

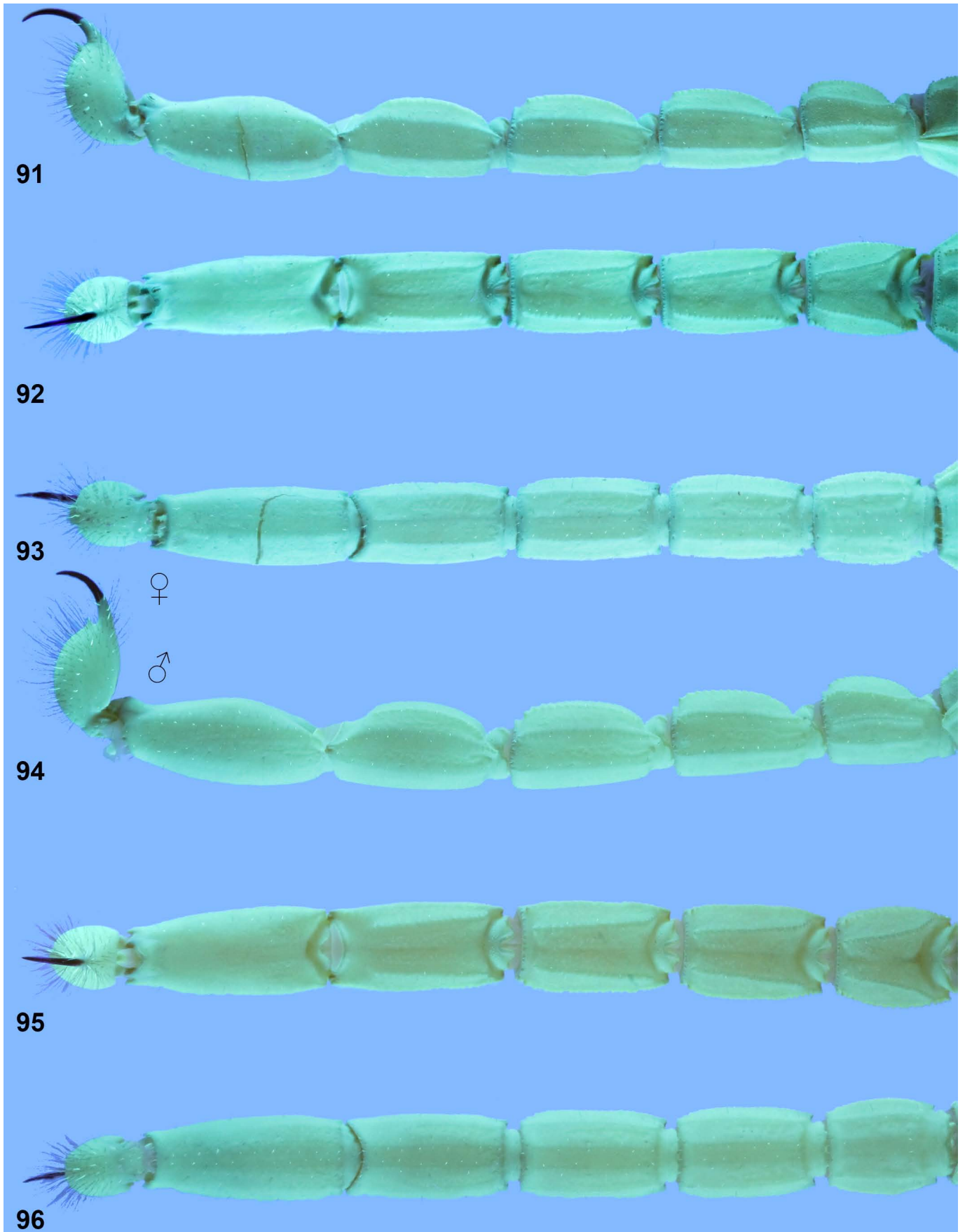


Figures 79–82. *Barbaracurus yemenensis*, female from Saudi Arabia, pedipalp in dorsal (79), external (80), ventral (81) and internal (82) views under UV fluorescence.



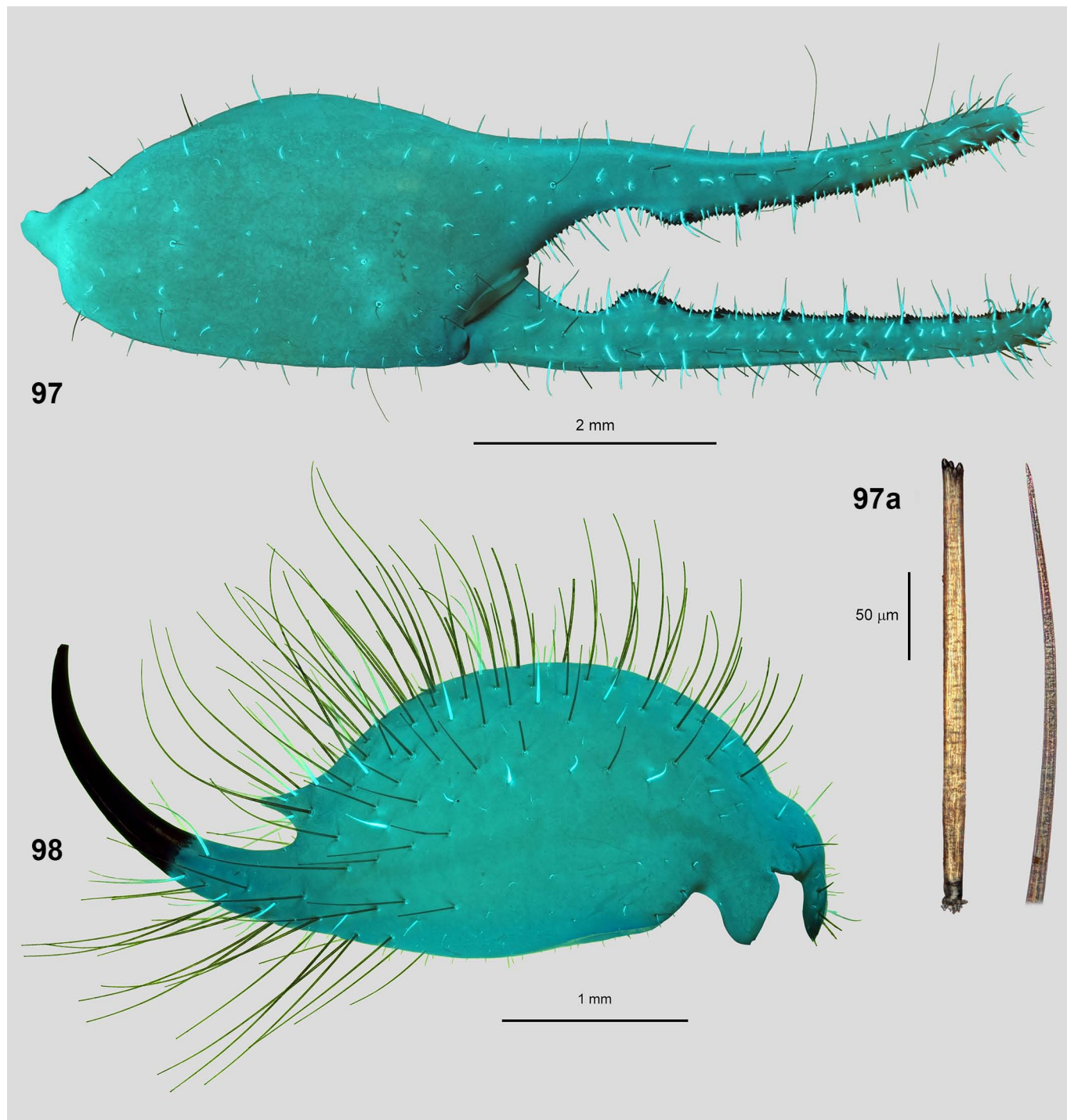


**Figures 83–90:** *Barbaracurus yemenensis* from Saudi Arabia. **Figures 83, 88–90.** Male, telson lateral (83), metasoma and telson, lateral (88), dorsal (89) and ventral (90) views. **Figures 84–87.** Female, telson lateral (84), metasoma and telson, lateral (85), dorsal (86) and ventral (87) views. Scale bars: 10 mm (85–87), 10 mm (88–90).



**Figures 91–96:** *Barbaracurus yemenensis* from Saudi Arabia. **Figures 91–93.** Female, metasoma and telson, lateral (91), dorsal (92) and ventral (93) views under UV fluorescence. **Figures 94–96.** Male, metasoma and telson, lateral (94), dorsal (95) and ventral (96) views under UV fluorescence.

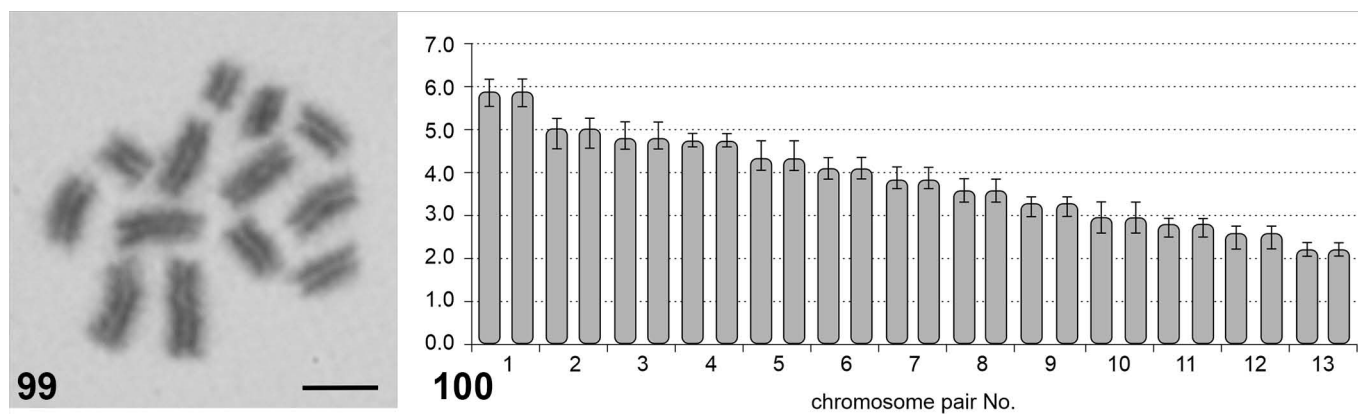




**Figures 97–98.** *Barbaracurus yemenensis*, male from Saudi Arabia (DNA No. 2419). Detail of setation of pedipalp chela and telson. **Figures 97–97a.** Setation of pedipalp chela. Right chela in lateral view under UV fluorescence (97), and two types of sensory setae from chela fixed finger (97a) under white transmitted light microscopy, differential interference contrast (left: a whole non-fluorescent macroseta with a blunt micropapillate tip; right: distal portion of fluorescent seta with tapered tip; both setae oriented distal end up). **Figure 98.** Setation of telson in lateral view under UV fluorescence. Scale bars: 2 mm (97), 50 µm (97a), 1 mm (98).

COMMENTS ON LOCALITIES AND LIFE STRATEGY. The locality, 22SF2 is a rocky mountain area (Fig. 34). The specimens of *Barbaracurus yemenensis* were recorded at night during UV collecting together with *Compsobuthus manzonii* (Borelli, 1915), *Hottentotta scaber* (Ehrenberg, 1828) and *Leiurus haenggii*

Lowe, Yağmur & Kovařík, 2014. Two of the authors (F.K. and P.J.) visited the locality on 20–22 October 2022 and recorded a maximum daytime temperature of 43 °C and a minimum nighttime temperature of 16 °C. The recorded humidity was between 20% (minimum at day) and 86% (maximum at night).



Figures 99–100. *Barbaracurus yemenensis*, male from Saudi Arabia. Postpachytene (99) and ideogram (100) (y axis - % of the chromosome length of the diploid set, lines indicate min.-max. values). Scale bar: 5  $\mu$ m (99).

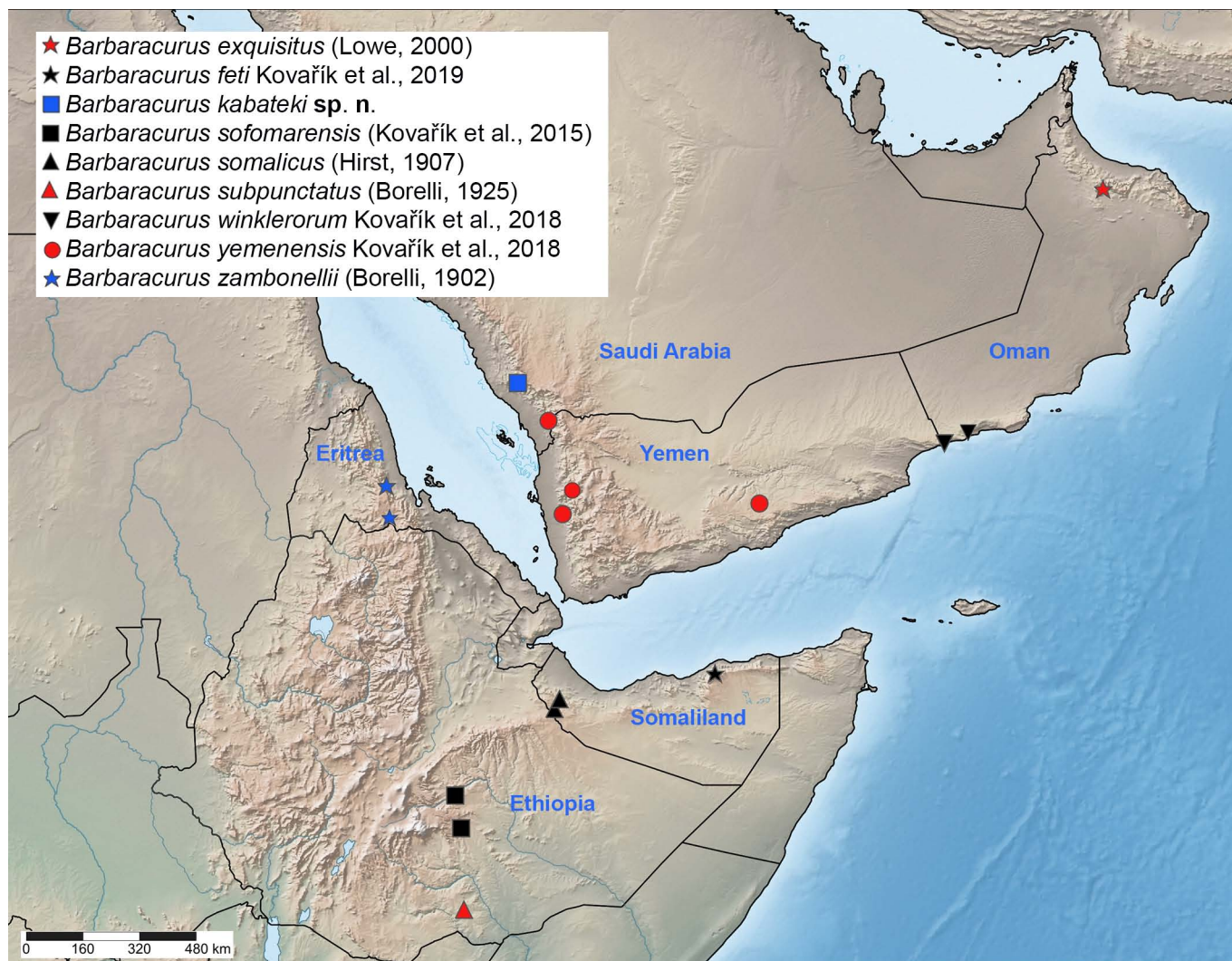
### Key to species of *Barbaracurus*

1. Pedipalp movable finger without an external accessory granule midway along most proximal granule row. .... 2
- Pedipalp movable finger with an external accessory granule midway along most proximal granule row. .... 3
2. Base color uniformly yellow or orange, without any darker markings; sternite VII with very weak carination. .... *B. prudenti* (Lourenço, 2013)
- Base color yellow with brown spots on carapace, dark stripes on tergites, dark pedipalp patella and metasoma V; sternite VII with 4 well developed carinae. .... *B. ugartei* (Kovařík, 2000)
3. Pedipalp movable finger with 6 rows of granules. .... 4
- Pedipalp movable finger with 7 rows of granules. .... 7
4. Pedipalp chela with narrower manus, chela length/ width ratio 4.3–5.6, finger margins weakly undulate at base, not leaving gap when closed (figs. 81, 84, 86 in Kovařík et al., 2015) ..... 5
- Pedipalp chela with broader manus, chela length/ width ratio 3.4–4.2, finger margins strongly undulate at base, leaving wide gap when closed. .... 6
5. Total length 22.5 mm in male, 32.1–32.25 mm in females; pectines with 16–17 teeth in both sexes; distributed in Ethiopia and Somalia ..... *B. subpunctatus* (Borelli, 1925)
- Total length 31.25 mm in male, 38.80 mm in female; pectines with 25–27 teeth in both sexes; distributed in Somaliland ..... *B. feti* Kovařík et al., 2019
6. Telson vesicle pyriform in lateral profile, deeper anteriorly (figs. 83–84 in Kovařík et al., 2018b); telson length/ depth ratio 2.75–2.89; pedipalp movable finger of female very weakly undulate at base; hemispermatophore basal lobe a weak carina (figs. 27, 35 in Kovařík et al., 2018b) ..... *B. somalicus* (Hirst, 1907)
- Telson vesicle symmetric in lateral profile (figs. 76–77 in Kovařík et al., 2015); telson length/ depth ratio 2.60–2.73; pedipalp movable finger of female moderately undulate at base; hemispermatophore basal lobe a well developed scoop-like lamina (figs. 26, 34 in Kovařík et al., 2018b) ... *B. sofomarensis* (Kovařík et al., 2015)
7. Pedipalp chela with broader manus (Figs 53–55, and figs. 58, 60 in Kovařík et al., 2018b), chela length/ width ratio 4.28–5.43 (♀), 3.2–3.42 (♂); proximal margins of pedipalp fingers of male strongly undulate, leaving gap with fingers closed (Fig. 54, and fig. 59 in Kovařík et al., 2018b) ..... 8
- Pedipalp chela with narrower manus (Figs. 7–9, figs. 62, 64, 66, 68, 210, 212 in Kovařík et al., 2018b), chela length/ width ratio 4.07–6.12 (♀, ♂); proximal margins of pedipalp fingers of male weakly undulate, not leaving gap with fingers closed (Fig. 8, and figs. 62–67 in Kovařík et al., 2018b). .... 9
8. Pectines with 17–19 teeth (♀, ♂); telson more bulbous, length/ depth ratio 2.27–2.37 (♀, ♂); distributed in Africa (Eritrea). .... *B. zambonellii* (Borelli, 1902)
- Pectines with 22–25 (♂) 19–23 (♀) teeth; telson less bulbous, length/ depth ratio 2.48–2.70 (♀, ♂); distributed in Arabian Peninsula. .... *B. yemenensis* Kovařík et al., 2018
9. Metasoma V length/ width ratio 2.71 (♂); pedipalp chela length/ width ratio 4.07 (♂); hemispermatophore basal lobe obsolete, reduced to a weak ridge (Figs. 102–103); found in Saudi Arabia. .... *B. kabateki* sp. n.
- Metasoma V length/ width ratio 2.40–2.47 (♂); pedipalp chela length/ width ratio 4.24–4.70 (♂); hemispermatophore basal lobe a well developed scoop-like lamina (figs. 24–25, 32–33 in Kovařík et al., 2018b); found in Oman. – Telson less slender (figs. 85–87 in Kovařík et al., 2018b), length/ depth ratio 2.70–2.72 (♂, ♀); not found in northern Oman. .... *B. winklerorum* Kovařík et al., 2018





**Figures 101–106.** Hemispermatophores of *Barbaracurus* species from Saudi Arabia. **Figures 101–103.** *B. kabateki* sp. n., holotype male (DNA No. 2430) left hemispermatophore trunk, capsule and flagellum (101); left capsule in convex view with lobes compressed (102); and left capsule in anterior view (103). **Figures 104–106.** *B. yemenensis* (DNA No. 2419), left hemispermatophore foot, trunk, capsule and flagellum (104); left capsule in convex view with lobes compressed (105); and right capsule in anterior view (106) mirror image shown for comparison to Figure 103. Scale bars: 1 mm (101), 200  $\mu\text{m}$  (102–103), 1 mm (104), 200  $\mu\text{m}$  (105–106).



**Figure 107.** Map showing confirmed distribution of *Barbaracurus* spp. except for *B. ugartei* (Kovařík, 2000) from Nigeria and *B. prudenti* (Lourenço, 2013) from Cameroon.

## References

- ARMAS L. F. DE. 1973. Escorpiones del Archipiélago Cubano. I. Nuevo género y nuevas especies de Buthidae (Arachnida: Scorpionidae). *Poeyana*, 114: 1–28.
- ARMAS, L. F. DE. 1974. Escorpiones del Archipiélago Cubano. III. Género *Tityus* C.L. Koch 1836 (Scorpionidae: Buthidae). *Poeyana*, 135: 1–15.
- CRUZ, J. DE LA & L. F. DE ARMAS. 1980. Macroquetas digitales en Buthidae (Arachnida: Scorpionida). *Poeyana*, 199: 1–10.
- FET, V. & G. LOWE. 2000. Family Buthidae C. L. Koch, 1837. Pp. 54–286 in Fet, V., W. D. Sissom, G. Lowe & M. E. Braunwalder. *Catalog of the Scorpions of the World (1758–1998)*. New York: The New York Entomological Society, 689 pp.
- KOVAŘÍK, F. 2000. Revision of *Babycurus* with descriptions of three new species (Scorpiones: Buthidae). *Acta Societatis Zoologicae Bohemicae*, 64: 235–265.
- 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., G. LOWE, P. JUST, A. I. AWALE, H. SH A. ELMI & F. ŠTÁHLAVSKÝ. 2018a. Scorpions of the Horn of Africa (Arachnida: Scorpiones). Part XV. Review of the genus *Gint* Kovařík et al., 2013, with description of three new species from Somaliland (Scorpiones, Buthidae). *Euscorpius*, 259: 1–41.
- KOVAŘÍK, F., G. LOWE, M. SEITER, J. PLÍŠKOVÁ & F. ŠTÁHLAVSKÝ. 2015. Scorpions of Ethiopia (Arachnida: Scorpiones), Part II. Genus *Babycurus* Karsch, 1886 (Buthidae), with description of two new species. *Euscorpius*, 196: 1–31.



- KOVAŘÍK, F., G. LOWE & F. ŠTÁHLAVSKÝ. 2018b. Review of the genus *Babycurus* Karsch, 1886 (Arachnida, Scorpiones, Buthidae), with description of *Barbaracurus* gen. n. and two new species from Oman and Yemen. *Euscorpius*, 267: 1–41.
- KOVAŘÍK, F., G. LOWE, F. ŠTÁHLAVSKÝ & A. A. HURRE. 2019. Scorpions of the Horn of Africa (Arachnida, Scorpiones). Part XX. *Barbaracurus feti* sp. n. from Somaliland (Buthidae). *Euscorpius*, 280: 1–11.
- 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., F. ŠTÁHLAVSKÝ, T. KOŘÍNKOVÁ, J. KRÁL & T. VAN DER ENDE. 2009. *Tityus ythieri* Lourenço, 2007 is a synonym of *Tityus magnimanus* Pocock, 1897 (Scorpiones: Buthidae): a combined approach using morphology, hybridization experiments, chromosomes, and mitochondrial DNA. *Euscorpius*, 77: 1–12.
- KOVAŘÍK, F., R. TERUEL & G. LOWE. 2016. Two new scorpions of the genus *Chaneke* Francke, Teruel et Santibáñez-López, 2014 (Scorpiones: Buthidae) from southern Mexico. *Euscorpius*, 218: 1–20.
- KOVAŘÍK, F. & S. WHITMAN. 2005. Cataloghi del Museo di Storia Naturale dell'Università di Firenze – sezione di zoologia «La Specola» XXII. Arachnida Scorpiones. Tipi. Addenda (1998–2004) e checklist della collezione (Euscorpiinae esclusi). *Atti della Società Toscana di Scienze Naturali, Memorie*, serie B, 111 (2004): 103–119.
- KRAEPELIN, K. 1913. Neue Beiträge zur Systematik der Gliederspinnen. III. A. Bemerkungen zur Skorpionenfauna Indiens. B. Die Skorpione, Pedipalpen und Solifugen Deutsch-Ostafrikas. *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten*, 30: 123–196.
- LAMORAL, B. H. 1976. *Akentrobuthus leleupi*, a new genus and species of humicolous scorpion from eastern Zaïre, representing a new subfamily of the Buthidae. *Annals of the Natal Museum*, 22(3): 681–691.
- LOWE, G. 2000. A new species of *Babycurus* (Scorpiones: Buthidae) from northern Oman. *Entomological News*, 111: 185–192.
- ROSSI, A., 2019. On two poorly known scorpions from Yemen: *Compsobuthus manzonii* (Borelli, 1915) and *Babycurus borellii* sp. n. (Scorpiones: Buthidae). *Arachnida – Rivista Aracnologica Italiana*, 2018, 16: 35–44 (dated February 2018 but published/accessible in March 2019).
- SAN MARTÍN, P. R. 1968. Estudio preliminar sobre una nueva quetotaxia en escorpiones (*Microtityus rickyi* - Buthidae). Morfología y acción mecánica. *Caribbean Journal of Science*, 8(3–4): 173–180.
- SISSOM, W. D. 1990. Systematics, biogeography and paleontology. Pp. 64–160 in POLIS, G. A. (Ed.) *The Biology of Scorpions*. Stanford, California: Stanford University Press.
- SISSOM, W. D. 1994. Descriptions of new and poorly known scorpions of Yemen (Scorpiones: Buthidae, Diplocentridae, Scorpionidae). *Fauna of Saudi Arabia*, 14: 3–39.
- 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. & T. M. RODRÍGUEZ-CABRERA. 2020. Revision of the genus *Tityopsis* Armas, 1974 (Scorpiones: Buthidae). Part 1. General updates and description of four new species. *Euscorpius*, 304: 1–40.
- VACHON, M. 1963. De l'utilité, en systématique, d'une nomenclature des dents de chélicères chez les scorpions. *Bulletin du Muséum National d'Histoire Naturelle, Paris*, (2), 35 (2): 161–166.
- 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.
- VACHON, M. 1975. Sur l'utilisation de la trichobothriotaxie du bras des pedipalps des Scorpions (Arachnides) dans le classement des genres de famille des Buthidae Simon. *Compte rendus hebdomadaires des séances de l'Académie des Sciences, Paris Série D Sciences Naturelles*, 281 (21): 1597–1599.