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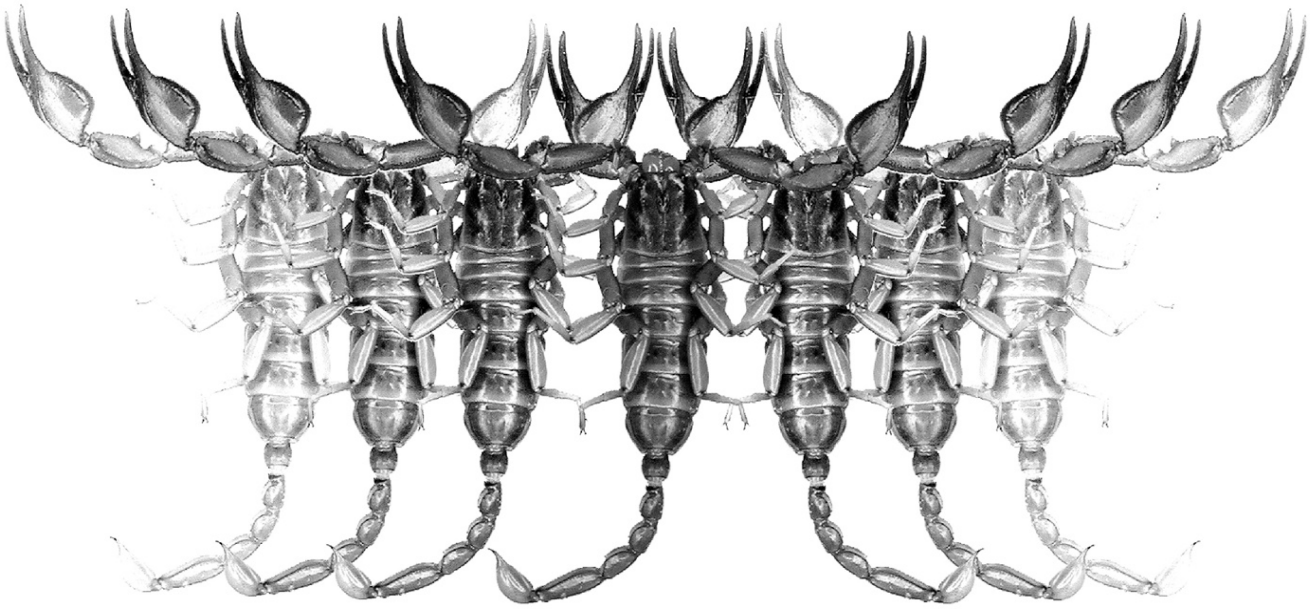

Scorpions of the Horn of Africa (Arachnida, Scorpiones). Part XX. *Barbaracurus feti* sp. n. from Somaliland (Buthidae)

František Kovařík, Graeme Lowe, František Šťáhlavský & Ali Abdi Hurre

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Scorpions of the Horn of Africa (Arachnida, Scorpiones). Part XX. *Barbaracurus feti* sp. n. from Somaliland (Buthidae)

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Summary

Barbaracurus feti **sp. n.** from Somaliland is described and compared with other species of the genus. Additional information is provided on the taxonomy and distribution of the genus *Barbaracurus*, fully complemented with color photos of specimens of both sexes of the new species, as well as of their habitat. In addition to morphology and hemispermatophores, we also describe the karyotypes of *B. feti* **sp. n.** (2n=23). Included is a key for *Barbaracurus*. *Babycurus borellii* Rossi, 2019 is synonymized with *Barbaracurus yemenensis* Kovařík et al., 2018 **syn. n.** as a junior synonym because the description dated in February 2018 was in reality published/accessible in March 2019.

Introduction

The genus *Barbaracurus* Kovařík, Lowe et Šťáhlavský, 2018 with type species *Babycurus sofomarensis* Kovařík et al., 2015, was recently defined and compared with the genus *Babycurus* Karsch, 1886 by Kovařík et al., 2018. Subsequent research in Somaliland led to the discovery of another new species from that country, described herein.

Methods, Material & Abbreviations

Nomenclature and measurements follow Stahnke (1971), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974) and hemispermatophore morphology (Kovařík et al., 2018).

Karyotype analyses were based on chromosome preparations prepared by the spreading technique which is frequently used in scorpions (e. g. Kovařík et al., 2009; Plíšková et al., 2016). The chromosomes were stained by 5% Giemsa solution in Sörensen phosphate buffer for 20 min. Five spermatocyte nuclei were measured using the software Image J 1.45r (http://rsbweb.nih.gov/ij) with the plugin Levan (Sakamoto & Zacaro, 2009).

Depositories: FKCP (František Kovařík, private collection, Prague, Czech Republic), GLPC (Graeme Lowe, private collection, Philadelphia, USA).

Systematics

Family Buthidae C. L. Koch, 1837

Barbaracurus Kovařík, Lowe et Šťáhlavský, 2018

(Figs. 1–46, 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 Šťáhlavský, 2018: 4–41, figs. 1–10, 24–28, 32–36, 50–251, 258–262, tabs. 1–2.

Type species. *Babycurus sofomarensis* Kovařík, Lowe, Seiter, Plíšková et Šťáhlavský, 2015.

Diagnosis (after Kovařík et al., 2018). Small to medium buthids, adults 22–47 mm. Carapace granular, lacking distinct carinae, flat, subrectangular with concave anterior margin. Median eyes on low ocular tubercle in anterior half of carapace; usually with 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 running 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, II–IV with 8 carinae, lacking lateral median carina. Metasoma V convex, sometimes dilated, carinae present or obsolete. Telson ellipsoidal, pyriform or slightly bulbous, with distinct subaculear tooth. Pectines with fulcra. Hemispermatophore capsule with 2-lobed sperm hemiduct and an oblique carinate or scoop-like basal lobe. Chelicerae with

Dimensions (MM)		*Barbaracurus feti* sp. n. ♂ holotype	*Barbaracurus feti* sp. n. ♀ paratype
Carapace	L / W	3.688 / 3.375	4.505 / 4.118
Mesosoma	L	7.602	10.624
Tergite VII	L / W	2.151 / 3.366	2.983 / 4.245
Metasoma + telson	L	19.959	23.666
Segment I	L / W / D	2.467 / 2.014 / 1.808	2.979 / 2.405 / 2.179
Segment II	L / W / D	2.945 / 1.919 / 1.720	3.555 / 2.188 / 1.974
Segment III	L / W / D	3.137 / 1.886 / 1.738	3.743 / 2.125 / 1.989
Segment IV	L / W / D	3.548 / 1.846 / 1.742	4.396 / 2.011 / 1.965
Segment V	L / W / D	4.392 / 1.741 / 1.677	5.098 / 1.913 / 1.930
Telson	L / W / D	3.470 / 0.947 / 1.069	3.895 / 1.102 / 1.200
Pedipalp	L	14.347	17.092
Femur	L / W	3.565 / 1.001	4.282 / 1.172
Patella	L / W	4.232 / 1.358	5.107 / 1.645
Chela	L	6.550	7.703
Manus	W / D	1.497 / 1.280	1.388 / 1.271
Movable finger	L	4.349	5.358
Total	**L**	**31.249**	**38.795**

Table 1. Comparative measurements of adults of *Barbaracurus feti* **sp**. **n**. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

typical buthid dentition, fixed finger armed with two denticles on ventral surface. Pedipalps orthobothriotaxic, type Aβ, femur trichobothrium d_2 internal, patella d_3 external to dorsomedian carina, chela *db* in distal half of fixed finger. Chela manus smooth, with carinae reduced or obsolete, dentate margins of chela movable finger armed with 6–7 non-imbricated, almost linear or contiguous rows of denticulate granules, each row terminated proximally by an enlarged granule flanked by adjacent single internal and external accessory granules. Most proximal granule row without internal accessory denticle, and either with (species from Horn of Africa and Arabian Peninsula) or without (species from Cameroon and Nigeria) a single isolated external accessory granule midway along its length. Pedipalp chelae sexually dimorphic, males typically with manus dilated and fingers proximally undulate on dentate margins, denticles of proximal granule rows bicuspid. Tibial spurs absent on leg III, present on leg IV, tibia and tarsus III–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*** **sp**. **n**. (Somaliland), ***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 = *Babycurus borellii* Rossi, 2019 **syn**. **n**. (Yemen), ***B***. ***zambonellii*** (Borelli, 1902) (Eritrea).

Barbaracurus feti sp. n.

(Figs. 1–46, Table 1)

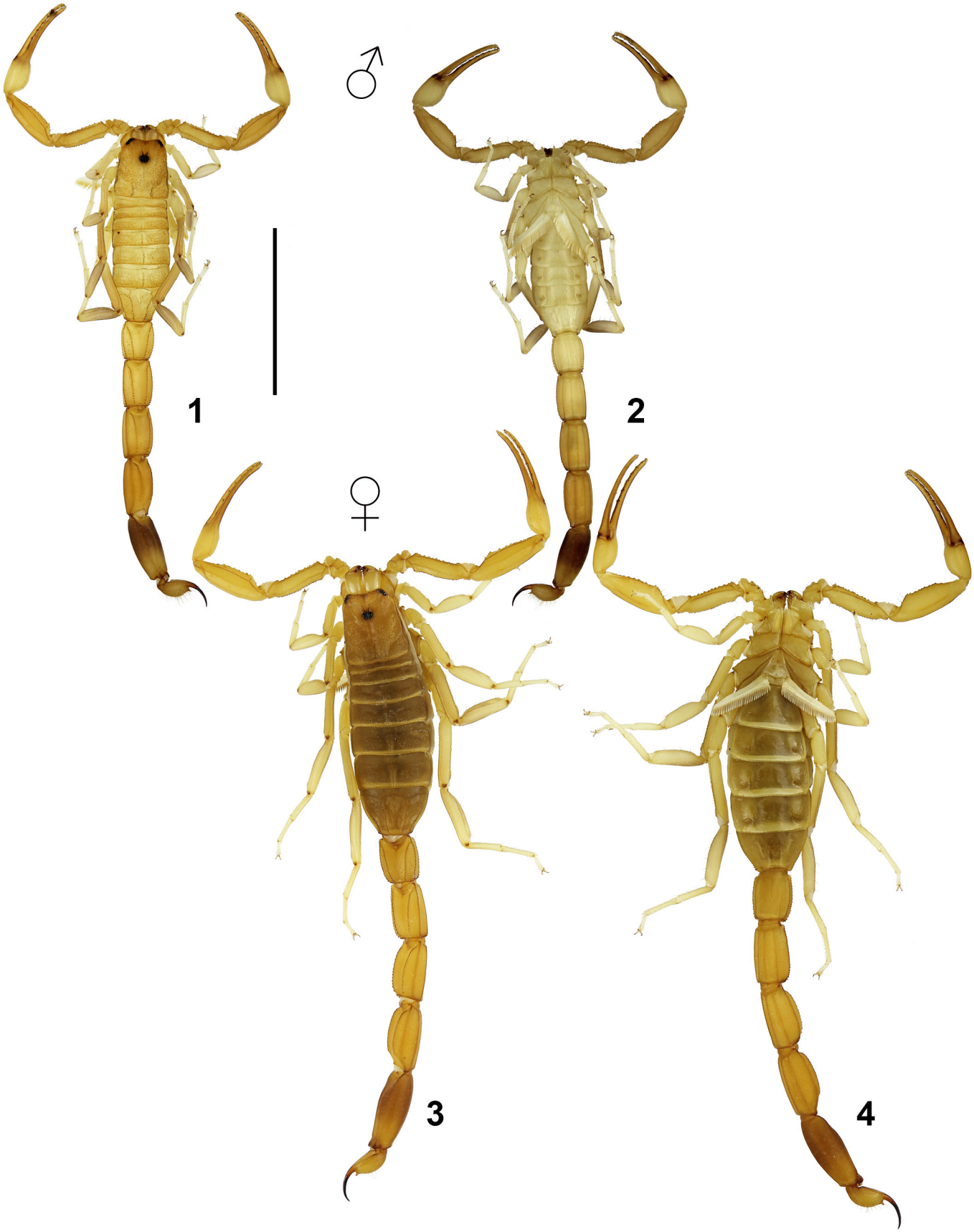
http://zoobank.org/urn:lsid:zoobank.org:act:46E7CEF1-B844-480D-9EFA-BA3A14E4A8D0

Type locality and type depository. Somaliland, Rugay village, between Erigavo and Maid, 10°50’46”N 47°18’23”E, 428 m a.s.l.; FKCP.

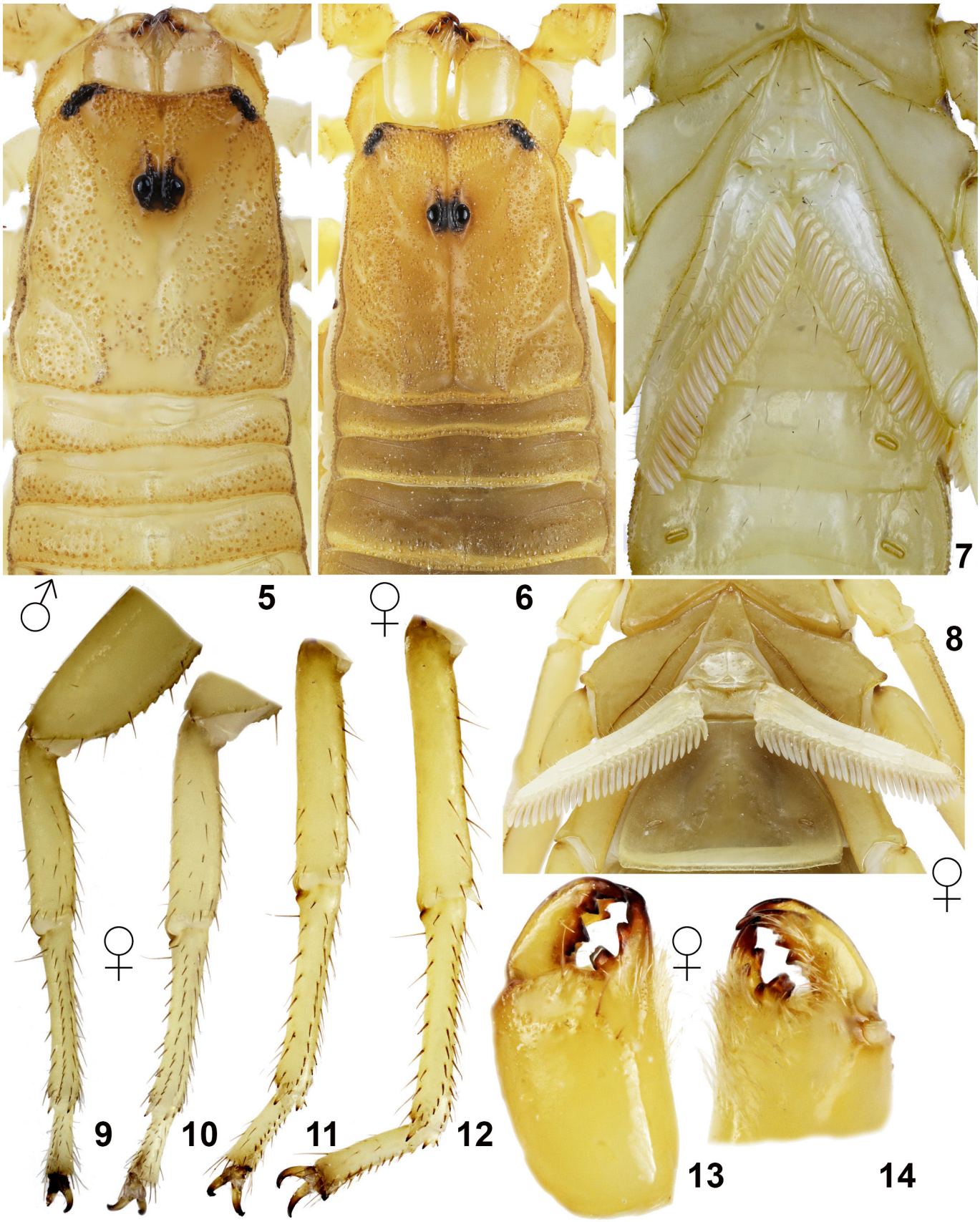
Type material examined. **Somaliland**, Rugay village, between Erigavo and Maid, 10°50‘46“N 47°18‘23“E, 428 m a.s.l. (Locality No. **18SE**), 24.VIII.2018,1♂ (holotype No. 1528) 1♀1juv. (paratypes), leg. F. Kovařík, FKCP, GLPC.

Etymology. The specific epithet honors Victor Fet (Marshall University, USA) for his friendship and lifelong dedication to scorpions.

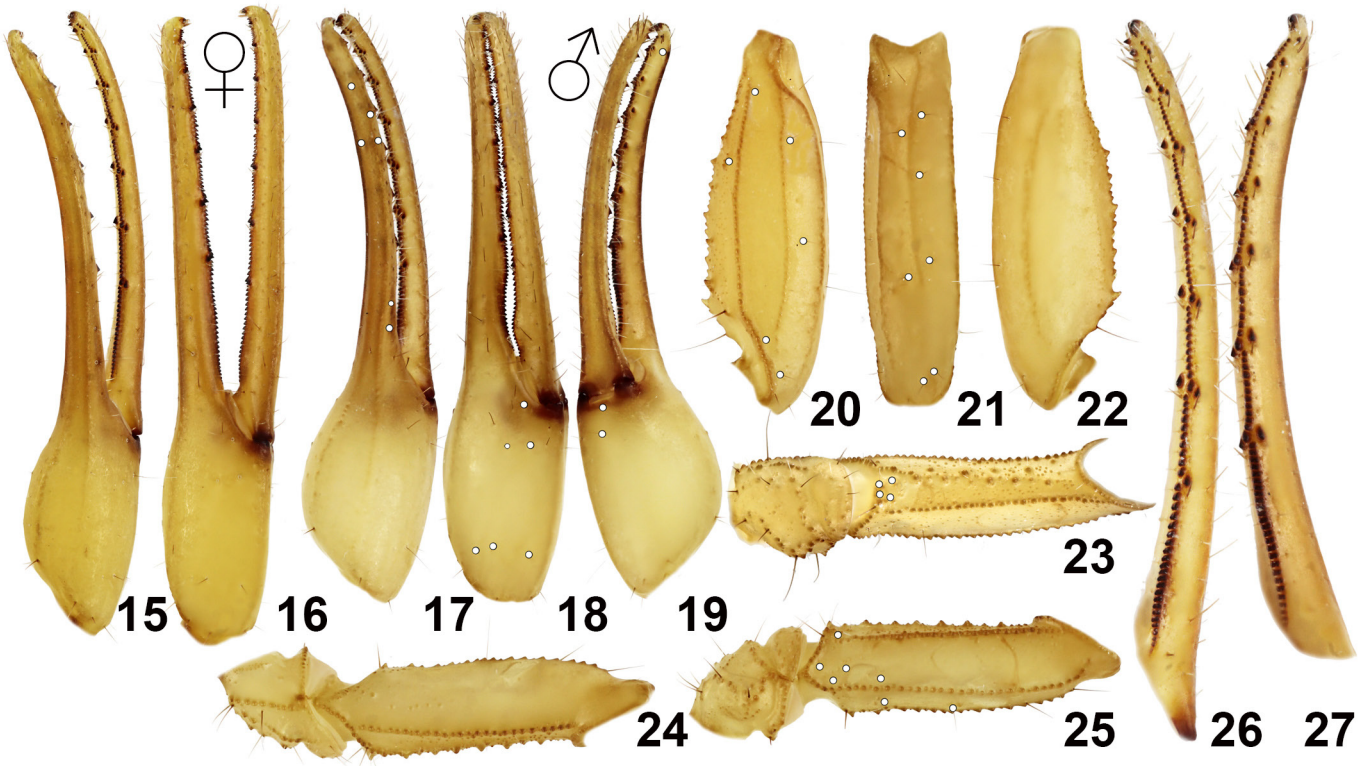
Diagnosis. Total length of adult male 31.25 mm, adult female 38.80 mm. Coloration pale yellow to light orange, chelicerae yellow without reticulation. Pedipalp chela manus wider in male than female, chela length/width ratio 4.38 in male and 5.55 in female; proximal margins of pedipalp fingers of female straight, of male weakly undulate with very small gap with fingers closed (Fig. 18); dentate margin of movable finger armed with 6 rows of granules, and a short apical row of 3 denticles (Fig. 26); most proximal granule row with one external accessory granule. Pectines with 25–27 teeth in both



Figures 1–4: *Barbaracurus feti* **sp. n. Figures 1–2**. Holotype male, dorsal (1) and ventral (2) views. **Figures 3–4**. Paratype female, dorsal (3) and ventral (4) views. Scale bar: 10 mm.



Figures 5–14: *Barbaracurus feti* **sp. n. Figures 5**, **7**. Holotype male, carapace and tergites I–III (5) and sternopectinal region and sternites III–V (7). **Figures 6**, **8**, **9–14**. Paratype female, carapace and tergites I–III (6), sternopectinal region and sternite III (8), distal segments of right legs I–IV, retrolateral views (9–12), left chelicera, dorsal (13) and ventral (14) views.



Figures 15–27: *Barbaracurus feti* **sp. n. Figures 15–16**. Paratype female. Pedipalp chela, dorsal (15), and external (16) views. **Figures 17–27**. Holotype male. Pedipalp chela, dorsal (17), external (18), and ventrointernal (19) views. Pedipalp patella, dorsal (20), external (21), and ventral (22) views. Pedipalp femur and trochanter, internal (23), ventral (24) and dorsal (25) views. Pedipalp chela, movable (26) and fixed (27) fingers dentate margin. The trichobothrial pattern is indicated in Figures 16–21, 23, and 25 (white circles).

sexes. Hemispermatophore basal lobe a short oblique lamina, length ca. half of basal width of posterior lobe. Metasoma narrow, metasoma V length/width ratio 2.52 in male and 2.66 in female; metasoma I with 10 carinae, II–IV with 8 carinae. Telson setose, bearing numerous long macrosetae and short, pointed subaculear tubercle; vesicle smooth, elongate, ellipsoidal or weakly pyriform in lateral profile, telson length/depth ratio 3.24 in both sexes; aculeus slender, curved, shorter than vesicle.

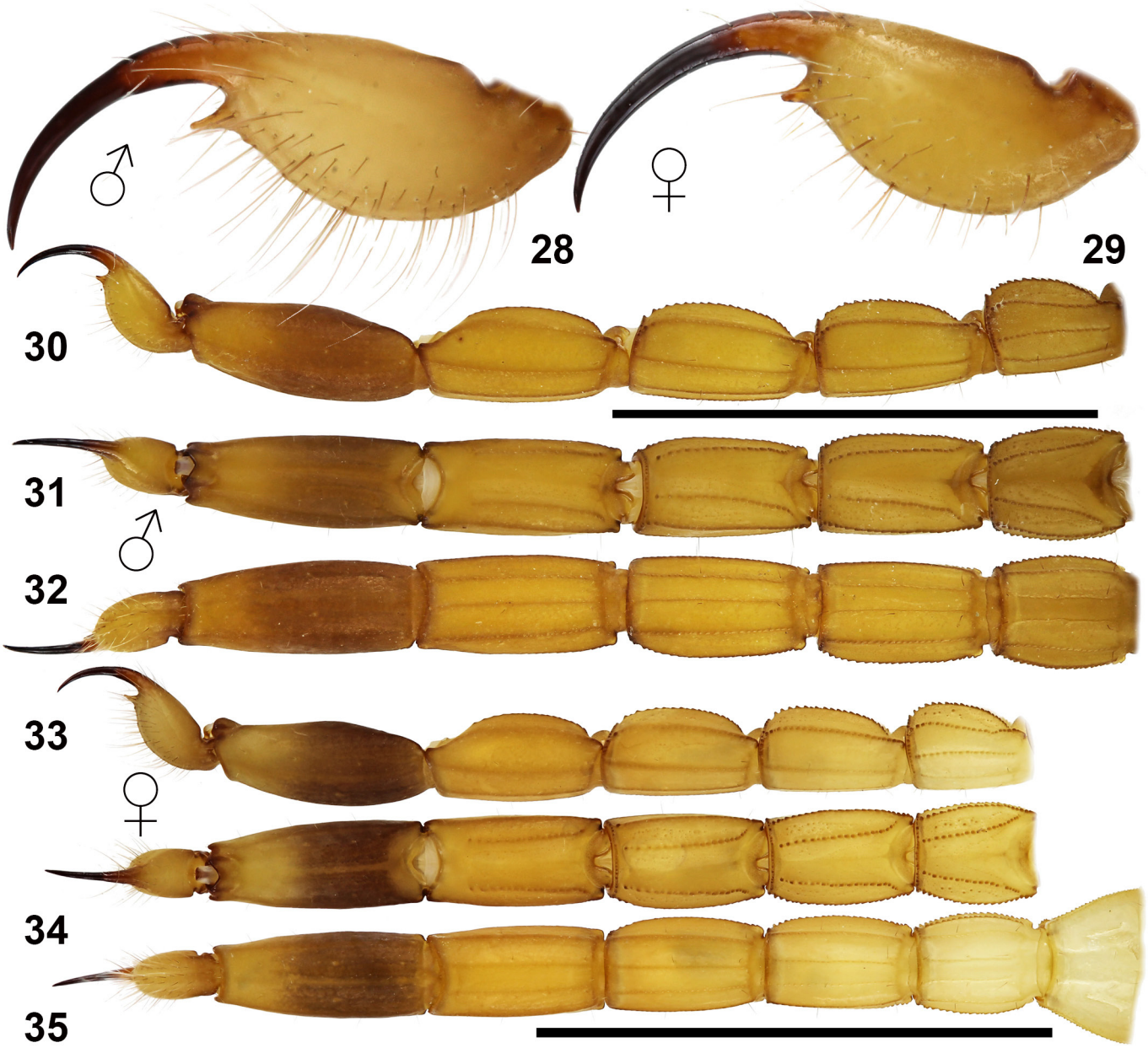
Description. Total length of adults 31.25 (male) – 38.80 mm (female). Measurements of the carapace, telson, segments of the metasoma and pedipalps are given in Table 1. Base color is pale yellow to light orange (Figs. 1–4), metasoma V is dark. Chelicerae are yellow without reticulation (Figs. 13–14). *Sexual dimorphism* minor, adult male with wider pedipalp chela than female, pedipalp chela length/width ratio 4.38 in male and 5.55 in female; pedipalps fingers are shorter in males, the fingers of females are straight, while those of males are weakly undulate proximally; no sexual difference in length and width of metasomal segments.

Pedipalp (Figs. 15–27). Pedipalp mostly very sparsely hirsute, but more densely so on ventral surface of movable finger. Femur granulated, with five granulose carinae. Patella almost smooth with seven granulose carinae developed. Chela smooth with traces of carinae visible; fingers long, curved; movable finger with 6 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 7 granule rows.

Carapace (Figs. 5–6). Slightly trapezoidal (narrower anteriorly) and slightly longer than wide; anterior margin concave, with some short microsetae. Carination 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. 1–4, 5–8). Tergites I–VI bear a single conspicuous median carina; tergite VII bears five well-defined carinae (median, submedians and laterals), which are long and serrate to crenulate. All tergites densely and coarsely granulose mainly on posterior parts. Sternum type 1, triangular in shape; medial depression large. Pectines extending to around a quarter of sternite V in male and a quarter of sternite IV in female. Tooth count 25–26 in male and juvenile, and 27 in female. Pectines with 3 marginal lamellae and 8–9 middle lamellae. Sternites lacking carinae, surfaces smooth and sparsely setose. Posterior margin of sternite V without smooth median patch in both sexes. Sternite VII with four well-defined carinae, which are long and serrate to crenulate.

Hemispermatophore (Figs. 38–42). Flagelliform. Trunk long, narrow, gradually widening basally. Capsule short, its length measured from basal lobe only 11% of trunk length. Flagellum

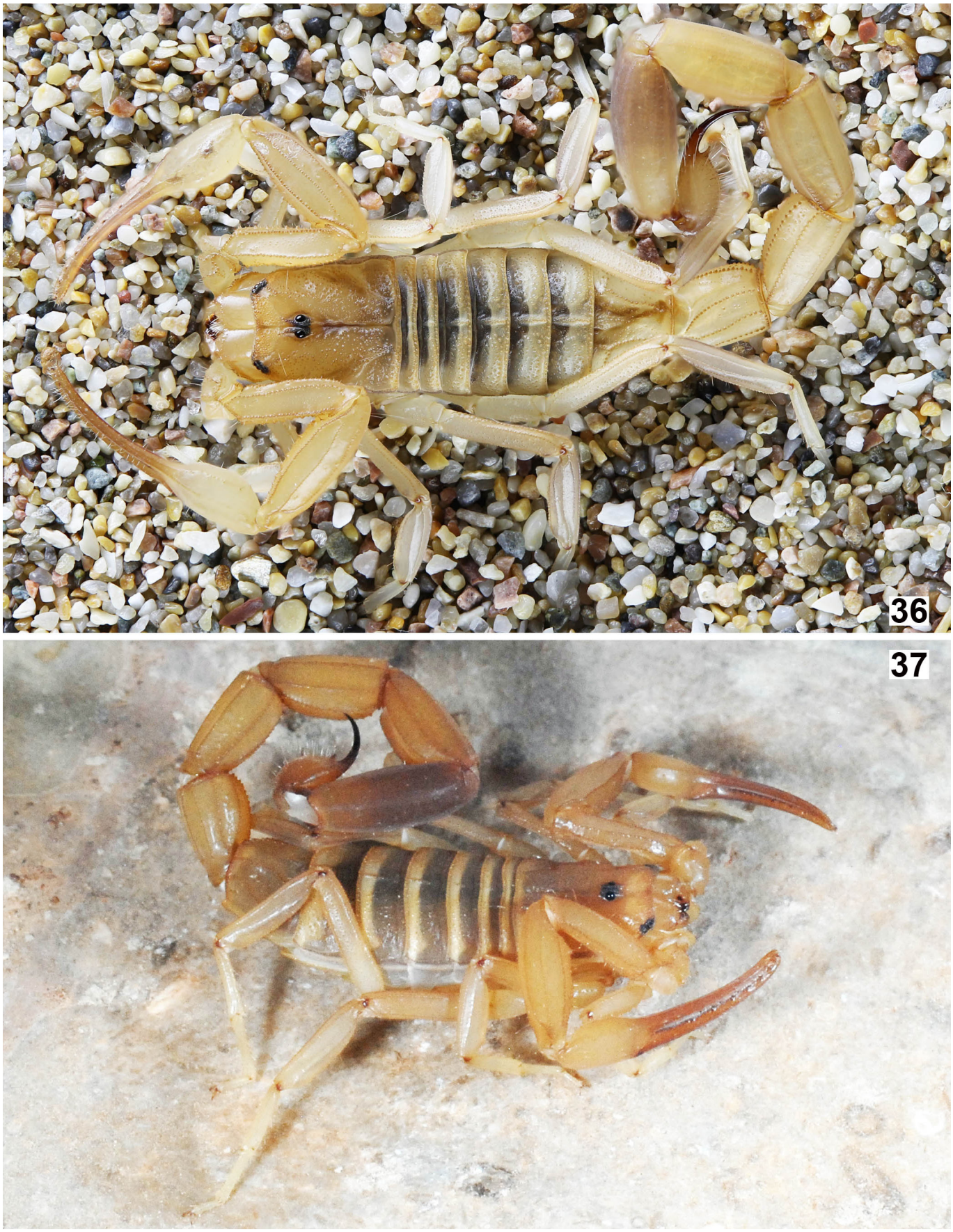


Figures 28–35: *Barbaracurus feti* **sp. n**. **Figures 28**, **30–32**. Holotype male, metasoma V and telson lateral view (28), metasoma and telson, lateral (30), dorsal (31) and ventral (32) views. **Figures 29**, **33–35**. Paratype female, metasoma V and telson lateral view (29), metasoma and telson, lateral (33), dorsal (34) ventral and sternite VII (35) views. Scale bar: 10 mm (30–32, 33–35).

narrow, slightly tapered, pars recta 45% of trunk length, pars reflecta is truncated in the available material. Sperm hemiduct with 2 elongated lobes, posterior lobe longer with broad base, subtriangular with distinct carina, apex blunt; anterior lobe shorter, constricted at base, separated from posterior lobe by small notch or aperture at base. Basal lobe a short lamina, prominently projecting from convex surface of capsule, oriented along oblique, transverse axis from anterior base of posterior lobe. Lamina length is about half of the basal width of the posterior lobe, similar to the shorter laminae of *B. zambonellii* and *B. somalicus* (cf. figs. 27–28, 35–36 in: Kovařík et al., 2018). Notably, these three allopatric species are distributed adjacently along the coastal region of the Horn of Africa.

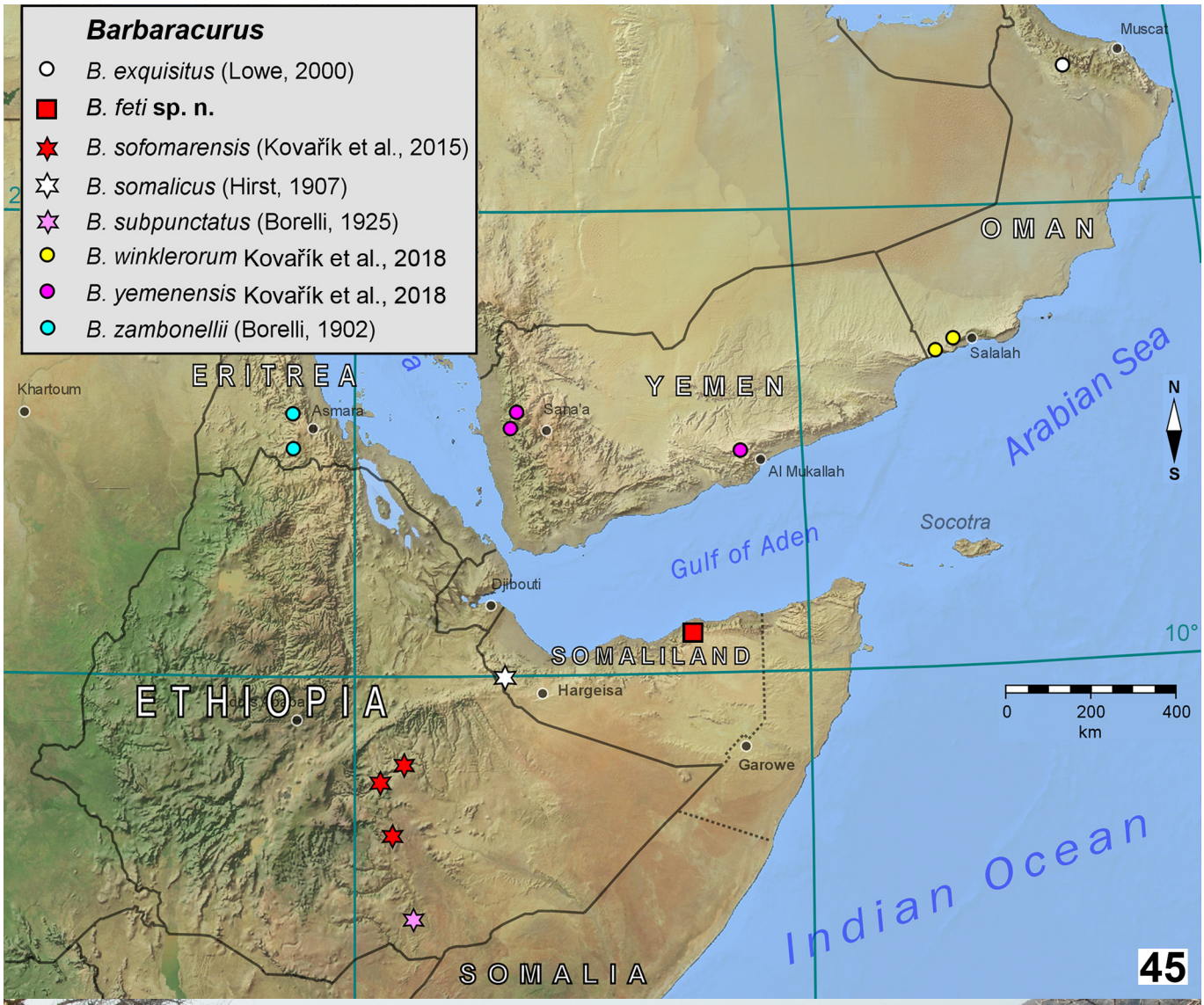
Legs (Figs. 9–12). Tarsomeres bearing two rows of macrosetae on their ventral surface and numerous macrosetae on other surfaces; bristle combs absent. Femur bearing only solitary macrosetae. Femur surface coarsely granulose, femur and patella with carinae developed. Moderate tibial spurs present on leg IV.

Metasoma and telson (Figs. 28–35). Segments I–IV with granulate, completely developed carinae, segment V with carinae indicated in both sexes. The carinae are composed of minute, rounded, equal-sized, evenly spaced granules. The first metasomal segment has a total of 10 carinae, the second through fourth segments have eight carinae, and the fifth segment has five indicated carinae. All metasomal



Figures 36–37: *Barbaracurus feti* **sp. n.**, in vivo habitus. Male holotype (36) and female paratype (37).

Figures 38–44: *Barbaracurus feti* **sp. n.** **Figures 38–42**: Right hemispermatophore of male holotype. **Figure 38**. Whole hemispermatophore, convex view. Scale bar: 1 mm. **Figures 39–42**. Capsule in convex compressed (39), convex (40), anterior (41) and posterior (42) views. Scale bar: 500 µm. **Figures 43–44**: Mitotic metaphase (43) and ideogram (44) (y axis - % of the chromosome length of the diploid set, lines indicate min.-max. values) of male holotype. Arrows show one extra large odd chromosome. Scale bar: 5 µm.



Figures 45–46: **Figure 45**. Map showing confirmed distribution of *Barbaracurus* spp. For exact position of Rugay village, the type locality of *Barbaracurus feti* **sp**. **n**. see fig. 84 in Kovařík et al., 2019. **Figure 46**. *Barbaracurus feti* **sp**. **n**., type locality.

segments are very sparsely granulated. Metasoma is very sparsely hirsute. Telson smooth with only a weakly indicated ventral carina and a dense cover of long setae mainly on the ventral surface. Subaculear tubercle short and pointed. Vesicle elongate, ellipsoidal or pyriform, telson length/depth ratio 3.24 in both sexes. Aculeus slender, curved, shorter than vesicle.

Karyotype (Figs. 43–44). We analyzed the male holotype. The diploid number of this specimen is 23 chromosomes. The lengths of first two chromosomes are similar and these two chromosomes correspond to the first chromosome pair that is distinctly longer (over 10% of the diploid set) than the remaining chromosomes. The third chromosome also has a distinctive length (7.67% of the diploid set) compared to the following chromosomes that gradually decrease in length from 5.23 to 1.92% of the diploid set (Fig. 44). This, the third chromosome, is probably the cause of the odd diploid number in this species (2n=23) as an effect of fusions/fissions of this chromosome. These types of chromosomal rearrangements are frequently detected in buthid scorpions with holocentric chromosomes (e. g. Mattos et al., 2013). Unfortunately, we did not observed meiosis in *B. feti* **sp**. **n**. This is the reason why we cannot specify the possible presence of multivalent association as was already described in *Barbaracurus sofomarensis* (2n=22) (Kovařík et al., 2015). These two species have similar karyotypes with different numbers of considerably longer chromosomes. In contrast to this, the karyotypes of *Barbaracurus zambonellii* (2n=26) and *Barbaracurus somalicus* (2n=36) contain higher numbers of chromosomes and all of them gradually decrease in length (Kovařík et al., 2018).

Comments on localities and life strategy. The type locality, 18SE is rocky semi-desert (Fig. 46 and fig. 42 in Kovařík et al., 2019). The types of *Barbaracurus feti* **sp**. **n**. were recorded at night during UV collecting together with *Hottentotta* sp. and *Pandiborellius meidensis* (Karsch, 1879). The first author (F.K.) visited the locality on 24–25 August 2018 and recorded maximum daytime temperatures of 38 ºC and a minimum nighttime temperature of 32 ºC. The recorded humidity was between 20% (minimum at day) and 33% (maximum at night). More information about the locality is available in Kovařík et al. (2019).

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. 16 and 18, and 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*** **sp**. **n**.

6 Telson vesicle pyriform in lateral profile, deeper anteriorly (figs. 83–84 in Kovařík et al., 2018); telson length/ depth ratio 2.75–2.89; pedipalp movable finger of female very weakly undulate at base. ..... ***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. ..... ***B***. ***sofomarensis*** **(**Kovařík et al., 2015)

7 Pedipalp chela with broader manus (figs. 58, 60 in Kovařík et al., 2018), chela length/ width ratio 4.28 (♀), 3.42 (♂); telson more bulbous, length/depth ratio 2.27–2.37 (♀, ♂); distributed in Africa. ..... ***B. zambonellii*** (Borelli, 1902)
– Pedipalp chela with narrower manus (figs. 62, 64, 66, 68, 210, 212 in Kovařík et al., 2018), chela length/ width ratio 4.73–6.12 (♀, ♂); telson ellipsoidal or pyriform, length/ depth ratio 2.63–2.89 (♀); distributed in Arabia. 8

8 Telson more slender (figs. 81–82 in Kovařík et al., 2018), length/depth ratio 2.89 (♀), 2.70 (♂); found in Al Hajar mountains of northern Oman. ... ***B***. ***exquisitus*** (Lowe, 2000)
– Telson less slender (figs. 85–87 in Kovařík et al., 2018), length/depth ratio 2.63–2.72 (♀); not found in northern Oman 9

9 Larger size, 40–42 mm (♀); less slender metasoma, metasoma V length/width ratio 2.30–2.46 (♀) .... ***B***. ***yemenensis*** Kovařík et al., 2018
– Smaller size, 30–34 mm (♀), 25–29 mm (♂); more slender metasoma, metasoma V length/width ratio 2.56–2.58 (♀) .....***B***. ***winklerorum*** Kovařík et al., 2018

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