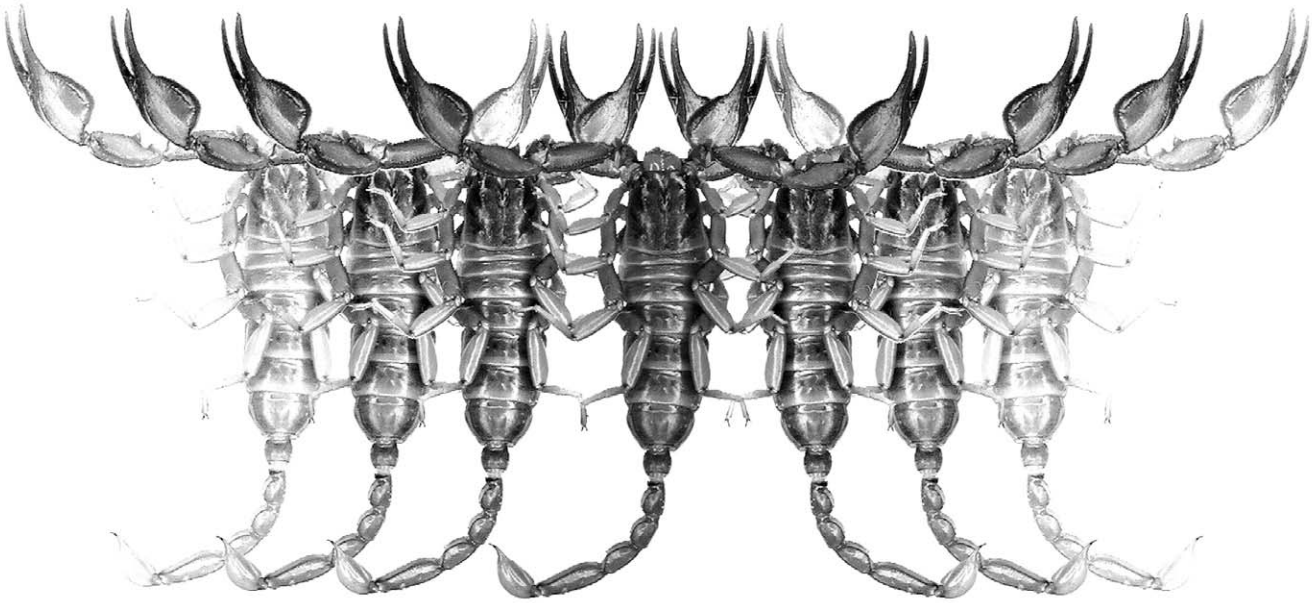
Euscorpius

Occasional Publications in Scorpiology



Scorpions of the Horn of Africa (Arachnida: Scorpiones). Part VII. *Parabuthus* Pocock, 1890 (Buthidae), with Description of *P. hamar* sp. n. and *P. kajibu* sp. n. from Ethiopia

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Scorpions of the Horn of Africa (Arachnida: Scorpiones). Part VII. *Parabuthus* Pocock, 1890 (Buthidae), with description of *P. hamar* sp. n. and *P. kajibu* sp. n. from Ethiopia

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http://www.zoobank.org/urn:lsid:zoobank.org:pub:65077794-E810-4C60-B7C1-D19D97295CB4

Summary

All *Parabuthus* species from Eritrea, Ethiopia, and Somaliland were newly collected and are revised for the first time. The complex of *Parabuthus liosoma* is split into three sibling species with separate areas of distribution: *P. abyssinicus* Pocock, 1901 (Eritrea, Djibouti, central and north-eastern parts of Ethiopia), *P. liosoma* (Ehrenberg, 1828) (Yemen and Saudi Arabia), and *P. maximus* Werner, 1913 (Tanzania and Kenya). *P. hamar* **sp. n.** and *P. kajibu* **sp. n.**, discovered during scorpiological expeditions in 2011–2016, are described. Information is provided about all *Parabuthus* species from the Horn of Africa, their taxonomy, distribution, and ecology, fully complemented with color photos of live and preserved specimens, as well as their habitat. The hemispermatophores of *P. abyssinicus* and *P. kajibu* **sp. n.** are illustrated and described. In addition to the analyses of external morphology and hemispermatophores, we also describe the karyotypes of *P. abyssinicus* (2n=16), *P. kajibu* **sp. n.** (2n=18), and *P. pallidus* (2n=20). The monotypic genus *Riftobuthus* Lourenço, Duhem et Cloudsley-Thompson, 2010 is synonymized with *Parabuthus*, based in part on pectinal tooth count analysis. Phylogenetic scaling and ontogenetic invariance of pectinal tooth count are shown for buthid scorpions.

Introduction

In the years 2011–2016, two of the authors (FK and JP) have had the opportunity to participate in expeditions to the Horn of Africa, study scorpions, and publish several articles on this fauna (Kovařík, 2011a, 2011b, 2012, 2013, 2015, Kovařík & Lowe, 2012, Kovařík & Mazuch, 2011, 2015, Kovařík et al., 2013, 2015, 2016, and Lowe & Kovařík, 2016). To date, 93 localities have been sampled, 53 of which have yielded specimens of the buthid genus *Parabuthus*. We analyze these specimens in this paper, the seventh in a series of articles concerning the composition and distribution of particular scorpion genera in the Horn of Africa.

Parabuthus is distributed both in Arabia (*P. liosoma*) and in Africa, where localities in Eritrea and Sudan represent the northern limits of its distribution. Although South African and Namibian *Parabuthus* have been revised extensively (Lamoral, 1979; Prendini, 2004; Prendini & Esposito, 2010), the *Parabuthus* species from the Horn of Africa have never been revised until now, because the available material was inadequate. However, our recently collected specimens now enable us to verify or exclude old published locality data, and help us to better understand the *P. liosoma* species complex.

Methods, Material & Abbreviations

Nomenclature and measurements follow Stahnke (1971), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974), and sternum (Soleglad & Fet, 2003a). Hemispermatophore terminology follows Kovařík et al. (2016).

We intentionally use here the name Somaliland (Hargeysa) for the northern territory corresponding to the former British colony (British Somaliland), which we distinguish from Somalia (Mogadisho). Somaliland has its own currency, a functional government with representation in several countries, and its officials contributed to our safe visit.

Specimens were found by ultraviolet (UV) detection by night, or by searching under surface debris and rocks by day. All collected material was preserved in 80%

ethanol. *Specimen Depositories*: BMNH (The Natural History Museum, London, United Kingdom); FKCP (František Kovařík, private collection, Prague, Czech Republic); MCSN (Museo Civico de Storia Naturale "Giacomo Doria", Genoa, Italy); MZUF (Museo Zoologico de "La Specola", Firenze, Italy); and ZMHB (Museum für Naturkunde der Humboldt-Universität, Berlin, Germany). *Morphometrics*: D, depth; L, length; W, width.

Systematics

Family Buthidae C. L. Koch, 1837

Parabuthus Pocock, 1890
(Figs. 1–204, Tables 1–2)

Buthus (*Parabuthus*): Pocock, 1890: 124–125.

Parabuthus: Pocock, 1895: 309–314, plate IX, figs. 4a–d ; Fet & Lowe, 2000: 200–211 (complete reference list until 2000); Kovařík, 2009: 22, 31; Prendini & Esposito, 2010: 673–710, figs. 1–17.

= *Heterobuthus* Kraepelin, 1891: 205–211 (63–69) (syn. by Kraepelin, 1895: 79 (7))

= *Riftobuthus* Lourenço et al., 2010: 281, figs. 1 and 2. **Syn. n.**

TYPE SPECIES. *Androctonus* (*Prionurus*) *liosoma* Ehrenberg in Hemprich et Ehrenberg, 1828

DIAGNOSIS. Total length 35–180 mm. Dorsal trichobothria of pedipalp femur arranged in α-configuration. Trichobothrium d_2 located external to dorsomedian carina of patella when carina is present. Trichobothrium *eb* located on fixed finger of chela. Pectines with fulcra. Pectinal teeth number 18–62. Sternum subtriangular. Tibial spurs present on third and fourth legs. Cheliceral fixed finger with two ventral denticles. Carapace without distinct carinae. Carapace in lateral view with entire dorsal surface horizontal or nearly so. Dentate margin of pedipalp chela movable finger with distinct granules divided into 9–14 rows, 3 terminal granules and one basal terminal granule. Tergites I–VI of mesosoma bear one carina. Telson without subaculear tubercle. Dorsal surfaces of first and second metasomal segments with stridulatory areas.

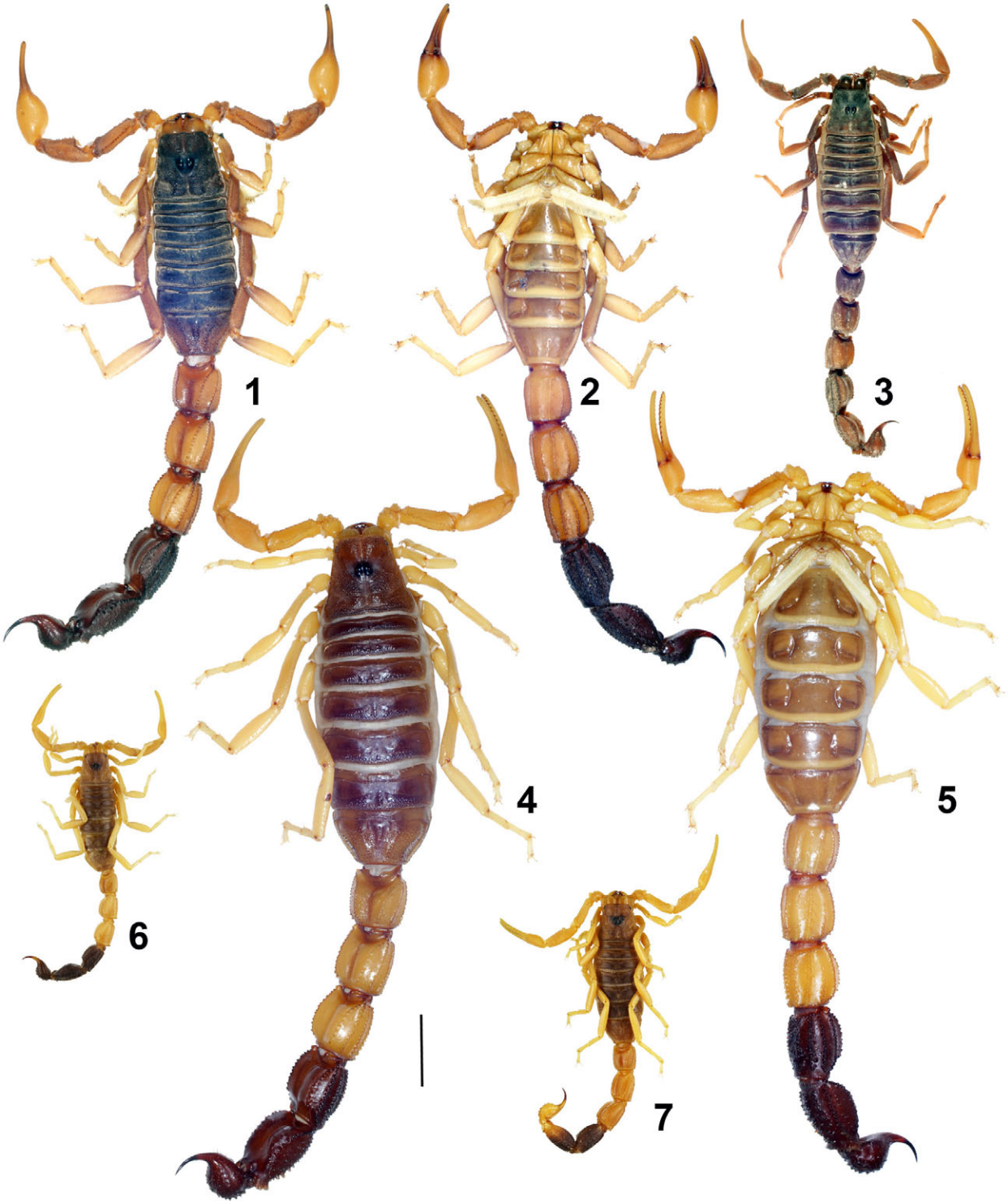
REMARKS ON THE HEMISPERMATOPHORES. The hemispermatophores of the two *Parabuthus* species cited here below are quite similar to each other. One possible minor difference is that the flagellum of *P. kajibu* **sp. n.** is shorter and thicker than that of *P.abyssinicus*, although we did not examine more than one sample and cannot specify the intraspecific variation. The hemispermatophores we found are also similar to published rough drawings or photographs of hemispermatophores of *P. villosus* (Peters, 1862) in Lamoral (1979: fig. 28), *P. mossambicensis* (Peters, 1861) (Fitzpatrick, 1994: fig. 2f), *P. glabrimanus* Prendini et Esposito, 2010, and *P. setiventer* Prendini et Esposito, 2010 (their figs. 12, 17). Common features include a distally dilated pars reflecta, and the presence of a broad median lobe, hook, and pointed internal lobe. Our findings agree with previous observations that *Parabuthus* hemispermatophores have rather uniform structures that lack clear diagnostic differences at the species level (Fitzpatrick, 1994; Lamoral, 1979; Prendini, 2004).

We provide here descriptions and illustrations of the capsule and lobe structures of the genus *Parabuthus* that are more detailed than previously reported. The 2 + 1 configuration of lobes (median, internal + basal), with the flagellum fused to a broad, carinated median lobe, is consistent with other non-*Buthus* group members of the family (Kovařík et al., 2016). A feature that has not been documented in other buthids is the distinctly thickened ridge or basal lobe carina (*blc*) on the dorso-internal surface of the capsule.

REMARKS ON THE KARYOTYPES. We analyzed male karyotypes of three different *Parabuthus* species from the Horn of Africa (Table 1). We used standard cytogenetic methods (e.g. Kovařík et al., 2009). The chromosome slides were stained with 5% Giemsa and the relative length of the chromosomes of the diploid set was measured for each specimen using the software Image J 1.45r (http://rsbweb.nih.gov/ij) with the plugin Levan (Sakamoto & Zacaro, 2009) based on 10 postpachytene spermatocyte nuclei.

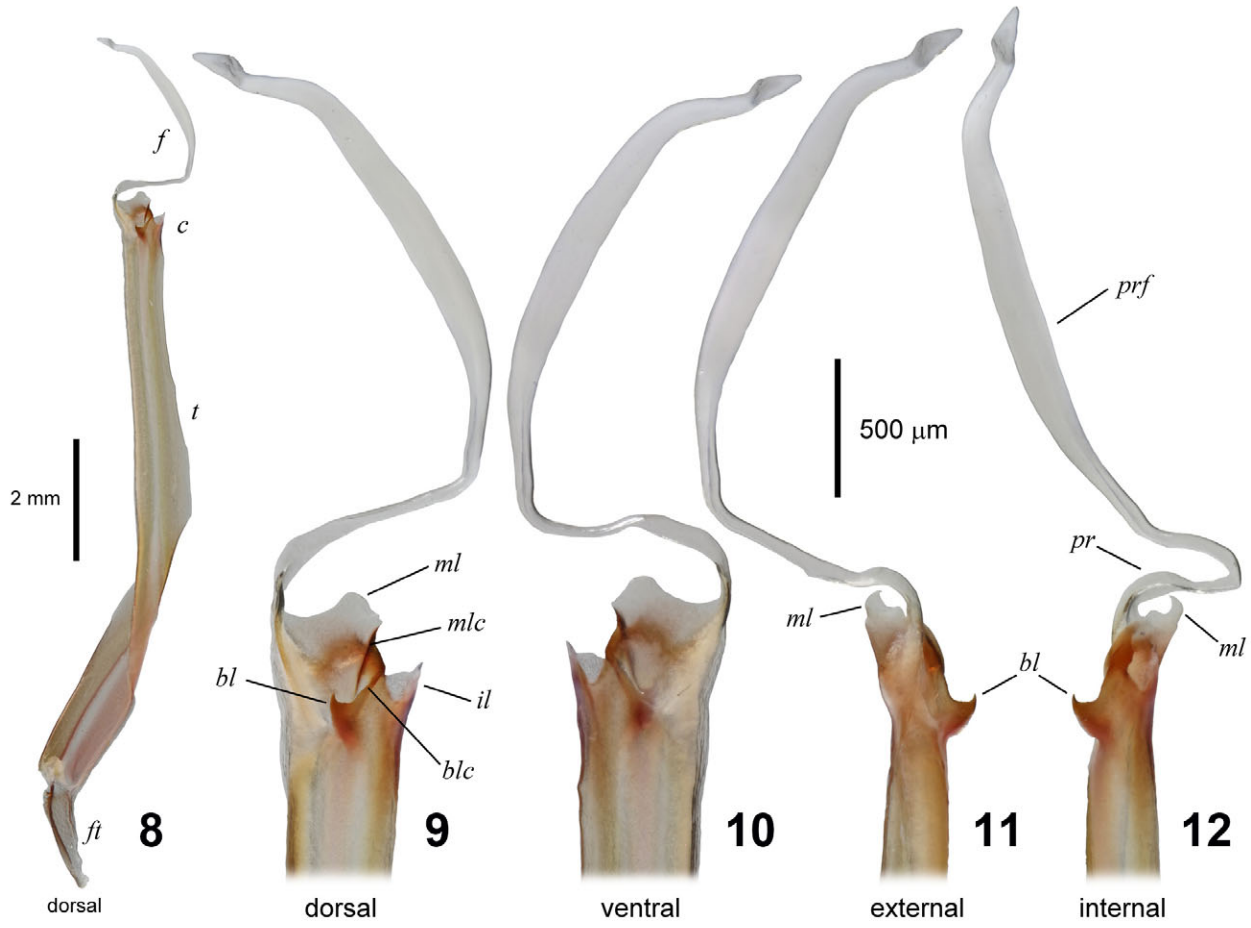
The chromosomes of all analyzed species (Figs. 28–35) correspond to the cytogenetic characteristic typical for the family Buthidae: holocentric chromosomes, achiasmatic meiosis in males, and lower number of chromosomes (e.g. Mattos et al., 2013). The diploid set of *P. abyssinicus* consists of 16 chromosomes in both observed males from two distant localities (Figs. 28, 30). The chromosomes gradually decrease in length from 7.51 % to 4.84 % of the diploid set in male from Ethiopia and from 7.34 % to 5.04 % of the diploid set in male from Eritrea (Table 1). During meiosis we found only bivalents in all observed postpachytene in both males (Figs. 29, 31). The diploid set of *P. kajibu* **sp. n.** consists of 18 chromosomes (Fig. 32). The chromosomes gradually decrease in length from 7.17 % to 3.81 % of the diploid set (Table 1). During meiosis we found only bivalents in all observed postpachytene in male of this species (Fig. 33). The diploid set of *P. pallidus* consists of 20 chromosomes (Fig. 34). The chromosomes gradually decrease in length from 7.11 % to 3.31 % of the diploid set (Table 1). During meiosis we found one quadrivalent in all observed postpachytene in analyzed male (Fig. 35).

The buthids represent the best explored scorpion family from the cytogenetic point of view. More than half of the cytogenetically analyzed scorpions so far



Figures 1–7: Figures 1–6. *Parabuthus abyssinicus***. Figures 1–2**. Male from Ethiopia, locality 11EW in dorsal (1) and ventral (2) views. **Figure 3**. Juvenile from Ethiopia, locality 11EW in dorsal view. **Figures 4–5:** Female from Eritrea, locality 15EF in dorsal (4) and ventral (5) aspects. **Figure 6**. Juvenile from Ethiopia, DireDawa in dorsal view. **Figure 7**. *Parabuthus liosoma*, juvenile from **Yemen Arab Republic**, Al Munirah env., 15°20'10"N 042°50'12"E, 21 m a.s.l., in dorsal view. Scale bar: 10 mm.

belong to this family (in total 63 species from 22 genera) (see Kovařík et al., 2016; Schneider et al., 2016). Nevertheless, we have still limited knowledge about the karyotype variability of this family. We have available information on the karyotypes of more than three species in the genera *Androctonus* Ehrenberg, 1828, *Reddyanus*



Figures: 8–12: *Parabuthus abyssinicus*, right hemispermatophore. **Figure 8.**Whole hemispermatophore with capsule region in dorsal view. Scale bar: 2 mm. **Figures 9–15.** Capsule region and flagellum, oriented to show capsule region in dorsal (9), ventral (10), external (11) and internal (12) views. In figures 9 and 10, the capsule is dorsoventrally compressed to show the form of the lobes. Scale bar: 500 µm. Abbreviations: *bl*, basal lobe; *blc*, basal lobe carina; *c*, capsule; *f*, flagellum; *ft*, foot; *il*, internal lobe; *ml*, median lobe; *mlc*, median lobe carina; *pr*, pars recta of flagellum; *prf*, pars reflecta of flagellum; *t*, trunk.

Vachon, 1972, *Tityus* C. L. Koch, 1836 and *Uroplectes* Peters, 1861 (Kovařík et al., 2016; Schneider et al., 2016). These genera represent three different patterns of intra- or interspecific karyotype variability. The intraspecific variability is documented in *Reddyanus* from Sri Lanka and *Tityus* from Brazil with the highest known range in *T. bahiensis* (Perty, 1833) (2n=5–19) (Piza, 1944; 1949). *Androctonus* displays uniform karyotypes with 2n=24 in all seven analyzed species from Northern Africa and Western Asia (Moustafa et al., 2005; Sadílek et al., 2015). *Uroplectes* shows distinct interspecific variability in Africa (Kovařík et al., 2016; Newlands & Martindale, 1980). *Parabuthus* may be a genus with distinctive interspecific variability. Our results support this hypothesis. This fact was documented also during previous cytogenetic analysis of six species from Zimbabwe (Newlands & Martindale, 1980). It is evident that karyotyped material is not substantial enough to rule out the existence of intraspecific variability and more investigation is needed to accurately determine karyotype variability in *Parabuthus* species.

TAXONOMIC REMARKS. The monotypic genus *Riftobuthus*, with single species *R. inexpectatus* Lourenço et al., 2010, is represented by a juvenile female from "Kenya, region of Turkana, N. Lokitaung", which the authors mistook for an adult female. The juvenile status of this specimen is indicated by an extraordinarily high pectinal tooth count (PTC = 36) for a buthid scorpion in its small size range, which if adult would violate the empirical scaling relation between PTC and body size of buthids (Figs. 202–203; see discussion below). In all likelihood, *Riftobuthus* is a juvenile of one of the local species, *Parabuthus pallidus*. During our studies of *Parabuthus* juveniles, we were struck by the fact that in this genus there is a great deal of morphological, morphometric, and color variation (Figs. 19–23). Lourenço et al. (2010: 281) cited a "unique combination characters" to diagnose the genus *Riftobuthus*, but almost all of these characters are exhibited by *Parabuthus* juveniles, and others are unreliable: **1)** "carapace and tergites acarinated and smooth"; however, on the same page the authors state "Tergites smooth with one

Figures 13–14: *Parabuthus abyssinicus*, in vivo habitus in Eritrea. Male (13) in locality 15EG, and female (14) in locality 15EF.

vestigial median carinae"; the carapace is acarinated and granulated in adult *Parabuthus* specimens but is often smooth in juveniles, and all *Parabuthus* species have tergites with one median carina; **2)** "pectines extremely long with an unusually large number of teeth (36-36), dilated basal middle lamellae and weakly marked

fulcra"; these are normal features for all females/juveniles of *Parabuthus* from the Horn of Africa (see Fig. 111 and fig. 1b in Lourenço et al., 2010: 282); **3)** "the dentate margins of pedipalp chela fingers composed of linear rows of granules, forming almost a single row"; however, on the same page the authors state "outer and inner accessory granules absent from both fingers; two very small granules located proximally to the terminal granule on the movable finger", which does not correspond to their fig. 2f which is poor but indicates some accessory granules. In other papers, Lourenço has published repeated errors about "the dentate margins of pedipalp chela fingers" (see for example comments in Kovařík et Ojanguren, 2013: 209), and the granulation is sometimes developed anomalously in some specimens (see Fig. 71 versus Fig. 73); the number of these rows and their linear orientation cited by the authors for *Riftobuthus* correspond to *Parabuthus pallidus* (Fig. 87); **4)** the cited trichobothrial pattern, metasomal segment V and telson also correspond exactly to *Parabuthus pallidus*; **5)** the poor drawing of chelicerae (fig. 1c in Lourenço et al., 2010: 282) and the text need to be checked. From the original description, it is evident that *Riftobuthus* is a junior synonym of *Parabuthus*, and probably *Riftobuthus inexpectatus* is a junior synonym of *P. pallidus*.

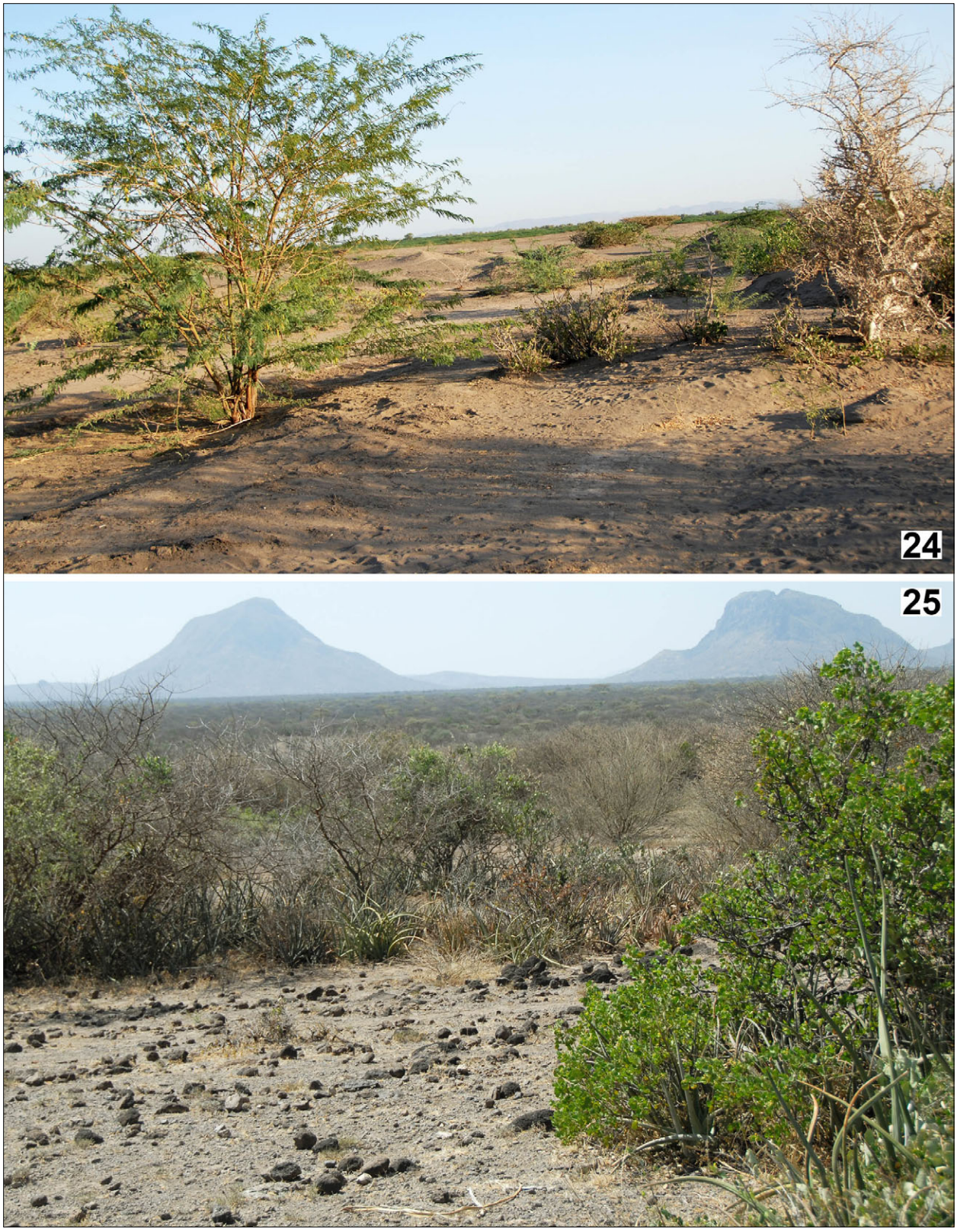
REMARKS ON BUTHID PECTINAL TOOTH COUNTS. Soleglad (1973: 353–361, tabs. 1–5, figs. 13–14) first reported a positive correlation between pectinal tooth count (PTC) and adult body length for certain groups of North American vaejovid and chactid scorpions. Soleglad & Fet (2003b: 61, 163–169, figs. 109–113, D1–D11) extended this observation to other chactoid families (Euscorpiidae, Superstitioniidae), and we recently confirmed it in more detail for the scorpiopine subfamily of Euscorpiidae using carapace length as a proxy for body size (Kovařík et al., 2015). The correlation slope varies significantly between taxonomic groups and has been used as a diagnostic character (Soleglad, 1973). Here we show that a similar positive correlation holds for the largest scorpion family Buthidae (Fig. 202), establishing this phylogenetic scaling law for the majority of extant scorpion taxa (herein termed '*Soleglad's Law*'). In contrast, we propose that as a rule PTC remains invariant when body size varies ontogenetically rather than phylogenetically, i.e. across different instars in the same species of scorpion. In buthids, this was previously indicated by the similarity of PTC values in juvenile and adult *Tityus fasciolatus* Pessôa, 1935 (Lourenço, 1980: 812–813), and *Centruroides gracilis* (Latreille, 1804) (Francke & Jones, 1982). We confirm it for three additional species of Old World buthids (Fig. 203; only females plotted, but a similar correlation exists for males (data not shown)). Together with Soleglad's Law, ontogenetic invariance of PTC provides a useful test for whether an individual is juvenile or adult. Since juvenile and adult PTCs should be similar, a juvenile will deviate significantly from the scaling relation of Soleglad's Law because its PTC will be too high for its body size or carapace length. This is exemplified by the cases of *Alloscorpiops troglodytes* Lourenço et Pham, 2015 (c.f. Kovařík et al., 2015), and *Riftobuthus inexpectatus*, which we discussed above.

What is the meaning of Soleglad's Law? Scorpion pectines bear dense fields of mechanoreceptive and chemoreceptive sensillae that are thought to be sensing substrate texture and substrate-borne chemical signals (reviewed in Farley, 2011). When a scorpion sweeps pectine combs over the substrate, it may be sampling a coarse spatial map of physical and/or chemical stimuli on that substrate. The pectine teeth may be basic units of sensory input for such spatial mapping. The rows of teeth on a comb could contribute a series of 'pixels' for building up the map. Soleglad's Law says that larger scorpions bear more teeth per comb, hence they would be acquiring higher resolution maps relative to their body size. The regression line in Fig. 202 yields a standard allometric scaling equation: $PTC = a.(CL)^b = 7.892.(CL)^{0.5266} \sim \sqrt{(CL)}$, where CL = carapace length. Scaling is sublinear, with exponent b having a value between two extremes, $0 < b < 1$: (i) $b = 0$ corresponds to PTC being constant, and the size of individual teeth increasing in direct proportion to body size, i.e. the size scale of substrate stimuli resolved is proportional to the size of the scorpion; (ii) $b = 1$ corresponds to PTC being proportional to body size (linear scaling), and the size of individual teeth beng constant, i.e. there would an absolute size scale of substrate stimuli resolved, independent of the size of the scorpion. The intermediate value of b suggests that larger species of scorpions may have some need to resolve finer substrate features, but not as much fine grained detail as smaller species. Soleglad's Law only applies to sexually mature scorpions, which suggests that it is relevant to the task of tracking sex pheromone trails. If trails are deposited by mature conspecifics, their spatial extent should scale upwards with body size, which could explain why larger species do not need to resolve the same level of detail as smaller species. The sublinear power law may be related to how the structure or effective width of a pheromone chemical trail scales with body size. For example, perhaps larger species lay down relatively narrower trails than smaller species. A similar analysis of male buthids (N = 745 species) yielded $b = 0.4464$, and the exponents for scorpiopines (Kovařík et al., 2015) were 0.3717 (males) and 0.4033 (females). We hypothesize that this is a universal law with similar scalings in other scorpion families.

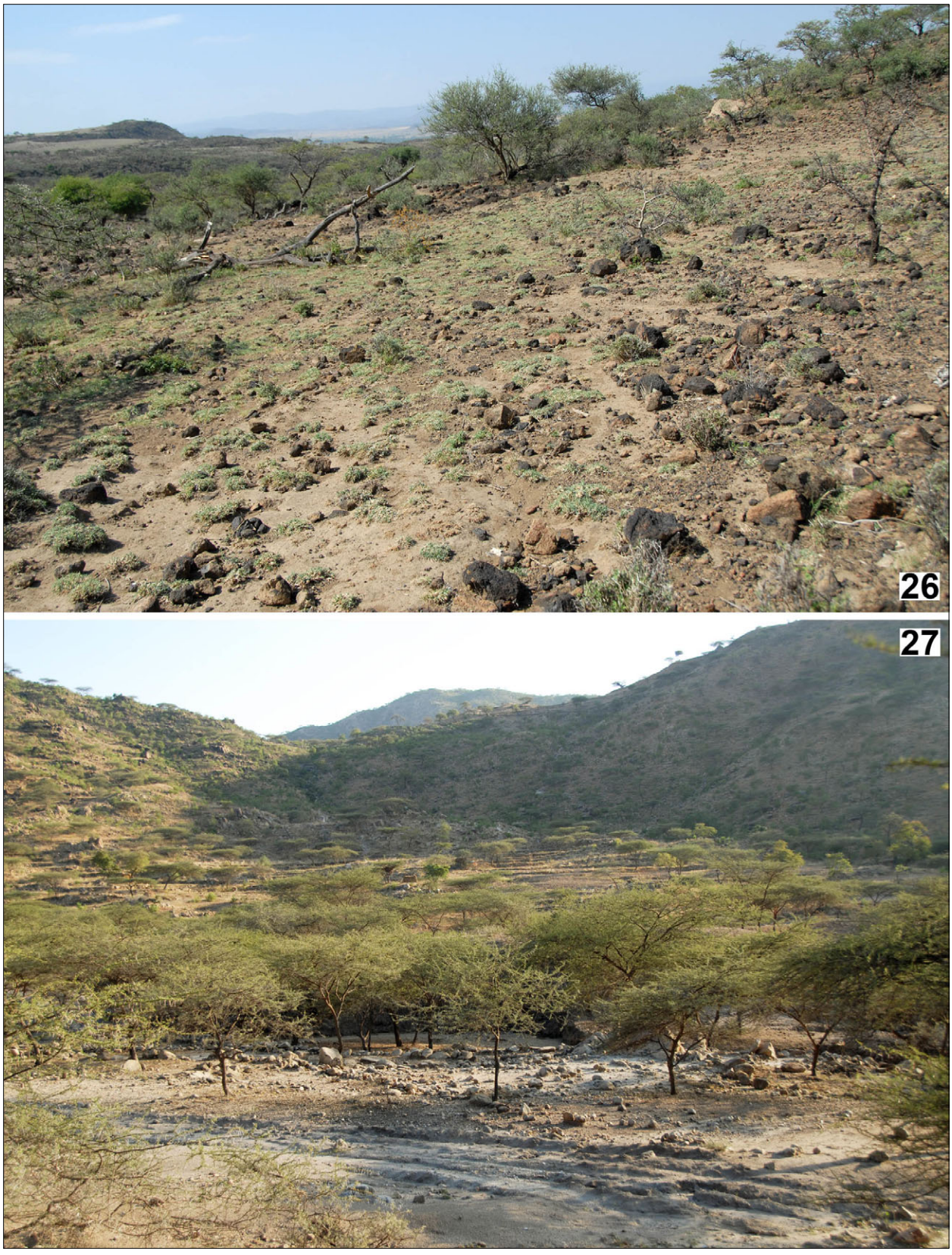
Figures 15–16: *Parabuthus abyssinicus*, two differently colored males in vivo habitus in Ethiopia, localities 11EW (15), and 12EP (16).

Figures 17–18: *Parabuthus abyssinicus*, female with first instar juveniles at Ethiopian locality 12EN (17) and the same female with second instar juveniles after first ecdysis (18).

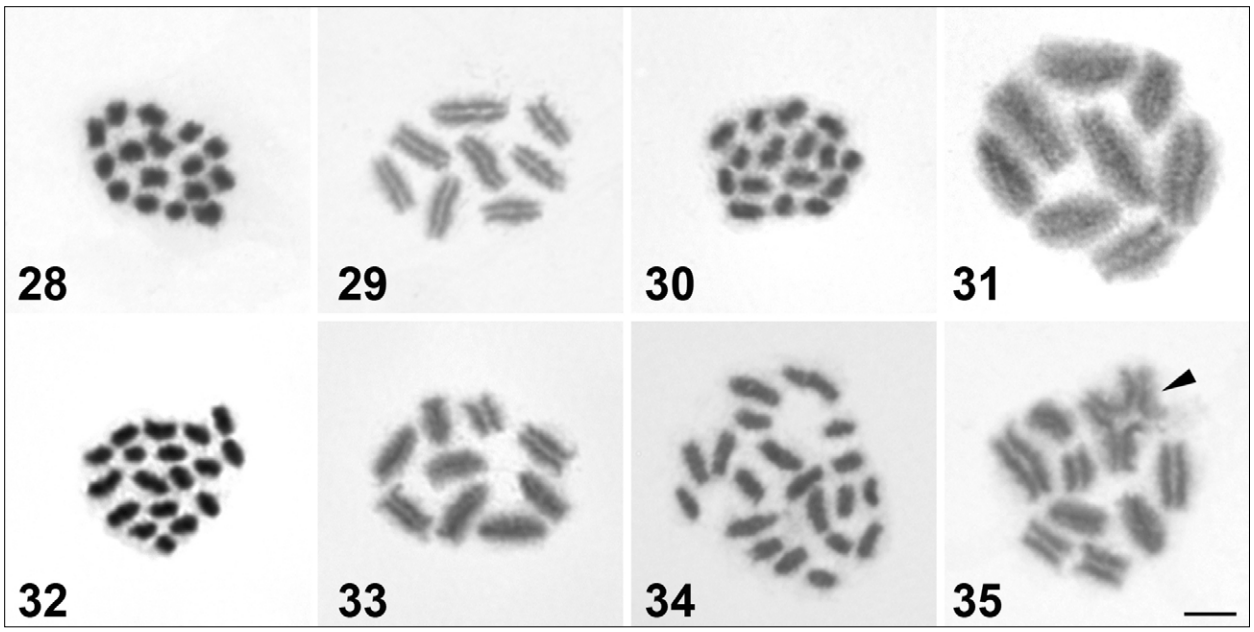
Figures 19–23: *Parabuthus abyssinicus*, differently colored juveniles in vivo habitus in Ethiopia, localities 12EN (19), 14ET (20), 12EW (21), and 11EW (22 and 23).



Figures 24–25: *Parabuthus abyssinicus*, Localities 12EM (24), Ethiopia, 11°43'30"N 40°58'45"E, 404 m a.s.l. and 12EW (25), Ethiopia, Awash, 09°00'34.5"N 40°17'56.5"E, 1012 m. a.s.l.



Figures 26–27: *Parabuthus abyssinicus*, Localities 14EV (26), Ethiopia, Oromia State, East Shewa, Fantale zone, volcanic crater Fantale near Metahara, 09°00'56.2"N 39°51'21"E, 1050 m a.s.l. and 15EF (27), Eritrea, route Halibaret to Keren, 15°43'31.4"N 38°36'02.7"E, 1457 m a.s.l.



Figures 28–35: Chromosomes of males of *Parabuthus* from Ethiopia and Eritrea. **Figure 28**. *P. abyssinicus* (2n=16) from Ethiopia, mitotic metaphase. **Figure 29.** *P. abyssinicus* (2n=16) from Ethiopia, postpachytene. **Figure 30.** *P. abyssinicus* (2n=16) from Eritrea, mitotic metaphase. **Figure 31**. *P. abyssinicus* (2n=16) from Eritrea, postpachytene. **Figure 32** *P. kajibu* **sp. n.** (2n=18), mitotic metaphase. **Figure 33.** *P. kajibu* **sp. n.** (2n=18), postpachytene. **Figure 34**. *P. pallidus* (2n=20), mitotic metaphase. **Figure 35**. *P. pallidus* (2n=20), postpachytene. Arrowhead indicates quadrivalent. Scale bar: 5 μm.

Species	2n	% TCL	Locality
Parabuthus abyssinicus	16	7.51 – 4.84	Ethiopia (11EW)
Parabuthus abyssinicus	16	7.34 – 5.04	Eritrea (15EG)
Parabuthus kajibu **sp. n.**	18	7.17 – 3.81	Ethiopia (16EA)
Parabuthus pallidus	20	7.11 – 3.31	Ethiopia (13EL)

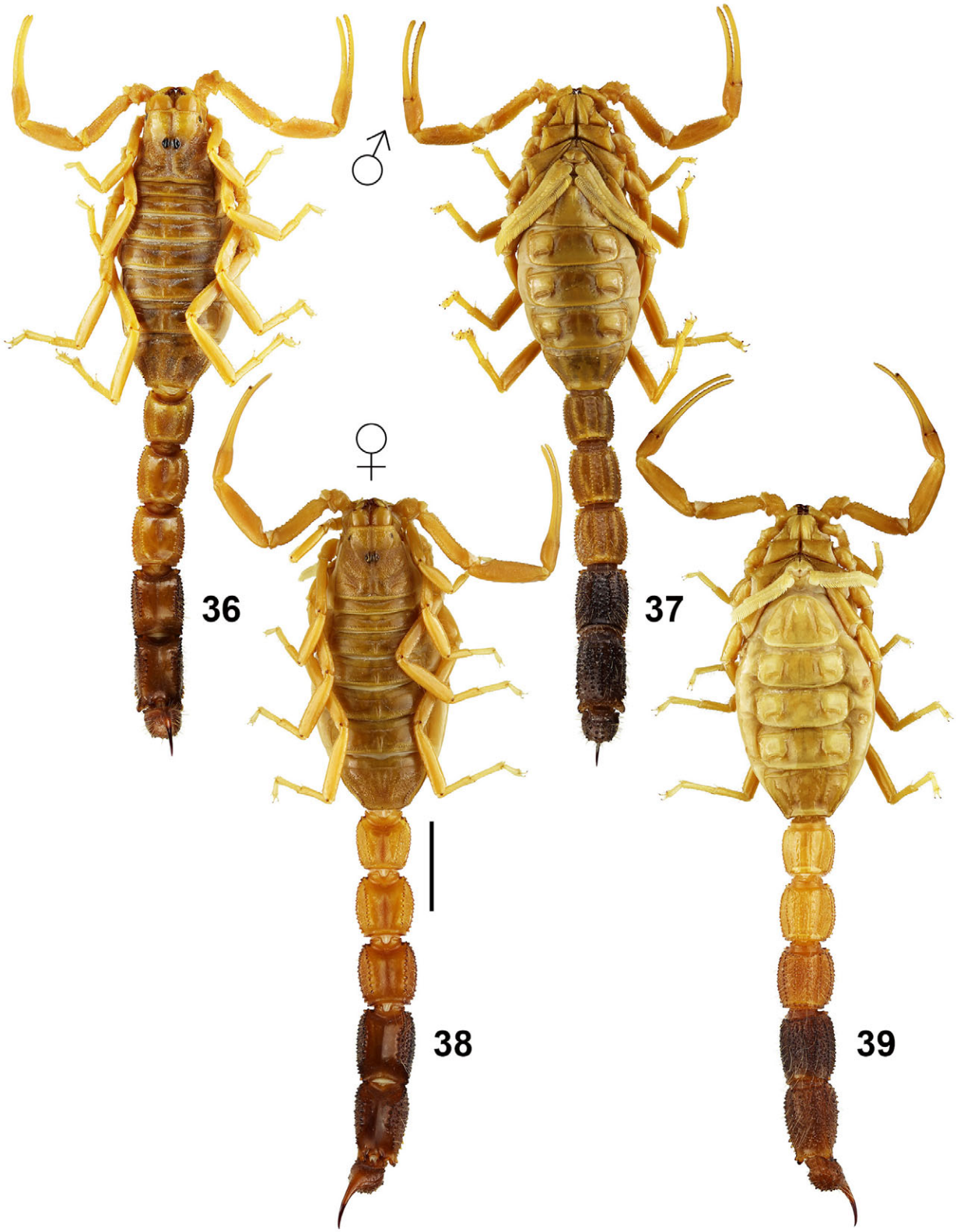
Table 1: The diploid numbers, the percentage of the total chromosome length of the diploid set (% TCL), and the localities of analyzed Horn of Africa *Parabuthus* species.

Parabuthus abyssinicus Pocock, 1901
(Figs. 1–6, 8–27, 166–167, 171, 181, 193, 204, Table 1)

Parabuthus abyssinicus Pocock, 1901: 1.
Parabuthus liosoma abyssinicus: Kraepelin, 1913: 172; Lamoral & Reynders, 1975: 519.
Parabuthus leiosoma abyssinicus: Fet & Lowe, 2000: 206 (complete reference list until 2000).
= *Parabuthus liosoma dmitrievi* Birula, 1903: 113 (syn. by Kovařík, 2003: 144).
Parabuthus liosoma dimitrivi: Borelli, 1925: 12–13.
Parabuthus liosoma dmitrievi: Fet & Lowe, 2000: 206 (complete reference list until 2000).
Parabuthus leiosoma (in part): Fet & Lowe, 2000: 205–206 (complete reference list until 2000); Kovařík, 2003: 144, figs 8–9; Kovařík & Whitman, 2005: 110–111.

TYPE LOCALITY AND TYPE REPOSITORY. Ethiopia, Abyssinia, Shoa (= now Ethiopia, Shewa Province); BMNH.

MATERIAL EXAMINED. **Djibouti**, Day, 1.VI.1990, 1♀, 14.VII.1990, 1♂. **Eritrea**, route Halibaret to Keren, 15°43'31.4"N 38°36'02.7"E, 1457 m a.s.l., 1.-2.XI.2015, (Fig. 27, Locality No. **15EF**), 1♂5♀ (Figs. 4–5, 14) 4juvs, leg. F. Kovařík; Keren, 15°48'33"N 38°28'14.6"E, 1328 m a.s.l., 2.XI.2015, (Locality No. **15EG**), 1♂ (Figs. 8–13), leg. F. Kovařík; near Massawa, 15°36' 55"N 39°24'22"E, 30 m a.s.l., 8.XI.2015, (Locality No. **15EK**), 1♂im., leg. F. Kovařík. **Ethiopia**, Shewa Province, Nazret, 1975, 1♂1♀, Nazret, Melcassa, IX.2000, 1♂3♀, leg. V. Beneš; Shewa Province, Awash, Metahara, 18.IV.1998, 1♀, leg. K. Werner; Awash, near Metahara, 08°54'N 39°54'E, 960-1050 m a.s.l., 2008, 1♀im1im.2juvs., leg. V. Trailin; Awash, near Metahara,



Figures 36–39: *Parabuthus cimrmani*. **Figures 36–37**. Male holotype in dorsal (36) and ventral (37) views. **Figures 38–39:** Female paratype in dorsal (38) and ventral (39) aspects. Scale bar: 10 mm.

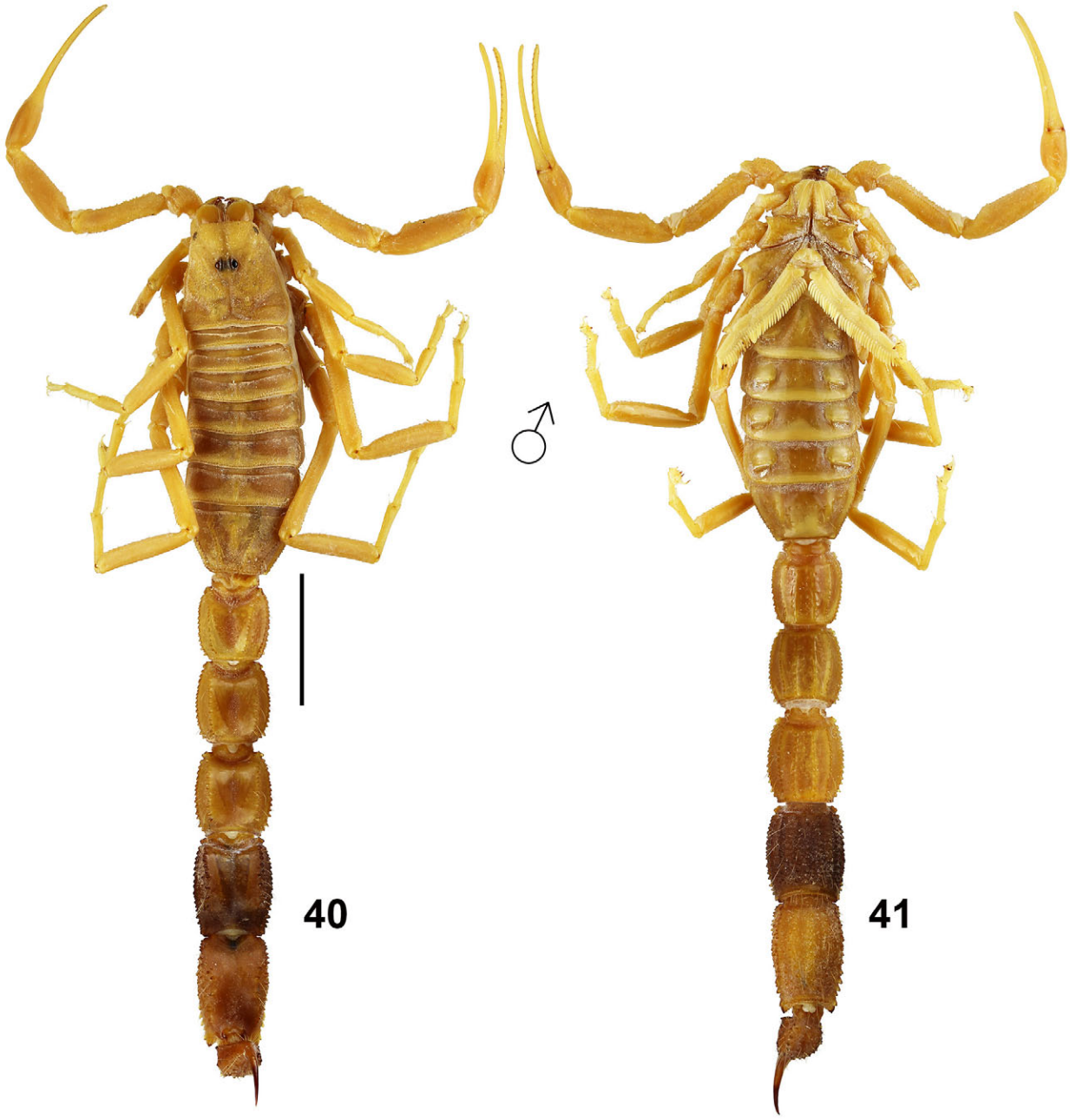
09°54.2'N 039°54.8'E, 960 m a.s.l., 2♂1♀1im.6juvs., XI.2010, leg. T. Mazuch; DireDawa, 09°34.647'N 041° 50.33'E, 1249 m a.s.l., 3juvs. (Fig. 6), XI.2010, leg. T. Mazuch; Awash, Metahara env., 08°54'N 39°54'E, 960-1050 m a.s.l., (Locality No. **11EA**), 4.-5., 19.-22. VII.2011, 8♂3♀ 4ims.13juvs., leg. F. Kovařík; Awash, 09°00'34.5"N 40°17'56.5"E, 1012 m a.s.l. (Locality No. **11EW**), 19.VII.2011, 2♂(Figs. 1–2, 15)1♀2juvs. (Figs. 22–23), leg. F. Kovařík; 13°36'05"N 38°08'46"E, 1412 m a.s.l. (Locality No. **12EE**), 16.XI.2012, 1im., leg. F. Kovařík; 11°43'30"N 40°58'45"E, 404 m a.s.l. (Locality No. **12EM**), 20.XI.2012, 1juv., leg. F. Kovařík; 10° 24'32.7"N 40°42'29.6"E, 796 m a.s.l. (Fig. 24, Locality No. **12EN**), 23.XI.2012, 1♀ (Figs. 17–18), leg. F. Kovařík; Gewane, 10°09'38"N 40°39'45"E, 631 m a.s.l. (Locality No. **12EO**), 23.XI.2012, 1juv., leg. F. Kovařík; 10°07'13.7"N 40°38'35.1"E, 631 m a.s.l. (Locality No. **12EP**), 24.XI.2012, 1♂ (Fig. 16), leg. F. Kovařík; 09°08'10.4"N 40°09'45.5"E, 835 m a.s.l. (Locality No. **12ER**), 24.XI.2012, 2juvs., leg. F. Kovařík; Awash, 09°00'34.5"N 40°17'56.5"E, 1012 m. a.s.l. (Fig. 25, Locality No. **12EW**), 25.XI.2012, 2♀1juv.(Figs. 3, 21), leg. F. Kovařík; Awash, near Metahara, 08°54'N 39°54'E, 960-1050 m a.s.l. (Locality No. **12EX**), 25.XI.2012, 1♂1♀3ims.2juvs., leg. F. Kovařík; Afar State, 09°08'10.4"N 40°09'45.5"E, 835 m a.s.l. (Locality No. **14ET** = 12ER), 26.-27.XI.2014, 1im.♂1im.♀2juvs. (Fig. 20), leg. F. Kovařík; Afar State, 09°34'06"N 40° 23'45.9"E, 601 m a.s.l. (Locality No. **14EU** =12EQ), 27.XI.2014, 2juvs., leg. F. Kovařík; Oromia State, East Shewa, Fantale zone, Metahara, 08°54'N 39°54'E, 960-1050 m a.s.l. 27.-30.XI.2014, (Locality No. **12EX**), photos only, leg. F. Kovařík; Oromia State, East Shewa, Fantale zone, vulcano crater Fantale near Metahara, 09°00'56.2"N 39°51'21"E, 1050 m a.s.l. 29.XI.2014, (Fig. 26, Locality No. **14EV**), photos only, leg. F. Kovařík; Oromia State, East Shewa, 08°46'26"N 39° 37'26.5"E, 1214 m a.s.l., 30.XI.2014, (Locality No. **14EW**), 1♂, leg. F. Kovařík; Afar State, Shewa Province, 10km N Metahara, Awash N.P., 08°57'01"N 39°50'30"E, 980 m a.s.l., 5.VI.2015, 2♂4juvs., leg. P. Kučera. All specimens are in the first authors collection (FKCP).

DIAGNOSIS. Adults from 72 mm (male) to 115 mm (female) long. Base color of adults uniformly yellow to yellowish brown, carapace, tergites, metasomal segments IV–V and telson are dark brown to black. Pectine teeth number 38–43 in males and 33–38 in females. Stridulatory area present on dorsal surface of metasomal segments I–II in both sexes, reduced or absent on third segment in adults. Metasoma densely hirsute. Metasomal segment V of male length/ width ratio 1.50–1.72. Movable and fixed fingers of pedipalp bearing 12–13 rows of granules, all with external and internal accessory granules. Fingers of pedipalp not enlarged, movable finger length/ manus length ratio 1.54–1.72 in male. Pedipalp fingers of male with inner side of base smooth, no trace of tubercle. Manus of pedipalp of male broad, pedipalp chela length/ width ratio 2.95–3.11 in male and 4.25–4.40 in female. Pedipalp manus smooth, patella finely granulated. Tarsomere I of all legs with bristlecombs.

Hemispermatophore (Figs. 8–12). Flagelliform, elongate and slender, trunk ca. 10 times length of capsule region. Flagellum fused to median lobe, with short ribbon-like, hyaline pars recta (*pr*) and much longer, opaque white pars reflecta (*prf*). Major distal portion of pars reflecta dilated, cylindriform. Capsule region with 3 lobes at base of flagellum. Median lobe (*ml*) broad, laminate, translucent, dorsal surface concave, apical margin concave with blunt, rounded apex on internal side that is slightly curled upwards (c.f. external and internal views in Figs. 11–12). Median lobe carina (*mlc*) robust, sclerotized, reddish in color. Basal lobe (*bl*) reddish, robust, hamate with sharp, fine tip, joined to a strong secondary dorsal carina (= basal lobe carina, *blc*) which extends to sclerotized, reddish distal margin of capsule on the internal side of the median lobe carina (Figs. 9–10). Internal lobe (*il*) angulate with a pointed corner.

COMMENTS. *P. abyssinicus* (Eritrea, Djibouti, central and north-east parts of Ethiopia), *P. liosoma* (Ehrenberg, 1828) (Yemen and Saudi Arabia), and *P. maximus* Werner, 1913 (Tanzania and Kenya) are morphologically very similar sibling species with separate areas of distribution which most authors considered as synonyms or subspecies (Birula, 1915, Kraepelin, 1913, Caporiacco, 1937, Fet & Lowe, 2000, Kovařík, 2003). An interesting question is the position of *P. maximus* which no author has synonymized, but most authors ignored this taxon. From Tanzania and Kenya, authors have cited *P. liosoma* or *P. liosoma abyssinicus* (Kraepelin, 1913: 171–172, Probst, 1973: 321 and others; see Lamoral & Reynders, 1975: 519–520 and Fet & Lowe, 2000: 205–207). The reason could be that Werner (1913: 172) described *P. maximus* from extremely large females, 140 mm long. The normal size range of this species is 80–120 mm, and males are clearly smaller.

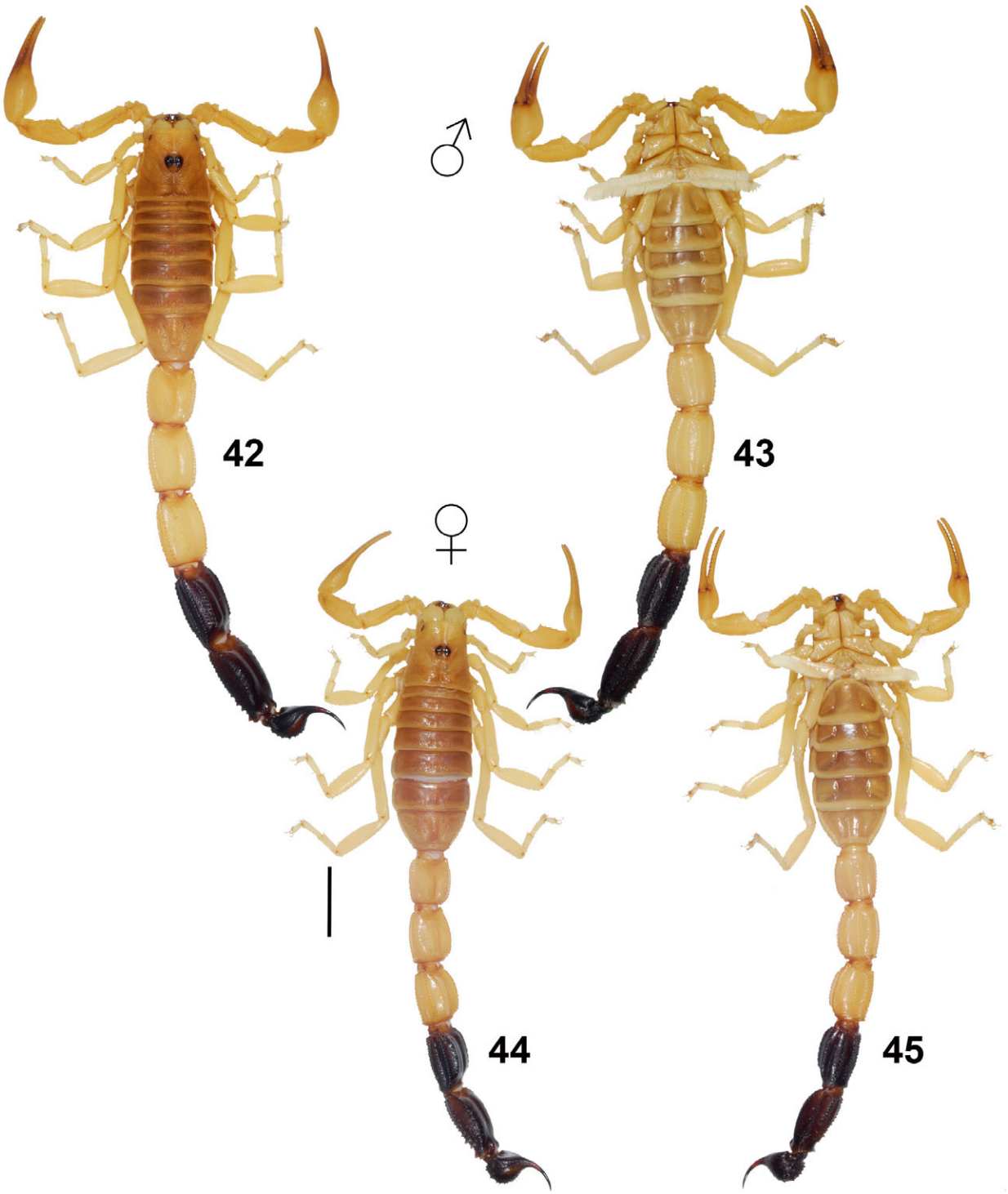
AFFINITIES AND VARIABILITY. *P. abyssinicus*, *P. liosoma*, and *P. maximus* can be separated mainly according to granulation of the pedipalp patella which is smooth in *P. liosoma* (Fig. 180), usually finely granulated in *P. abyssinicus* (Fig. 181), and strongly granulated in *P. maximus* (Fig. 182); and according to granulation and measurements of tergites and metasomal segments (Pocock, 1901: 1, Figs. 183–185). Other differences are in color of the telson and the posterior part of metasomal segment V which are usually entirely



Figures 40–41: *Parabuthus eritreaensis*, male from Somalia, Gardo, Migiurtina in dorsal (40) and ventral (41) views.

black (the same color as metasomal segment IV) in *P. abyssinicus* (Fig. 194) and *P. maximus*, but light in juveniles and often in young adults of *P. liosoma* (Fig. 7). However, there is further variability in the color of *P. abyssinicus* juveniles. While studying juveniles of *P. abyssinicus* in the field, we were surprised by the fact that there is a great deal of color variation, in addition to morphological and morphometric variation. Several juveniles immediately after the second ecdysis have the same color as adults (Figs. 6 and 19), whereas other juveniles still have very different color (Figs. 20–23) after the third and even the fourth ecdysis (mainly those inhabiting dark volcanic terrain). However, in *P. abyssinicus* juveniles we never observed the color pattern that is standard for juveniles of *P. liosoma* (Fig. 7).

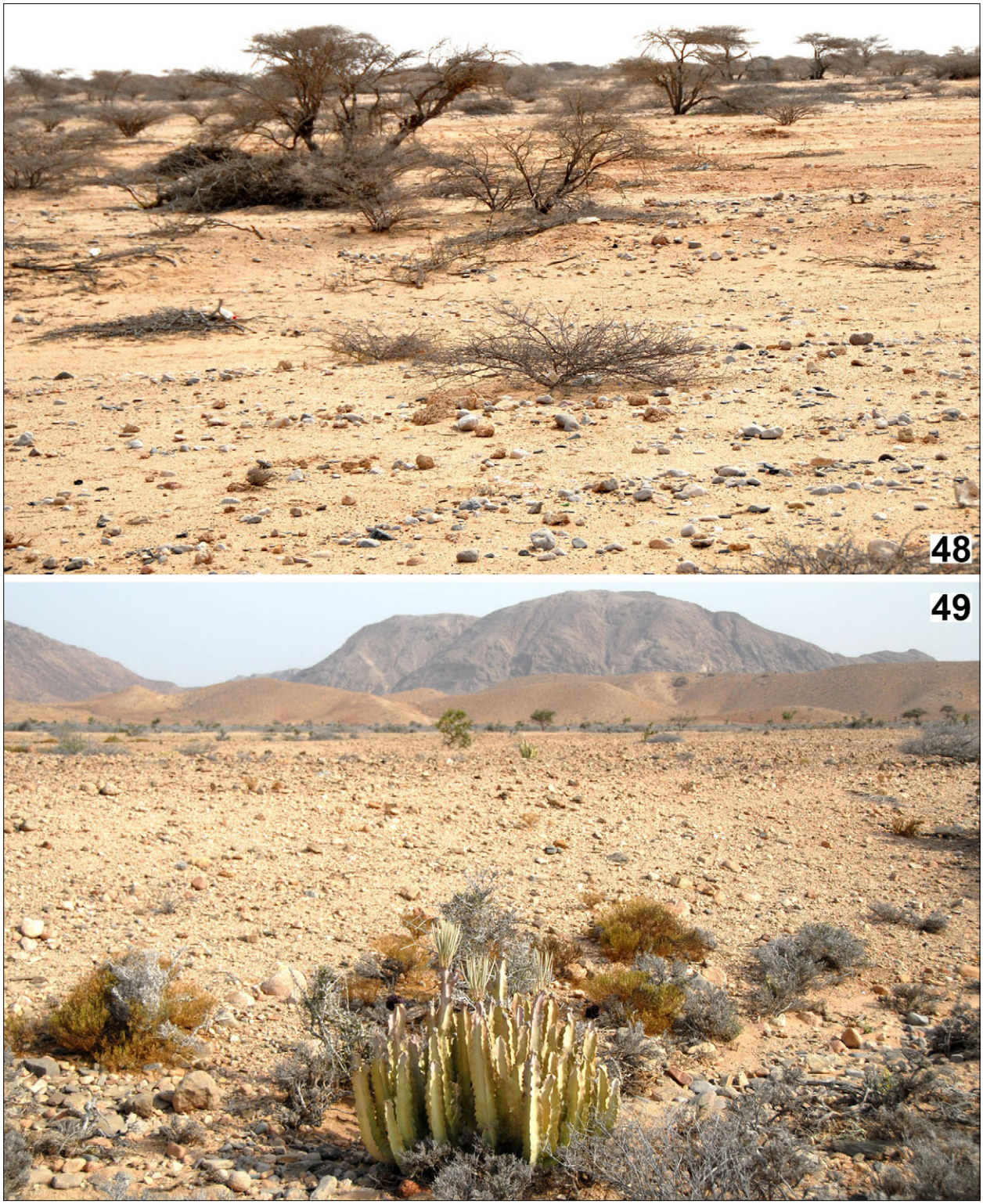
COMMENTS ON LOCALITIES AND LIFE STRATEGY. In Ethiopia, Shewa Province (type locality) the first author recorded *P. abyssinicus* at several localities among



Figures 42–45: *Parabuthus granimanus* from locality 11SE. **Figures 42–43**. Male in dorsal (42) and ventral (43) views. **Figures 44–45:** Female in dorsal (44) and ventral (45) views. Scale bar: 10 mm.

which we describe the semi-desert region in the proximity of the town of Metahara. This area is characterized by volcanic bedrock with lava fields around a lake, and the terrain transitions to sandy semi-desert with scattered volcanic boulders further away from town (Figs. 25–26). This environment appears to be optimal for *P. abyssinicus*, which occurs here sympatrically with *Buthus awashensis* Kovařík, 2011,

Figures 46–47: *Parabuthus granimanus*, in vivo habitus in Somaliland at locality 11SE. Male (46) and female (47).



Figures 48–49: *Parabuthus granimanus*, localities 11SE (48), Somaliland, near Berbera, 10°22.8'N 45°02.2'E, 107 m a.s.l. and 11SG (49), Somaliland, near Berbera, 10°16'01"N 45°06'21.3"E, 367 m a.s.l.

Compsobuthus abyssinicus Birula, 1903, *Neobuthus awashensis* Kovařík et Lowe, 2012, and *Pandinus awashensis* Kovařík, 2012.

The first author visited the Eritrean localities **15EF** (Fig. 27) and **15EG** on 1–2 November 2015 and collected with a UV light. *P. abyssinicus* was active immediately after sunset. Near these localities, the first author recorded nighttime temperatures of 28.6 ºC shortly after sunset, dropping to 21.3 ºC (minimum temperature) before sunrise and humidity varied between 41% and 64%. In addition to *P. abyssinicus* at these localities the first author also recorded *Compsobuthus werneri* (Birula, 1908), *Hottentotta minax* (L. Koch, 1875), *Pandinus magrettii* Borelli, 1901 (type locality), and *Scorpio* sp. (the first record of the genus for Eritrea). On 8th November 2015 the first author stopped at locality **15EK** and found *P. abyssinicus* during the day (temperature 34.5°C) under stones. In addition, at this locality was recorded *Compsobuthus eritreaensis* Kovařík et al, 2016 and *Neobuthus eritreaensis* Lowe et Kovařík, 2016.

DISTRIBUTION. Djibouti, Eritrea, Ethiopia, ? Somaliland, ? Sudan.

Parabuthus cimrmani Kovařík, 2004
(Figs. 36–39, 88, 172–173, 188, 197, 204)

Parabuthus cimrmani Kovařík, 2004: 15–19, figs. 1–5, table 1.

TYPE LOCALITY AND TYPE REPOSITORY. Somalia, Maxaans env; FKCP

TYPE MATERIAL EXAMINED. **Somalia**, Maxaans env., 1972, 1♂1♀ (Figs. 36–39, 88, 172–173, 188, 197, holotype and allotypic paratype), FKCP.

DIAGNOSIS. Adults from 83 mm (male) to 85.3 mm (female) long. Base color uniformly yellow to yellowish brown, only fourth and fifth metasomal segments and telson dark. Pectine teeth number 61–62 in male and 32–33 in female. Stridulatory area present on dorsal surface of first and second segments, absent on third segment in female and small, in a disc only, in male. Metasoma densely hirsute. Movable finger of pedipalp more than twice as long as manus, bearing 14 rows of granules which include external and internal granules. Manus of pedipalp smooth and very narrow in both sexes, pedipalp chela length/ width ratio 5.90 in male and 7.42 in female. Tarsomere I of all legs with bristlecombs.

DISTRIBUTION. Somalia.

Parabuthus eritreaensis Kovařík, 2003
(Figs. 40–41, 89, 174–175, 189, 198, 204)

Parabuthus eritreaensis Kovařík, 2003: 142–143, 159, figs. 10–11, table 2; Kovařík, 2004: 18–19, fig. 6; Kovařík & Whitman, 2005: 110.

TYPE LOCALITY AND TYPE REPOSITORY. Eritrea, Asmara env. (see comment below); FKCP.

TYPE MATERIAL EXAMINED. **Eritrea**, Asmara env., 1♂ (holotype) 1♀ (allotypic paratype), 1983, leg. Dorsak; FKCP.

ADDITIONAL MATERIAL EXAMINED. **Somalia**, Gardo, Migiurtina, V. 1930, 1♂ (Figs. 40–41, 89,174–175, 189, 198), leg. M. Milano & Luppi, FKCP No. 1133; Run, 16.VIII.1969, 1♂, S.B.S., MZUF No. 1127.

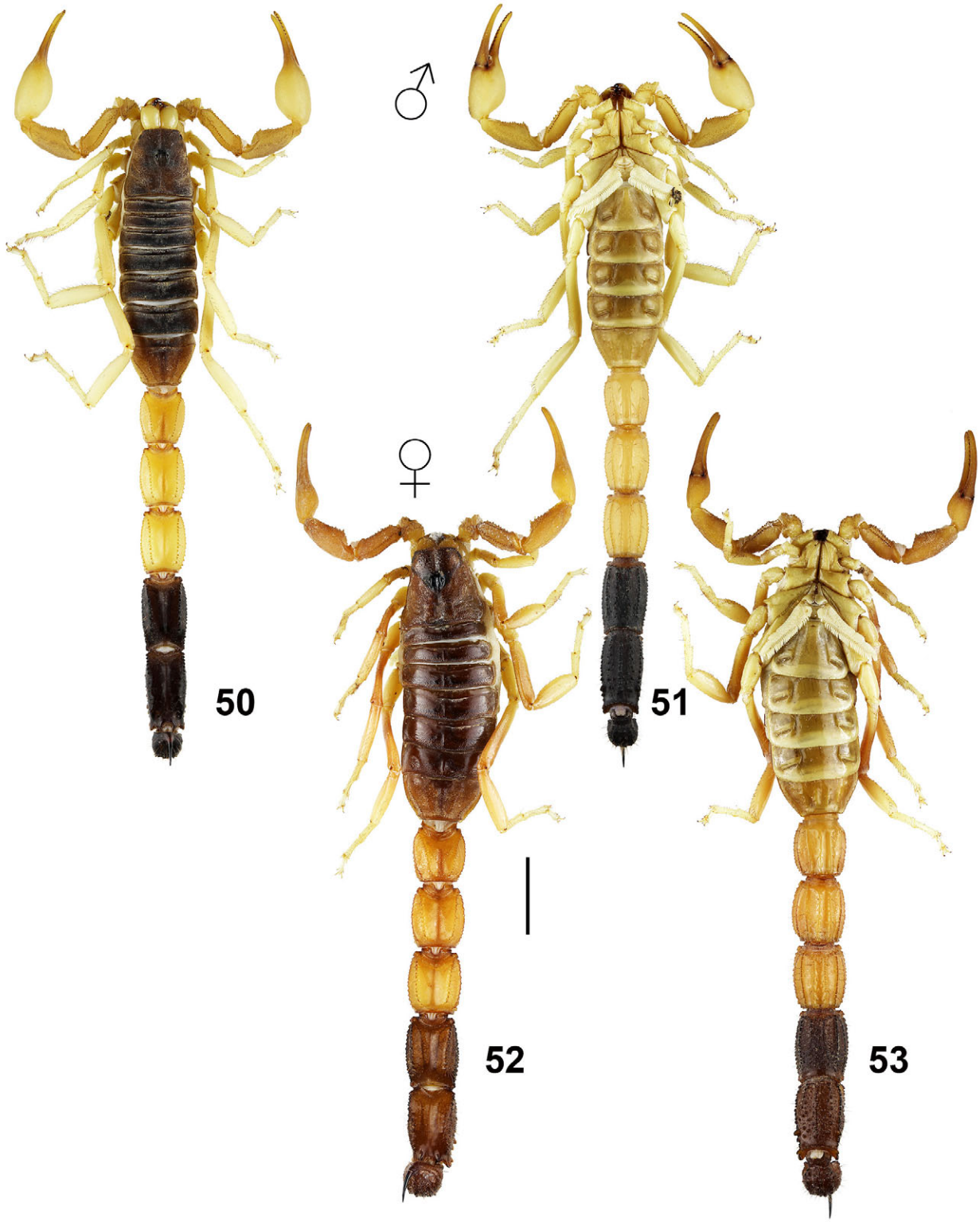
DIAGNOSIS. Adults from 71.5 mm (male) to 90 mm (female) long. Base color uniformly yellow to yellowish brown, only fourth metasomal segment and telson dark. Pectine teeth number 39 in male and 35–36 in female. Stridulatory area present on dorsal surface of first to third segments, more pronounced on first and second segments. Metasoma densely hirsute. Movable finger of pedipalp more than twice as long as manus, bearing 13–15 rows of granules which include both external and internal granules. Manus of pedipalp smooth and very narrow in both sexes, pedipalp chela length/ width ratio 6.13 in male and 7.23 in female. Tarsomere I of all legs with bristlecombs.

COMMENTS ABOUT DISTRIBUTION AND TYPE LOCALITY. We believe that the type locality "Eritrea, Asmara env." is incorrect, the types were mislabeled and the origin of the types is in reality Somaliland or Somalia (Puntland). There are three reasons for this opinion:

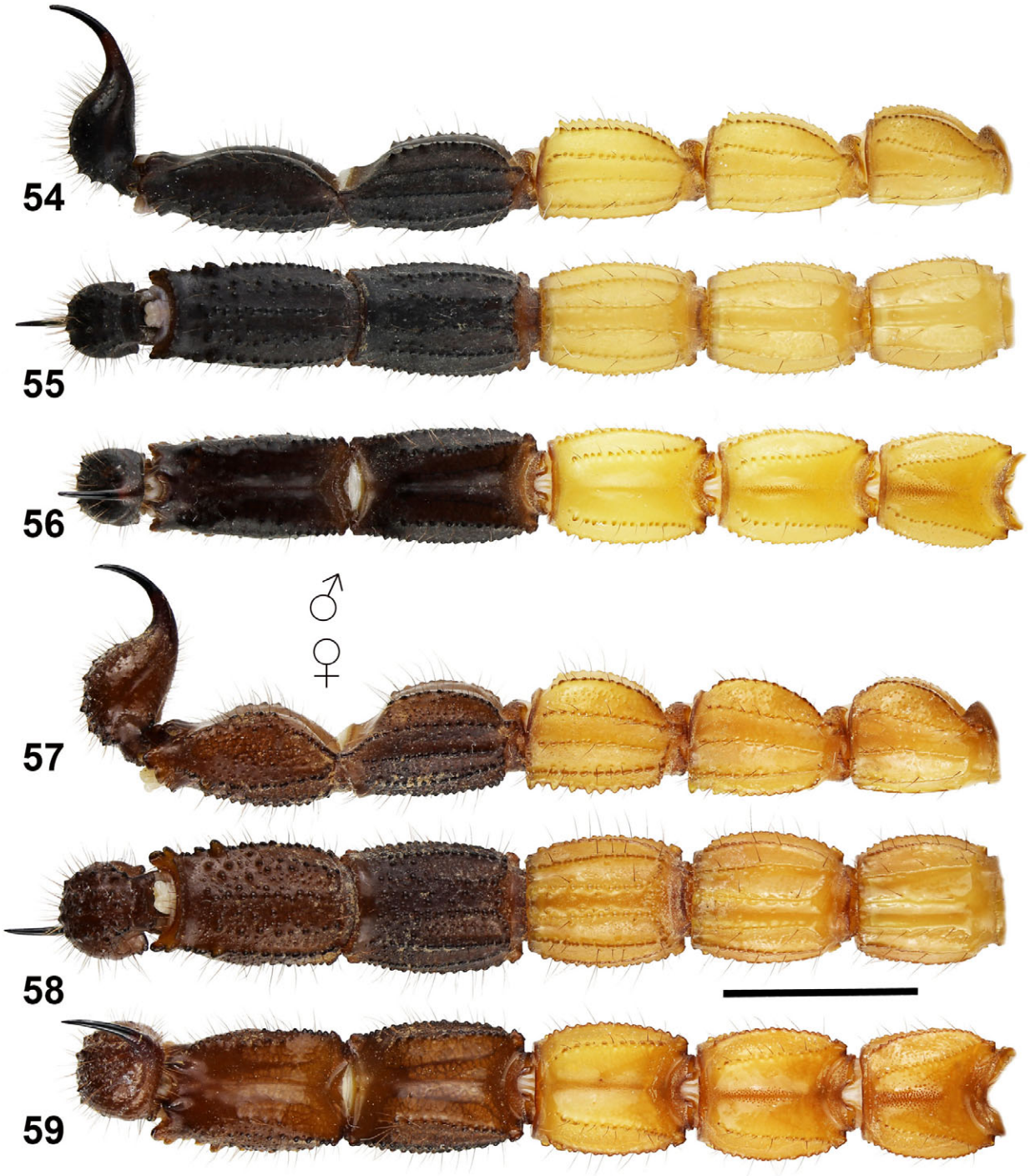
1) In October 2015 the first author visited the vicinity of the Asmara City which is situated at 2300–2450 m a.s.l. This is too high an altitude for most known scorpion species in the Horn of Africa. At similar high altitudes in the Horn of Africa, only *Hottentotta* specimens were collected by the first author. In the vicinity of Asmara City, only *Hottentotta minax* (L. Koch, 1875) was collected (Eritrea, Asmara env., 15°20'39.9"N 38°57' 41.6"E, 2417 m a.s.l., 27.X.2015; and 15°14'42.7"N 38°52'48.6"E, 2307 m a.s.l., 28.X.2015). During 2011–2016 expeditions, all Horn of Africa *Parabuthus* specimens were collected below 1741 m a. s. l. (*P. abyssinicus* 30–1457 m a. s. l., *P. granimanus* 107–896 m a. s. l., *P. hamar* **sp. n.** 373– 1406 m a. s. l., *P. heterurus* 896–1741 m a.s.l., *P. kajibu* **sp. n.** 918 m a. s. l., and *P. pallidus* 373–1695 m a. s. l.).

2) According to the labels of the additional non-type specimens of *P. eritreaensis*, two other localities are "Somalia, Gardo, Migiurtina" (Fig. 204) and " Somalia, Run, S.B.S.".

3) In the first authors collections there are also three specimens of *P. granimanus* labeled evidently incorrectly by the same label "Eritrea, Asmara env., 1983, leg. Dorsak". In reality, only very hot localities in the vicinity of Berbera, Somaliland (see below) were veri-

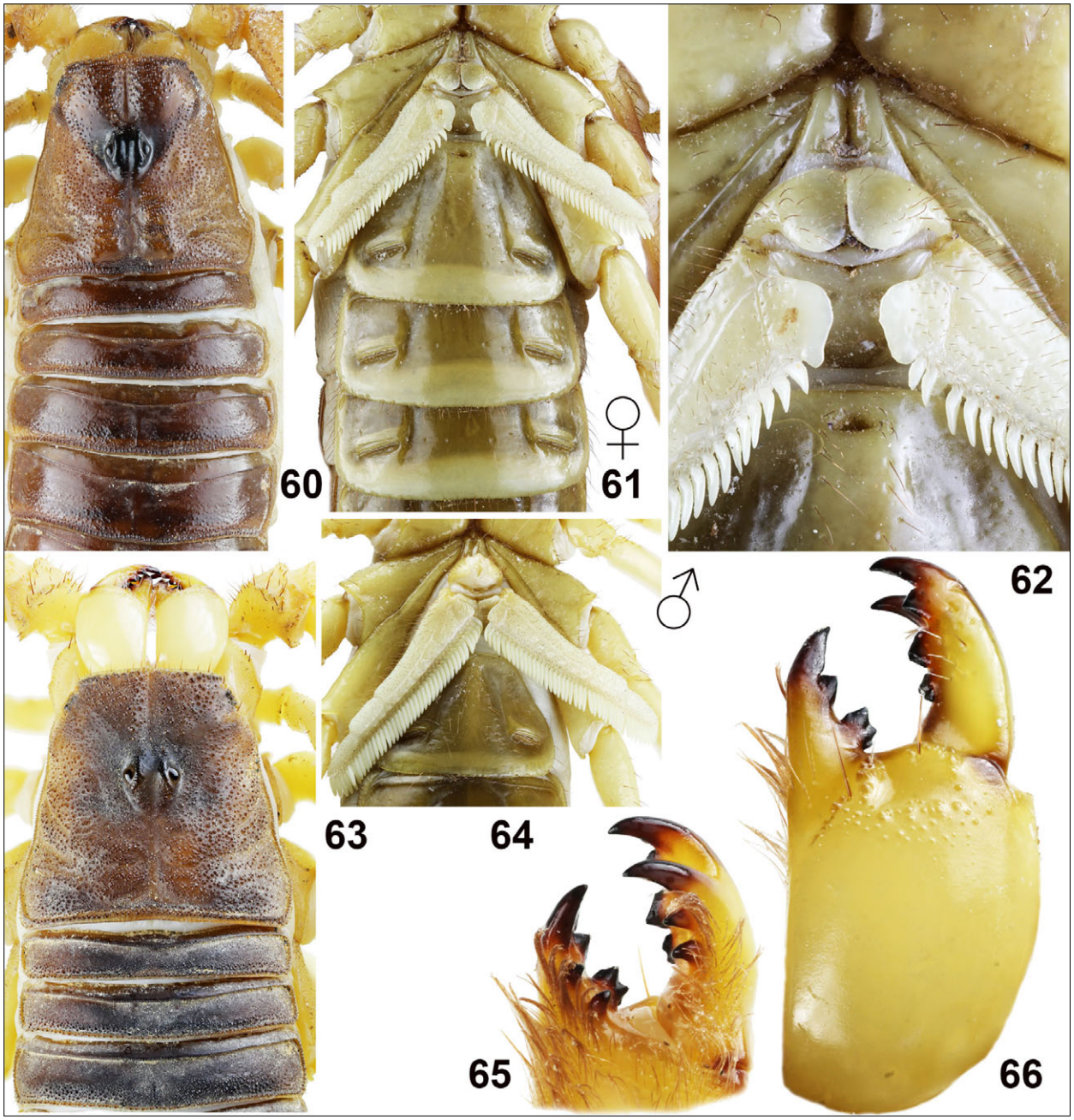


Figures 50–53: *Parabuthus hamar* **sp. n. Figures 50–51**. Male holotype in dorsal (50) and ventral (51) views. **Figures 52–53:** Female paratype from locality 16EH in dorsal (52) and ventral (53) aspects. Scale bar: 10 mm.



Figures 54–59: *Parabuthus hamar* **sp. n**, metasoma and telson. **Figures 54–56**. Male holotype, lateral (54), ventral (55), and dorsal (56) views. **Figures 57–59**. Female paratype from locality 16EH, lateral (57), ventral (58), and dorsal (59) views. Scale bar: 10 mm.

fied for *P. granimanus*. These localities are relatively close to the *P. granimanus* type locality which is also hot and near the sea (Fig. 204). The types of *P. granimanus fuscicauda* Caporiacco, 1947 are also from Eritrea according to the label (Eritrea, dint. Elghena (Hassi Habab), XI.-XII.1902, MZUF, Nos 548 and 549), but these old labels are also suspect, and require verification.



Figures 60–66: *Parabuthus hamar* **sp. n. Figures 60–62**. Female paratype from locality 16EH, carapace and tergites I–III (60), coxosternal area and sternites (61–62). **Figures 63–66**. Male holotype, carapace and tergites I–III (63), coxosternal area (64), right chelicera ventral (65) and dorsal (66) views.

Parabuthus granimanus Pocock, 1895
(Figs. 42–49, 170–171, 186, 196, 204)

Parabuthus granimanus Pocock, 1895: 311–312, pl. IX, figs. 4–4d; Pocock, 1896: 178; Fet & Lowe, 2000: 202 (complete reference list until 2000); Kovařík, 2003: 144, fig. 7; Kovařík, 2004: 19, fig. 8; ? 2003: 144, fig. 7; Kovařík, 2004: 19, fig. 8; ? Kovařík & Whitman, 2005: 110.

= *Parabuthus granimanus fuscicauda* Caporiacco, 1947: 228 (syn. by Kovařík, 2003: 144).

TYPE LOCALITY AND TYPE REPOSITORY. Somalia (now Somaliland), Zeyla (now Zeila, in Somali Saylac, 11°21' N 43°28'E); BMNH.

TYPE MATERIAL EXAMINED. **Somaliland**, Zeyla, 1♂1♀ (lectotype and paralectotype), BMNH. **Eritrea**, dint. Elghena (Hassi Habab), XI.-XII.1902, 1♂1♀ (lectotype and paralectotype of *Parabuthus granimanus fuscicauda* Caporiacco, 1947), MZUF, Nos 548 and 549 (see comments in *P. eritreaensis*).

ADDITIONAL MATERIAL EXAMINED. "**Eritrea**, Asmara env.", 1983, leg. Dorsak, 1♂2♀ (see comments in *P. eritreaensis*). **Somaliland**, near Berbera, 1juv.♀, XI.2010, leg. T. Mazuch; near Sheikh, foothills of Goolis Mts, 09°59.881'N 45°09.762'E, 896 m a.s.l., 1im.♂2juvs., XI.2010, leg. T. Mazuch; Berbera env., 10°22.8'N 45°02.2'E, 107 m a.s.l. (Fig. 48, Locality No. **11SE**), 8.-10.VII.2011, 3♂3♀ (Figs. 42–49, 170–171, 186, 196), leg. F. Kovařík; near Berbera, 10°16'01"N 45°06'21.3"E, 367 m a.s.l. (Fig. 49, Locality No. **11SG**), 10.VII.2011, 1im.♀, leg. F. Kovařík. All specimens are in the first authors collection (FKCP).

DIAGNOSIS. Adults from 90 mm to 120 mm long. Base color uniformly yellow to yellowish brown, carapace, tergites, metasomal segments IV–V and telson dark brown to black. Pectine teeth number 42–49 in males and 36–39 in females. Stridulatory area present on dorsal surface of metasomal segments I–II, absent on third segment absent. Metasoma densely hirsute. Metasoma of male narrow; metasomal segment V length/ width ratio 1.95–2.05 in male. Movable and fixed fingers of pedipalp bear 12–13 rows of granules, all with external and internal accessory granules. Fingers of pedipalp not enlarged. Fingers of pedipalps of male with a tubercle on inner side of base (Fig. 171). Male with chela of pedipalps broader than those of female, pedipalp chela length/ width ratio 3.10–3.3 in male. Pedipalp manus and patella strongly granulated. Tarsomere I of legs I–II with bristlecombs.

COMMENTS ON LOCALITIES AND LIFE STRATEGY. The first author together with Tomáš Mazuch collected *P. granimanus* at sandy deserts in the vicinity of Berbera City in northwestern Somaliland, in an area called Guban, whose southern edge lies in close proximity to the Goolis and Ogo Mountain Range. This low-lying area is extremely warm and dry, and hosts scorpions *Neobuthus berberensis* Hirst, 1911 and *Hottentotta polystictus* (Pocock, 1896) that have been able to adapt to a variety of biotopes in the region. *P. granimanus* was found in close proximity to Berbera City, in the sandy desert (Locality No. **11SE,** Fig. 48). In the local rocky semideserts (Locality No. **11SG**, Fig. 49) *P. granimanus* occurs together with *Buthus berberensis* Pocock, 1900, *Compsobuthus somalilandus* Kovařík, 2012, *Hottentotta polystictus*, *Leiurus* cf. *quinquestriatus* Ehrenberg, 1828, *Neobuthus ferrugineus* (Kraepelin, 1898), and *Hemiscorpius novaki* Kovařík et Mazuch, 2011. At this locality we recorded a daytime temperature of 48.4 ºC and 9.9% humidity. At a further removed locality near Sheikh, in the foothills of the Goolis Mountains, *P. granimanus* reaches relatively higher altitudes around 900 m a.s.l. and occurs together with *Neobuthus ferrugineus*, *Hottentotta polystictus*, and *Pandinus phillipsii* (Pocock, 1896).

DISTRIBUTION. ? Eritrea, ? Ethiopia, ? Djibouti, ? Somalia, Somaliland. Kovařík & Whitman (2005: 110) cited also specimens labeled "Yemen Arab Republic, Aden, 1882" but these must be mislabeled.

Parabuthus hamar Kovařík, Lowe, Plíšková et Šťáhlavský, sp. n.

(Figs. 50–83, 90–91, 168–169, 187, 195, 204, Table 2)

http://www.zoobank.org/urn:lsid:zoobank.org:act:AFEF853A-9B05-4756-9793-2C51A1A1690F

TYPE LOCALITY AND TYPE REPOSITORY. Ethiopia, SNNPR, 20 km SE Konzo, 05°14'33"N 37°32'06"E, 839 m a.s.l. (Locality No. 16EF, Fig. 93), FKCP.

TYPE MATERIAL. **Ethiopia**, Southern Nationalities and Peoples Region Federal State (SNNPR), near Turmi, 04°44'21"N 36°19'53"E, 565 m a.s.l. (Locality No. **16EC**), 11.-12.IV.2016, 1♂ (Figs. 67–70, 73–82, 91, 168–169, 195, paratype), leg. F. Kovařík; SNNPR, 20 km SE Konzo, 05°14'33"N 37°32'06"E, 839 m a.s.l. (Fig. 93, Locality No. **16EF**), 14.-15.IV.2016, 1♂ (Figs. 50–51, 54–56, 63–66, 187, holotype), leg. F. Kovařík; Oromia State, Sidamo Province, Wachile, 04°32'33"N 39°03'07"E, 1051 m a.s.l.(Locality No. **16EH**), 1♀ (paratype, Figs. 52–53, 57–62, 71–72, 83), 16.-17.IV.2016, leg. F. Kovařík; Oromia State, Borana Province, 04°25'31.5"N 38°58'14"E, 1171 m a.s.l. (Locality No. **13EI**), 27.-28.VI.2013, 2juvs.♂♀ (paratypes), leg. F. Kovařík; SNNPR, Omorate (Kelem), 04°48'42"N 36°03'16.7"E, 373 m a.s.l. (Fig. 92, Locality No. **13EU**), 4.-5.VII.2013, 1im.♂1juv.♂ (paratypes), leg. F. Kovařík et J. Plíšková; SNNPR, "lower valley of the Omo river", Chew Bahr, 04°50'38.5"N 36°44'11.4"E, 625 m a.s.l. (Locality No. **13EW**), 5.-6.VII.2013, 1im.♂ (paratype), leg. F. Kovařík et V. Socha; SNNPR, Gamo Gofa Province, 20km SE Konso, 05°14'33"N 37°32'06"E, 850 m a.s.l., 11-13.V.2015, 1♂ (paratype), leg. P. Kučera; Oromia State, Borena region, between Negele and Filtu, 05°13'12.2"N 39°52'29.3"E, 1406 m a.s.l. (Locality No. **14EE**), 19.XI.2014, 2ims.♂ 3ims.♀2juvs. (paratypes), leg. F. Kovařík; Somali State, Liben region, Filtu, 05°06'48.7"N 40°39'18.3"E, 1229 m a.s.l. (Locality No. **14EG**), 19.-21.XI.2014, 1im.♂6juvs. (Fig. 90, paratypes), leg. F. Kovařík; Somali State, Liben Region, between Filtu and Dolo Odo, 04°50'18.1"N 40°56'23.5"E, 885 m a.s.l. (Locality No. **14EH**), 20.XI.

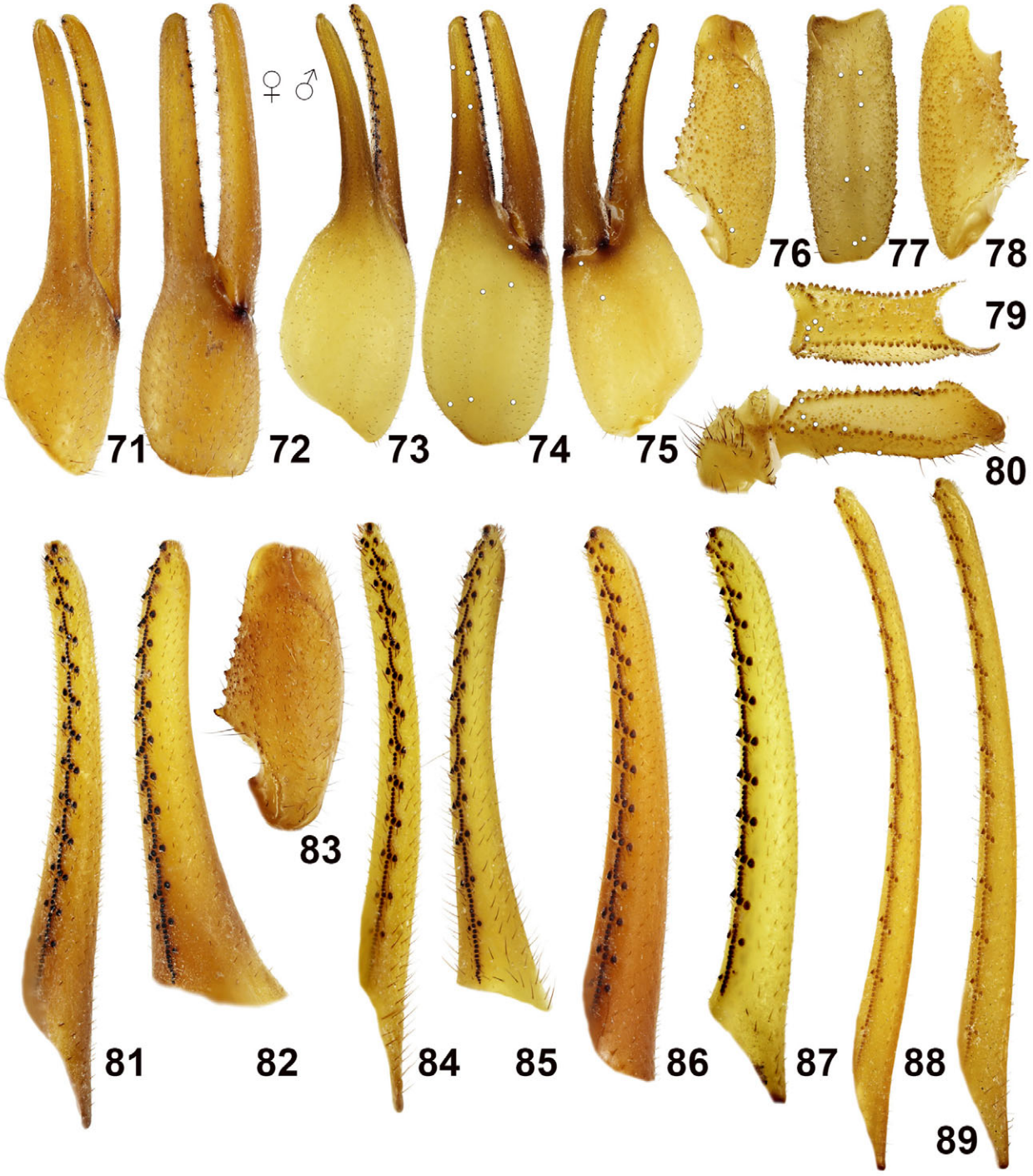
Figures 67–70: *Parabuthus hamar* **sp. n.**, male paratype from locality 16EC, left legs I–IV, retrolateral aspect.

2014, 1juv.♀ (paratype), leg. F. Kovařík. All types are in the first authors collection (FKCP).

ETYMOLOGY. Named after the Hamar people, an Omotic community inhabiting southwestern Ethiopia. They live in Hamer woreda (or district), a fertile part of the Omo River valley of the Southern Nationalities and Peoples Region Federal State (SNNPR). They are largely pastoralists, so their culture places a high value on cattle. They speak the Hamar language of Omotic group and representing approximately 0.1% of the total Ethiopian population. Several of the localities of this species are directly on their territory.

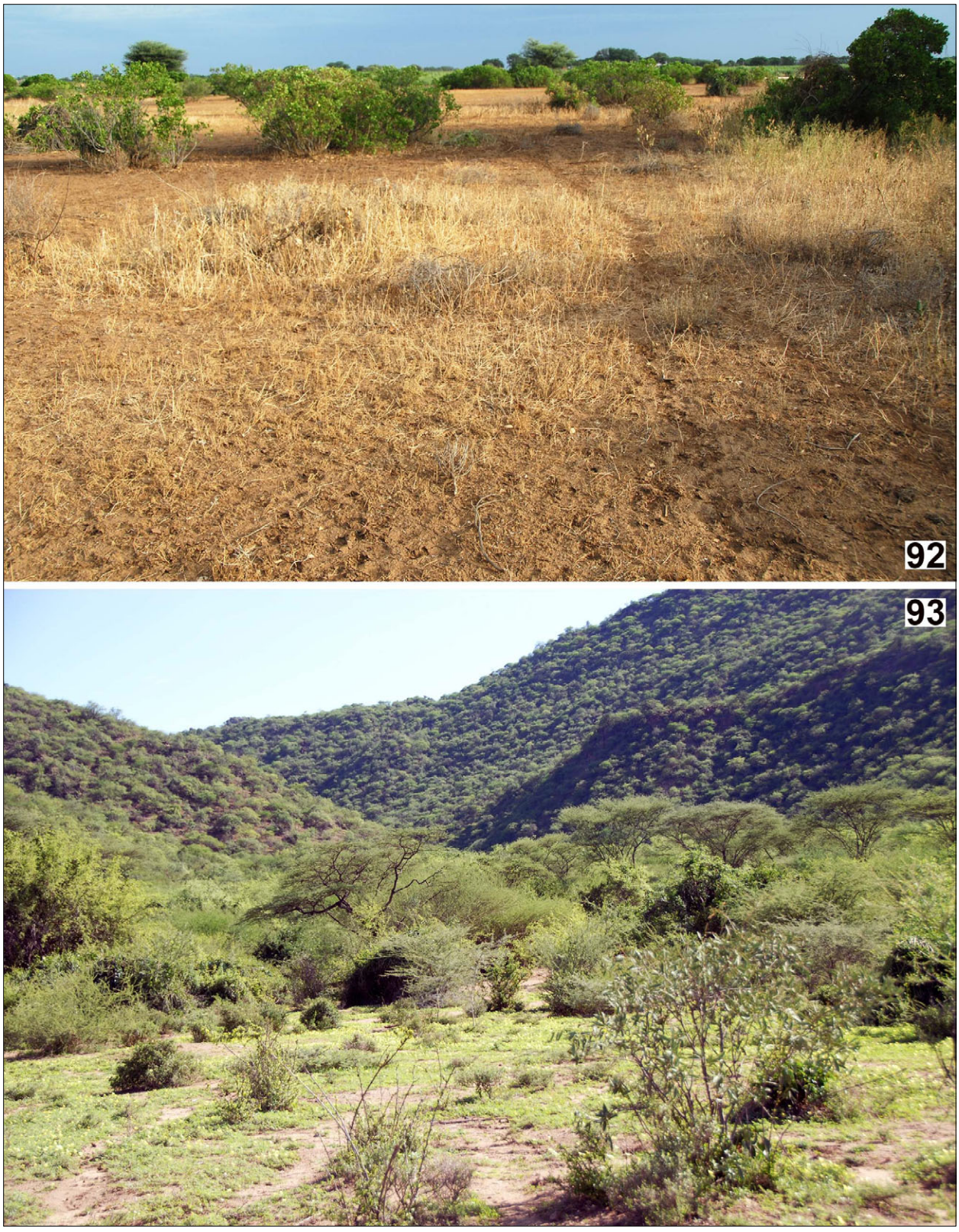
DIAGNOSIS. Adults from 88 mm to 92 mm long. Base color uniformly yellow to yellowish brown, carapace, tergites, metasomal segments IV–V and telson dark brown to black. Pectine teeth number 38–44 in males and 30–35 in females. Stridulatory area present on dorsal surface of metasomal segments I–II in both sexes, absent on third segment in adult male and very reduced in female. Metasoma densely hirsute. Metasoma of male narrow; metasomal segment V length/ width ratio 1.82–2.05 in male. Movable and fixed fingers of pedipalp bearing 12–13 rows of granules, all with external and internal accessory granules. Fingers of pedipalp not enlarged, movable finger length/ manus length ratio 1.7 in male. Fingers of pedipalps of male with inner side of base smooth, no trace of tubercle. Manus of pedipalp of male broad, pedipalp chela length/ width ratio 3.05–3.13 in male and 4.27 in female. Pedipalp manus smooth, patella strongly granulated. Tarsomere I of all legs with bristlecombs.

DESCRIPTION. The adults are 88–92 mm long. The habitus is shown in Figs. 50–53. For position and distribution of trichobothria of pedipalps see Figs. 74–77 and 79–80. Sexual dimorphism: adult males with chela of pedipalps broader (Figs. 71 and 73), metasomal segments narrower (Figs. 54–59), and carapace and tergites

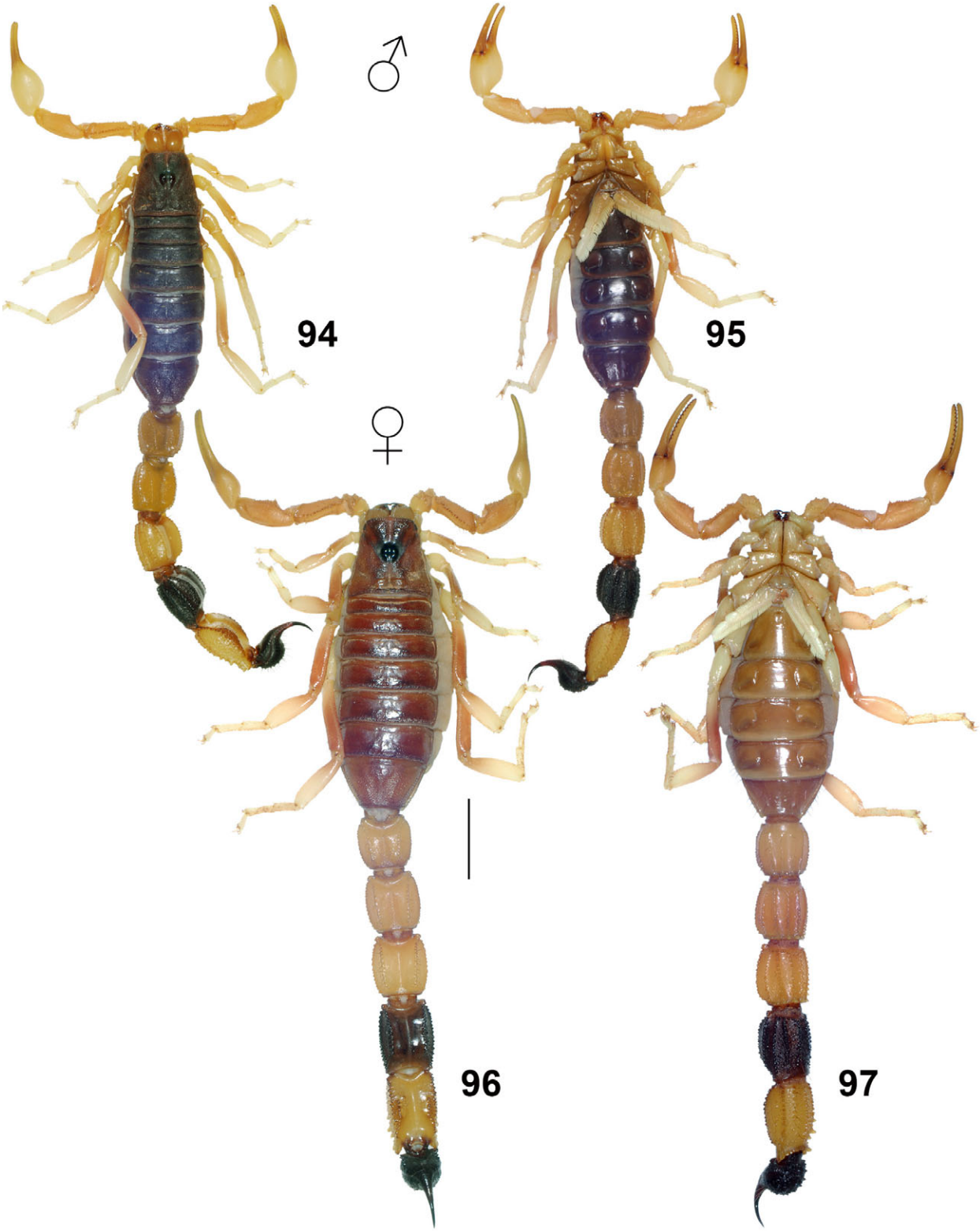


Figures 71–89: **Figures 71–83**. *Parabuthus hamar* **sp. n.**, pedipalp segments. **Figures 71–72, 83**. Female paratype from locality 16EH, chela dorsal (71) and external (72). Patella dorsal (83). **Figures 73–82**. Male paratype from locality 16EC, chela dorsal (73), external (74), and ventral (75). Patella dorsal (76), external (77) and ventral (78). Femur internal (79) and femur and trochanter dorsal (80). Movable finger (81) and fixed finger (82) dentition. Trichobothrial pattern is indicated in Figures 74–77 and 79–80. **Figures 84–85**. *P. kajibu* **sp. n.**, male holotype, movable finger (84) and fixed finger (85) dentition. **Figure 86**. *P. maximus*, male from Kenya, Voi, movable finger dentition. **Figure 87**. *P. pallidus*, male from locality 16EA, movable finger dentition. **Figure 88**. *P. cimrmani*, female paratype, movable finger dentition. **Figure 89**. *P. eritreaensis*, male from Somalia, Gardo, Migiurtina, movable finger dentition.

Figures 90–91: *Parabuthus hamar* **sp. n.**, in vivo habitus in type locality. Juvenile male paratype at locality 14EG (90), and male paratype at locality 16EC (91).

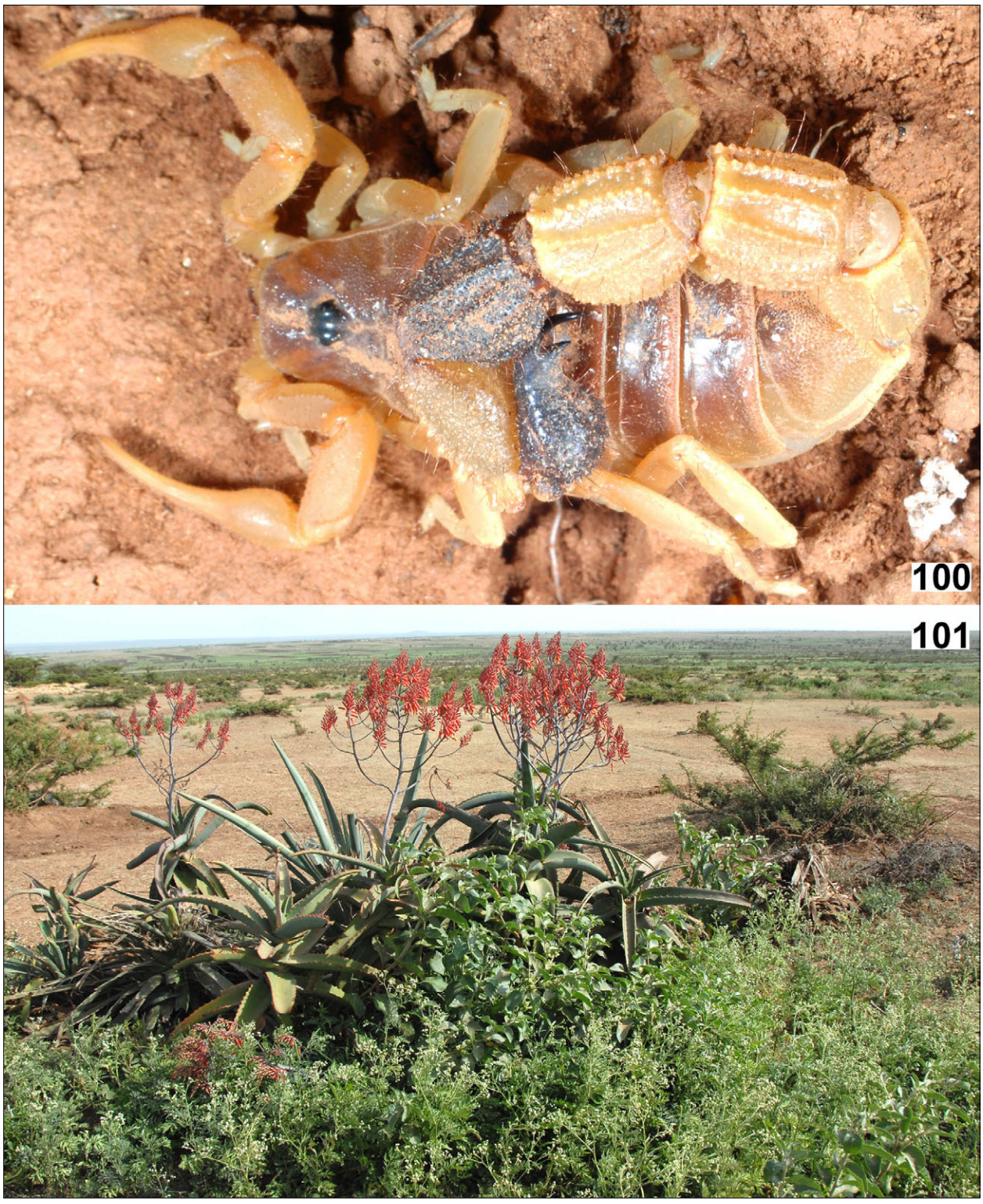


Figures 92–93: *Parabuthus hamar* **sp. n.**, locality 13EU (92), Ethiopia, SNNPR, Omorate (Kelem), 04°48'42"N 36°03'16.7"E, 373 m a.s.l. and type locality 16EF (93), SNNPR, 20 km SE Konzo, 05°14'33"N 37°32'06"E, 839 m a.s.l.

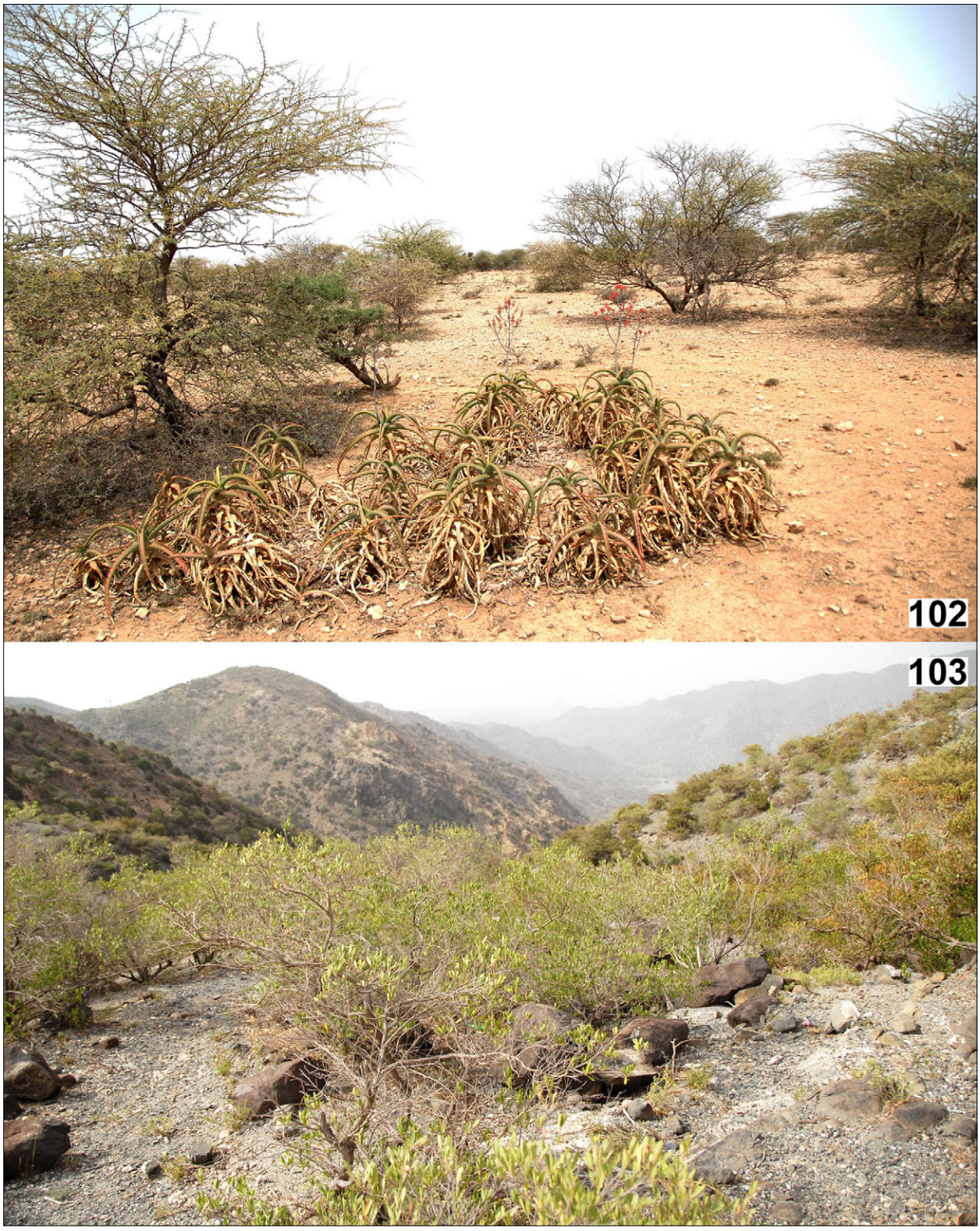


Figures 94–97: *Parabuthus heterurus*. **Figures 94–95**. Male from locality 11SQ in dorsal (94) and ventral (95) views. **Figures 96–97:** Female from locality 11EU in dorsal (96) and ventral (97) aspects. Scale bar: 10 mm.

Figures 98–99: *Parabuthus heterurus*, in vivo habitus in locality. Female at locality 11SN (98), and male at locality 11SQ (99).



Figures 100–101: *Parabuthus heterurus*. **Figure 100**. Female with anomalous development (c.f. secondary aculeus-like process on telson vesicle) in vivo habitus in locality 11EU. **Figure 101**. Locality 11EU, Ethiopia, beetwen Jijiga and Degehbur, 09°09'18.7"N 43°08'03.5"E, 1740 m a.s.l.



Figures 102–103: *Parabuthus heterurus*, locality 11SQ (102) Somaliland, between Hargeisa and Salahle, 09°12'16"N 44°99'51.5"E, 1229 m. a.s.l. and 11SN (103) Somaliland, Sheikh, 09°57'25.9"N 45°09'52.2"E, 1492 m a.s.l.

dull (in female glossy). Female with basal pectinal tooth wide (Fig. 62) and smaller number of pectines.

Coloration (Figs. 50–53). The base color of pedipalps, chelicerae, legs, sternites and metasomal segments I–III is uniformly yellow to yellowish brown. Carapace, tergites, metasomal segments IV–V and telson are dark brown to black.

Carapace and mesosoma (Figs. 50–53, 60–64)**.** The entire carapace is covered by large granules, and only between posterior and median eyes are there two symmetrical smooth places mainly in the females. Carinae are absent. The anterior margin of the carapace is almost straight, although medially it can be weakly convex, and it bears 10 or 12 symmetrically distributed short, stout spiniform macrosetae. The tergites are granulated, more so in males. Tergite VII is pentacarinate, with lateral pairs of carinae strong, serrato-crenulate. The pectinal tooth count is 38–44 (3x38, 1x39, 2x40, 5x41, 5x42, 2x43, 1x44) in males and 30–35 (1x30, 1x32, 3x33, 5x34, 2x35) in females. The pectine marginal tips extend to half of the fourth sternite in the male, and to end of the third sternite in the female. The pectines have three marginal lamellae and 10–11 middle lamellae. The lamellae and fulcra bear numerous dark setae. All sternites are smooth, except that there is a stridulatory area on the third sternite that is more visible in the male. Sternite VII bears four usually crenulate carinae.

Metasoma and telson (Figs. 54–59)**.** The first to fourth metasomal segments bear a total of 10 variously granulated carinae. The fifth segment has five carinae, and its ventral and lateral surfaces are granulated in females. Males have granulation only on the ventral surface of metasomal segments IV–V and the upper lateral part of metasomal segment I. Dorsolateral keels of the third and fourth segments terminate in sharp teeth in males, and blunt denticles in females, of which the posteriormost denticle is not enlarged. The stridulatory area is located on the dorsal surface of the first and second segments in both sexes. On the third segment the stridulatory area is absent in males and very reduced in females. The entire metasoma, but especially the third to fifth segments, and the telson are densely pilose. The ventral surface of the telson is strongly granulated. The metasoma of males is more narrow; metasomal segment V length/ width ratio is 1.82–2.05 in males and 1.57 in females. The telson is bulbous, with the aculeus shorter than the vesicle in females and the same length as the vesicle in males.

Pedipalps (Figs. 71–83)**.** The pedipalps are hirsute with short setae, only the trochanter and femur bear long setae externally. The femur bears four carinae. The patella is strongly granulated without distinct carinae. The chela is smooth without carinae. The movable and fixed fingers of the pedipalp bear 12–13 rows of granules, all with external and internal accessory granules. Pedipalp fingers are not enlarged, movable finger length/ manus length ratio 1.7 in male. Pedipalp fingers of male with inner side of base smooth, no trace of tubercle. Manus of pedipalp of male broad, pedipalp chela length/ width ratio is 3.05–3.13 in males and 4.27 in females.

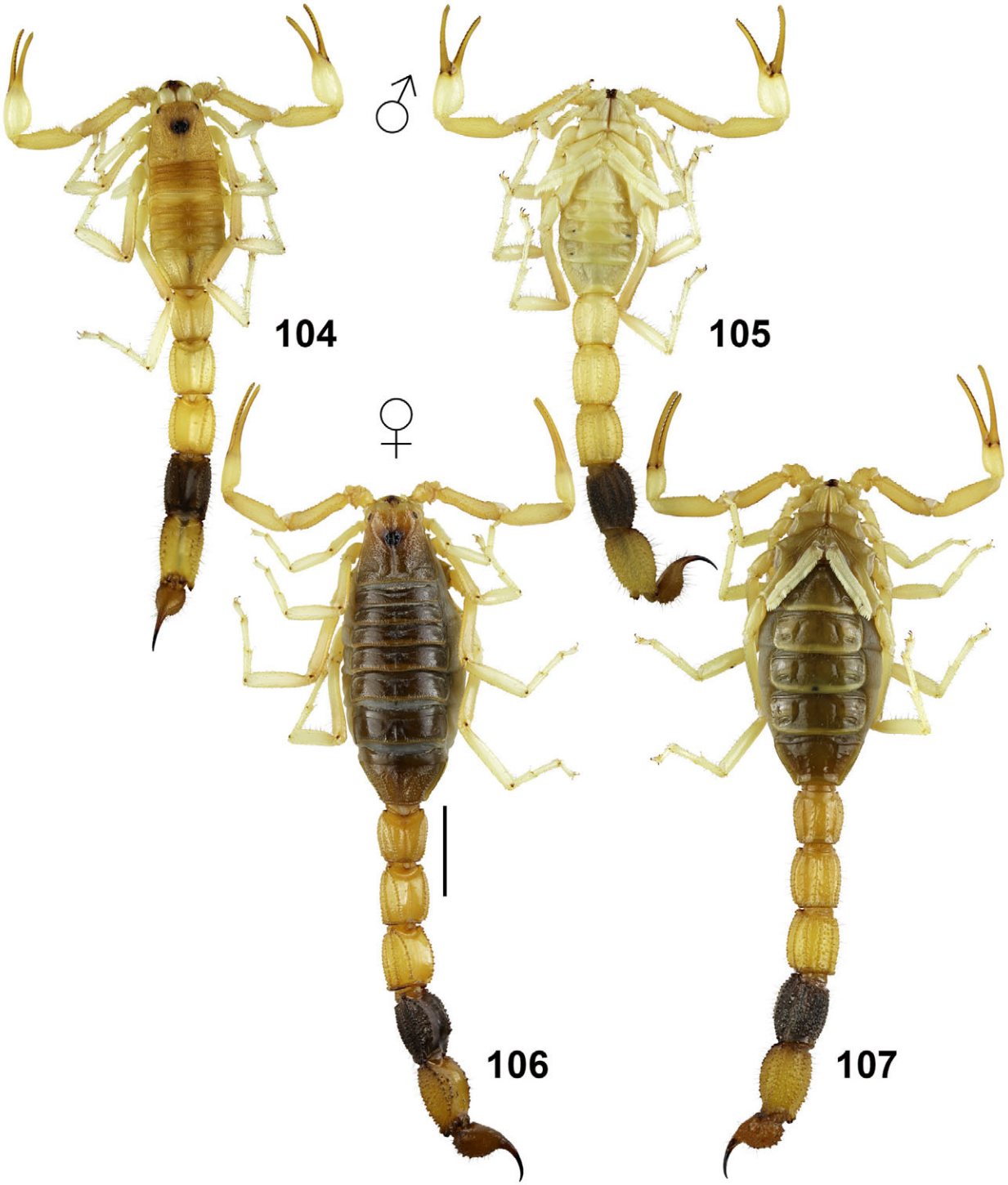
Legs (Figs. 67–70). Legs III and IV bear tibial spurs. Retrolateral and prolateral pedal spurs are present on all legs. All legs without distinct carinae and smooth. The tarsomeres bear two rows of macrosetae on the ventral surface and other macrosetae on the other surfaces. Bristlecombs are present on all legs, although slightly reduced on the fourth leg.

Measurements. See Table 2.

AFFINITIES. The described features distinguish *P. hamar* **sp. n.** from all other species of the genus. They are recounted in the key below. *P. hamar* **sp. n.** is similar to members of the "*Parabuthus liosoma* complex" represented by *P. abyssinicus*, *P. leiosoma*, and *P. maximus* from which can be unequivocally separated by: **1**) metasoma of male narrow, for example metasomal segment V length/ width ratio is 1.82–2.05 in male *P. hamar* **sp. n.** and broader in the other three species (Figs. 187 versus 183–185; metasomal segment V length/ width ratio is 1.50–1.73 in males *P. abyssinicus*, *P. liosoma*, and *P. maximus*); **2**) dorsal stridulation area of metasomal segment III absent in male *P. hamar* **sp. n.**. present or reduced in the other three species (Figs. 187 versus 183–185); **3**) patella of pedipalp strongly granulated in *P. hamar* **sp. n.** (Fig. 76) and in *P. maximus* (Fig. 182), smooth in *P. liosoma* (Fig. 180) and finely granulated in *P. abyssinicus* (Fig. 181).

COMMENTS ON LOCALITIES AND LIFE STRATEGY. The first author visited the type locality **16EF** (Fig. 93) on 14–15 April 2016 and collected with UV light. At the locality, the first author recorded a maximum daytime temperature of 34.7 ºC, and nighttime temperatures of 27.4 ºC shortly after sunset, dropping to 21.7 ºC (minimum temperature) before sunrise, and humidity varied between 55% and 65%. In addition to *P. hamar* **sp. n.** the first author also recorded at this locality *Hottentotta trilineatus* (Peters, 1862), *Lychas obsti* Kraepelin, 1913, *Parabuthus pallidus* Pocock, 1895, and *Somalicharmus whitmanae* Kovařík, 1998. All four of these scorpion species were more common at this locality than *P. hamar* **sp. n.**

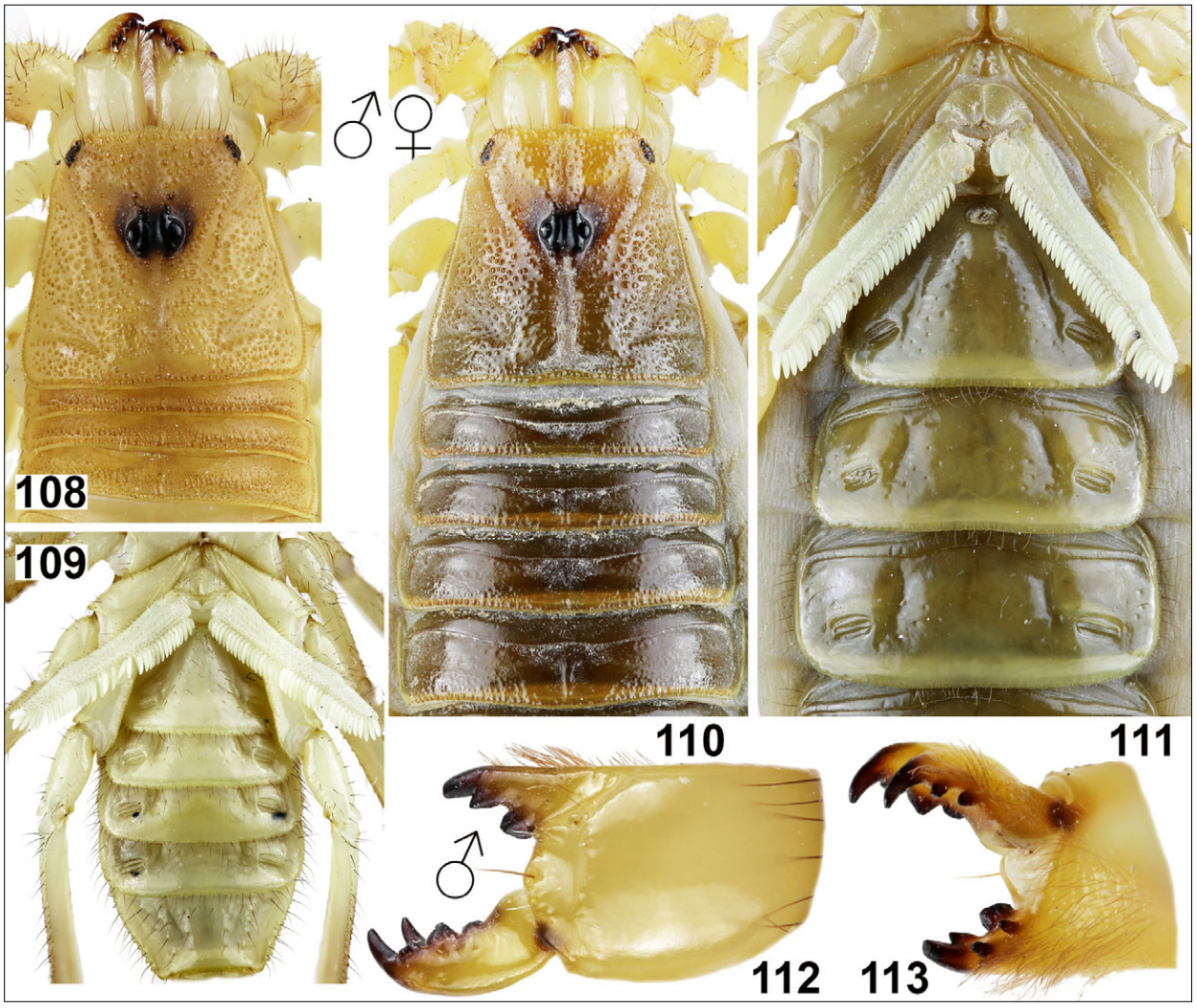
The first author visited the locality **16EC** on 11–12 April 2016 and collected the male paratype of *P. hamar* **sp. n.** on the margin of a dry river-bed with UV light. At the locality, the first author recorded nighttime temperatures of 28.1 ºC shortly after sunset, dropping to 22.6 ºC (minimum temperature) before sunrise, and humidity varied between 59% and 78%. In addition to *P. hamar* **sp. n.** the first author also recorded at this locality *Hottentotta trilineatus*, *Lychas obsti*, and *Parabuthus*



Figures 104–107: *Parabuthus kajibu* **sp. n. Figures 104–105**. Male holotype in dorsal (104) and ventral (105) views. **Figures 106–107:** Female paratype in dorsal (106) and ventral (107) views. Scale bar: 10 mm.

pallidus. All three of these scorpion species were relatively common at this locality.

The first author visited the locality **16EH** on 16–17 April 2016. The female paratype of *P. hamar* **sp. n.** was in a ca. 40 cm deep borrow with the entrance in open terrain. At this locality, the first author recorded a maximum daytime temperature 30.5 ºC, and nighttime temperatures of 25.0 ºC shortly after sunset, dropping to 17.8 ºC (minimum temperature) before sunrise, and humidity varied between 46% and 99% (raining season).



Figures 108–113: *Parabuthus kajibu* **sp. n. Figures 108–109, 112–113**. Male holotype, carapace and tergites I–III (108), coxosternal area and sternites (109), left chelicera dorsal (112) and ventral (113) views. **Figures 110–111**. Female paratype, carapace and tergites I–IV (110), coxosternal area and sternites III–V (111).

In addition to *P. hamar* **sp. n.** the first author also recorded at this locality *Gint gaitako* Kovařík et al., 2013, *Hottentotta trilineatus*, *Parabuthus pallidus*, and *Pandinops* sp.

Parabuthus heterurus Pocock, 1897
(Figs. 94–103, 176–177, 190, 199, 204)

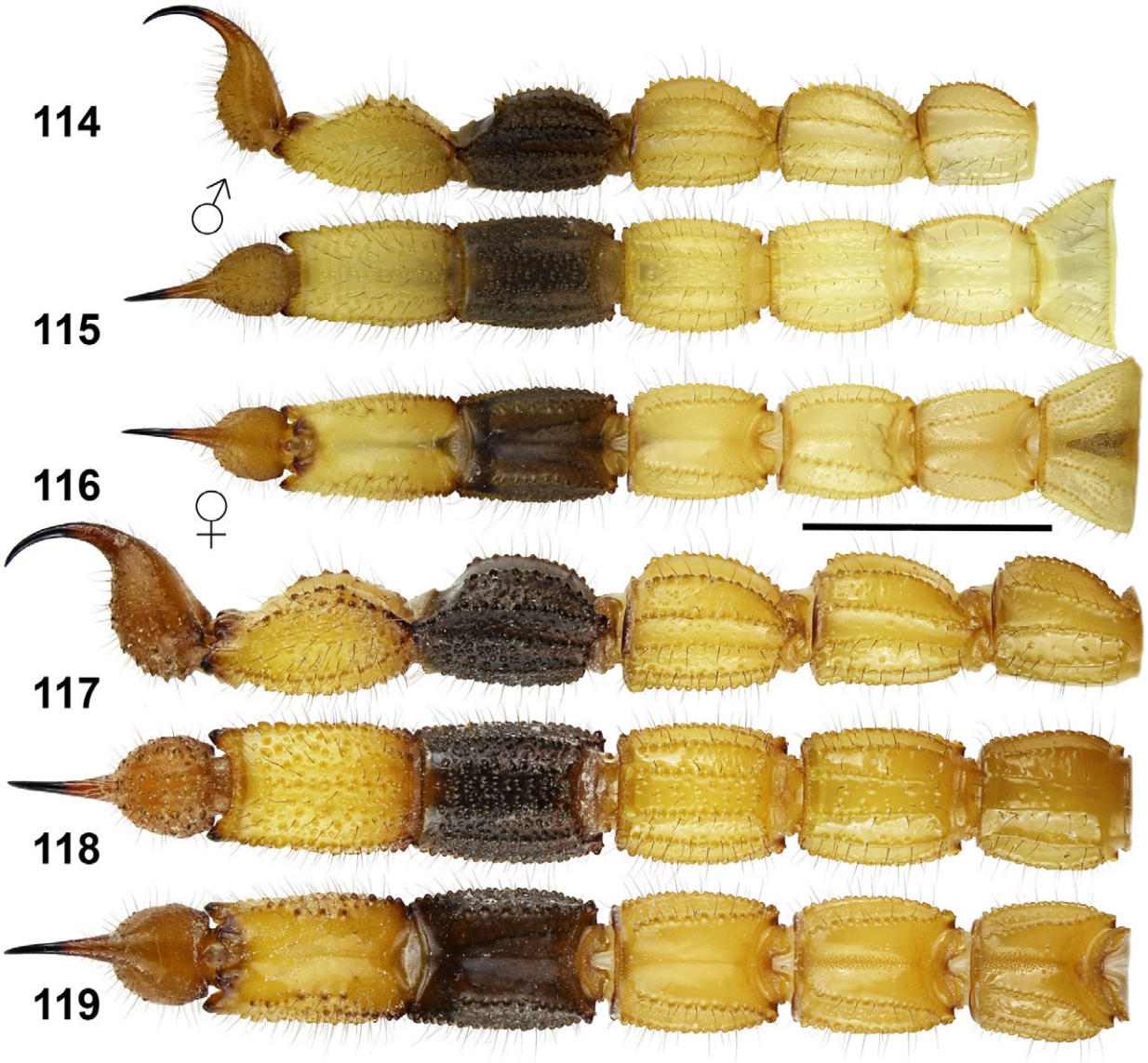
Parabuthus heterurus Pocock, 1897: 402; Fet & Lowe, 2000: 204 (complete reference list until 2000); Kovařík, 2003: 144; Kovařík, 2004: 19, fig. 9; Kovařík & Whitman, 2005: 110.

= *Parabuthus stefaninii* Caporiacco, 1927: 58; Kovařík & Whitman, 2005: 112 (syn. by Kovařík, 2003: 144, 159).

TYPE LOCALITY AND TYPE REPOSITORY. Somalia (now Somaliland), Shebegh River (dsg. by Prendini, 2000); BMNH.

TYPE MATERIAL EXAMINED. Somalia (now Somaliland), Schebegh River, 1♂ (paralectotype) 1♀ (lectotype dsg. by Prendini, 2000), BMNH.

ADDITIONAL MATERIAL EXAMINED. **Ethiopia**, ca 20 km on road from Jijiga to Dagah Bur, 09°09.353'N 43°07.962'E, 1741 m a.s.l., 1♂1♀2juvs.♂♀, XI.2010, leg. T. Mazuch; beetwen Jijiga and Degehbur, 09°09' 18.7"N 43°08'03.5"E, 1740 m a.s.l. (Fig. 101, Locality No. **11EU**), 17.VII.2011, 4♀ (Figs. 96–97, 100) 1im. ♂2ims.♀, leg. F. Kovařík. **Somaliland**, Paintings, Laas Gel, 50 km NE from Hargeisa, 1♂, XI.2010, leg. T.



Figures 114–119: *Parabuthus kajibu* **sp. n**, metasoma and telson with sternite VII in Fig. 115 and tergite VII in Fig.116. **Figures 114–116**. Male holotype, lateral (114), ventral (115), and dorsal (116) views. **Figures 117–119**. Female paratype, lateral (117), ventral (118), and dorsal (119) views. Scale bar: 10 mm.

Mazuch; near Sheikh, foothills of Gous Mts, 09°59. 881'N 45°09.762'E, 896 m a.s.l., 1♀1juv., XI.2010, leg. T. Mazuch; Berbera env., 2juvs., XI.2010, leg. T. Mazuch; Sheikh, 09°57'25.9"N 45°09'52.2"E, 1492 m a.s.l. (Fig. 103, locality No **11SN**), 12.VII.2011, 1♀ (Fig. 98) 1juv., leg. F. Kovařík; beetwen Hargeisa and Salahle, 09°12'16"N 44°99'51.5"E, 1229 m. a.s.l., (Fig. 102, locality No. **11SQ**), 14.VII.2011, 1♂ (Figs. 94–95, 99, 176–177, 190, 199) 1♀, leg. F. Kovařík. All specimens are in the first authors collection (FKCP).

DIAGNOSIS. Adults from 71 mm to 98 mm long. Base color uniformly yellow to yellowish brown, tergites brown to black, fourth metasomal segment and telson dark. Pectine teeth number 33–39 in male and 32–36 in female. Stridulatory area on dorsal surface of first to third segments, more pronounced on first and second segments. Metasoma densely hirsute. Metasomal segment V of male length/ width ratio is 1.50–1.60 in male. Movable and fixed fingers of pedipalp bear 12–14 rows of granules, all with external and internal accessory granules. Fingers of pedipalp are not enlarged. Fingers of pedipalps of male with inner side of base smooth, no trace of tubercle. Manus of pedipalp of male broad, pedipalp chela length/ width ratio 2.85–3.00 in male and 3.90–4.25 in female. Pedipalp manus smooth, patella coarsely granulated. Tarsomere I of legs I–III with bristlecombs.

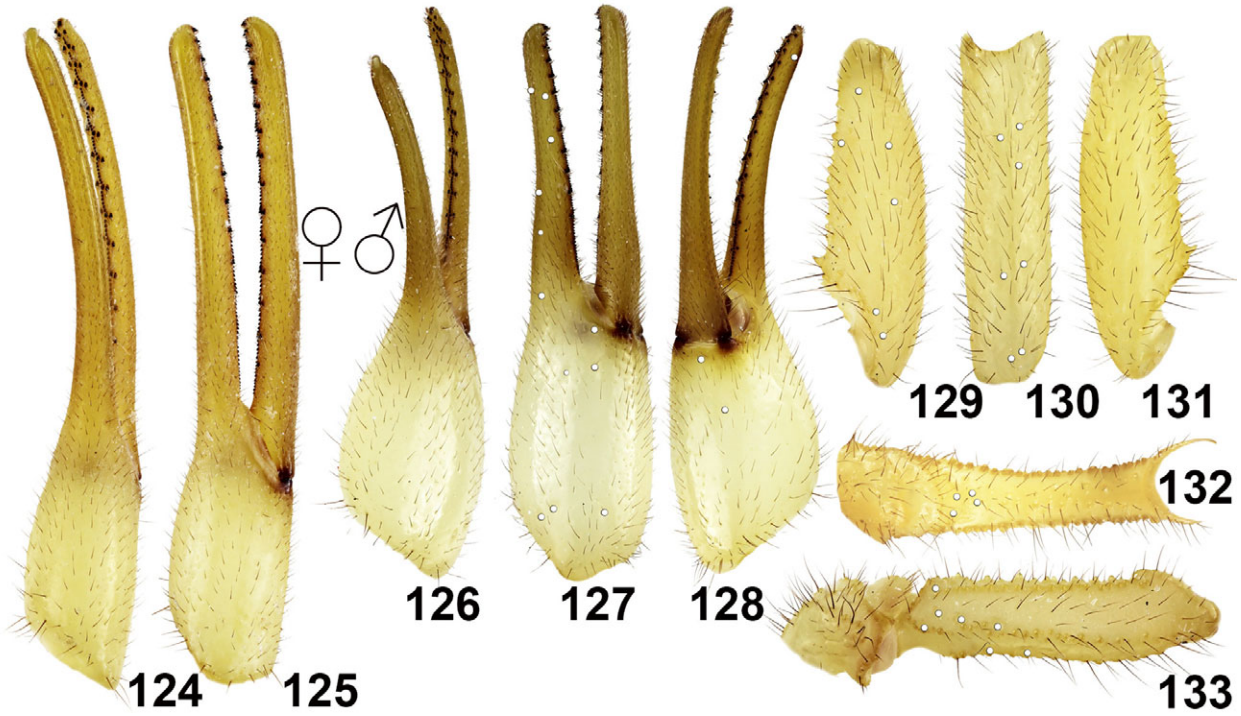
Figures 120–123: *Parabuthus kajibu* **sp. n.**, male holotype, right legs I–IV, retrolateral aspect. Scale bar: 5 mm.

DISTRIBUTION. Ethiopia, ? Somalia, Somaliland.

***Parabuthus kajibu* Kovařík, Lowe, Plíšková et Šťáhlavský, sp. n.**
(Figs. 84–85, 104–143, 178–179, 191, 200, 204, Tabs. 1–2)
http://www.zoobank.org/urn:lsid:zoobank.org:act:AFEF853A-9B05-4756-9793-2C51A1A1690F

TYPE LOCALITY AND TYPE REPOSITORY. Ethiopia, Oromia State, West Harerge, 07°49'12.6"N 40°31'54"E, 918 m a.s.l. (Figs. 142–143); FKCP.

TYPE MATERIAL. **Ethiopia**, Oromia State, West Harerge, 07°49'12.6"N 40°31'54"E, 918 m a.s.l. (Locality No.



Figures 124–133: *Parabuthus kajibu* **sp. n.**, pedipalp segments. **Figures 124–125**. Female paratype, chela dorsal (124) and external (125). **Figures 126–133**. Male holotype, chela dorsal (126), external (127), and ventral (128). Patella dorsal (129), external (130) and ventral (131). Femur and trochanter internal (132) and dorsal (133). Trichobothrial pattern is indicated in Figures 127–130 and 132–133.

16EJ =14ER), 21.-22.IV.2016, 1♂(Figs. 84–85, 104–105, 108–109, 112–116, 120–123, 126–138, 140, 178–179, 191, 200, 204, holotype) 3♀(Figs. 106–107, 110–111, 117–119, 124–125, 141, paratypes) 8juvs. (3♂5♀, Fig. 139, paratypes), leg. F. Kovařík. All types are in the first authors collection (FKCP).

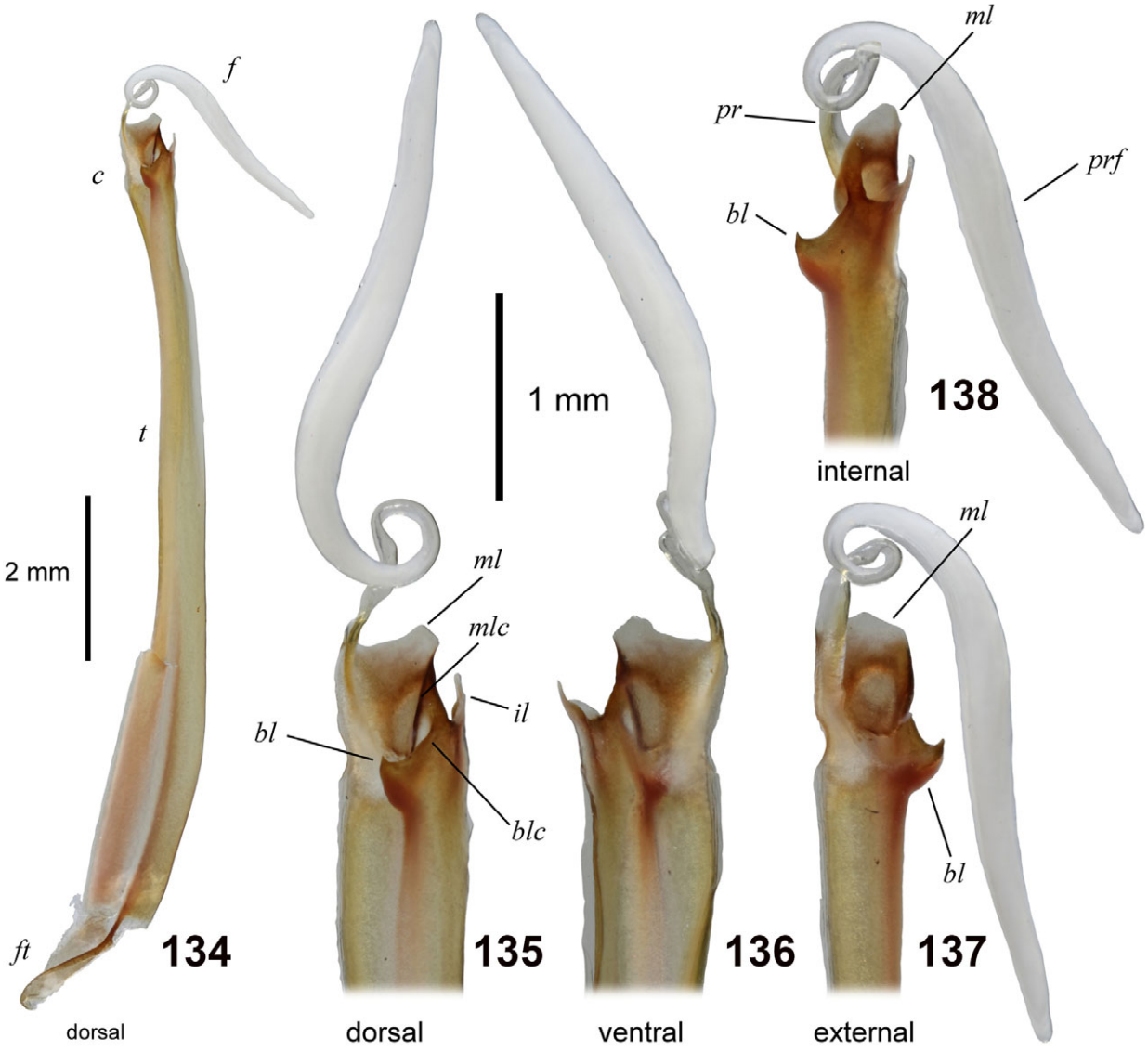
ETYMOLOGY. *Kajibu* means scorpion in Oromia language.

DIAGNOSIS. Adults from 55 mm to 80 mm long. Base color uniformly yellow to yellowish brown, tergites yellow (male) or brown to black (female), fourth metasomal segment dark. Telson yellowish brown to orange. Pectine teeth number 37–39 in males and 33–35 in females. Stridulatory area present on dorsal surface of first and second metasomal segments, absent in metasomal segments III–V. Metasoma densely hirsute. Metasomal segment V length/ width ratio is 1.62 in male. Dorsal carina of metasomal segment IV posteriorly composed of strong pointed granules in males. Movable and fixed fingers of pedipalp bear 12–13 rows of granules, all with external and internal accessory granules. Fingers of pedipalp not enlarged. Fingers of pedipalps of male with inner side of base smooth, no trace of tubercle. Manus of pedipalp of male broad, pedipalp chela length/ width ratio 3.52 in males and 5.25–5.45 in females. Pedipalp chela and patella smooth. Tarsomere I of legs I–III with bristlecombs.

DESCRIPTION. The adults are 55–80 mm long. The habitus is shown in Figs. 104–107. For position and distribution of trichobothria of pedipalps see Figs. 127–130 and 132–133. Sexual dimorphism: adult males with pedipalp chela broader (Figs. 124 and 126), metasomal segments narrower (Figs. 114–119), and carapace and tergites dull (in female glossy). Female with basal pectinal tooth wide (Fig. 111) and smaller number of pectine teeth.

Coloration (Figs. 104–107). The base color of pedipalps, chelicerae, legs, sternites and metasomal segments I–III and V is uniformly yellow to yellowish brown. The pedipalp chela in males can be almost white. Metasomal segment IV is dark brown to black, telson yellowish brown to orange. Carapace and tergites can be yellow (male holotype) or brown to black (female paratypes)

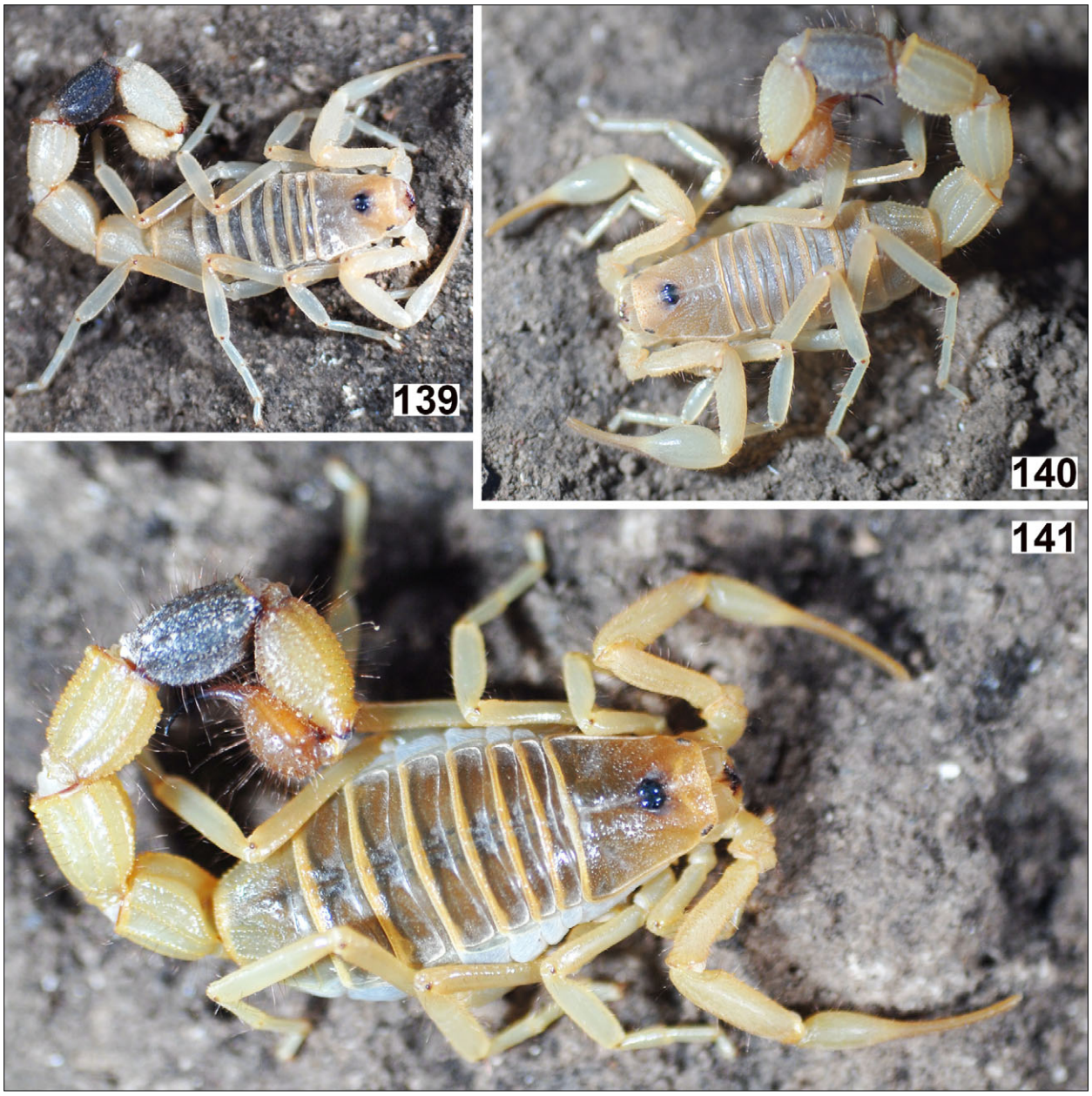
Carapace and mesosoma (Figs. 104–107, 108–111)**.** The entire carapace is covered by large granules. Carinae are absent. The anterior margin of the carapace is almost straight, medially weakly convex, and bears 16–20 symmetrically distributed short, stout spiniform macrosetae. The tergites are granulated, more so in males. Tergite VII is pentacarinate, with lateral pairs of



Figures 134–138: *Parabuthus kajibu* **sp. n.**, right hemispermatophore. **Figure 134.** Whole hemispermatophore with capsule region in dorsal view. Scale bar: 2 mm. **Figures 135–138.** Capsule region and flagellum, oriented to show capsule region in dorsal (135), ventral (136), external (137) and internal (138) views. In Figures 135 and 135, the capsule is dorsoventrally compressed to show the form of the lobes. Scale bar: 1 mm. Abbreviations: *bl*, basal lobe; *blc*, basal lobe carina; *c*, capsule; *f*, flagellum; *ft*, foot; *il*, internal lobe; *ml*, median lobe; *mlc*, median lobe carina; *pr*, pars recta of flagellum; *prf*, pars reflecta of flagellum; *t*, trunk.

carinae strong, serratocrenulate. The pectinal tooth count is 37–39 (1x37, 6x38, 1x39) in males and 33–35 (4x33, 5x34,7x35) in females. The pectine marginal tips extend to the end of the fourth sternite in the male and to a quarter of the fourth sternite in the female. The pectines have three marginal lamellae and 11–13 middle lamellae. The lamellae and fulcra bear numerous dark setae. All sternites are smooth, except that there is a stridulatory area on the third sternite that is more visible in the male. Sternite VII bears four carinae that are more visible in the male.

Metasoma and telson (Figs. 114–119)**.** The first to fourth metasomal segments bear a total of 10 granulated carinae. The fifth segment has five carinae, and its ventral and lateral surfaces are granulated in females. The ventral surface of metasomal segment V has three strong paired granules symmetricaly located laterally in the middle part. Dorsolateral keels of the third and fourth segments terminate in sharp teeth in males and blunt denticles in females, of which the posteriormost denticle is not enlarged. The stridulatory area is located on the dorsal surface of the first and second segments in both sexes. On the third to fifth segment the stridulatory area is absent. The entire metasoma and the telson are densely pilose with long hairs. The ventral surface of the telson is strongly granulated. The metasoma of males is



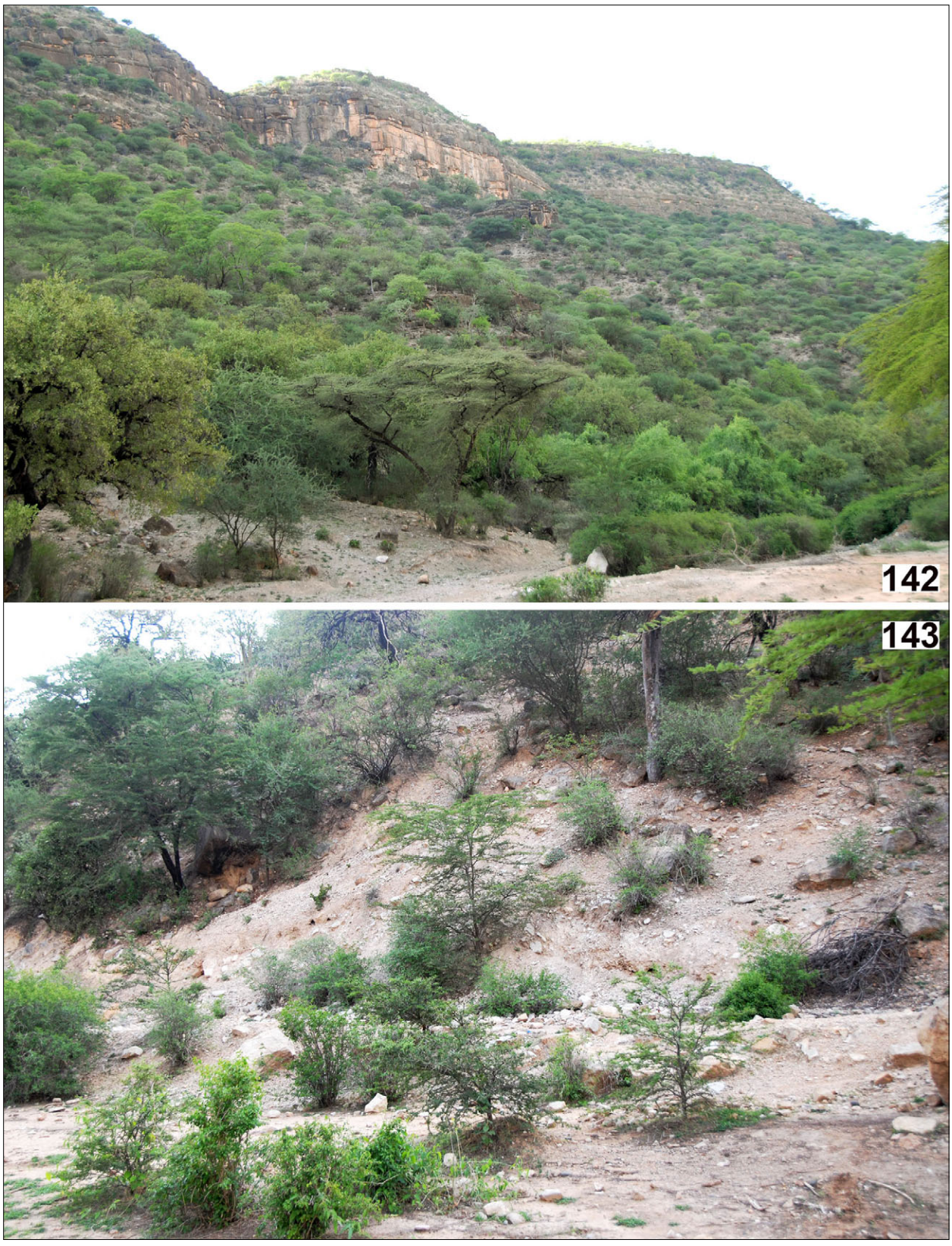
Figures 139–141: *Parabuthus kajibu* **sp. n.**, in vivo habitus in type locality. Juvenile paratype (139), male holotype (140) and female paratype (141).

more narrow; metasomal segment V length/ width ratio is 3.52 in males and 5.25–5.45 in females. The telson is rather bulbous, with the aculeus shorter than the vesicle in females, and the same length as the vesicle in males.

Pedipalps (Figs. 84–85, 124–133)**.** The pedipalps are hirsute with shorter setae on the chela and longer setae on the patella, femur, and trochanter. The femur bears four carinae. The patella and chela are smooth without carinae. The movable and fixed fingers of pedipalp bear 12–13 rows of granules, all with external and internal accessory granules. Pedipalp fingers are not enlarged, movable finger length/ manus length ratio is 1.6 in male. Fingers of pedipalps of male with inner side of base smooth, no trace of tubercle. Manus of pedipalp of male broad, pedipalp chela length/ width ratio is 3.52 in males and 5.25–5.45 in females.

Legs (Figs. 120–123). Legs III and IV bear tibial spurs. Retrolateral and prolateral pedal spurs are present on all legs. All legs without distinct carinae and smooth. The tarsomeres bear two rows of macrosetae on the ventral surface and other macrosetae on the other surfaces. The bristlecombs are present on all legs, although slightly reduced on the fourth leg.

Measurements. See Table 2.



Figures 142–143: *Parabuthus kajibu* **sp. n.**, type locality, Ethiopia, Oromia State, West Harerge, 07°49'12.6"N 40°31'54"E, 918 m a.s.l., locality 16EJ.

DIMENSIONS (MM)		*P. hamar* **sp. n.** ♂ **holotype**	♀ **paratype** 16EH	*P. kajibu* **sp. n.** ♂ **holotype**	♀ **paratype**
Carapace	L / W	8.70 / 9.05	10.0 / 11.1	6.20 / 6.90	8.85 / 9.90
Mesosoma	L	24.8	26.2	12.5	21.0
Tergite VII	L / W	7.00 / 9.10	5.75 / 10.8	4.35 / 7.10	6.00 / 10.6
Metasoma & telson	L	55.35	52.9	37.05	49.70
Segment I	L / W / D	7.40 / 6.10 / 5.10	7.00 / 6.90 / 6.15	4.85 / 4.70 / 4.20	6.70 / 6.40 / 5.20
Segment II	L / W / D	8.30 / 6.10 / 5.25	8.20 / 6.95 / 6.20	5.70 / 4.75 / 4.05	7.55 / 6.45 / 5.30
Segment III	L / W / D	8.75 / 6.10 / 5.25	8.45 / 7.00 / 6.30	5.80 / 4.80 / 4.30	7.90 / 6.45 / 5.40
Segment IV	L / W / D	10.3 / 6.05 / 5.00	9.50 / 6.95 / 5.80	6.60 / 4.65 / 4.40	8.75 / 6.45 / 5.30
Segment V	L / W / D	10.6 / 5.50 / 4.50	10.3 / 6.55 / 5.45	7.20 / 4.45 / 4.05	9.50 / 6.05 / 5.10
Telson	L / W / D	10.0 / 4.10 / 3.65	9.45 / 5.05 / 4.55	6.90 / 3.00 / 2.75	9.30 / 4.60 / 3.70
Pedipalp	L	32.5	28.6	24.10	30.95
Femur	L / W	7.90 / 2.25	6.85 / 2.80	6.20 / 1.70	8.00 / 2.10
Patella	L / W	9.10 / 3.45	8.30 / 3.45	7.00 / 2.10	8.95 / 2.60
Chela	L	15.5	13.45	10.9	14.0
Manus	L / W / D	6.7 / 4.95 / 4.75	4.25 / 3.15 / 3.40	4.20 / 3,10 / 2.85	4.10 / 2.60 / 2.50
Movable finger	L	8.8	9.20	6.70	9.90
Total	**L**	**88.85**	**89.1**	**55.75**	**79.55**

Table 2: Comparative measurements of adults of *Parabuthus hamar* **sp. n.** and *P. kajibu* **sp. n.** Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

Hemispermatophore (Figs. 134–138). Flagelliform, elongate and slender, trunk ca. 10 times length of capsule region.Flagellum fused to median lobe, with short ribbon-like, hyaline pars recta (*pr*) and much longer, opaque white pars reflecta (*prf*). Major distal portion of pars reflecta well dilated, cylindriform, gradually tapering apically. Capsule region with 3 lobes at base of flagellum. Median lobe (*ml*) broad, laminate, translucent, dorsal surface concave, apical margin concave with blunt, rounded apex on internal side. Median lobe carina (*mlc*) robust, sclerotized, reddish in color. Basal lobe (*bl*) reddish, robust, hamate with sharp, fine tip, joined to strong basal lobe carina (*blc*) extending to sclerotized distal margin (Figs. 135–136). Internal lobe (*il*) narrow and tapered at apex.

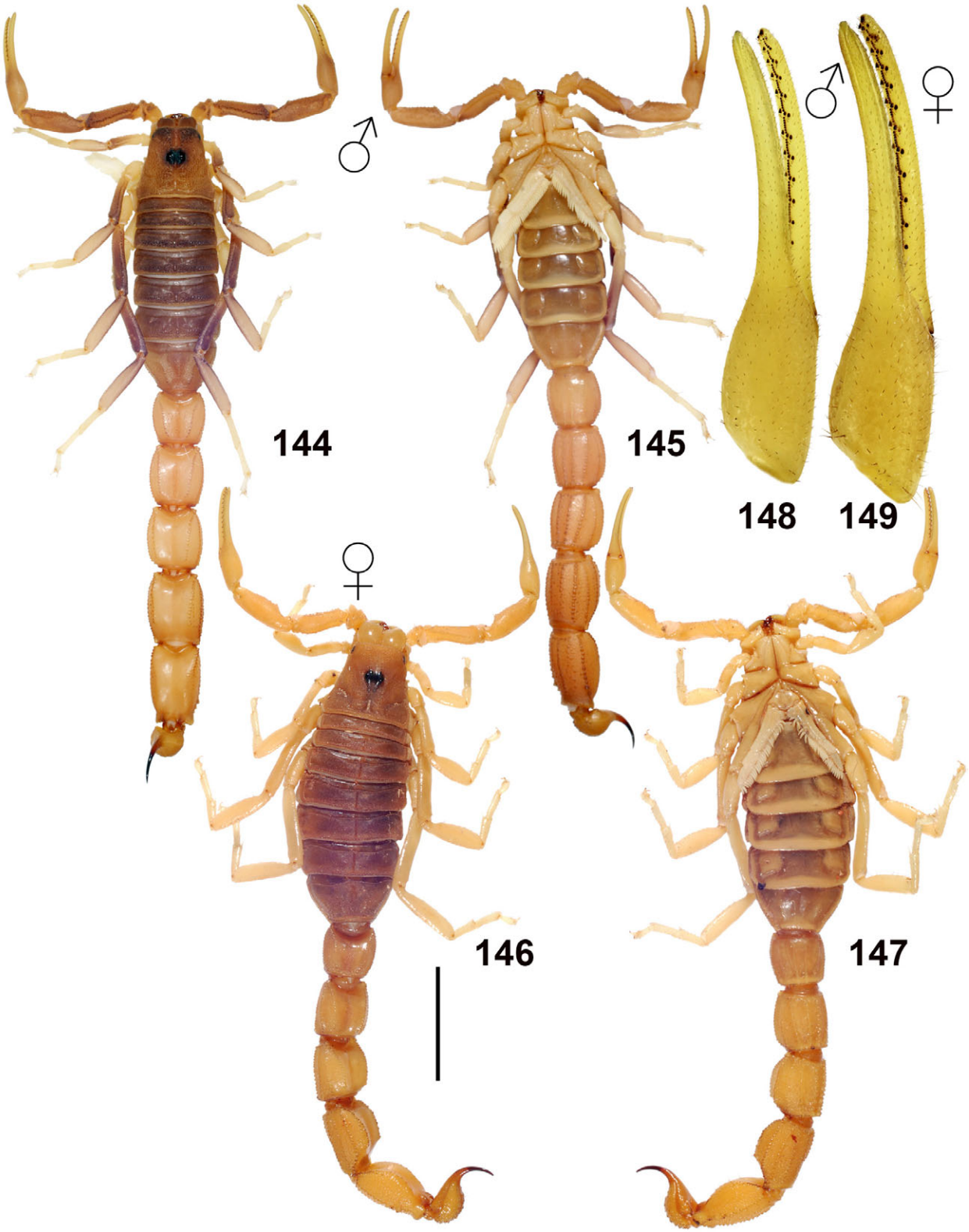
AFFINITIES. The described features distinguish *P. kajibu* **sp. n.** from all other species of the genus. They are recounted in the key below. *P. kajibu* **sp. n.** is similar to *P. heterurus*. Both of these species do not have enlarged pedipalp fingers (Figs. 176–179), and have a combination of metasomal segment IV black and V yellow (Figs. 199 and 200). These two characters differentiate *P. kajibu* **sp. n.** and *P. heterurus* from all other Horn of Africa *Parabuthus*. These two species can be separated unequivocally by: **1**) dorsal surface of metasomal segment III with stridulation area absent in *P. kajibu* **sp. n.**, present in *P. heterurus* (Figs. 190–191); **2**) telson yellowish brown to orange in *P. kajibu* **sp. n.**, black in *P. heterurus* (Figs. 200 and 199); **3**) dorsal carina of metasomal segment IV posteriorly composed of strong pointed granules in male *P. kajibu* **sp. n.**, small blunt granules in male *P. heterurus* (Figs. 200 and 199); **4**) tergites yellow to yellowish brown in male *P. kajibu* **sp. n.**, dark brown to black in male *P. heterurus* (Figs. 104 and 94); **5**) adults 55–80 mm long in *P. kajibu* **sp. n.**, 71–98 mm long in *P. heterurus*.

COMMENTS ON LOCALITIES AND LIFE STRATEGY. The first author visited the type locality **16EJ** (Figs. 142–143) on 21–22 April 2016 and collected all 12 type specimens in a small area of no more than 200 m^2, on the hillside of a margin of the valley near a river (Fig. 143) at night (UV detection). At the type locality, the first author recorded a maximum daytime temperature 38.8 ºC, and nighttime temperatures of 27.4 ºC shortly after sunset, dropping to 21.0 ºC (minimum night temperature) before sunrise, and humidity varied between 56% and 84%. In addition to *P. kajibu* **sp. n.** the first author also recorded at this locality *Babycurus* sp., *Hottentotta trilineatus*, and *Pandinurus platycheles* (Werner, 1916) **comb. n.**

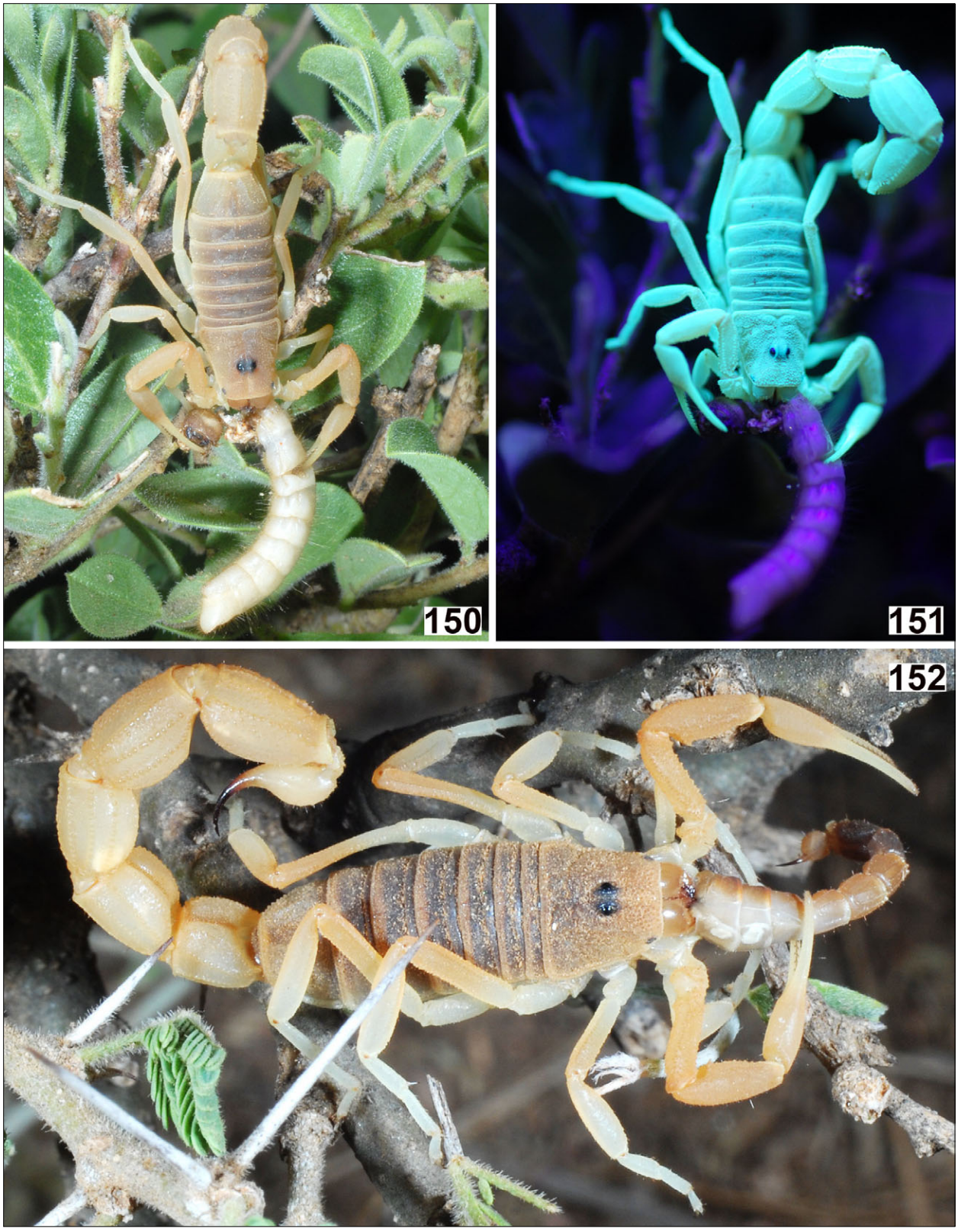
Parabuthus pallidus Pocock, 1895
(Figs. 87, 144–163, 192, 201, 204, Table 1)

Parabuthus pallidus Pocock, 1895: 312–314; Fet & Lowe, 2000: 208–209 (complete reference list until 2000); Kovařík, 2003: 145; Kovařík & Whitman, 2005: 111–112.

= *Parabuthus mixtus* Borelli, 1925: 13–16; Caporiacco, 1941: 34; Fet & Lowe, 2000: 207 (syn. by Kovařík, 2003: 145).



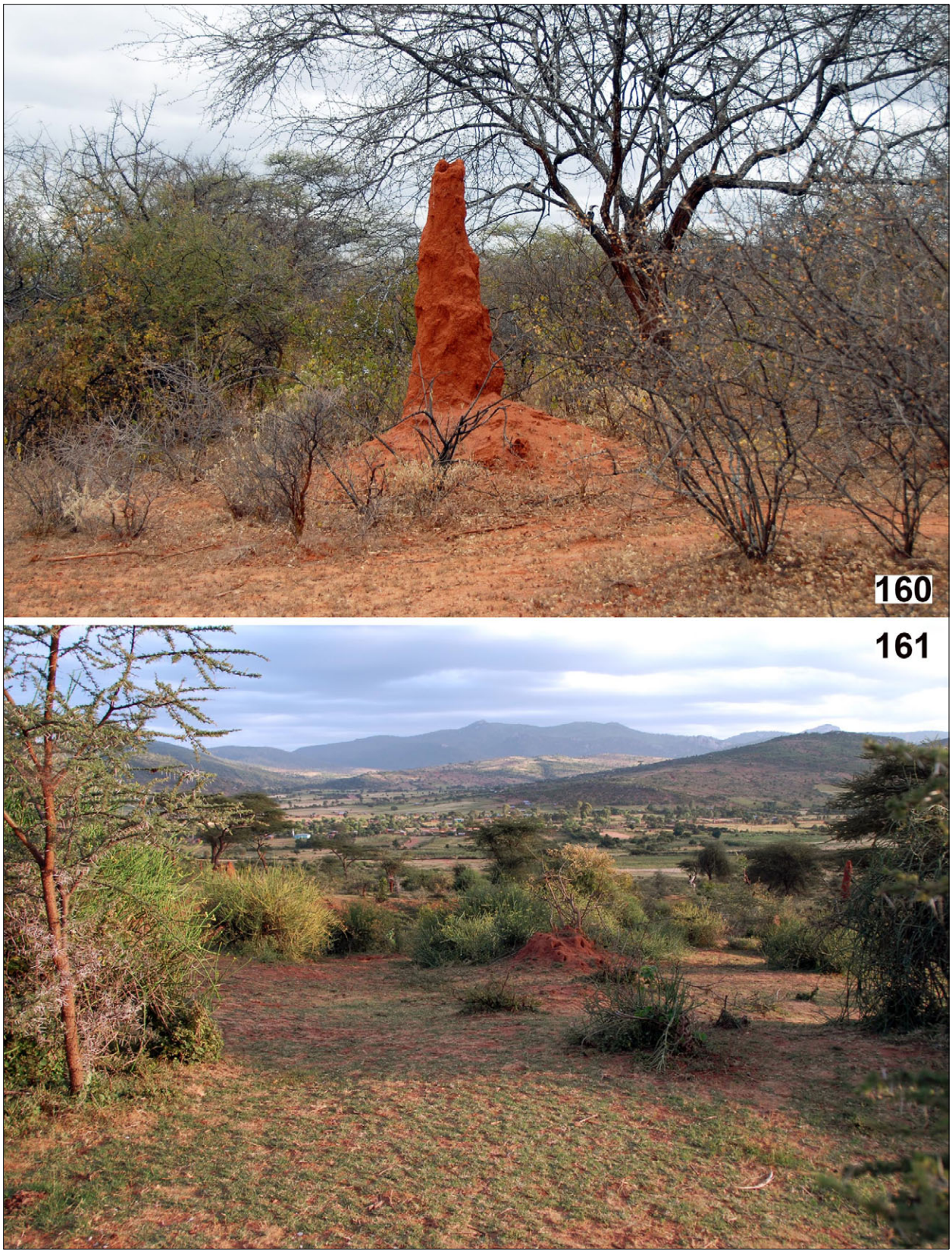
Figures 144–149: *Parabuthus pallidus*. **Figures 144–145**. Male from locality 13EU in dorsal (144) and ventral (145) views. **Figures 146–147:** Female from locality 13EU in dorsal (146) and ventral (147) views. Scale bar (Figs. 144–147): 10 mm. **Figures 148–149**. Pedipalp chela dorsal, male (148) and female (149) from locality 16EA.



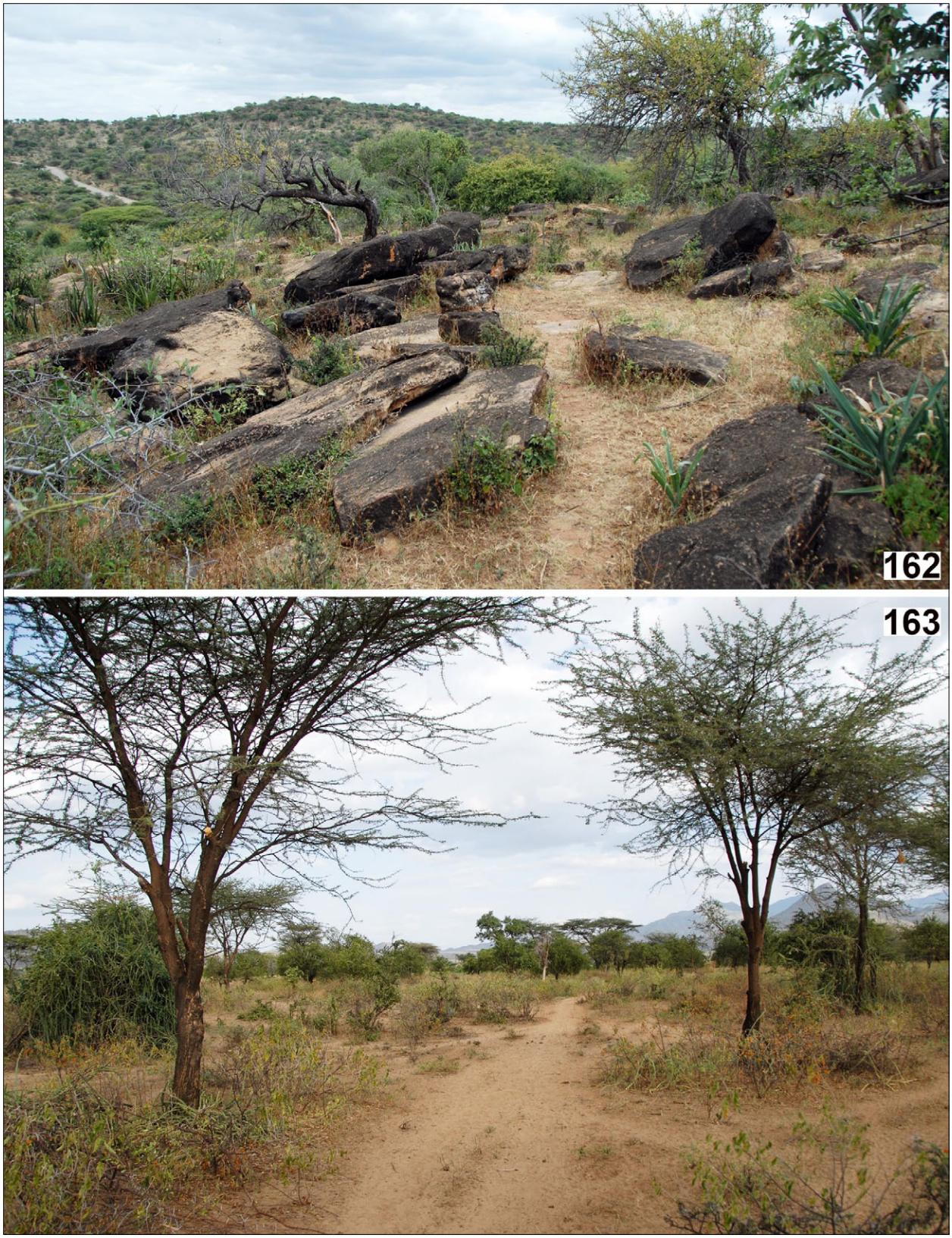
Figures 150–152: *Parabuthus pallidus*, males eating coleopteran larva (Fig. 150 under standard light/flash and Fig. 151 under UV light) and juvenile of *Parabuthus hamar* **sp. n.** (Fig. 152) at locality 13EP at night. More information in paragraph "Comments on life strategy" in *P. pallidus* section.

Figures 153–157: *Parabuthus pallidus*, males observed at night at localities 13EJ (153, 155, 157) and 13EL (154) and a juvenile at locality 13EJ (156) feeding on Heteroptera (153), Solifugae (154), Gryllidae (155), and Caelifera (156).

Figures 158–159: *Parabuthus pallidus*, female from locality 13EJ with first instar juveniles (158) and the same female with second instar juveniles after first ecdysis (159).



Figures 160–161: *Parabuthus pallidus*, Localities 13EH (160), Oromia State, Borana Province, Wachille, 04°50'50"N 39°18'25.3"E, 808 m a.s.l. and 13EL (161), Oromia State, Borana Province, Yabello, 04°53'27.7"N 38°07'42.5"E, 1695 m a.s.l.



Figures 162–163: *Parabuthus pallidus*, Localities 13EM (162), Oromia State, 04°58'05"N 37°53'13.2"E, 1327 m a.s.l. and 13EP (163), SNNPR, Tsamai, Luqua, 05°27'20"N 36°49'50"E, 660 m a.s.l.

= *Parabuthus mixtus obscurior* Caporiacco, 1941: 34; Fet & Lowe, 2000: 207; Kovařík & Whitman, 2005: 111 (syn. by Kovařík, 2003: 145).
= *Parabuthus zavattarii* Caporiacco, 1939: 305–306; Fet & Lowe, 2000: 211; Kovařík & Whitman, 2005: 112 (syn. by Kovařík, 2003: 145, 159).
= ? *Riftobuthus inexpectatus* Lourenço et al., 2010: 281, figs. 1 and 2. **Syn. n.** (see comments under genus)

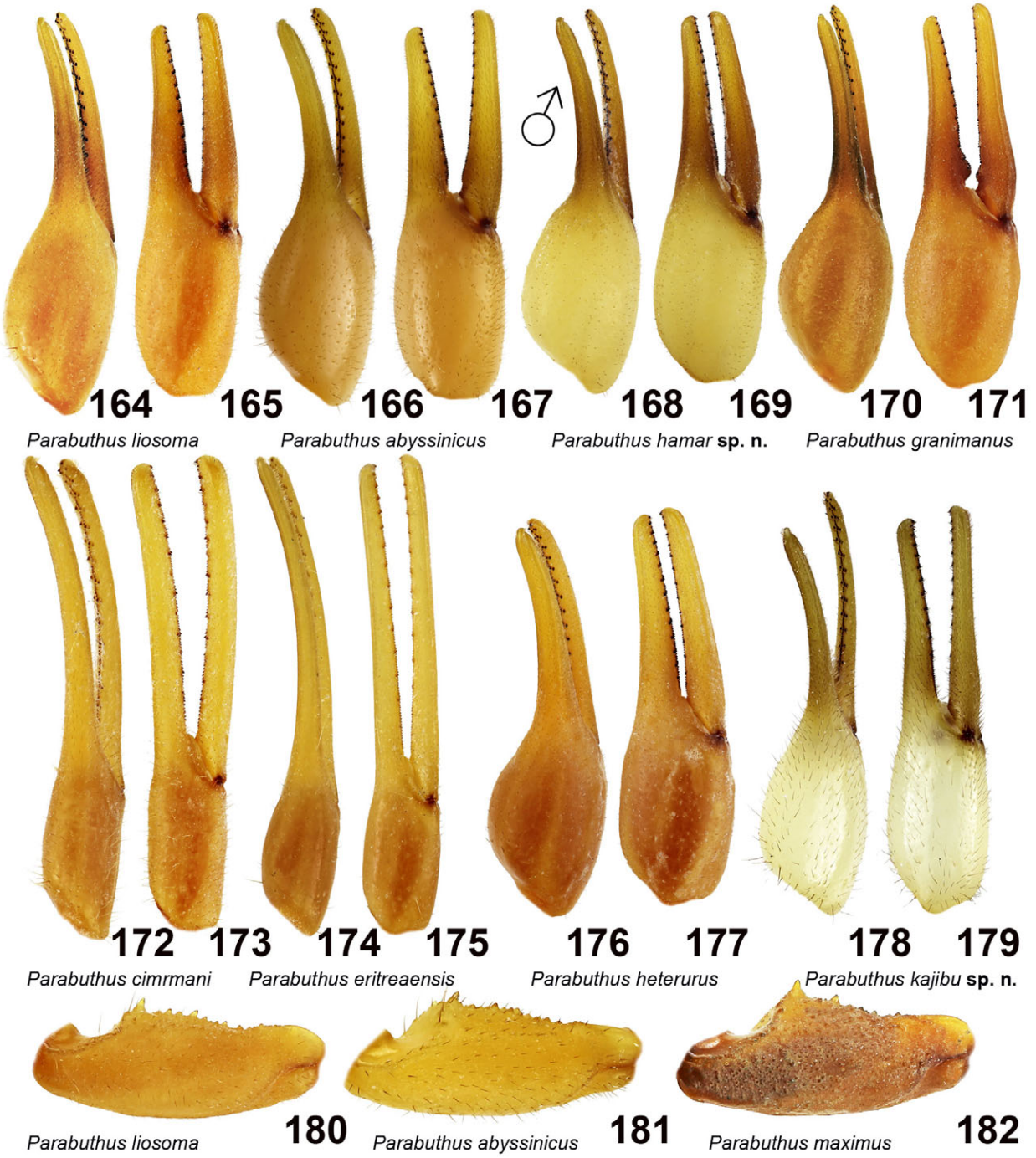
TYPE LOCALITY AND TYPE REPOSITORY. Kenya, Mombasa; BMNH.

TYPE MATERIAL EXAMINED. **Ethiopia**, Sagan-Omo, El Banno, 2.V.1939, 1♀1im. (lectotype and paralectotype No. 1 of *Parabuthus mixtus obscurior* Caporiacco, 1941), leg. E. Zavattari, rev. M. Vachon (VA 1578), MZUF No. 547. **Somalia**, Balad, 2♀ (lectotype and paralectotype of *Parabuthus mixtus* Borelli, 1925), MCSN.

ADDITIONAL ETHIOPIAN MATERIAL RECENTLY EXAMINED. **Ethiopia**, Oromia State, Borena region, Negele env., 05°57'14"N 39°40'30"E, 1343 m a.s.l. (Locality No. **13ED**), 19.XI.2014, 1♂, leg. F. Kovařík; Oromia State, Borana Province, Negele env., 05°21'36"N 39°32'04.7"E, 1452 m a.s.l. (Locality No. **13EF**), 26.-27.VI.2013, 1♂, leg. F. Kovařík; Oromia State, Borana Province, 05°04'01"N 39°28'47.7"E, 1044 m a.s.l. (Locality No. **13EG**), 27.VI.2013, 5♂1♀1im., leg. F. Kovařík; Oromia State, Borana Province, Wachille, 04°50'50"N 39°18'25.3"E, 808 m a.s.l. (Fig. 160, Locality No. **13EH**), 27.VI.2013, 3♂3♀, leg. F. Kovařík; Oromia State, Borana Province, 04°25'31.5"N 38°58'14"E, 1171 m a.s.l. (Locality No. **13EI**), 27.-28.VI.2013, 1♂3♀, leg. F. Kovařík; Oromia State, Borana Province, 04°10'35"N 38°18'52.2"E, 1515 m a.s.l. (Locality No. **13EJ**), 28.VI.2013, 11♂8♀ (Figs. 158–159), leg. F. Kovařík; Oromia State, Borana Province, Yabello, 04°53'27.7"N 38°07'42.5"E, 1695 m a.s.l. (Fig. 161, Locality No. **13EL**), 29.-30.VI.2013, 3♂2♀, leg. F. Kovařík et J. Plíšková; Oromia State, 04°58'05"N 37°53'13.2"E, 1327 m a.s.l. (Fig. 162, Locality No. **13EM**), 30.VI.2013, 1♀, leg. F. Kovařík et J. Plíšková; Southern Nationalities and Peoples Region Federal State (SNNPR), Konso, Dabub, 05°20'33"N 37°26'57"E, 1381 m a.s.l. (Locality No. **13EN**), 30.VI.2013, 2♂, leg. F. Kovařík et J. Plíšková; SNNPR, Woito, 05°22'23.7"N 36°59'37.3"E, 598 m a.s.l. (Locality No. **13EO**), 1.VII.2013, 1♂, leg. F. Kovařík; SNNPR, Tsamai, Luqua, 05°27'20"N 36°49'50"E, 660 m a.s.l. (Fig. 163, Locality No. **13EP**), 1.-2.VII.2013, 2♂2♀3ims.16juvs., leg. F. Kovařík; SNNPR, Hammar, 05°27'29"N 36°39'42"E, 1398 m a.s.l. (Locality No. **13EQ**), 3.VII.2013, 4♂2♀, leg. F. Kovařík; SNNPR, near Omorate, 04°48'20.4"N 36°25'32.3"E, 761 m a.s.l. (Locality No. **13ET**), 4.VII.2013, 1juv., leg. F. Kovařík; SNNPR, Omorate (Kelem), 04°48'42"N 36°03'16.7"E, 373 m a.s.l. (Locality No. **13EU**), 4.-5.VII.2013, 1♂ (Figs. 144–145) 2♀ (Figs. 146–147) 10juvs., leg. F. Kovařík et J. Plíšková; SNNPR, Hammar, E of Turmi, 04°52'17"N 36°38'44"E, 385 m a.s.l. (Locality No. **13EV**), 5.VII.2013, 1♀, leg. F. Kovařík et P. Novák; SNNPR, "lower valley of the Omo river", Chew Bahr, 04°50'38.5"N 36°44'11.4"E, 625 m a.s.l. (Locality No. **13EW**), 5.-6.VII.2013, 3♀9juvs., leg. F. Kovařík et V. Socha; SNNPR, Gamo Gofa Province, 20 km SE Konso, 05°14'33"N 37°32'06"E, 850 m a.s.l., 11-13.V.2015, 2♀3♂5juvs., leg. P. Kučera; SNNPR, Gamo Gofa Province, 40 km W Konso, 05°19'44"N 37°03'54"E, 600 m a.s.l., 14.V.2015, 2♂1♀1juv., leg. P. Kučera; SNNPR Gamo Gofa Province, Turmi env., 04°58'05"N 36° 29'13"E, 940 m a.s.l., 16.V.2015, 1♀2juvs., leg. P. Kučera; Oromia State, Sidamo Province, 115 km N Moyale, near Wachile, 04°32'34"N 39°03'08"E, 1070 m a.s.l., 22-23.V.2015, 1♂, leg. P. Kučera; Oromia State, Sidamo Province, 60 km SSW Negele borena, Goba village, 04°51'48"N 39°18'35"E, 750 m a.s.l., 24.V. 2015, 1♀5juvs., leg. P. Kučera; SNNPR, Turmi, 04°58' 32"N 36°30'53"E, 908 m a.s.l. (Locality No. **16EA**), 5♂ (Figs. 87, 148, 192, 201) 2♀ (Fig. 149) 1juv., 9.-11.IV.2016, leg. F. Kovařík; SNNPR, near Turmi, 04°44'21"N 36°19'53"E, 565 m a.s.l. (Locality No. **16EC**), 11.-12.IV.2016, 1♂1♀, leg. F. Kovařík; SNNPR, 20 km SE Konzo, 05°14'33"N 37°32'06"E, 839 m a.s.l. (Locality No. **16EF**), 14.-15.IV.2016, 1♂1♀ 3juvs., leg. F. Kovařík; Oromia State, Sidamo Province, Wachile, 04°32'33"N 39°03'07"E, 1051 m a.s.l.(Locality No. **16EH**), 16.-17.IV.2016, 1♂1♀, leg. F. Kovařík. All specimens are in the first authors collection (FKCP).

DIAGNOSIS. Adults from 45 mm (male) to 90 mm (female) long. Base color uniformly yellow to yellowish brown to grey including metasomal segments and telson. Pectine teeth number 33–38 in males and 28–36 in females. Stridulatory area present on dorsal surface of metasomal segments I to IV in both sexes, more pronounced on first and second segments, reduced on third and fourth segments. Metasoma hirsute, more so in female. Metasomal segment V length/ width ratio 1.40–1.65 in males. Movable and fixed fingers of pedipalp bearing 10–12 rows of granules, all with external and internal accessory granules. Pedipalp fingers not enlarged. Pedipalp fingers of males with inner side of base smooth, no trace of tubercle. Manus of pedipalp smooth and narrow in both sexes, pedipalp chela length/ width ratio 4.30–4.80 in both sexes. Tarsomere I of legs I–III with bristlecombs reduced, usually composed of 6–10 bristles.

COMMENTS ON LIFE STRATEGY. Figures 150–157 were taken at night and show foraging and feeding behavior. The first author observed predation behavior of *P.*



Figures 164–182: **Figures 164–179**. Comparison of male pedipalp chelae of *Parabuthus* spp., dorsal and external views. **Figures 164–165**. *Parabuthus liosoma* from Yemen Arab Republic, Al Hudaydah gov., 10 km W Al Manşuriah, 14°43'N 43°12'E, 110 m a.s.l. **Figures 166–167**. *P. abyssinicus* from Eritrea, locality 15EG. **Figures 168–169**. *P. hamar* **sp. n.** paratype from Ethiopia, locality 16EC. **Figures 170–171**. *P. granimanus* from Somaliland, locality 11SE. **Figures 172–173**. *P. cimrmani* holotype. **Figures 174–175**. *P. eritreaensis* from Somalia, Gardo, Migiurtina. **Figures 176–177**. *P. heterurus* from Somaliland, locality 11SQ. **Figures 178–179**. *P. kajibu* **sp. n.** holotype. **Figures 180–182**. Comparisons of male pedipalp patellae of *Parabuthus* spp., dorsal views. **Figure 180**. *P. liosoma* from Yemen Arab Republic, Al Hudaydah gov., 10 km W Al Manşuriah, 14°43'N 43°12'E, 110 m a.s.l. **Figure 181**. *P. abyssinicus* from Eritrea, locality 15EG. **Figure 182**. *P. maximus* from Tanzania, Arusha.

pallidus in the field at night. The scorpions were able to capture and feed on coleopteran (Tenebrionidae, probably Pimeliinae) larvae. These larvae were found in burrows at the bottom of funnels in sand, similar to ant lion larvae (Myrmeleontidae). The scorpions seized the larvae with the tips of their pedipalp fingers and extended the metasoma and telson over the entire body to sting it. After waiting for the injected venom to induce flaccid paralysis and loosen the muscles of the prey, they pulled out the larva and carried it to a nearby shrub, climbed up on a twig, and devoured it there (Figs. 150–151). The same hunting strategy was observed to be employed by other scorpions, for example *Neobuthus awashensis* Kovařík et Lowe, 2012 (see Lowe & Kovařík, 2016: 43, figs. 162–165). Other photos show *P. pallidus* eating different insects and arachnids - a juvenile of the scorpion *Parabuthus hamar* **sp. n.** (Fig. 152), Heteroptera (Fig. 153), Solifugae (Fig. 154), Gryllidae (Fig. 155), and Caelifera (Fig. 156).

DISTRIBUTION. Ethiopia, Kenya, Somalia, Tanzania.

KEY TO SPECIES OF *PARABUTHUS* IN THE HORN OF AFRICA

1. All metasomal segments yellow or yellowish brown (Fig. 201). ..... ***P. pallidus*** Pocock, 1895
– Fourth metasomal segment black (Figs. 193–200). ... 2

2. Fifth metasomal segment yellow or yellowish brown (Fig. 198–200). 3
– Fifth metasomal segment black (Figs. 193–197). 5

3. Manus of pedipalp of male very narrow in both sexes, pedipalp chela length/ width ratio 6.13 in male and 7.23 in female (Figs. 174–175)... ***P. eritreaensis*** Kovařík, 2003
– Manus of pedipalp of male broad, pedipalp chela length/ width ratio 2.85–3.52 in male and 3.90–5.45 in female (Figs. 176–179) .....……..... 4

4. Metasomal segment III with dorsal stridulation area present (Fig. 190). Telson black (Fig. 199). Dorsal carina of metasomal segment IV composed of small blunt granules in male (Fig. 199).... ***P. heterurus*** Pocock, 1897
– Metasomal segment III with dorsal stridulation area absent (Fig. 191). Telson yellowish brown to orange (Fig. 200). Dorsal carina of metasomal segment IV composed posteriorly of strong pointed granules in male (Fig. 200)...……..... ***P. kajibu*** **sp. n**.

5. Manus of pedipalp smooth and very narrow in both sexes, pedipalp chela length/ width ratio 5.90 in male and 7.42 in female (Figs. 172–173)…….. ...……...……..... ***P. cimrmani*** Kovařík, 2004
– Manus of pedipalp of male broad, pedipalp chela length/width ratio 2.95–3.30 in male and 4.25–4.40 in female (Figs. 166–171) ...……..... 6

6. Manus granulated. Fingers of pedipalps of male with a tubercle on inner side of base (Figs. 170–171)…….. .....……..... ***P. granimanus*** Pocock
– Manus smooth. Fingers of pedipalps of male with inner side of base smooth, no trace of tubercle (Figs. 166–169) .....……..... 6

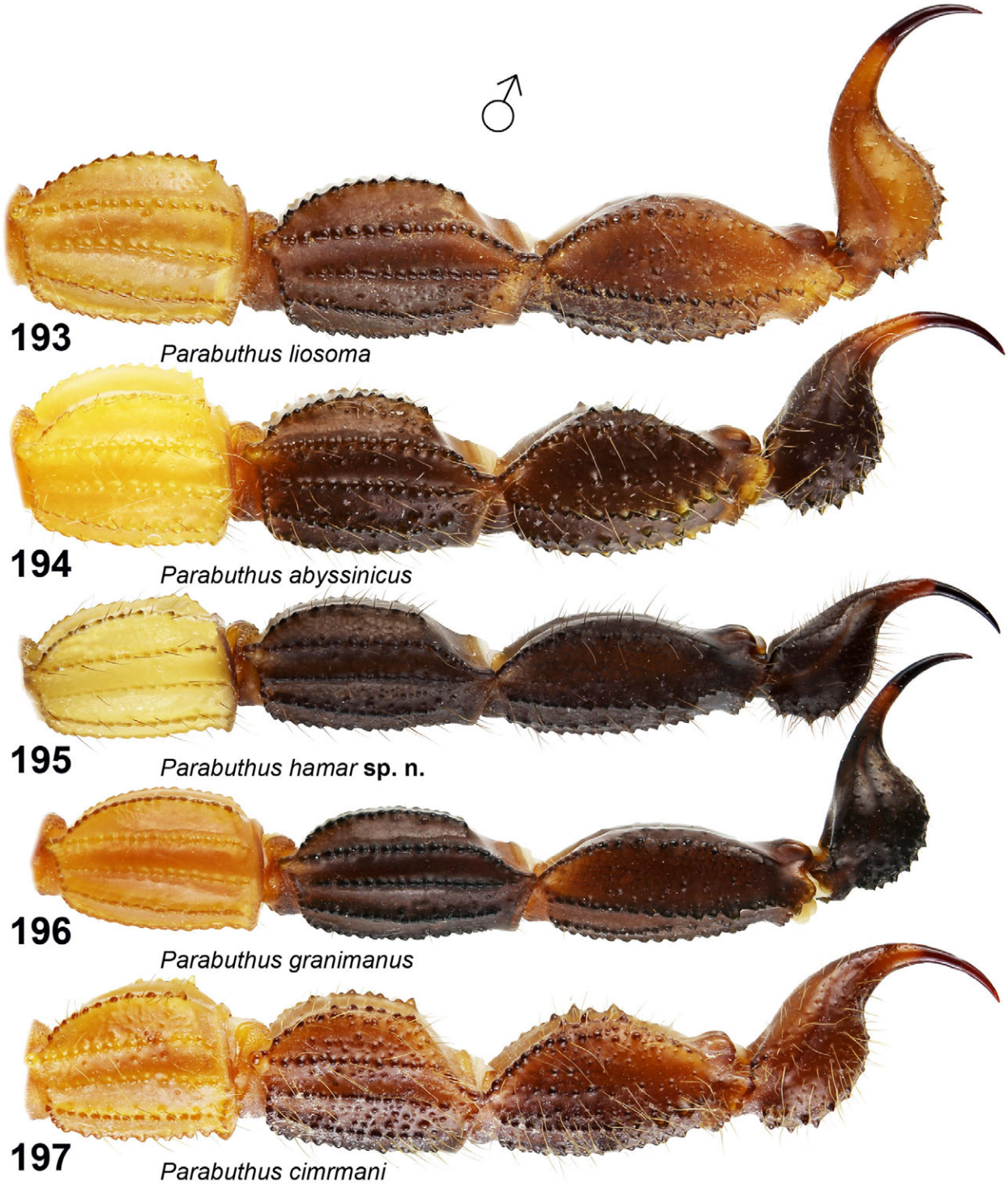
6. Metasoma of male narrow; metasomal segment V length/width ratio 1.82–2.05 in male (Fig. 187). Metasomal segment III with dorsal stridulation area absent in male (Fig. 187) and reduced in female. Patella of pedipalp strongly granulated (Figs. 76 and 83). ...……..... ***P. hamar*** **sp. n**.
– Metasomal segment V length/ width ratio 1.50–1.73 in male (Fig. 185). Metasomal segment III with dorsal stridulation area present or reduced (Fig. 185). Patella of pedipalp finely granulated (Fig. 181). ...……..... ……..……. ***P. abyssinicus*** Pocock, 1901

Additional material examined.

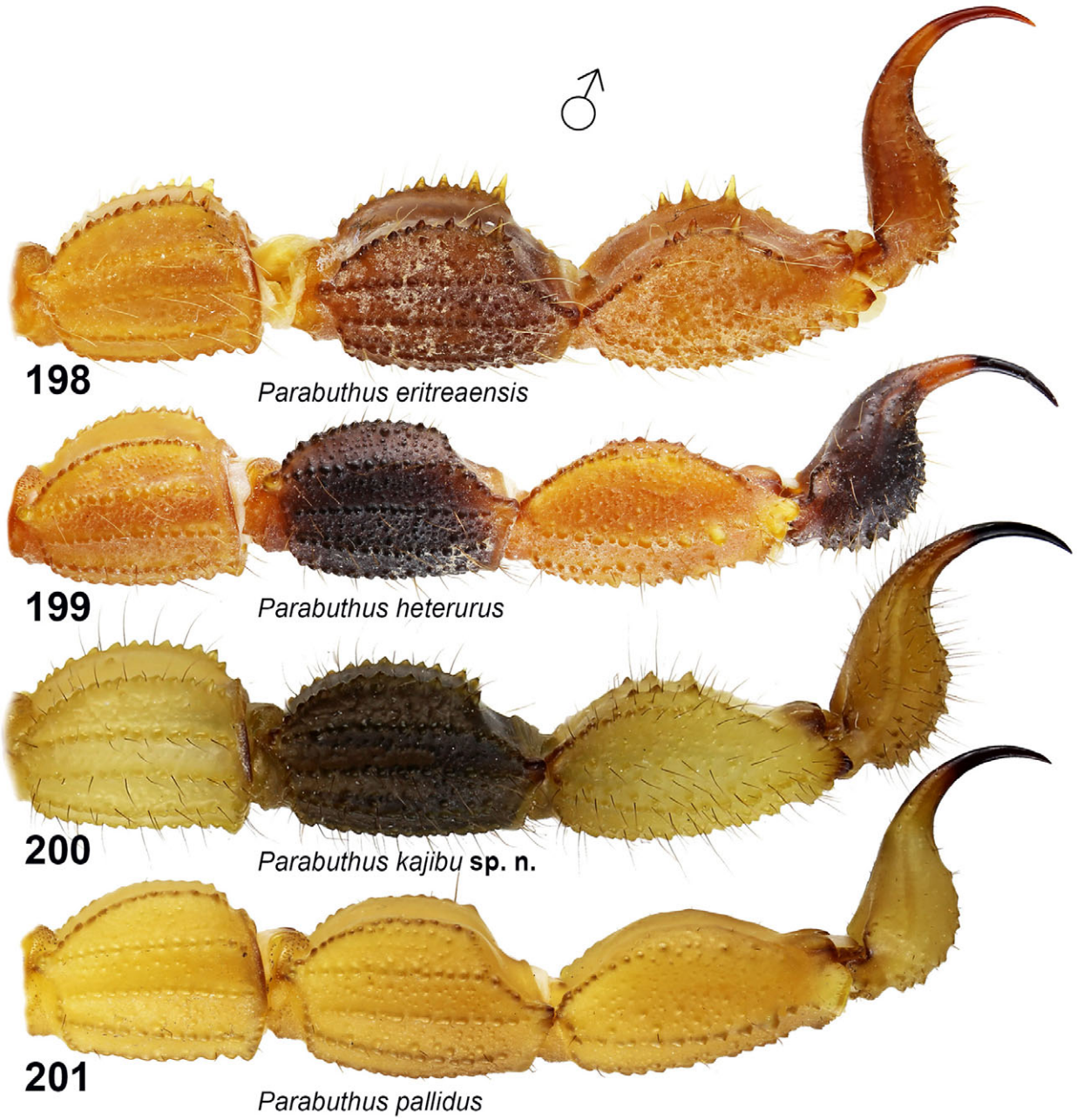
Parabuthus liosoma (Ehrenberg, 1828)
TYPE MATERIAL EXAMINED. Arabia, 1♀im. (holotype), ZMHB No. 129.
ADDITIONAL MATERIAL EXAMINED. **Saudi Arabia**, Isola Seir Farasān Kebir, 1juv. **Yemen Arab Republic**, near Sana´a, 12.XI.2003, 1♀, leg. P. Kabátek and D. Král; Wādī Ānis 60 km SW San'ā', 15°00'N 44°09'E, 1522 m a.s.l., 7.X.2005, 1♀, leg. P. Kabátek; S Nuqbah (S Habbān), 18°04'N 51°31'E, 970 m a.s.l., 22.X.2005, 1juv., leg. P. Kabátek; Abyan gov., 22.–23.X.2005, Lawdar W env., 13°52'36"N 045°48'01"E, 1151 m a.s.l., 3♀, leg. D. Král; Al Hudaydah gov., 31.X.–1.XI.2005, Al Munirah env., 15°20'10"N 042°50'12"E, 21 m a.s.l., 1juv.(Fig. 7), leg. D. Král; Al Hudaydah gov., Djabal bura mts (Riqab env.), 14°53'N 043°24'E, 225–600 m a.s.l., 19.–22.III.2007, 1juv., leg. D. Král; Al Hudaydah gov., Wadi Zabid (E Zabid), 14°09'N 043°31'E, 325 m a.s.l., 22.–23.III.2007, 1im., leg. D. Král; Al Hudaydah gov., 10 km W Al Manşuriah, 14°43'N 43°12'E, 110 m a.s.l., 8.IV.2007, 3♂ (Figs. 164–165, 180, 183, 193), leg. P. Kabátek, 2♀, leg. D. Král. All specimens are in the first authors collection (FKCP).

Parabuthus maximus Werner, 1913
MATERIAL EXAMINED. **Kenya**, Voi (Tsavo), 8.-18.XI.1996, 1♂, 10.XII.1999, 1♂(Figs. 86 and 184) 1♀1juv., leg. M. Snížek. **Tanzania**, Arusha, 1950, 1♂ (Fig. 182); Arusha-Namanga, 6.IV.1997, 1♂, leg. K. Werner et R. Lízler; 2002, 1♂1♀, 2004, 1♂4ims. All specimens are in the first authors collection (FKCP).

Figures 183–192: Comparison of male metasomal segments I–III of *Parabuthus* spp., dorsal views. **Figure 183**. *Parabuthus liosoma* from Yemen Arab Republic, Al Hudaydah gov., 10 km W Al Manşuriah, 14°43'N 43°12'E, 110 m a.s.l. **Figure 184**. *P. maximus* from Kenya, Voi. **Figure 185**. *P. abyssinicus* from Ethiopia, locality 11EA. **Figure 186**. *P. granimanus* from Somaliland, locality 11SE. **Figure 187**. *P. hamar* **sp. n.** holotype. **Figure 188**. *P. cimrmani* holotype. **Figure 189**. *P. eritreaensis* from Somalia, Gardo, Migiurtina. **Figure 190**. *P. heterurus* from Somaliland, locality 11SQ. **Figure 191**. *P. kajibu* **sp. n.** holotype. **Figure 192**. *P. pallidus* from Ethiopia, locality 16EA.



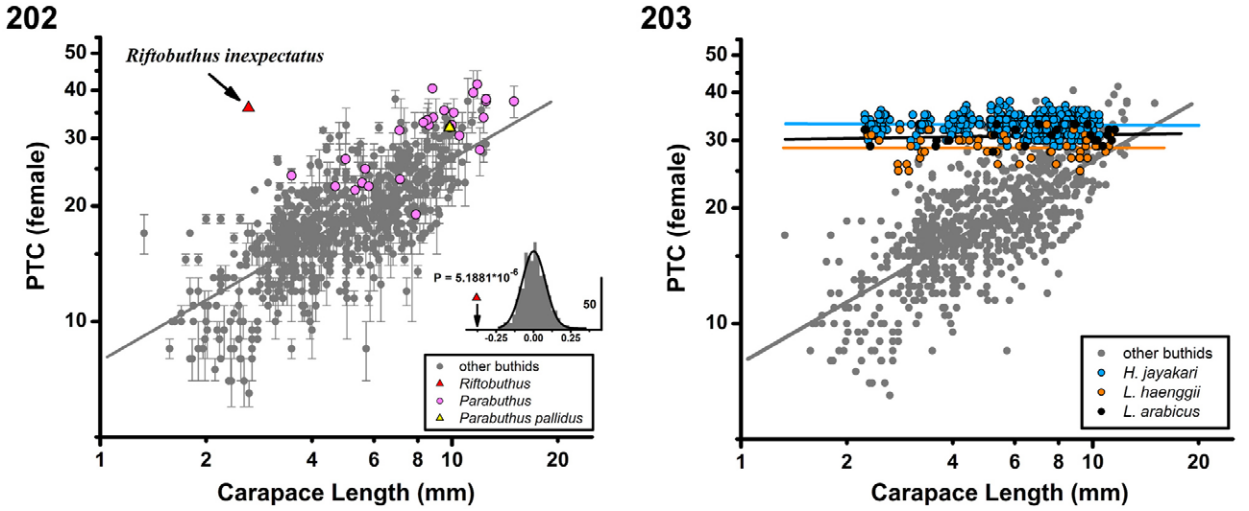
Figures 193–197: Comparison of male metasomal segments III–V and telson of *Parabuthus* spp., lateral views. **Figure 193**. *Parabuthus liosoma* from Yemen Arab Republic, Al Hudaydah gov., 10 km W Al Manşuriah, 14°43'N 43°12'E, 110 m a.s.l. **Figure 194**. *P. abyssinicus* from Eritrea, locality 15EG. **Figure 195**. *P. hamar* **sp. n.** paratype from Ethiopia, locality 16EC. **Figure 196**. *P. granimanus* from Somaliland, locality 11SE. **Figure 197**. *P. cimrmani* holotype.



Figures 198–201: Comparison of male metasomal segments III–V and telson of *Parabuthus* spp., lateral views. **Figure 198**. *P. eritreaensis* from Somalia, Gardo, Migiurtina. **Figure 199**. *P. heterurus* from Somaliland, locality 11SQ. **Figure 200**. *P. kajibu* **sp. n.** holotype. **Figure 201**. *P. pallidus* from Ethiopia, locality 16EA.

***Parabuthus pallidus* Pocock, 1895**

ADDITIONAL MATERIAL EXAMINED. **Kenya**, Lodwar, 20.XII.1995, 1♂14♀, leg. M. Snížek & P. Smrž; Lake Baringo, 10.XI.1996, 2♂2♀, leg. J. Bačovský; Voi (Tsavo), 27.III.-4.IV.1997, 1♂2♀1juv., 13.-17.XII.1997, 3ims., leg. M. Snížek, 1.VI.1997, 1♂, leg. O. Bužga; Kasingu Mts., Rokanga, 26.IX.1997, 2♂, leg. M. Snížek; Kiboko env., 21.XI.1999, 2♂, leg. M. Snížek; Mwingi, Nguni env., 28.XI.1999, 4♂1♀, leg. M. Snížek; El Wak, 1.V.2001, 1♀, leg. K. Werner & P. Smrž; between Isiola and Turkana lake, IX.2003, 1♂1♀, leg. T. Mazuch; Malindi, Marafa, 12.IV.2004, 1im.♂, leg. M. Snížek; between Madogo and Garissa, west of Tana river, VIII.2005, 1♂, leg. T. Mazuch; E of Nguni, N. Gomeni, 11.V.2007, 1juv., leg. M. Snížek; Sosoma, 202 km E of Thika, 20.XI.2007, 1im.♂, leg. M. Snížek; E. of Thika, Mwingi, Nguni, 29.XII.2007, 1♀, leg. M. Snížek; Mt. Kenya, IX.2008, 4♂2♀; Sosoma, 202 km E of Thika,



Figures 202–203: Phylogenetic scaling and ontogenetic invariance of pectinal tooth count (PTC) versus carapace length in female buthid scorpions. **Figure 202**. Phylogenetic scaling. Double logarithmic bivariate scatter plot of PTC vs. carapace length (mm) of N = 751 species of adult (or perhaps subadult?) female extant buthids from 74 genera (gray circles, with gray line being a least squares regression fit to the log data; R = 0.7287, P < 0.0001). Circles are midpoints of PTC ranges, vertical bars the ranges. Members of the genus *Parabuthus* are highlighted as magenta circles, and *P. pallidus* as a yellow triangle. Also plotted is *Riftobuthus inexpectatus* (red triangle), showing its position as an extreme outlier relative to all other extant buthids. Note that *R. inexpectatus* is at nearly the same horizontal level as *P. pallidus*. **Inset**: distribution of orthogonal distances of points from the log regression line, fitted to a Normal Distribution (solid line, σ = 0.0779 log units). Red triangle and arrow indcates distance of *R. inexpectatus*, a value with very low probability for belonging to the same distribution ($P = 5.1881.10^{-6}$). **Figure 203**. Ontogenetic invariance. Gray circles are double logarithmic bivariate scatter plot of PTC vs. carapace length (mm) of female buthids, as in Fig. 202. Ontogenetic PTC data from females of 3 species are superposed: *Hottentotta jayakari* (Pocock, 1895) (blue circles), *Leiurus haenggii* Lowe, Yagmur et Kovařík, 2014 (orange circles), and *Leiurus arabicus* Lowe, Yagmur et Kovařík, 2014 (black circles). Plotted values are measurements from individual specimens. Corresponding colored lines are least squares regression fits which are nearly horizontal, showing that in each case PTC is an ontogenetic invariant: P = 0.544 (N = 810 combs), 0.995 (N = 50 combs), and 0.410 (N = 25 combs) respectively. These data* are entirely consistent with our conclusion that the 'not expected' *R. inexpectatus* is merely a juvenile of a much larger buthid species, probably *P. pallidus.*

26.IV.2008, 3♂1♀1im., leg. M. Snížek; SW of Voi, 8.-12.XII.2009, 3♂1♀, leg. M. Snížek; E of Thika, Mwingi env., 30.IV.2011, 1♀, leg. M. Snížek; S of Garissa, 40 km N of Bura, 25.IV.2011, 1♂1♀, leg. M. Snížek; Voi, Sagala env., 750 m a.s.l, 13.-19.XI.2011, 2♂1♀, leg. M. Snížek; Eastern, E of Thika, Kangonde, 1500 m a.s.l., 25.XI.2011, 1♀, leg. M. Snížek. **Tanzania**, Babati, 1juv., XII.1993, leg. K. Werner. All specimens are in the first authors collection (FKCP).

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* Data in Figs. 202–203 were compiled from published species descriptions and direct measurement of specimens in our collections. Genera and number of species included: *Afghanobuthus* 1, *Afroisometrus* 1, *Akentrobuthus* 2, *Alayotityus* 4, *Ananteris* 54, *Ananteroides* 2, *Androctonus* 19, *Anomalobuthus* 2, *Apistobuthus* 2, *Austalobuthus* 1, *Babycurus* 23, *Birulatus* 3, *Buthacus* 14, *Butheloides* 11, *Butheolus* 5, *Buthiscus* 1, *Buthoscorpio* 5, *Buthus* 31, *Centruroides* 53, *Chaneke* 3, *Charmus* 3, *Cicileiurus* 1, *Cicileus* 5, *Compsobuthus* 31, *Congobuthus* 1, *Femtobuthus* 1, *Gint* 5, *Grosphus* 13, *Hemibuthus* 1, *Hemilychas* 1, *Himalayotityobuthus* 2, *Hottentotta* 37, *Iranobuthus* 1, *Isometroides* 1, *Isometrus* 4, *Karasbergia* 1, *Kraepelinia* 1, *Leiurus* 7, *Liobuthus* 1, *Lissothus* 3, *Lychas* 31, *Lychasioides* 1, *Mauritanobuthus* 1, *Mesobuthus* 9, *Mesotityus* 1, *Microananteris* 1, *Microbuthus* 6, *Microcharmus* 7, *Microtityus* 23, *Nanobuthus* 1, *Neobuthus* 7, *Neogrosphus* 1, *Neoprotobuthus* 1, *Odontobuthus* 4, *Orthochiroides* 1, *Orthochirus* 28, *Pantobuthus* 1, *Parabuthus* 31, *Picobuthus* 2, *Polisius* 1, *Pseudolychas* 3, *Razianus* 3, *Reddyanus* 15, *Rhopalurus* 9, *Sassanidotus* 1, *Somalicharmus* 1, *Thaicharmus* 2, *Tityobuthus* 12, *Tityopsis* 2, *Tityus* 158, *Uroplectes* 19, *Vachoniolus* 4, *Vachonus* 2, *Zabius* 3.

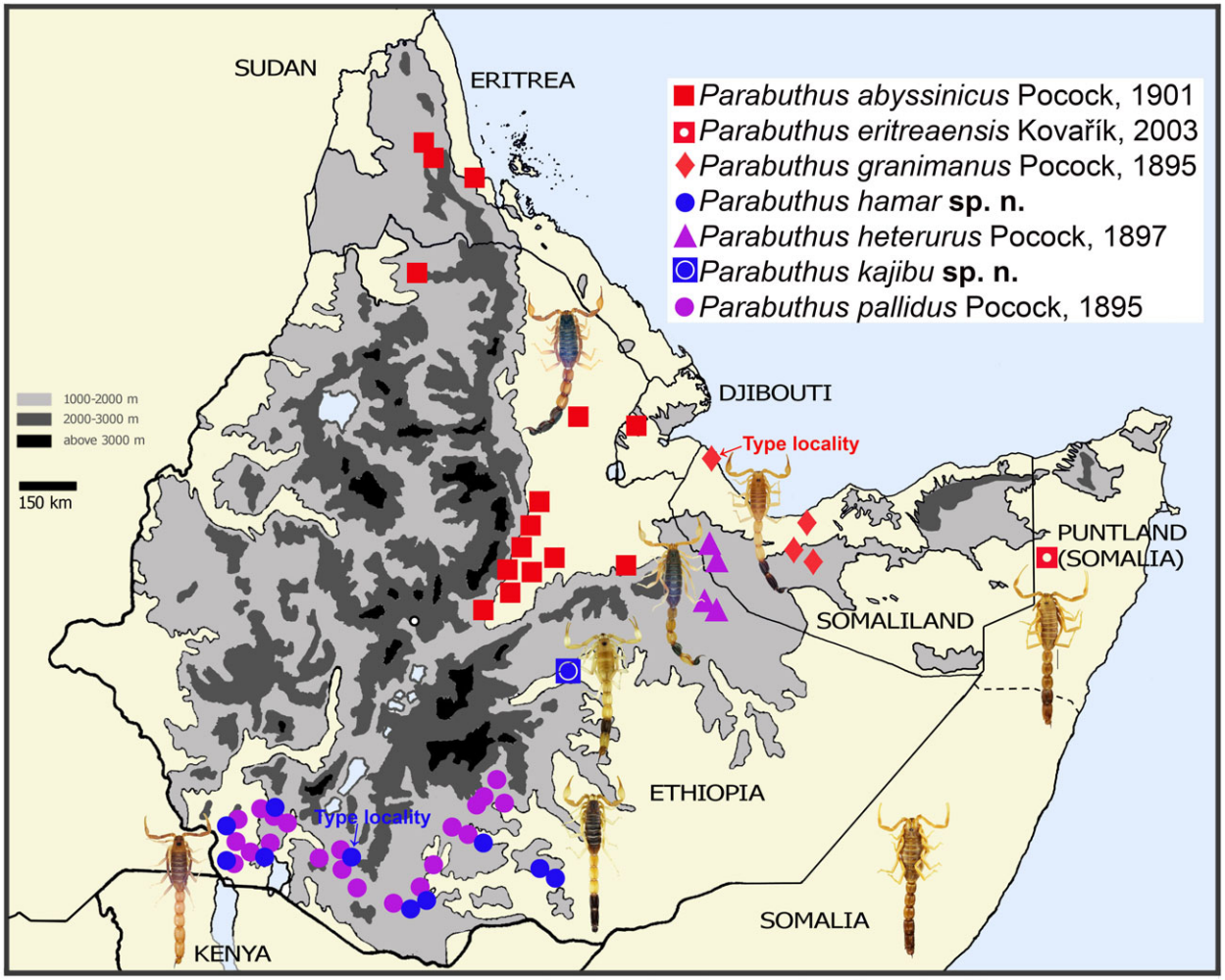

Figure 204: Map showing confirmed distribution of *Parabuthus* spp. in Djibouti, Eritrea, Ethiopia, Somaliland and *P. eritreaensis* in Somalia (Puntland). Most points indicate sites sampled during 2011–2016 expeditions. We have not included in the map locality data for old specimens mainly from Somalia deposited in Italian museums which include large collections from this region (Kovařík & Whitman, 2005: 110–112), because these specimens are often mislabeled. Without corroboration from recently collected specimens, it is problematic to verify which of the locality labels are correct.

Lízler, Tomáš Mazuch, Pavel Smrž, and Miroslav Snížek of the Czech Republic, and Karl Werner of Germany passed cited specimens on to first author; and Tomáš Mazuch, Victor Fet and Michael Soleglad for their help in processing the manuscript. The cytogenetic analysis was supported by the grant received from Ministry of Education, Youth and Sports of the Czech Republic no. SVV 260313/2016. Further, we thank two anonymous reviewers for their comments on the manuscript.

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