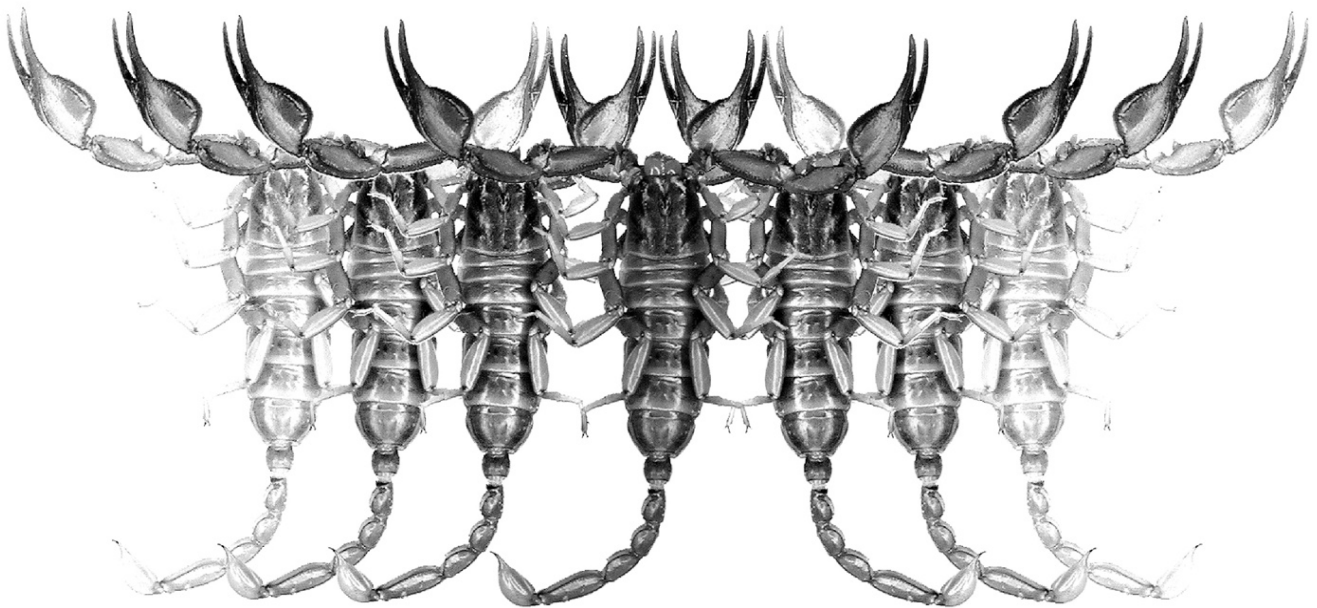


Euscorpius

Occasional Publications in Scorpiology



**A revision of the genus *Mesobuthus* Vachon, 1950,
with a description of 14 new species
(Scorpiones: Buthidae)**

**František Kovařík, Victor Fet, Benjamin Gantenbein,
Matthew R. Graham, Ersen Aydin Yağmur, František Štáhlavský,
Nikita M. Poverennyi & Nizami E. Novruzov**

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Euscorpius

Occasional Publications in Scorpiology

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Publication date: 10 March 2022

<http://zoobank.org/urn:lsid:zoobank.org:pub:2E901BF2-5D35-48E4-B31B-5C9B64A56BD3>

A revision of the genus *Mesobuthus* Vachon, 1950, with a description of 14 new species (Scorpiones: Buthidae)

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<http://zoobank.org/urn:lsid:zoobank.org:pub:2E901BF2-5D35-48E4-B31B-5C9B64A56BD3>

To the memory of Victor A. Krivokhatsky (1954 – 2021)

Summary

The Asian genus *Mesobuthus* Vachon, 1950, s. str. (Buthidae) (also known as an informal ‘*M. eupeus* complex’), which includes the most common scorpion species found from Turkey to China, is revised based on new collections, mainly from Central Asia, Turkey, and Iran, using both morphological and mitochondrial DNA data. Available type specimens of all species were studied; neotypes and lectotypes were designated when necessary. The type species *Mesobuthus eupeus* (C. L. Koch, 1839), s. str., is restricted to the Caucasus Mts. Currently, the genus includes 29 valid species. Fifteen previously described taxa are recognized as species: *Mesobuthus afghanus* (Pocock, 1889) (Afghanistan, Iran, Turkmenistan) (= ?*Buthus agnetis* Werner, 1936, **syn. n.**), *M. barszcevskii* (Birula, 1904), **stat. n.** (Uzbekistan), *M. bogdoensis* (Birula, 1896) (= *Buthus eupeus volgensis* Birula, 1925, **syn. n.**) (Kazakhstan, Russia), *M. eupeus* (C. L. Koch, 1839) (Armenia, Azerbaijan, Georgia, Iran, Russia [North Caucasus], Turkey), *M. haarlovi* Vachon, 1958 (Afghanistan, Pakistan), *M. iranensis* (Birula, 1917) (Iran), *M. kirmanensis* (Birula, 1900), **stat. n.** (Iran) (= *Buthus pachysoma* Birula, 1900, **syn. n.**), *M. macmahoni* (Pocock, 1900) (Pakistan), *M. mesopotamicus* (Penther, 1912), **stat. n.** (Iraq, Syria, Turkey), *M. persicus* (Pocock, 1899) (Azerbaijan, Iran), *M. philippovitschi* (Birula, 1905), **stat. n.** (Iran), *M. phillipsii* (Pocock, 1889) (Iran), *M. thersites* (C.L. Koch, 1839) (= *Buthus eupeus mongolicus* Birula, 1911, **syn. n.**) (China, Kazakhstan, Kyrgyzstan, Mongolia), *M. vesiculatus* (Pocock, 1900) (Iran), and *M. zarudnyi* Novruzov et al., 2022 (Azerbaijan). Fourteen new species are described: *Mesobuthus birulai* **sp. n.** (Iran), *M. crucittii* **sp. n.** (Iran), *M. farleyi* **sp. n.** (Iran), *M. fomichevi* **sp. n.** (Tajikistan, Uzbekistan), *M. galinae* **sp. n.** (Turkmenistan), *M. kaftani* **sp. n.** (Iran), *M. marusiki* **sp. n.** (Uzbekistan), *M. mirshamsii* **sp. n.** (Iran), *M. navidpourii* **sp. n.** (Iran), *M. rahsenae* **sp. n.** (Turkey), *M. turcicus* **sp. n.** (Turkey), *M. vignolii* **sp. n.** (Iran), *M. yagmuri* **sp. n.** (Turkey), and *M. zonsteini* **sp. n.** (Uzbekistan). No subspecies are currently recognized. A key to all studied species is given. A DNA phylogeny based on *COI* marker is presented including 25 species.



Figures 1–5: *Mesobuthus*, live specimens and a locality. **Figure 1.** *M. barszczewskii*, male. **Figure 2.** *M. haarlovi*, female. **Figure 3.** *M. haarlovi*, male. **Figure 4.** *M. turcicus* sp. n., female. **Figure 5.** Afghanistan, Kabul, locality of *M. haarlovi*.

Introduction

The scorpion genus *Mesobuthus* Vachon, 1950 traditionally included almost exclusively Asian species, mostly arid, very common and widespread in the deserts and mountains from Turkey to Mongolia and China. This genus underwent significant taxonomic changes since being listed in the *Catalog of the Scorpions of the World* by Fet & Lowe (2000). Several Indian species were transferred from *Mesobuthus* to *Hottentotta*. A number of new species has been recently described (Fet et al., 2018), which now are placed in a recently resurrected genus *Olivierus* (Fet et al., 2018, 2021; Kovařík, 2019). The latter work also established a new genus *Aegaeobuthus* Kovařík, 2019, which incorporated some taxa formerly in *Mesobuthus*.

For the resulting restricted genus *Mesobuthus* s. str., Kovařík (2019) listed 12 species, of which 7 were elevated from the subspecies rank. One more new species from Azerbaijan was described recently (Novruzov et al., 2022). With addition of 14 new species described here, and taxonomic changes introduced in this paper, the genus *Mesobuthus* now includes 29 species.

As numerous new, diverse populations of *Mesobuthus* (then in the ‘umbrella’ genus *Buthus*) were discovered in the 1880s–1910s from Anatolia to China, a tradition emerged to lump them as subspecies under Koch’s “*Buthus eupeus*”. This trend in scorpions was naturally facilitated by scarce material and few clear morphological characters available for comparison. Fet & Lowe (2000) listed as many as 14 valid subspecies of *Mesobuthus eupeus*. A map from Vachon (1958, fig. 37, featuring 15 subspecies) was even used by Ernst Mayr in his *Principles of Systematic Zoology* (Mayr, 1969) as a textbook example of a polytypic species. The second author (V.F.) remembers seeing this map 50 years ago in a treasured Russian translation of Mayr’s book (Mayr, 1971, fig. 5).

Within the recent two decades, however, the “polytypic” trend in scorpion systematics has been reversed, and we recognize no subspecies for *Mesobuthus*. In our current revision, most of taxa traditionally described as subspecies are elevated to species rank, usually guided by DNA analysis.

Birula (1917a: 40–41) grouped all subspecies of *Buthus eupeus* into two groups (which he called “sections”): “*eupeus*” and “*thersites*”. Later (Birula, 1918: 15–16) he also added a group “*phillipsi*”. Our DNA data (see Discussion) shows that Birula’s “sections” correspond to three major clades within the genus *Mesobuthus*.

Already the first pilot DNA phylogeny of Gantenbein et al. (2003: 415), which included 9 sequences from ‘*Mesobuthus eupeus*’ suggested that the populations were “highly structured, indicating the possible existence of multiple species” in the “*Eupeus* complex”. For Central Asia, Gantenbein et al. (2003: 417) noticed that “a special clade exists for a sand desert population from Turkmenistan [Repetek], as opposed to the clade of several populations from Uzbekistan, Kazakhstan and China... This can be an indication of an ancient separation between southern and northern desert forms, possibly valid at least at the subspecies level...”

All this complexity forced us to return to the *Mesobuthus* analysis, especially since extensive new collections from Iran and Turkey became available to our research group in the recent decade. In addition, important DNA data on the Iranian populations were published by Mirshamsi et al. (2010).

Here, we present a comprehensive revision, which, however, still misses many pieces of the puzzle. It became possible through extensive new collections from many Asian countries, the gradual acquisition of DNA data, as well as analysis of old museum collections and type material. We were able to analyze virtually all available types, and designated neotypes in rare cases when types were missing. Especially important in this regard were visits by two of the authors (F.K. and E.A.Y.) in 2018–2019 to the Zoological Institute in St. Petersburg, Russia, which allowed to study the scorpion collection of A. A. Birula preserved there.

Methods, Material & Abbreviations

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

Molecular techniques. Our dataset of 98 *COI* DNA sequences (“barcode markers”) (Table 16) was compiled from several sources. From GenBank, we extracted 32 *COI* sequences of *Mesobuthus* from Central Asia (Kazakhstan, Uzbekistan, Turkmenistan) and China, which were obtained in our earlier studies (Gantenbein et al., 2003, 2005; see these papers for methods of DNA extraction, PCR amplification, and sequencing). Also, a number of published sequences from Iran (Mirshamsi et al., 2010) and one representative sequence from Mongolia (Shi et al., 2013) was retrieved from GenBank. Of all the Iranian sequences available in GenBank, we used a subset of 37 sequences, which could be matched by locality to our specimens collected in Iran independently by the team led by S. Navidpour. Most of this material has been published in a series of joint publications (Navidpour et al., 2008a, 2008b, 2008c, 2008d, 2010, 2011, 2012, 2013, 2019; Pirali-Kheirabadi et al., 2009). In addition, we obtained 29 new *COI* sequences. Of these, 18 sequences from Afghanistan, Armenia, Azerbaijan, Kyrgyzstan, Pakistan, Turkey, and Uzbekistan were obtained in the laboratory of F. Štáhlavský (Charles University, Prague, Czech Republic) (for methods, see Kovařík et al., 2009); and 11 new sequences from Armenia, Kazakhstan, and Russia were obtained by Nikita Poverennyi (Saratov State University, Saratov, Russia; for methods, see Poverennyi & Anikin, 2020a, 2020b). All new *COI* sequences were deposited in GenBank under accession numbers GenBank OM905075–OM905081 and OM905083–OM905103. GenBank accession numbers for previously published sequences are provided in Table 16.

Phylogenetic Analysis. The analysis of the combined dataset was performed by M.R.G. Mitochondrial *COI* sequences were aligned in AliView 1.7.1 (Larsson, 2014) using MUSCLE (Edgar, 2004) with default parameters. Alignments were assessed visually, and ends were trimmed manually in AliView. We then used the trimmed alignment with BEAST 1.8.0 (Drummond et al., 2012) to simultaneously estimate

phylogenetic relationships and timing of diversification among *Mesobuthus* spp. The best-fit model of nucleotide substitution was determined with Molecular Evolutionary Genetics Analysis (MEGA X; Kumar et al., 2018). Using the best-fit model (HKY+G), we performed two independent MCMC runs for 50 million generations each and sampling every 5,000 generations, with an uncorrelated lognormal clock model and Yule tree prior. We calibrated the molecular clock following Graham et al. (2019) by using a normal mean rate prior (ucl.d.mean) set to 0.007 substitutions per site per million years, as estimated for other buthid scorpions (Gantenbein et al., 2005). We adjusted the standard deviation so that 95% of the normal distribution included minimum and maximum rates previously estimated for COI (SD: 0.00146) in scorpions (Bryson et al., 2014; Graham et al., 2017). We used Tracer 1.7 (Rambaut et al., 2018) to confirm convergence among runs and to ensure that ESS values exceeded 200 for all parameters. We combined individual tree files and constructed a maximum clade credibility tree with TreeAnnotator (part of the BEAST package). The resulting consensus tree (Fig. 1172) was visualized in Figtree 1.4.0 (<http://tree.bio.ed.ac.uk/software/>). *Species Delimitation*. We delimited *Mesobuthus* species using the COI data and the ASAP (Assemble Species by Automatic Partitioning) program (Puillandre et al., 2021). This method calculates pairwise genetic distances and uses hierarchical clustering to build a list of best partitions from single locus alignments. Each partition is ranked by score based on a combination of barcode gap width and probability of panmixia. ASAP does not require any a priori information about the study system: i.e. number of species, a phylogenetic tree, or a priori-defined genetic distances. We uploaded our COI alignment to the ASAP web server (<https://bioinfo.mnhn.fr/abi/public/asap/>) and used the Jukes-Cantor (JC69) substitution model to compute genetic distances. The resulting ASAP model with the best score was considered to represent optimal number of species partitions (Fig. 1173).

Specimen Depositories: AZMM (Alaşehir Zoological Museum, Manisa Celal Bayar University, Alaşehir, Manisa, Turkey); BMNH (The Natural History Museum, London, United Kingdom); FKCP (František Kovařík, private collection, Prague, Czech Republic); MMBC, Moravian Museum, Brno, Czech Republic; MNHN (Muséum National d'Histoire Naturelle, Paris, France); MZHF (Zoological Museum, Finnish Museum of Natural History, University of Helsinki, Finland); NHMW (Naturhistorisches Museum Wien, Vienna, Austria); NMPC (National Museum of Natural History, Prague, Czech Republic); ZISP (Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia); and ZMHB (Museum für Naturkunde der Humboldt-Universität, Berlin, Germany).

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

The Russian label dates before 1918 are given in "Old Style" (Julian) with "New Style" (Gregorian) in square brackets: 27 April [10 May]; the two calendars differed 12 days in the 19th century and 13 days in the 20th.

Specimen locality coordinates cited without parentheses were provided by collectors (or were cited in the original

descriptions), while coordinates in parentheses were estimated or inferred from online resources (e.g. Google Earth™).

Systematics

Family Buthidae C. L. Koch, 1837

Genus *Mesobuthus* Vachon, 1950

(Figures 1–1173, Tables 1–17)

<http://zoobank.org/urn:lsid:zoobank.org:act:4F401F4C-FA87-4FE2-905A-3DDDEF0C81BE>

Mesobuthus Vachon, 1950: 152 (in part).

TYPE SPECIES. *Androctonus eupeus* C. L. Koch, 1839.

REFERENCES (selected):

- Mesobuthus* (in part): Vachon, 1952: 324; Vachon, 1958: 141; Fet & Lowe, 2000: 169–181 (in part; complete references list until 1998).
Mesobuthus: Kovařík, 2019: 17, figs. 134–137, 148, 161–163, 171–172.

DIAGNOSIS. Medium-sized buthids, adults 35–65 mm. Sternum type 1 (Soleglad & Fet, 2003), various degrees of an irregular pentagon in shape. Pedipalps orthobothriotaxic, type A β (Vachon, 1974, 1975), femur trichobothrium d_2 dorsal, patella d_3 dorsal of dorsomedian carina. Chelal trichobothrium db usually located between est and esb , or may be on level with trichobothrium est . Trichobothrium eb clearly on fixed finger of pedipalp. Pectines with fulcra. Dentate margin of pedipalp-chela movable finger with distinct denticles divided into 11–12 linear rows and 5 terminal denticles. Chelicerae with typical buthid dentition (Vachon, 1963, figs. 32–33), fixed finger armed with two denticles on ventral surface. Tergites I–VI granular, with three carinae, tergite VII with 5 carinae. Carapace with distinct carinae, entire dorsal surface nearly flat. First sternite with two granulated lateral stridulatory areas, which however may be reduced in some species. Metasoma elongate, segment I with 10 carinae, segments II–III with 8–10 carinae, segment IV with 8 carinae. Ventrolateral carinae of metasomal segment V posteriorly usually with several large lobed denticles. Telson elongated or bulbous, bumpy and granulated, without subaculear tooth. Legs III and IV with well developed tibial spurs. No sexual dimorphism in shape of metasoma.

REMARKS ON THE KARYOTYPES. We analyzed karyotypes of six *Mesobuthus* species using the spreading technique, which is successfully used in scorpions (e. g. Kovařík et al., 2009; Sadílek et al., 2015). The chromosomes of these species (Figs. 1159–1166) fully correspond to the cytogenetic characteristic typical for the family Buthidae such as holocentric chromosomes, achiasmatic meiosis in males, and lower number of chromosomes (e. g. Šťáhlavský et al., 2020). The karyotypes of almost all analyzed *Mesobuthus* species consist of 22 chromosomes, which gradually decrease

in length. The only exception was the karyotype of *M. rahsenae* sp. n. Both analyzed males of this species have $2n=20$. Moreover, the first pair of the chromosomes in this species is considerably longer in comparison to other chromosomes, which gradually decrease in length (Table 15, Fig. 1165). This reduction of $2n$ and a longer pair of the chromosomes may be the result of chromosomal fusion. This type of chromosomal rearrangement is well known in buthid scorpions with holocentric chromosomes, and may even cause high intraspecific variation of $2n$ in some species (e. g. Adilardi et al., 2020). However, we observed $2n=20$ and the same length of chromosomes in two males of *M. rahsenae* sp. n.. It is the reason we consider this distinct karyotype as a typical characteristic of this species. This idea is supported by the stability of karyotypes in all remaining species ($2n=22$). Such stability of the diploid number is typical also for several other buthid genera belonging to the "*Buthus* group" such as *Compsobuthus* ($2n=22$ in seven species), *Buthus* ($2n=22$ in five species), *Leiurus* ($2n=22$ in four species) and *Androctonus* ($2n=24$ in 11 species) (see Šťáhlavský et al., 2020). It should be noted that there exists some previous information about the karyotypes of *Mesobuthus* species (see Schneider et al., 2021). Šťáhlavský et al. (2020) described karyotypes of *M. eupeus* ($2n=22$) from two localities in Turkey. We confirmed the karyotype of *M. eupeus* (Fig. 1161) in one more female (sample No. 363) from the same locality in Turkey and also in Georgia (Fig. 1159) and Armenia (Fig. 1160). According to our results, the remaining information about the karyotypes of *Mesobuthus* species seems to be very disputable. Makino (1956) published $2n=22$ in *M. eupeus* without a specific locality, so the species determination cannot be confirmed. Sharma et al. (1959) described $2n=24$ in *M. macmahoni* from Punjab in northwestern India, but this is likely a misidentification at genus level.

The last information about the chromosomes of *M. eupeus* is also disputable. Karataş et al. (2019) did not specify three different localities of analyzed samples from the Niğde Province in Turkey. Moreover, these authors declared $2n=20$ in this species, however, the four photographs of the chromosomes have low quality and only one of them exactly demonstrates the stated chromosome number. At this moment, it is necessary to consider this information as erroneous; a more precise cytogenetic analysis is recommended to confirm the karyotype of *Mesobuthus* from the Niğde Province in Turkey.

Our cytogenetic analysis shows that the information about the chromosomes has only limited use in taxonomy of *Mesobuthus* because the majority of species displays a high similarity of their karyotypes. However, in some specific cases (e. g. *M. rahsenae* sp. n.) the karyotypes may help to identify the species with similar morphology.

DISTRIBUTION. Afghanistan, Armenia, Azerbaijan, China, Georgia, Iran, Iraq, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia, Syria, Tajikistan, Turkey, Turkmenistan, Uzbekistan (Figs. 1155–1158).

SUBORDINATE TAXA (29 species; no subspecies are currently recognized)

Mesobuthus afghanus (Pocock, 1889) (Afghanistan, Iran, Turkmenistan)

= ?*Buthus agnetis* Werner, 1936, **syn. n.**

Mesobuthus barszczewskii (Birula, 1904), **stat. n.** (Uzbekistan)

Mesobuthus birulai sp. n. (Iran)

Mesobuthus bogdoensis (Birula, 1896) (Kazakhstan, Russia)

= *Buthus eupeus volgensis* Birula, 1925, **syn. n.**

Mesobuthus crucittii sp. n. (Iran)

Mesobuthus eupeus (C. L. Koch, 1839), s. str. (Armenia, Azerbaijan, Georgia, Iran, Russia, Turkey)

= *Androctonus ornatus* Nordmann, 1840

= *Buthus cognatus* L. Koch, 1878

Mesobuthus fomichevi sp. n. (Tajikistan, Uzbekistan)

Mesobuthus farleyi sp. n. (Iran)

Mesobuthus galinae sp. n. (Turkmenistan)

Mesobuthus haarlovi Vachon, 1958 (Afghanistan, Pakistan)

Mesobuthus iranensis (Birula, 1917) (Iran)

Mesobuthus kaftani sp. n. (Iran)

Mesobuthus kirmanensis (Birula, 1900), **stat. n.** (Iran)

= *Buthus pachysoma* Birula, 1900, **syn. n.**

Mesobuthus macmahoni (Pocock, 1900) (Pakistan)

Mesobuthus marusiki sp. n. (Uzbekistan)

Mesobuthus mesopotamicus (Penther, 1912), **stat. n.** (Iraq, Syria, Turkey)

Mesobuthus mirshamsii sp. n. (Iran)

Mesobuthus navidpourii sp. n. (Iran)

Mesobuthus persicus (Pocock, 1899) (Azerbaijan, Iran)

Mesobuthus philippovitschi (Birula, 1905), **stat. n.** (Iran)

Mesobuthus phillipsii (Pocock, 1889), s. str. (Iran)

Mesobuthus rahsenae sp. n. (Turkey)

Mesobuthus thersites (C. L. Koch, 1839) (China, Kazakhstan, Kyrgyzstan, Mongolia)

= *Buthus eupeus mongolicus* Birula, 1911, **syn. n.**

Mesobuthus turcicus sp. n. (Turkey)

Mesobuthus vesiculatus (Pocock, 1899) (Iran)

Mesobuthus vignolii sp. n. (Iran)

Mesobuthus yagmuri sp. n. (Turkey)

Mesobuthus zarudnyi Novruzov et al., 2022 (Azerbaijan)

Mesobuthus zonsteini sp. n. (Uzbekistan)

Mesobuthus afghanus (Pocock, 1889)

(Figures 6–50, 1155, 1157–1158, 1170, Table 1)

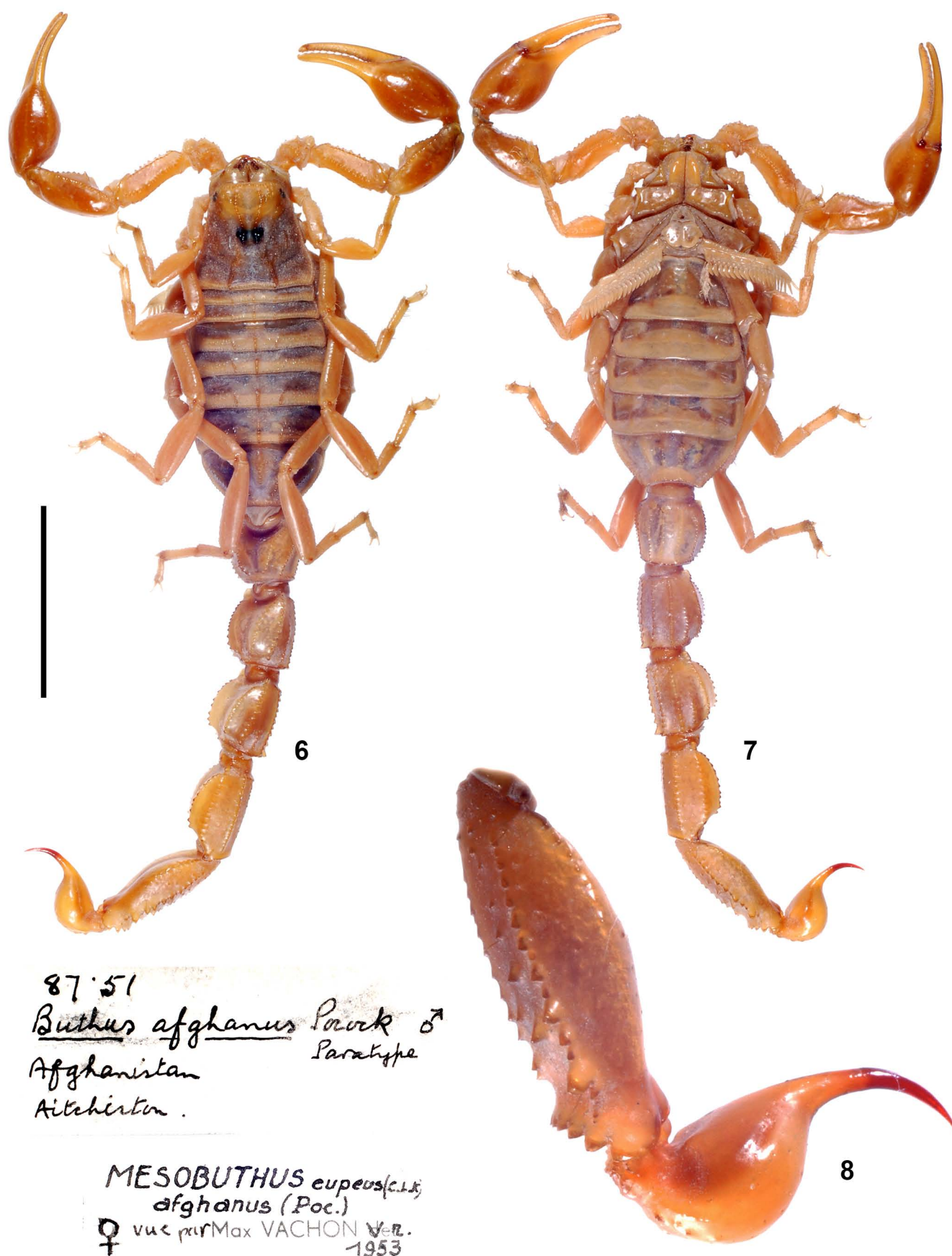
<http://zoobank.org/urn:lsid:zoobank.org:act:17C4F1AB-3298-4667-A013-EECC31865F8A>

Buthus afghanus Pocock, 1889: 116–117, pl. XIII, fig. 4.

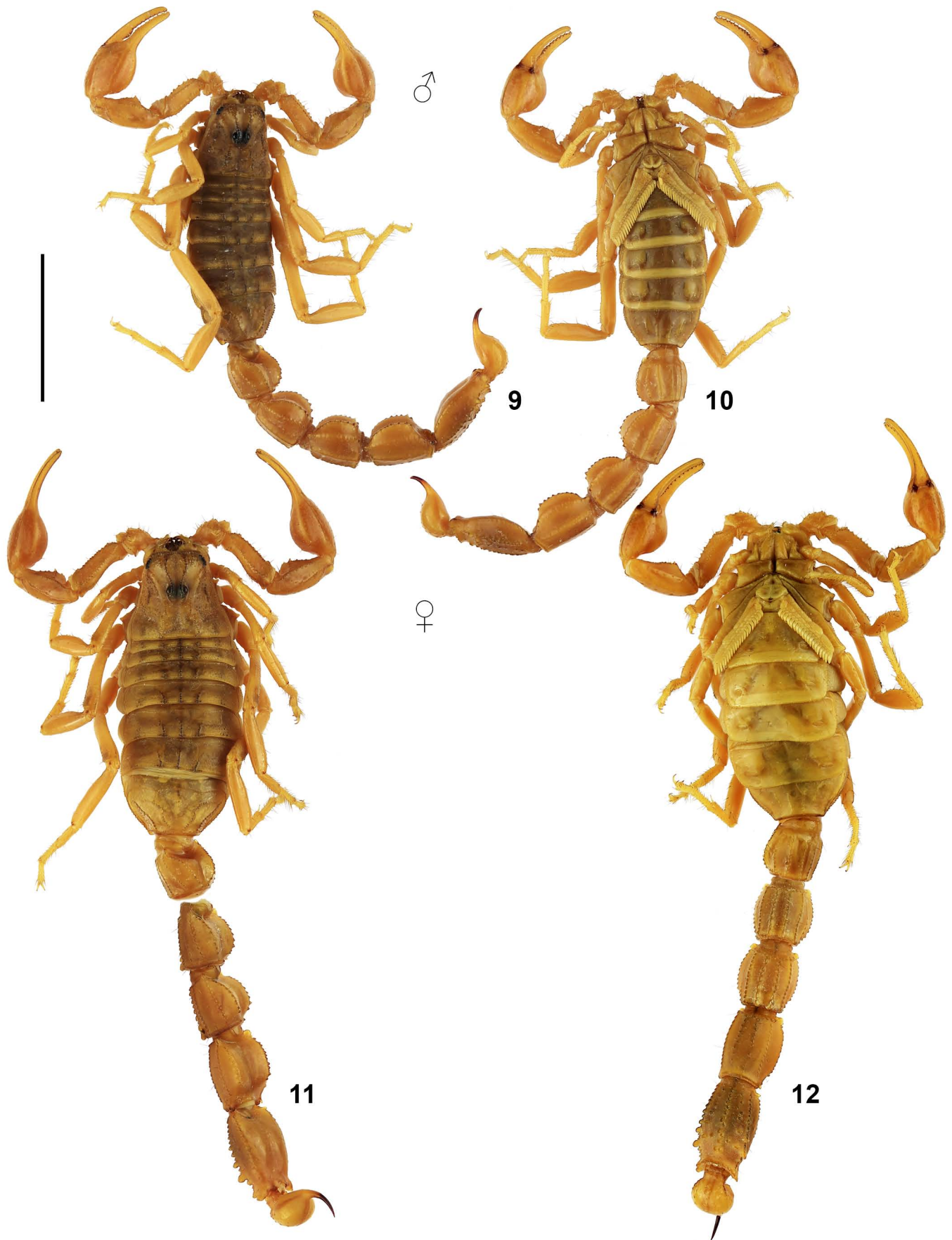
TYPE LOCALITY AND TYPE REPOSITORY. Iran, *Razavi Khorasan Province*, between Harirud Valley and Meshed; BMNH.

SYNONYMS:

= ?*Buthus agnetis* Werner, 1936: 202 (type locality: Iran,



Figures 6–8: *Mesobuthus afghanus*, female lectotype. **Figures 6–7.** Dorsal (6) and ventral (7) views. **Figure 8.** Metasoma V and telson ventral view. Scale bar: 10 mm (6–7).



Figures 9–12: *Mesobuthus afghanus*, Iran, Razavi Khorasan Province, Bazangan, 20 km of Mozduran, NMPC. **Figures 9–10.** Male, dorsal (9) and ventral (10) views. **Figures 11–12.** Female, dorsal (11) and ventral (12) views. Scale bar: 10 mm.

Razavi Khorasan Province, Meshed (36.30°N 59.44°E); (repository unknown). **Syn. n.**

<http://zoobank.org/urn:lsid:zoobank.org:act:CE5CC940-97CA-4679-AFBB-493D586AB7CE>

REFERENCES (selected):

- Buthus eupeus* forma γ : Birula, 1896: 240 (in part).
Buthus eupeus afghanus: Birula, 1900a: 360–363 (in part); Birula, 1904b: 30; Birula, 1905a: 122, 124; Birula, 1917a: 41 (in part).
Buthus eupeus thersites: Birula, 1917a: 41 (in part).
Buthus afghanus: Birula, 1900b: 3.
 ? *Mesobuthus agnetis*: Vachon, 1950: 153; Vachon, 1952: 325; Vachon, 1966: 212; Fet & Lowe, 2000: 170.
Mesobuthus eupeus afghanus: Vachon, 1958: 155–159, figs. 37–38; Fet, 1989: 86, 99; Fet, 1994: 527; Fet & Lowe, 2000: 172 (complete references list until 1998); Mirshamsi et al., 2010: 2867 (in part).
Mesobuthus eupeus thersites (in part): Vachon, 1958: 155; Fet, 1989: 95–98; Fet, 1994: 526; Fet & Lowe, 2000: 171; Gantenbein et al., 2003: 413; Mirshamsi et al., 2010: 2867; Mirshamsi et al., 2011a: 9, figs. 9–23.
Mesobuthus eupeus: Mirshamsi et al., 2011b: 20 (in part).
Mesobuthus afghanus: Kovařík, 2019: 17.

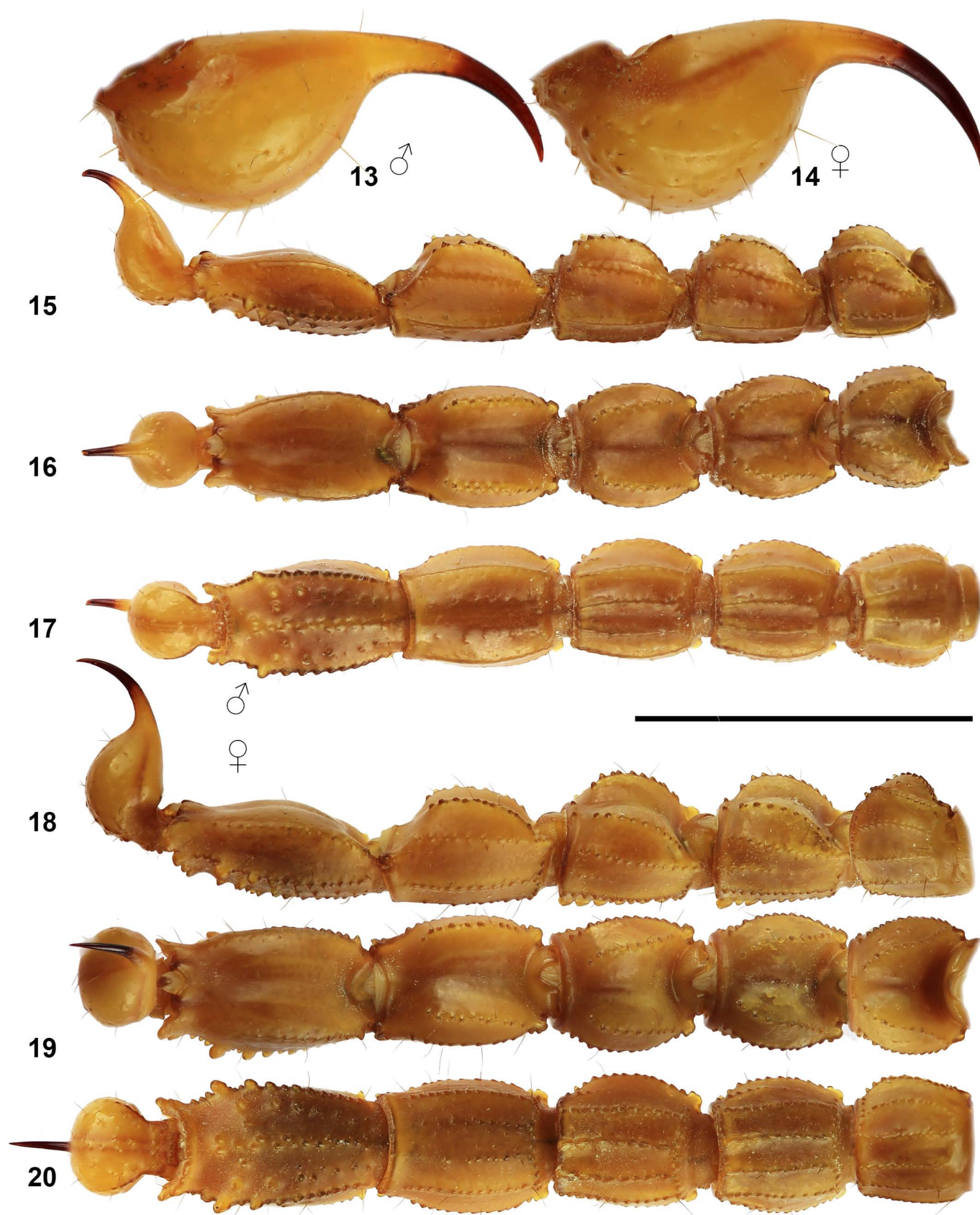
TYPE MATERIAL EXAMINED. **Iran, Razavi Khorasan Province**, between Harirud Valley and Meshed (see Comments) (36.30°N 59.44°E; estimated locality); 1 ♀ (lectotype, designated here), leg. J. E. T. Aitchison, BMNH 87.51.

OTHER MATERIAL EXAMINED. **Afghanistan, Jowzjan Province**, N of Agcha (36.91°N 66.19°E), 1964, 2 ♂ 1 ♀, FKCP, 1 ♂ 1 ♀, NMPC; **Iran, Razavi Khorasan Province**, 10 km W of Baqbaqu, 36°05'N 60°25'E (36.08°N 60.42°E), 680 m a. s. l., 10 May 1997, 1 ♀, leg. M. Kaftan, NMPC; Bazangan, 20 km of Mozduran, 36°17'N 60°33'E (36.28°N 60.55°E), 660 m a. s. l., 11 May 1997, 2 ♂ 2 ♀ 1 juv. (Figs. 6–50, Table 1), leg. M. Kaftan, NMPC. **Turkmenistan, Akhal Province**, Tejen District, near Tejen Reservoir, ca. 12 km SSE of Gangaly, 36°55'51"N 60°50'22"E (36.92°N 60.83°E), 235 m a. s. l., 3 April 2002, 1 ♀ 3 juvs., leg. A. Gromov & V. Fet (NG-039), NMPC. **Lebap Province**, Charzhev District, East Karakum Desert, Repetek Nature Reserve (38.56°N 63.16°E), 3 ♀ 3 ♂ 3 juvs., FKCP, 1 ♂ juv., NMPC, 14–28 April 1990, leg. J. Farkač; same locality, 4 ♀, 14–18 April 2002, leg. V. Fet, NMPC; Repetek Nature Reserve, 38°33'54"N 63°10'51"E (38.55°N 63.17°E), 201 m a. s. l., 3 juvs., 15 April 2002, leg. A. Gromov & V. Fet (NG-044), NMPC; **Mary Province**, Serhetabat District, Badkhyz Nature Reserve, 1991, 2 ♀, 1992, 1 ♂ 2 ♀ 4 juvs., leg. K. Atamuradov, NMPC; Serhetabat District, Kushka River valley, 35°16'48"N 62°21'09"E (35.27°N 62.35°E), 667 m a. s. l., 4 juvs., 5 April 2002, leg. V. Fet (NG-034), NMPC; same locality and date, 1 ♀ 1 juv., leg. V. Fet (NG-087), NMPC; Serhetabat District, Serhetabat, 35°28'21"N 62°24'32"E (35.47°N 62.40°E), 521 m a. s. l., 5 April

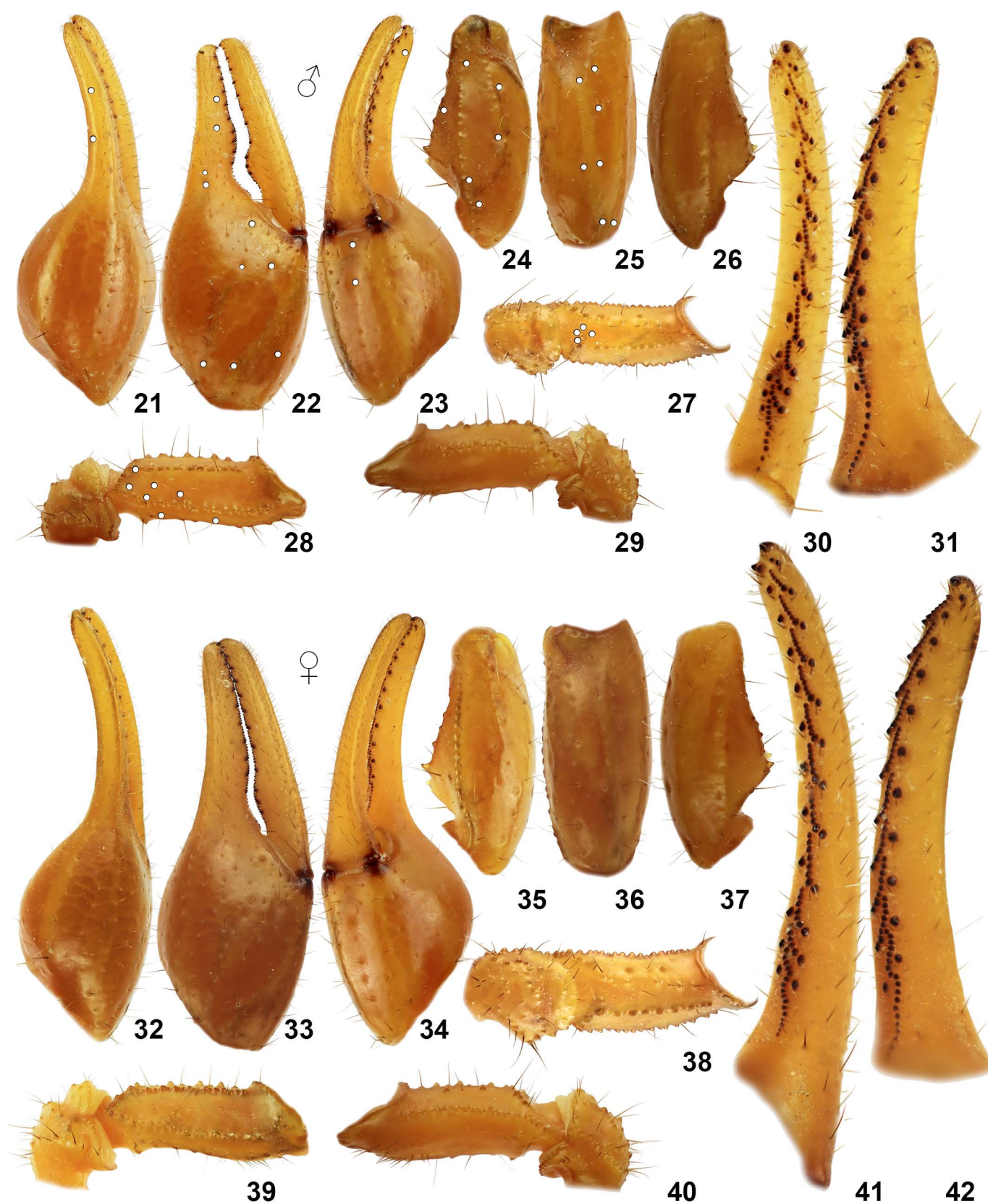
2002, 1 ♂ juv., leg. V. Fet (NG-062), NMPC; same locality and date, 2 juvs. (metasomas only), leg. V. Fet (NG-073), NMPC; near Kushka (now Serhetabat) (35.27°N 62.30°E), 10 April 1988, 1 ♀, leg. T. N. Shirokova, NMPC; Serhetabat District, Badkhyz Plateau, 6 April 2002, 35°40'52"N 62°01'34"E (35.67°N 62.02°E), 452 m a. s. l., 1 ♀ 2 juvs., leg. A. Gromov (NG-077), NMPC; Serhetabat District, Badkhyz Plateau, 35°37'21"N 62°15'17"E (35.62°N 62.25°E), 769 m a. s. l., 6 April 2002, 1 ♂, leg. A. Gromov (NG-078), NMPC; Serhetabat District, Badkhyz Plateau, Eroilanduz Depression, 7 April 2002, 35°39'40"N 61°50'13"E (35.65°N 61.83°E), 374 m a. s. l., 2 juvs., leg. V. Fet & A. Gromov (NG-006), NMPC; Serhetabat District, Badkhyz Plateau, Eroilanduz Depression, 35°40'55"N 61°49'18"E (35.67°N 61.82°E), 343 m a. s. l., 7 April 2002, 3 juvs., leg. V. Fet & A. Gromov (NG-121), NMPC; Serhetabat District, Badkhyz Plateau, 35°49'31"N 61°50'56"E (35.82°N 61.84°E), 723 m a. s. l., 9 April 2002, 3 juvs., leg. V. Fet & A. Gromov (NG-110), NMPC; Serhetabat District, Badkhyz Nature Reserve, Kepele, 10 April 2002, 35°48'41"N 61°32'51"E (35.80°N 61.53°E), 810 m a. s. l., 1 ♂ juv., leg. V. Fet (NG-058), NMPC; Serhetabat District, Badkhyz Nature Reserve, Kepele, 10 April 2002, 35°47'08"N 61°27'36"E (35.78°N 61.45°E), 765 m a. s. l., 2 juvs., leg. A. Gromov (NG-013), NMPC; Serhetabat District, Badkhyz Plateau, ca. 20 km WNW of Kala-i-Mor, Kaazly Sands, 35°42'39"N 62°20'29"E (35.70°N 62.33°E), 633 m a. s. l., 11 April 2002, 1 ♀, leg. V. Fet (NG-026), NMPC; Serhetabat District, near Oktyabr'skii Well, ca. 5 km WSW of Niyazov adyndaky, sands, 13 April 2002, 36°41'58"N 62°24'04"E (36.68°N 62.40°E), 382 m a. s. l., 1 ♀ juv., leg. A. Gromov (NG-016), NMPC.

DNA DATA. *M. afghanus* was represented in our survey by 19 DNA sequences, of which 15 originated from 11 localities in Turkmenistan. It was also represented among the populations studied by Mirshamsi et al. (2010) in their DNA survey of Iranian *Mesobuthus* (four sequences from northeastern Razavi Khorasan Province, Robat-e Sharaf, 31.32°N 60.58°E) (Table 16).

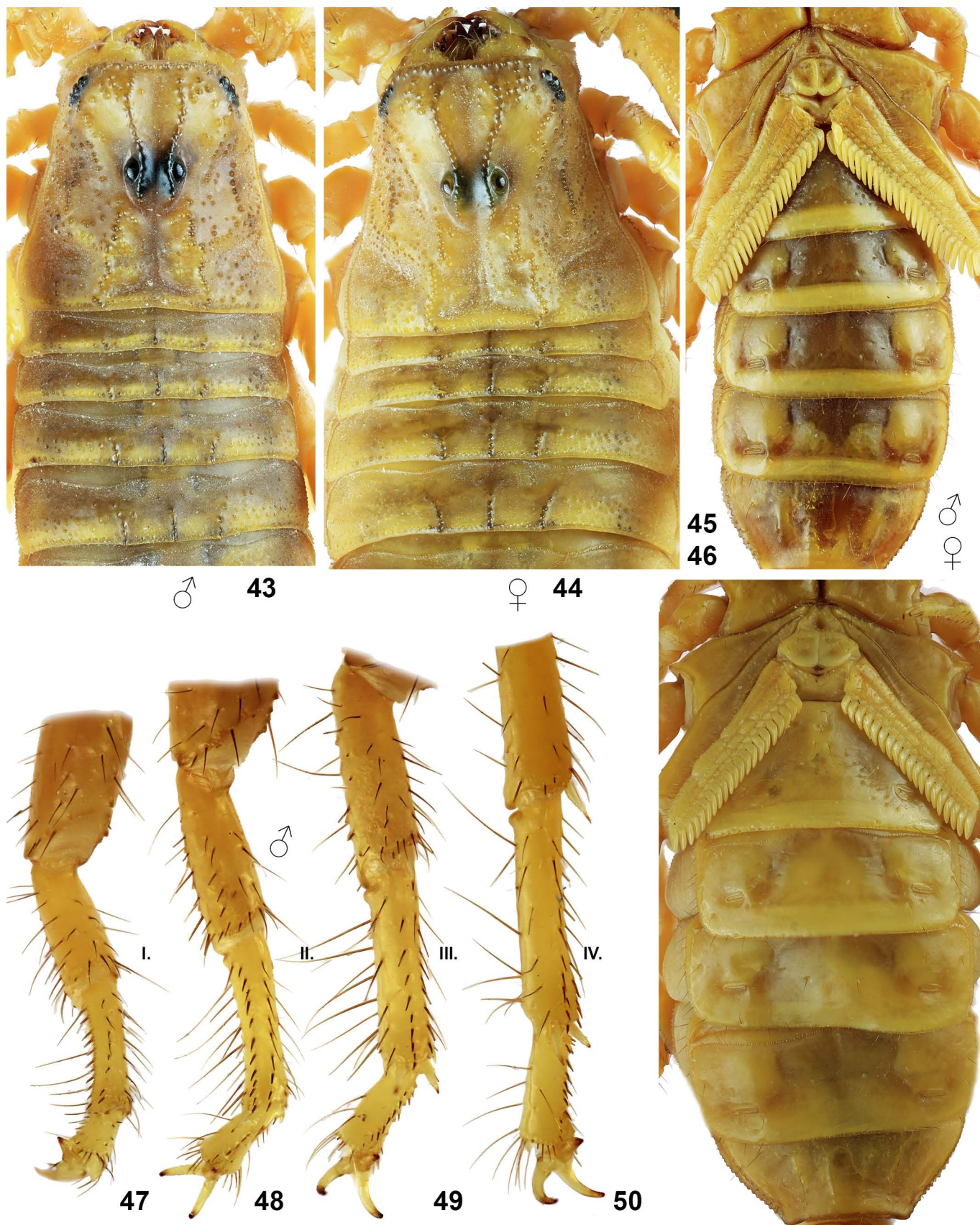
DIAGNOSIS. Total length of adults 38 mm (male) to 50 mm (female). Entire body usually light yellow. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male has fingers proximally slightly more twisted than female. Pedipalp chela length/width ratio 2.7–2.9 in male and 3.22–3.30 in female. Pectinal teeth number 20–25 in male, 18–21 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 granulated or smooth carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII with 4 well marked, smooth carinae. Metasomal segment I with 10 carinae; segments II to IV



Figures 13–20: *Mesobuthus afghanus*, Iran, Razavi Khorasan Province, Bazangan, 20 km of Mozduran, NMPC. **Figures 13, 15–17.** Male, telson lateral (13), metasoma and telson, lateral (15), dorsal (16), and ventral (17) views. **Figures 14, 18–20.** Female, telson lateral (14), metasoma and telson, lateral (18), dorsal (18), and ventral (20) views. Scale bar: 10 mm (13–20).



Figures 21–42: *Mesobuthus afghanus*, Iran, Razavi Khorasan Province, Bazangan, 20 km of Mozduran, NMPC, pedipalps. **Figures 21–31.** Male, chela, dorsal (21), external (22), and ventral (23) views. Patella, dorsal (24), external (25) and ventral (26) views. Femur and trochanter, internal (27), dorsal (28), and ventral (29) views. Movable (30) and fixed (31) fingers. **Figures 32–42.** Female, chela, dorsal (32), external (33), and ventral (34) views. Patella, dorsal (35), external (36) and ventral (37) views. Femur and trochanter, internal (38), dorsal (39), and ventral (40) views. Movable (41) and fixed (42) fingers. The trichobothrial pattern is indicated in Figures 21–25, 27–28.



Figures 43–50: *Mesobuthus afghanus*, Iran, Razavi Khorasan Province, Bazangan, 20 km of Mozduran, NMPC. **Figures 43, 45, 47–50.** Male, chelicerae, carapace and tergites I–IV (43), sternopectinal region and sternites (45), left legs I–IV, retrolateral aspect (47–50). **Figures 44, 46.** Female, chelicerae, carapace and tergites I–IV (44) and sternopectinal region and sternites (46).

Dimensions (mm)		<i>M. afghanus</i> ♂ from Bazangan	<i>M. afghanus</i> ♀ from Bazangan	<i>M. barszczewskii</i> ♀ 1785	<i>M. birulai</i> sp. n. ♂ holotype
Carapace	L / W	4.87 / 5.20	6.15 / 6.98	6.92 / 8.06	3.55 / 4.00
Mesosoma	L	11.19	14.85	21.53	10.06
Tergite VII	L / W	3.08 / 4.88	3.47 / 6.82	4.59 / 8.67	2.69 / 3.86
Metasoma + telson	L	25.49	28.71	34.13	19.92
Segment I	L / W / D	3.28 / 3.45 / 3.18	3.80 / 3.63 / 3.59	4.42 / 4.82 / 4.25	2.38 / 2.34 / 2.01
Segment II	L / W / D	3.66 / 3.54 / 3.11	3.98 / 3.88 / 3.54	4.85 / 4.75 / 4.11	2.80 / 2.18 / 2.04
Segment III	L / W / D	3.75 / 3.57 / 3.02	4.09 / 3.75 / 3.70	4.92 / 4.76 / 4.01	3.00 / 2.15 / 2.12
Segment IV	L / W / D	4.62 / 3.44 / 2.92	5.02 / 3.82 / 3.15	6.11 / 4.75 / 3.96	3.55 / 2.06 / 2.03
Segment V	L / W / D	5.59 / 3.09 / 2.25	6.21 / 3.41 / 2.61	7.43 / 4.57 / 3.31	4.38 / 1.91 / 1.73
Telson	L / W / D	4.59 / 2.23 / 1.88	5.61 / 2.76 / 2.25	6.40 / 3.40 / 2.96	3.81 / 1.49 / 1.45
Pedipalp	L	15.86	18.33	21.84	13.71
Femur	L / W	3.78 / 1.33	4.37 / 1.46	4.99 / 1.91	3.19 / 1.00
Patella	L / W	4.47 / 2.05	5.04 / 2.18	6.09 / 2.69	3.93 / 1.50
Chela	L	7.61	8.92	10.76	6.59
Manus	W / D	2.66 / 2.91	2.72 / 3.01	3.89 / 4.11	1.84 / 1.82
Movable finger	L	4.63	5.46	6.79	4.01
Total	L	41.55	49.71	62.58	33.53

Table 1. Comparative measurements of *Mesobuthus afghanus*, *M. barszczewskii*, and *M. birulai* sp. n. specimens. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma IV with lateromedian carina smooth to absent in male but allways present and granulated in female; all other carinae granulated. Length to depth ratio of metasoma III 1.2–1.3 in male, 1.1–1.2 in female; of metasoma IV 1.55–1.62 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi not densely hirsute, in adults with 8–11 retroinferior macrosetae on basitarsus III. Telson elongated. Anal lobe divided into two parts.

HISTORY OF STUDY. Pocock (1889) described *Buthus afghanus* based on two specimens (“probably males”) collected by the British naturalist James Edward Tierney Aitchison in a previously unexplored area, which now lies within three countries: Iran (northeast of the Razavi Khorasan Province), Afghanistan (northwest of the Herat Province), and Turkmenistan (south of the Mary Province, Serhetabat District). Aitchison’s travels were part of exploration during the Afghan Delimitation Commission that established the final border between Afghanistan and the Russian Empire (in its newly annexed Transcaspian Region). While most Aitchison’s trips were within Afghanistan (and none within the Russian Empire), some ventured into northeastern Iran; his detailed travelogues and maps are published (Aitchison, 1888). As he traveled “between Harirud Valley and Meshed”, Aitchison would traverse low-altitude Paropamisus Mts from Afghanistan to Iran. Harirud River (also known as the Tejen River) forms the modern border between Iran and

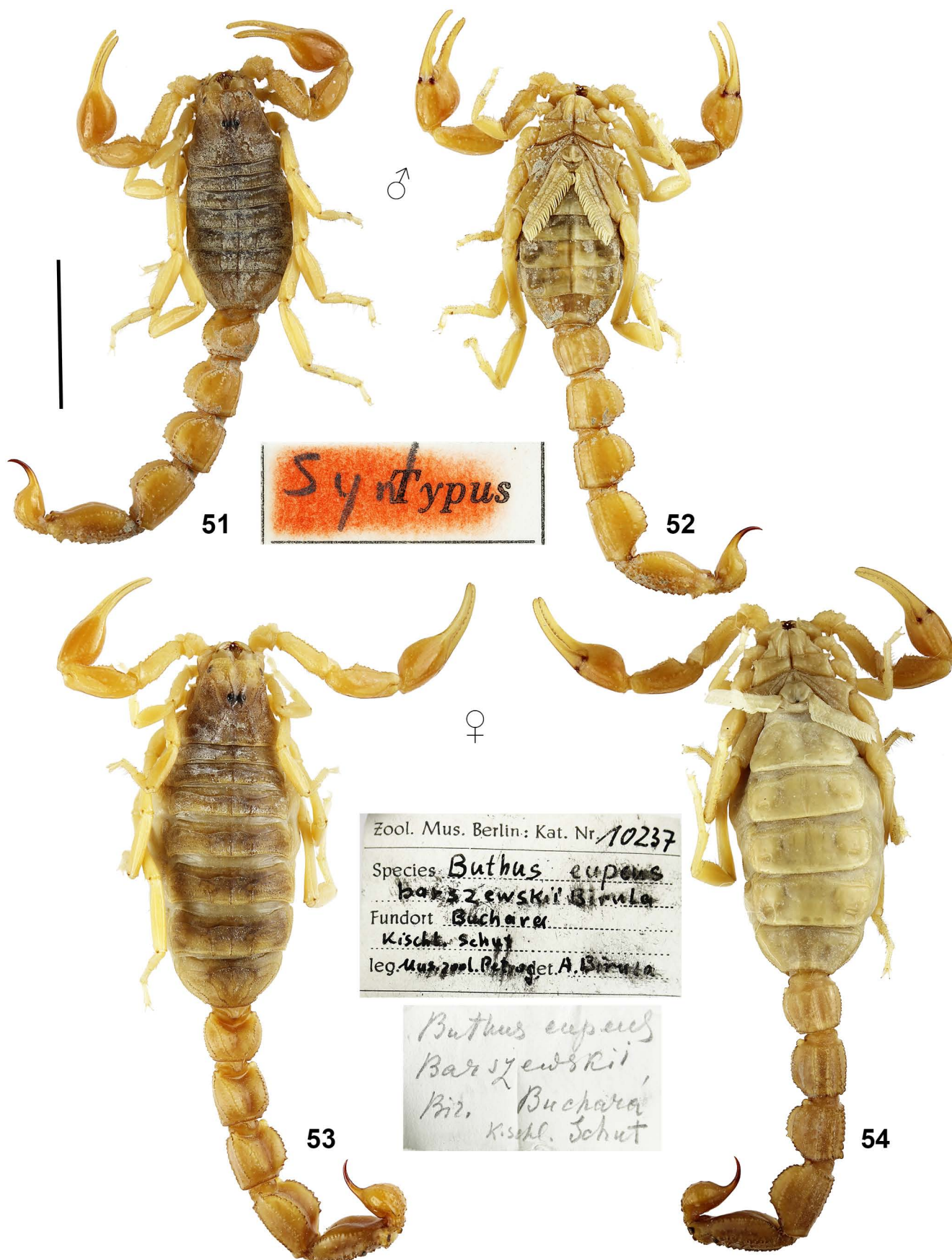
Turkmenistan. From Aitchison’s travelogues, we approximate the type locality (which was not precisely defined) at 36.00°N 60.25°E. The same type locality is accepted for another very common buthid scorpion in this area, *Olivierus parthorum* (Pocock, 1889) (Buthidae), described in the same paper (see Fet et al., 2018). Our specimens from the Kushka River valley (Turkmenistan, 35.47°N 62.40°E) are the closest to type locality in Iran.

All subsequent researchers dealing with the Turkmenistan fauna listed most of its “*Mesobuthus eupeus*” populations, together with other Central Asian ones, under an umbrella name *M. eupeus thersites* (see Fet, 1989, 1994; Gantenbein et al., 2003, 2005; Mirshamsi et al., 2010, 2011a). Until the current revision no one assumed that Pocock’s taxon is distributed as far north as the Amu-Darya River.

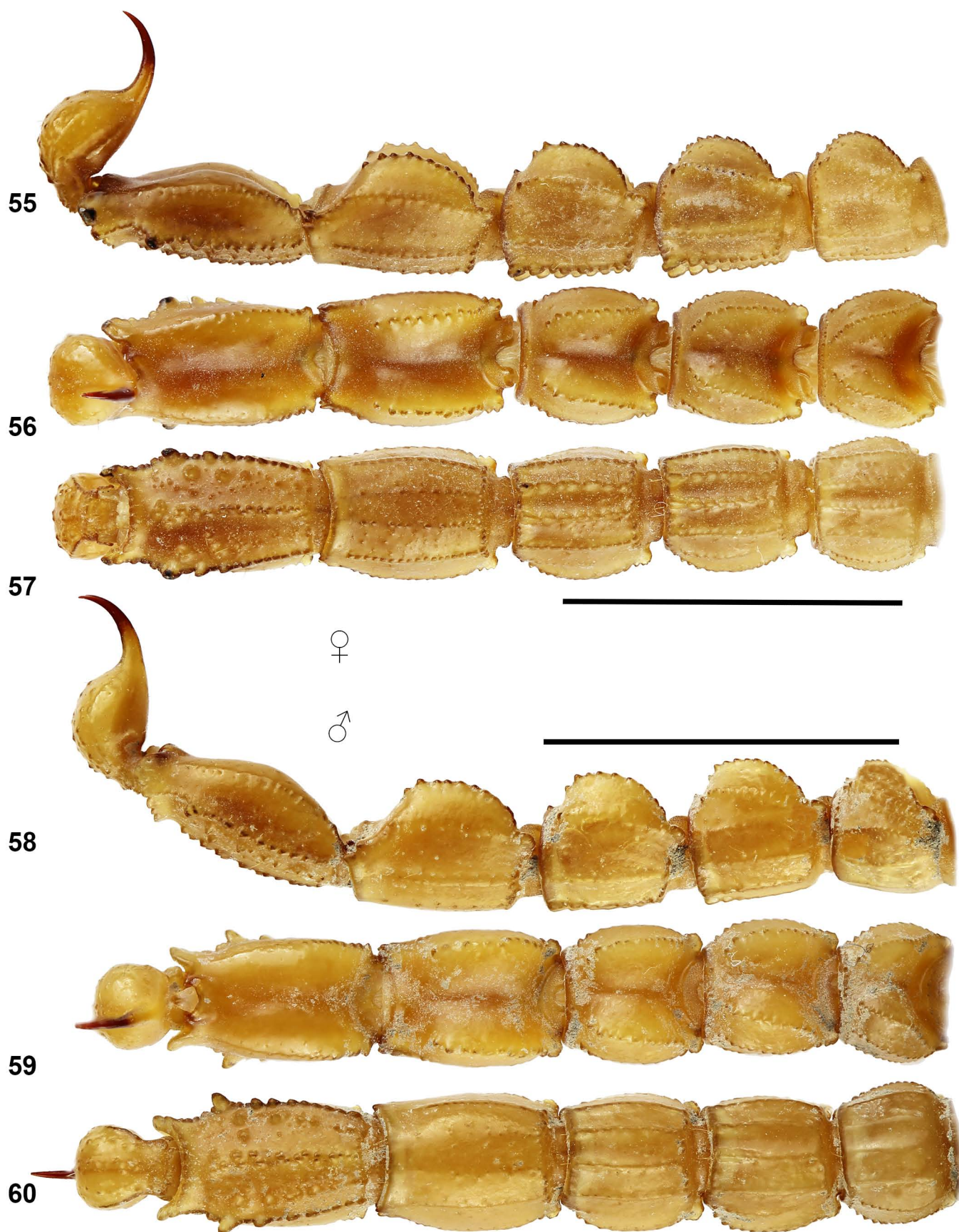
COMMENTS. According to his unpublished records (a handwritten catalog deposited in ZISP), A. Birula intended to describe a separate subspecies, “*Buthus eupeus caspius*”. With this name he labeled a number of specimens from the lowland Turkmenistan in ZISP collection (see also Pavlovsky, 1934: 200, where this name, clearly referable to Birula, appeared as a *nomen nudum*); they correspond to our *M. afghanus*.

Mesobuthus agnetis (Werner, 1936) from Iran was listed by Fet & Lowe (2000: 170) as a dubious taxon, possibly a synonym of *Sassanidotus zarudnyi* (Birula). We place it under question in synonymy of *M. afghanus*.

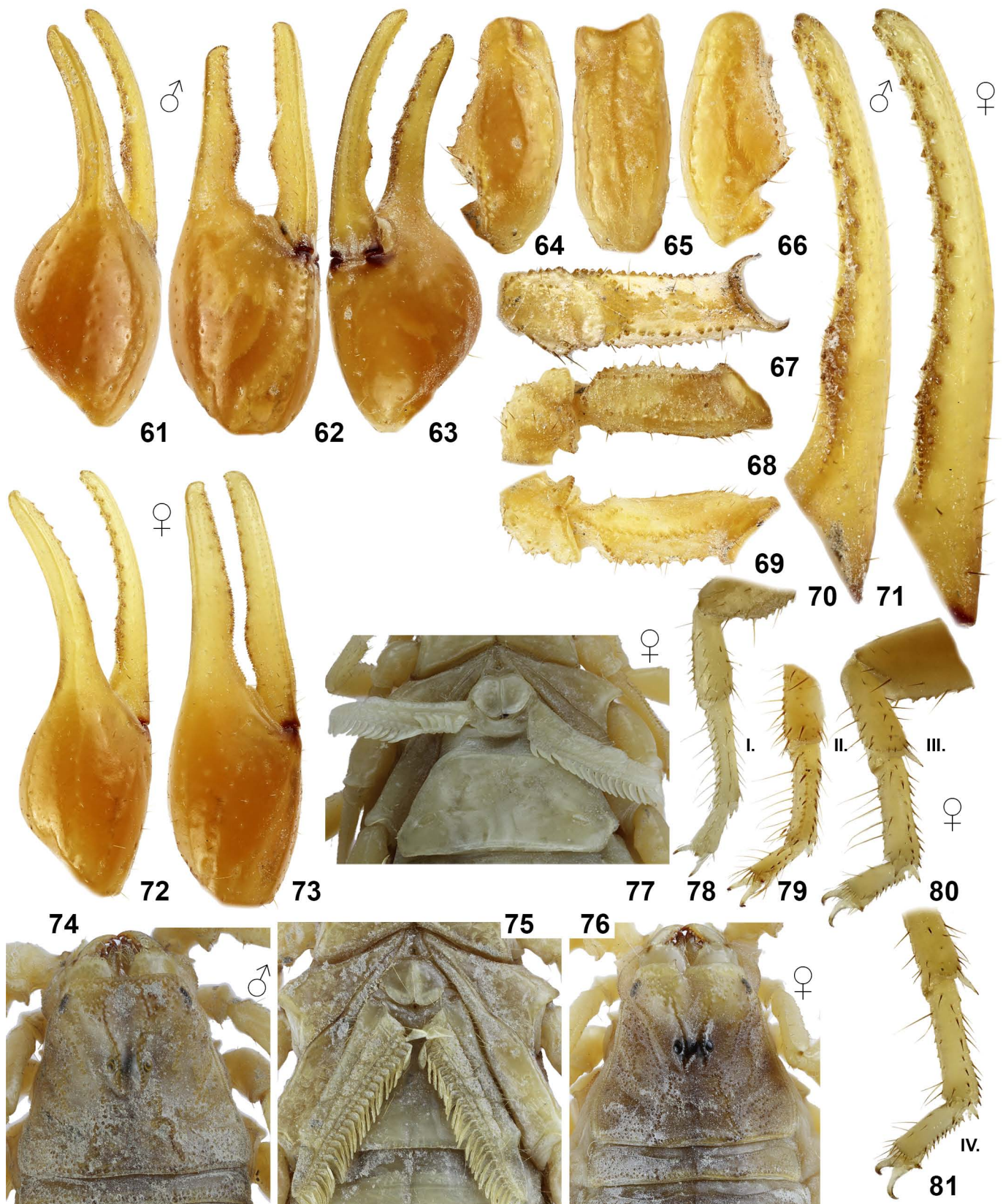
DISTRIBUTION. Afghanistan, Iran (Razavi Khorasan Province), Turkmenistan (Figs. 1155, 1157).



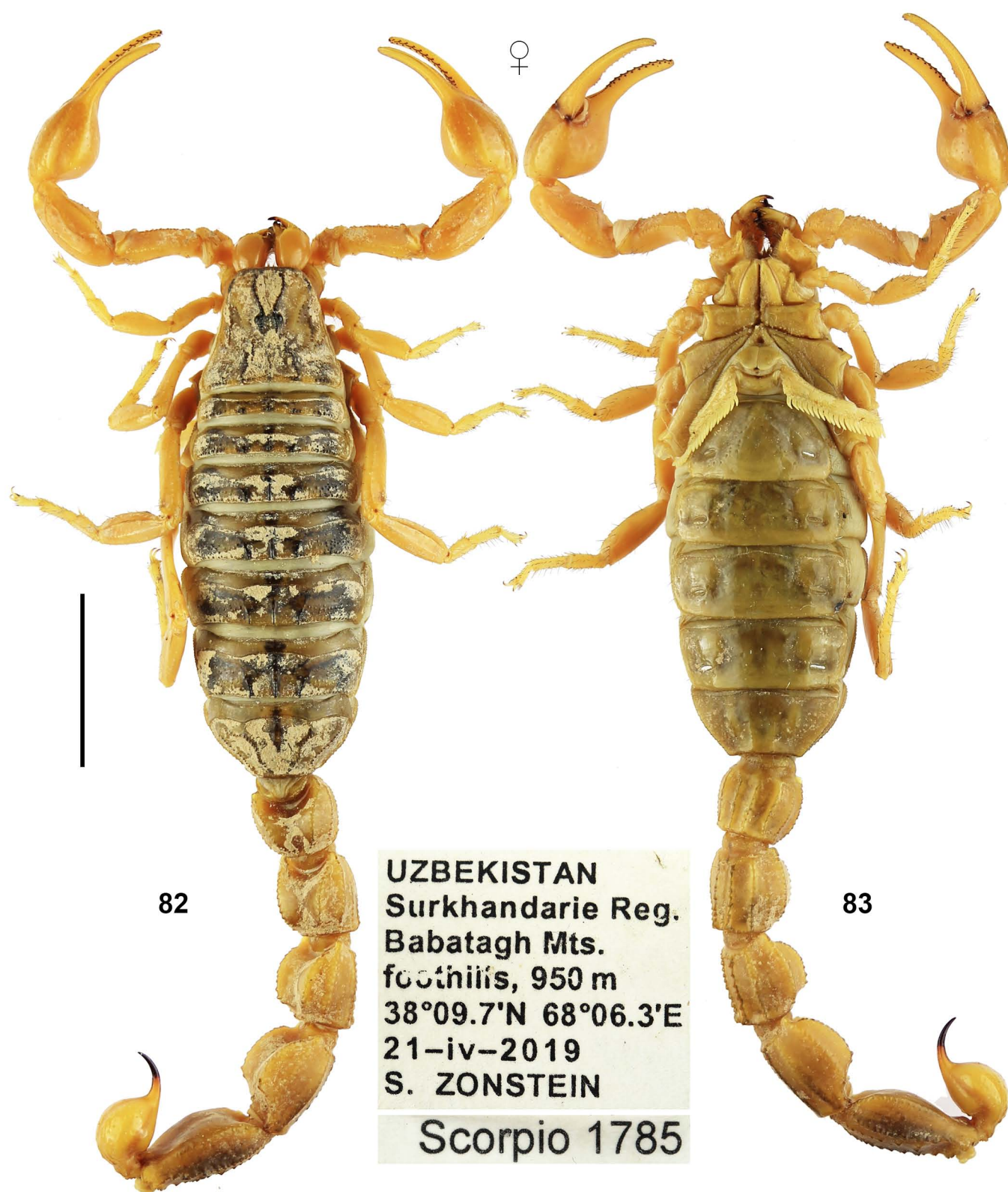
Figures 51–54: *Mesobuthus barszevskii*, ZMHB. Figures 51–52. Lectotype male, dorsal (51) and ventral (52) views. Figures 53–54. Paralectotype female, dorsal (53) and ventral (54) views. Scale bar: 10 mm.



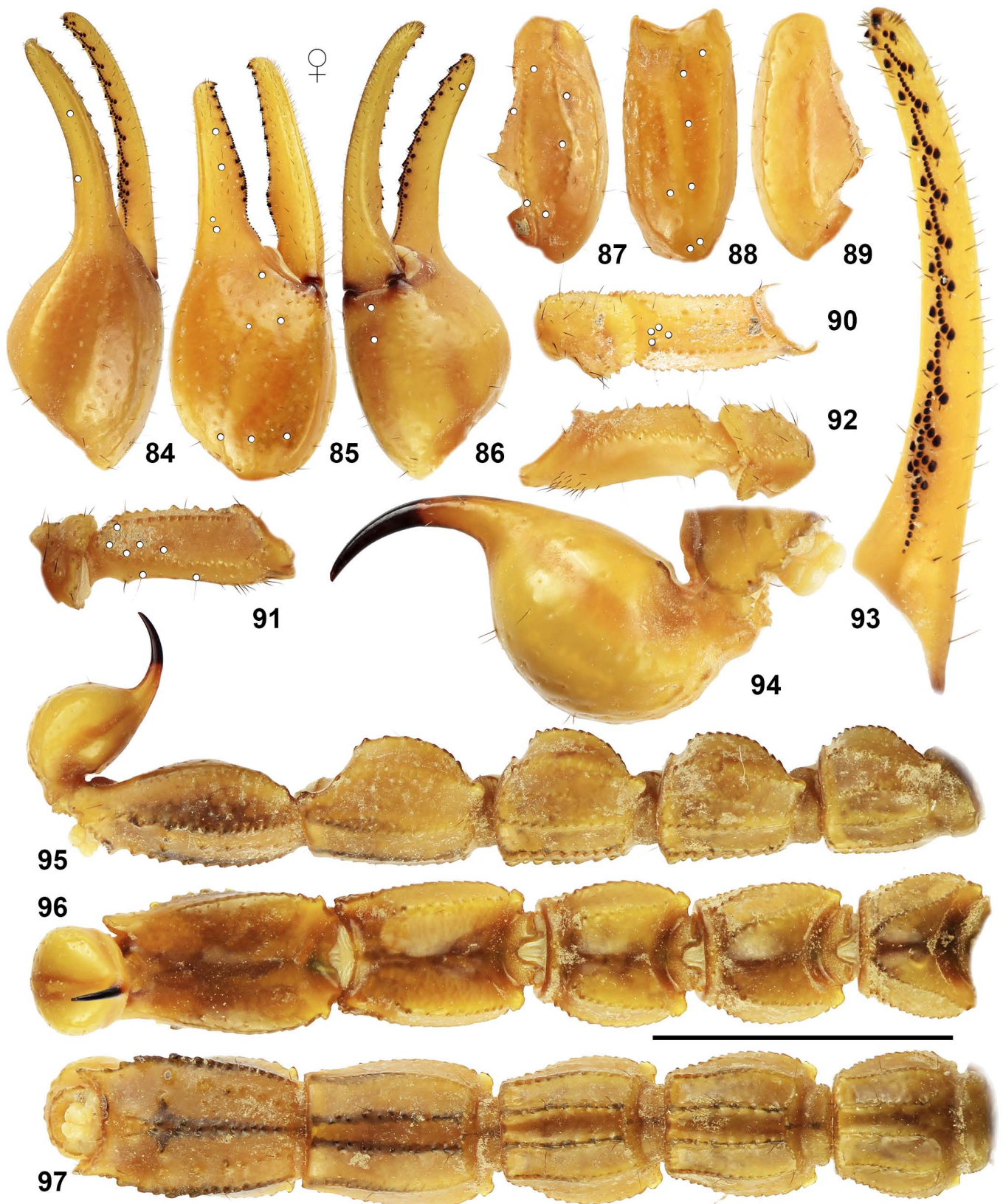
Figures 55–60: *Mesobuthus barszchevskii*, ZMHB. **Figures 55–57.** Lectotype male, metasoma and telson, lateral (55), dorsal (56), and ventral (57) views. **Figures 58–60.** Paralectotype female, metasoma and telson, lateral (58), dorsal (59), and ventral (60) views. Scale bar: 10 mm.



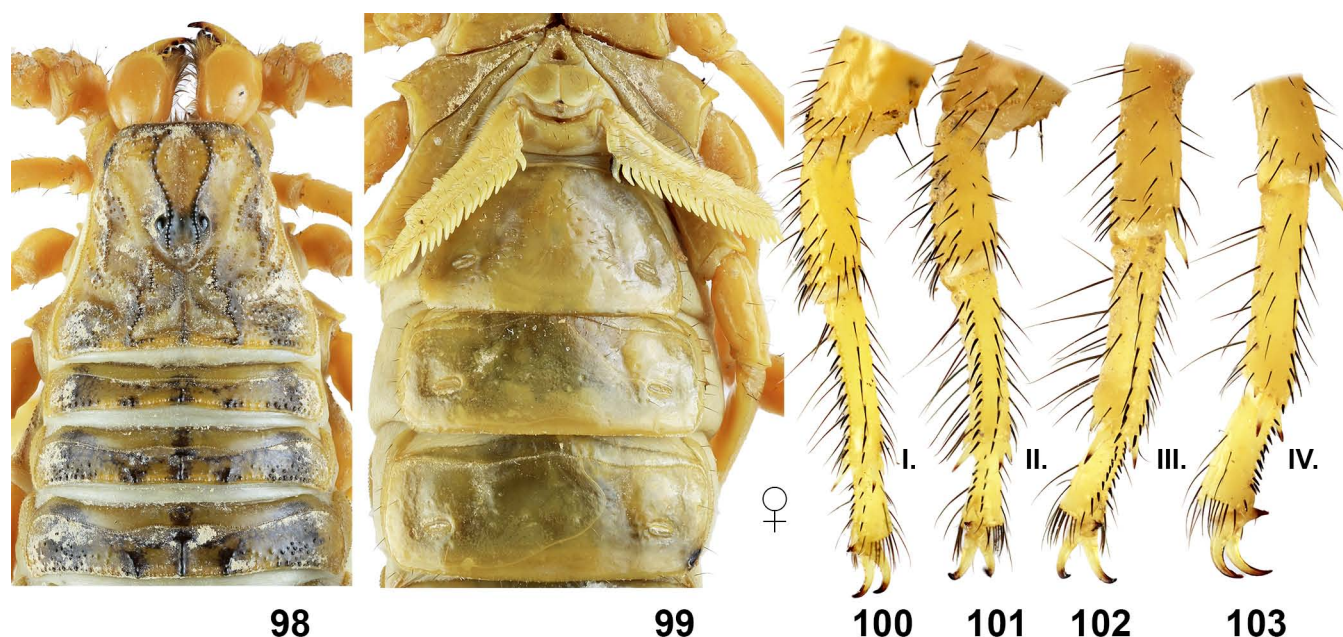
Figures 61–81: *Mesobuthus barszczevskii*, ZMHB. **Figures 61–70, 74–75.** Lectotype male, pedipalp chela, dorsal (61), external (62), and ventral (63) views. Pedipalp patella, dorsal (64), external (65) and ventral (66) views. Pedipalp femur and trochanter, internal (67), dorsal (68), and ventral (69) views. Movable finger (70). **Figures 71–73, 76–81.** Paralectotype female, movable finger (71), chelicerae and carapace (74), sternopectinal region (75), sternite III (77), and left legs I–IV, retrolateral aspect (78–81).



Figures 82–83: *Mesobuthus barszcewskii*, Uzbekistan, Surxondaryo Province, Babatagh Mts., female, dorsal (82) and ventral (83) views. Scale bar: 10 mm.



Figures 84–97: *Mesobuthus barszchevskii*, Uzbekistan, Surxondaryo Province, Babatag Mts., female. **Figures 84–93.** Pedipalp. Chela, dorsal (84), external (85), and ventral (86) views. Patella, dorsal (87), external (88) and ventral (89) views. Femur and trochanter, internal (90), dorsal (91), and ventral (92) views. Movable finger (93). The trichobothrial pattern is indicated in Figures 84–88, 90–91. **Figures 94–97.** Telson lateral (94), metasoma and telson, lateral (95), dorsal (96), and ventral (97) views. Scale bar: 10 mm (95–97).



Figures 98–103: *Mesobuthus barszcewskii*, Uzbekistan, Surxondaryo Province, Babatag Mts., female, chelicerae, carapace and tergites I–III (98), sternopectinal region and sternites III–V (99), and left legs I–IV, retrolateral aspect (100–103).

***Mesobuthus barszcewskii* (Birula, 1904)**

(Figures 1, 51–103, 1155, 1158, 1171, Table 1)

<http://zoobank.org/urn:lsid:zoobank.org:act:E6296564-59FD-4C83-9D7C-EE69B97543D9>

Buthus eupeus barszcewskii Birula, 1904a: 21.

TYPE LOCALITY AND TYPE REPOSITORY. Uzbekistan, *Qashqadaryo Province*, Shakhrisabz District, Shut (39.15°N 67.57°E); ZMHB.

REFERENCES (selected):

- Buthus eupeus barszcewskii*: Birula, 1905a: 122–123.
Buthus eupeus thersites var. *barszcewskii*: Birula, 1911b: 167.
Buthus eupeus barszcewskii (incorrect spelling): Birula, 1917a: 41; Moritz & Fischer, 1980: 310.
Mesobuthus eupeus barszcewskii: Vachon, 1958: 155.
Mesobuthus eupeus barszcewskii (incorrect spelling): Fet, 1989: 100 (complete references list for the former USSR); Fet, 1994: 527; Fet & Lowe, 2000: 172 (complete references list until 1998); Fet et al., 2018: 28.
Mesobuthus eupeus thersites: Gantenbein et al., 2003: 413 (in part; Uzbekistan: Babatag).

TYPE MATERIAL EXAMINED. Uzbekistan, *Qashqadaryo Province*, Shakhrisabz District, Shut (39.15°N 67.57°E), 4–5 [16–17] June 1896, leg. L.S. Barszcewsky; 1♂ (lectotype, designated here), 1♀ (paralectotype), ZMHB No. 10237.

OTHER TYPE MATERIAL (NOT EXAMINED): Uzbekistan, *Qashqadaryo Province*, Shakhrisabz District, Shut (39.15°N 67.57°E), 4–5 [16–17] June 1896, "Numerous ♂, ♀ & pulli" (Birula, 1904a: 21). Fet (1989: 100) saw and listed the following syntypes from Shut: 7♂17♀45 juvs. (ZISP 437) and 3♂2♀1 juv. (ZISP 438).

OTHER MATERIAL EXAMINED. Uzbekistan, *Surxondaryo Province*, W slope of Babatag Mts, 29 April 2002, 38°12'43"N 68°03'01"E (38.20°N 68.05°E), 633 m a. s. l., 2juvs., leg. V. Fet (NG-061), NMPC; Babatag Mts., 21 April 2019, 38°09.7'N 68°06.3'E (38.17°N 68.10°E), 950 m a. s. l., 2♀ (Figs. 82–103, Nos. 1785, 1786, Table 1), leg. S. Zonstein, NMPC; 20 km N of Sherobod (Shirabad), 37°51.339'N 67°00.394'E (37.85°N 67.00°E), 668 m a. s. l., 17 May 2019, 1♀, leg. W. Grosser, NMPC.

DNA DATA. *Mesobuthus barszcewskii* was represented in our survey by four DNA sequences from Uzbekistan (Table 16).

DIAGNOSIS. Total length of adults 38 mm (male) to 63 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than female. Pedipalp chela length/width ratio 2.75–3.16 in both sexes. Pectinal teeth number 24–25 in male, 18–21 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites yellowish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII with 4 well marked, smooth carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma IV with lateromedian and ventral carinae smooth to absent in

male but present and granulated in female, all other carinae granulated. Intercarinal surfaces on metasoma I laterally granulated. Length to depth ratio of metasoma III 1.02–1.07 in male, 1.2–1.3 in female; metasoma IV 1.52–1.62 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–12 retroinferior macrosetae on basitarsus III. Telson elongated in male and bulbous in female. Anal lobe divided into two parts.

HISTORY OF STUDY. This taxon was briefly described by Birula (1904a: 21) as a subspecific form (“a local race”), with a very dark coloration, dorsal surface almost black, with four yellow spots in the anterior edge of mesosomal tergites, two parts (“teeth”) on the anal lobe (as opposed to three in the Caucasian specimens of *M. eupeus* studied by Birula), and 2–3 very large, prominent denticles in the ventrolateral carinae of metasoma V.

Syntypes of *M. barszevskii* were collected during the first expedition to the remote mountains of the Buchara Khanate (then semi-independent from the Russian Empire) by two famous explorers, the Captain Lev Semënovich Barszevsky (1849–1910) and Vladimir Ippolitovich Lipsky (1863–1937) in June 1896 (not 1898 as listed by Fet, 1989: 100). Barszevsky’s collection was obtained by ZISP, where Alexei Birula himself at that time was in charge of the 1st Invertebrates Division including Arachnida. Barszevsky’s collection is mentioned in the Report of the Zoological Museum for the year 1896 covering materials obtained by ZISP in 1896. The report was published in the same 3d volume of the *Annuaire du Musée Zoologique* (December 1897). Barszevsky’s travelogue was narrated in great detail in a voluminous report by his collaborator (Lipsky, 1902). It allows to identify the type locality in the northwestern spurs of the Gissarsky Mountain range (Hasrat-Sultan), kishlak [village] Shut (6722 ft, or 2049 m asl), where Barszevsky collected on 5 June 1896 (ZISP label says 4 June). In addition to the specimens from type locality, Birula’s syntype series (1904a: 21) included also two juveniles from Chopukh (or Chopug, 5958 ft, or 1816 m, visited by Barszevsky on 14 [26] June 1896, and two females from Kurgan-Tyube (or Qurgonteppa, now Bokhtar, Tajikistan, 37.8364°N 68.7803°E, collected next year by A.N. Kaznakov, 22 April [6 May] 1897).

Moritz & Fischer (1980) listed three syntypes from Shut in ZMHB collection of Berlin (ZMHB 10237) as “Ex. Mus. Zool. Petrograd”. This label indicates that these specimens were passed to Berlin by Birula in the early 1920s (St. Petersburg was renamed to Petrograd in 1914, when communication with Germany ceased due to the war; and Petrograd was further renamed to Leningrad in 1924). We found two of those syntypes, courtesy of Jason Dunlop, and designated one of them here as a lectotype.

The taxon was later treated as a subspecies but was never revised; it was listed (under question) as a synonym of *M. thersites* by Kovařík (2019: 17).

COMMENTS. Birula (1911b: 167) placed under this taxon also specimens from Tajikistan (Kshtut in Khujand Province and Kyzylsu Post in Kulyab Province). At this moment, we have no confirmation of the Tajikistan range for *M. barszevskii*. So far, the only *Mesobuthus* confirmed from Tajikistan (Khatlon Province) (and neighboring southeastern Uzbekistan) is *M. fomichevi* sp. n., which is described below. We do not have matching specimens for a Tajikistan population from Khujand sequenced by Shi et al. (2013), so we did not include it in our analysis.

DISTRIBUTION. Uzbekistan (Figs. 1155, 1158).

Mesobuthus birulai sp. n.

(Figures 104–126, 1155, 1157, Table 1)

<http://zoobank.org/urn:lsid:zoobank.org:act:F24CCA40-7CB7-4CB2-B55B-CCF8F03825E4>

TYPE LOCALITY AND TYPE REPOSITORY. Iran, *Fars Province*, Abadeh, Semirom road, 31°08'03"N 52°19'50"E (31.13°N 52.31°E), 2288 m a. s. l.; NMPC.

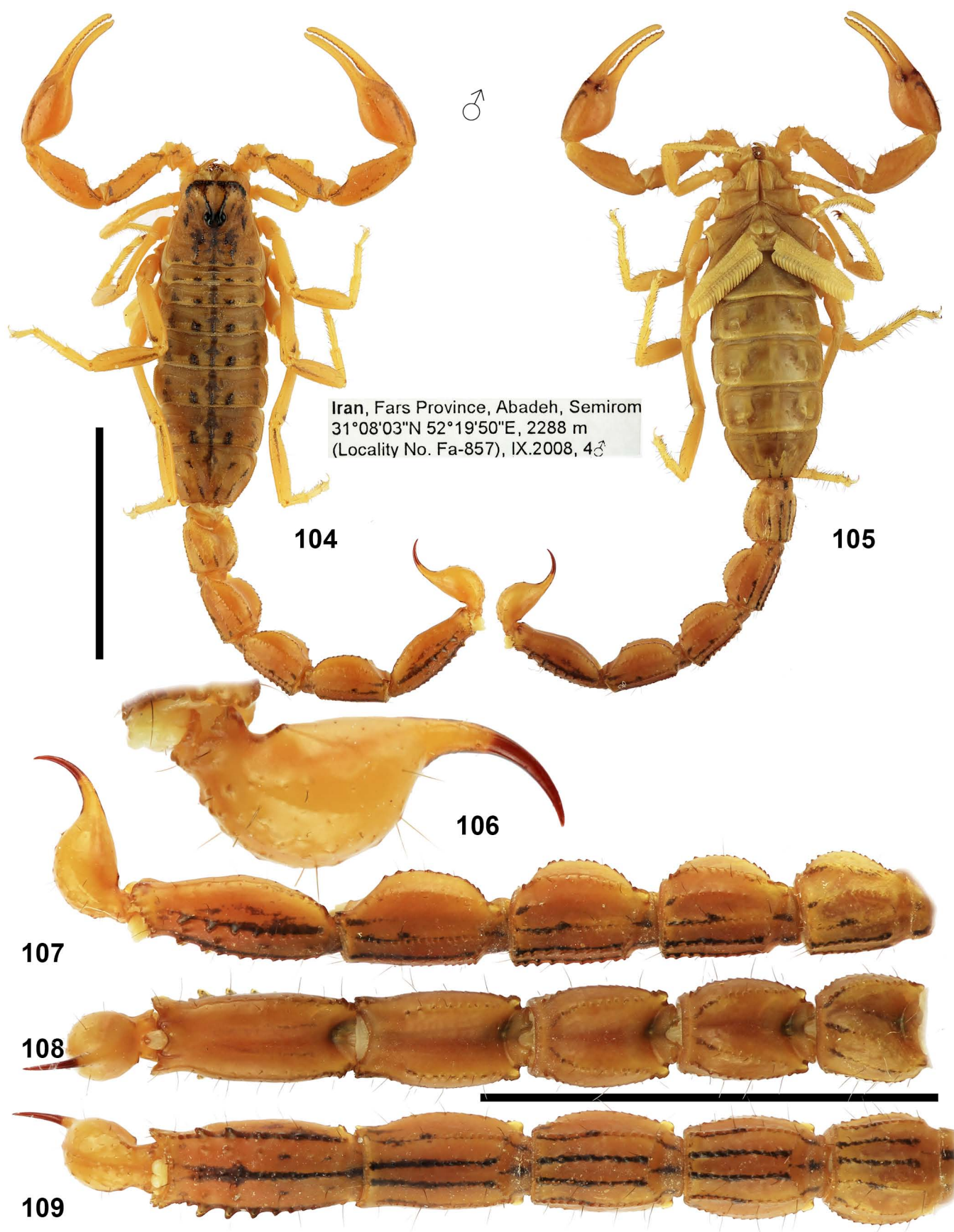
REFERENCES:

Mesobuthus eupeus persicus: Navidpour et al., 2012: 11 (in part).

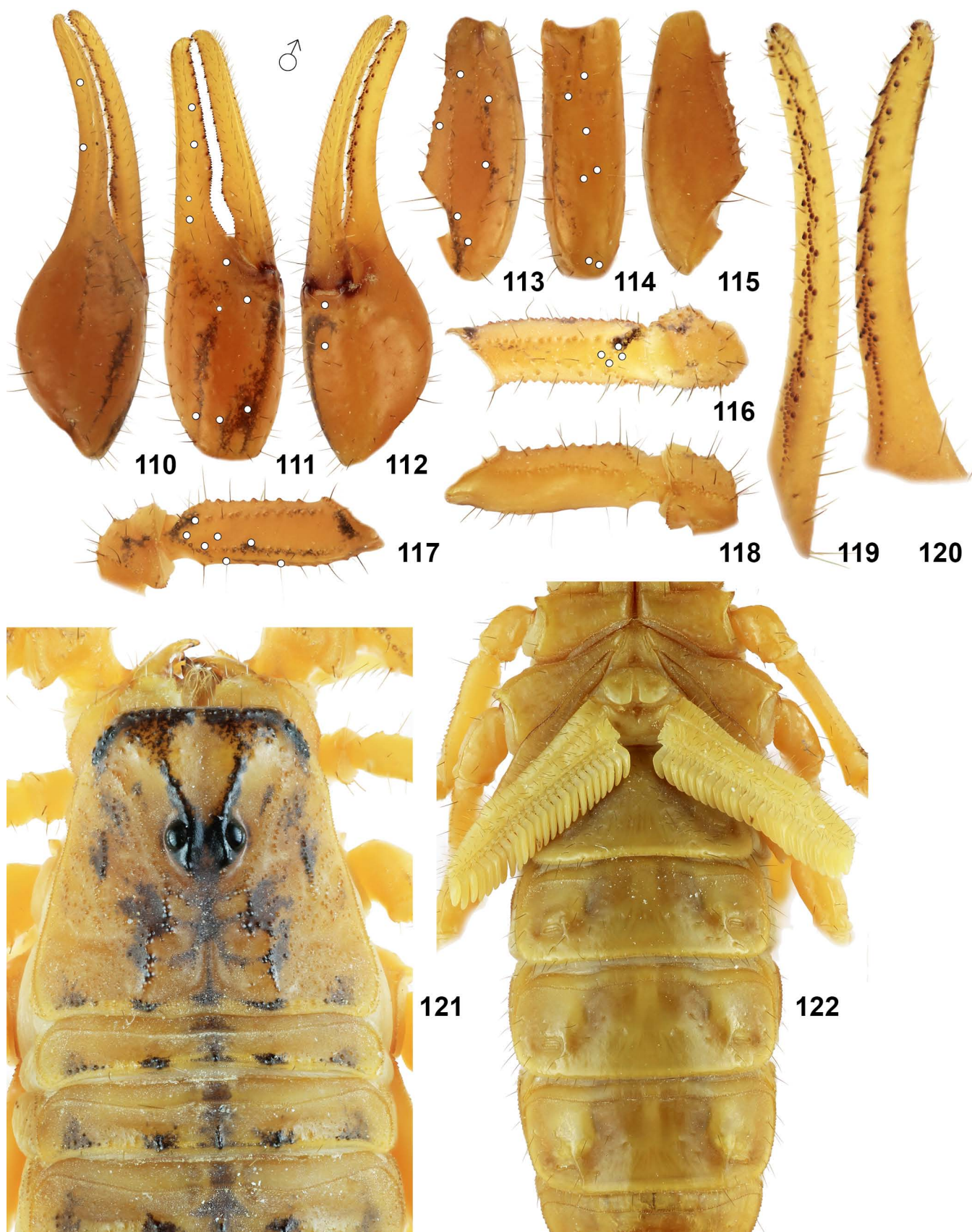
TYPE MATERIAL. Iran, *Fars Province*, Abadeh, Semirom road, 31°08'03"N 52°19'50"E (31.13°N 52.31°E), 2288 m a. s. l. (Locality No. Fa-857), September 2008, 4♂ (holotype and paratypes), leg. Mashipour, Hayader, Bahrani, NMPC.

ETYMOLOGY. The new species is named in honor of one of the greatest scorpion researchers of all time, Alexey Andreevich Bialynitsky-Birula (1864–1937).

DIAGNOSIS. Total length 28–35 of males; female unknown. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esh*, near to *est*. Male with fingers proximally a little bit twisted. Pedipalp chela length/width ratio 3.5–3.6 in males. Pectinal teeth number 22–24 in males. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites reddish brown, with black pigmentation; metasoma, telson, pedipalps and legs yellow or reddish brown with dark spots. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, only dorsal and internal are granulated. Chela lacks carinae. Movable fingers of pedipalps with 12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII medially smooth with 4 usually granulated carinae. First metasomal segment with 10 carinae; second to fourth with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; fifth with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasomal



Figures 104–109: *Mesobuthus birulai* sp. n., male holotype. **Figures 104–105.** Dorsal (104) and ventral (105) views. **Figures 106–109.** Telson lateral (106), metasoma and telson, lateral (107), dorsal (108), and ventral (109) views. Scale bars: 10 mm (104–105, 107–109).



Figures 110–122: *Mesobuthus birulai* sp. n., male holotype. **Figures 110–120.** Pedipalp. Chela, dorsal (110), external (111), and ventral (112) views. Patella, dorsal (113), external (114) and ventral (115) views. Femur and trochanter, internal (116), dorsal (117), and ventral (118) views. Movable (119) and fixed (120) fingers. The trichobothrial pattern is indicated in Figures 110–114, 116–117. **Figures 121–122.** Chelicerae, carapace and tergites I–III (121), sternoplectinal region and sternites (122).



Figures 123–126: *Mesobuthus birulai* sp. n., male holotype, left legs I–IV, retrolateral aspect.

Dimensions (mm)		<i>M. bogdoensis</i> ♂ lectotype	<i>M. bogdoensis</i> ♀ paralectotype	<i>M. crucittii</i> sp. n. ♂ holotype	<i>M. crucittii</i> sp. n. ♀ paratype
Carapace	L / W	4.23 / 4.66	5.19 / 5.90	4.87 / 5.08	6.42 / 7.12
Mesosoma	L	10.96	16.78	10.10	17.44
Tergite VII	L / W	2.63 / 4.83	3.05 / 5.97	3.24 / 5.11	4.21 / 7.16
Metasoma + telson	L	22.72	23.56	27.41	33.62
Segment I	L / W / D	2.82 / 2.90 / 2.51	3.02 / 3.26 / 2.83	3.48 / 3.44 / 3.08	4.04 / 4.37 / 4.09
Segment II	L / W / D	3.31 / 2.84 / 2.67	3.37 / 3.16 / 2.77	4.07 / 3.49 / 3.17	4.84 / 4.31 / 4.10
Segment III	L / W / D	3.29 / 2.82 / 2.72	3.37 / 3.14 / 2.90	4.48 / 3.45 / 3.23	5.13 / 4.43 / 3.96
Segment IV	L / W / D	3.97 / 2.70 / 2.39	4.00 / 3.06 / 2.74	4.89 / 3.28 / 3.08	5.87 / 4.18 / 3.67
Segment V	L / W / D	4.80 / 2.62 / 2.08	5.15 / 2.78 / 2.20	5.65 / 2.96 / 2.53	7.07 / 3.68 / 3.31
Telson	L / W / D	4.53 / 1.81 / 1.65	4.65 / 2.11 / 1.69	4.84 / 2.33 / 2.17	6.67 / 3.44 / 3.02
Pedipalp	L	15.20	16.92	17.04	19.33
Femur	L / W	3.54 / 1.25	3.99 / 1.40	3.97 / 1.33	4.48 / 1.79
Patella	L / W	4.33 / 1.76	4.84 / 1.98	4.87 / 1.91	5.55 / 2.42
Chela	L	7.33	8.09	8.20	9.30
Manus	W / D	2.35 / 2.27	2.40 / 2.25	2.58 / 2.68	2.56 / 2.93
Movable finger	L	4.65	4.83	4.76	5.94
Total	L	37.91	45.53	42.38	57.48

Table 2. Comparative measurements of *Mesobuthus bogdoensis* and *M. crucittii* sp. n. types. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

segments smooth. Length to depth ratio of metasoma III 1.4–1.45, metasoma IV 1.7–1.8 in males. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, adults with 7–9 retroinferior macrosetae on basitarsus III. Tibial spur on both legs III and IV moderate. Telson elongated. Anal lobe divided in three parts.

DESCRIPTION. Total length of adult males 28–35 mm; female unknown. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male has the fingers proximally a little bit twisted. For measurements, see Table 1.

Coloration (Figs. 104–105). Carapace and tergites reddish brown with black pigmentation. Chelicerae yellow, without reticulation. Metasoma, telson, pedipalps and legs reddish brown with dark spots. Chelicerae yellow, without reticulation, the tips of teeth on chelical fingers black.

Mesosoma and carapace (Figs. 121–122). Carapace carinate, unevenly covered with granules of varying size; much of the granulation is fine, but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII pentacarinat. Pectinal tooth count 22–24 in males. Pectinal marginal tips extend almost to the end of the fourth sternite in males. Pectines have three marginal lamellae and seven to eight middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. All sternites are smooth and sparsely hirsute. Sternite VII with four usually granulated carinae. Other sternites have two furrows.

Pedipalps (Figs. 110–120). Pedipalps sparsely hirsute and smooth. Femur has four to five granulated carinae, the middle carina on internal surface consists of several strong irregular granules. Patella with eight carinae from which internal and dorsal are granulated. Chela without carinae. Movable fingers of pedipalps have 12 cutting rows of denticles, every row with external and internal denticles present, and five terminal denticles.

Legs (Figs. 123–126). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, adults with 7–9 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present, moderate to strong on legs III and IV, and absent on the other legs.

Metasoma and telson (Figs. 106–109). Metasomal segments are sparsely hirsute. Metasomal segment I with 10 carinae, segments II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, segment IV with 8 carinae, and segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma smooth. Ventrolateral carinae of metasoma V posteriorly with several large lobated denticles. Telson very sparsely hirsute, elongate in male, bumpy and smooth. Anal lobe divided in three parts.

COMMENTS. No DNA data on this new species are yet available.

DISTRIBUTION. Iran (Fars Province) (Figs. 1155, 1157).

***Mesobuthus bogdoensis* (Birula, 1896)**

(Figures 127–153, 1155, Table 2)

<http://zoobank.org/urn:lsid:zoobank.org:act:251A9D8B-B9C6-4E63-8C92-4F852E278B8C>*Buthus eupeus* forma δ *bogdoensis* Birula, 1896: 241.

TYPE LOCALITY AND TYPE REPOSITORY. **Kazakhstan, West Kazakhstan Province**, Bokeyorda District, Maloe Bogdo hill (48.4572°N, 47.0750°E); ZISP.

SYNONYMS:

= *Buthus eupeus volgensis* Birula, 1925: 96, **syn. n.**<http://zoobank.org/urn:lsid:zoobank.org:act:FD7CA11F-420D-43F1-8B76-7423F1F4D628>

TYPE LOCALITY AND TYPE REPOSITORY. **Russia, Astrakhan Province**, “Yenotayevsky District, Akhtuba River (a branch of the Volga River delta), Selitryanoye Village”, now Kharabaly District, Selitrennoe (47.1667°N, 47.45°E), 2 ♂♀ (ZISP 418), syntypes, not found in ZISP in 2019.

REFERENCES (selected):

Buthus eupeus bogdoensis: Birula, 1900b: 3; Birula, 1904b: 30; Birula, 1905a: 122–123.*Buthus eupeus bogdoensis*: Birula, 1917a: 41.*Buthus eupeus volgensis*: Birula, 1917a: 41, *nomen nudum* (description not published).*Buthus eupeus thersites* n[atio]. *volgensis* Birula, 1928: 338.*Mesobuthus eupeus bogdoensis*: Vachon, 1958: 155; Fet, 1989: 99 (complete references list for the former USSR); Fet, 1994: 527; Fet & Lowe, 2000: 172 (complete references list until 1998); Fet, 2010: 4; Anikin & Poverenny, 2017: 20.*Mesobuthus eupeus volgoensis* (incorrect spelling): Vachon, 1958: 155.*Mesobuthus eupeus thersites*: Fet, 1989: 92 (in part; Kazakhstan, in part), 94 (in part; Russia); Poverenny, 2018: 110.*Buthus occitanus* (misidentification): Anikin, 1997: 28; Anikin & Kireev, 1998: 106; Anikin, 2006: 48.*Mesobuthus eupeus volgensis*: Fet, 2010: 4; Anikin & Poverenny, 2017: 20; Poverenny & Anikin, 2020b: 12.*Mesobuthus eupeus*: Poverenny, 2015: 153; Anikin & Sazhnev, 2016: 316; Anikin & Poverenny, 2017: 20; Poverenny & Anikin, 2017: 333; 2019: 9.*Mesobuthus bogdoensis*: Kovařík, 2019: 17.*Mesobuthus volgensis*: Poverenny & Anikin, 2020a: 98.

TYPE MATERIAL EXAMINED. **Kazakhstan, West Kazakhstan Province**, Bokeyorda District, Maloe Bogdo hill, (48.45°N 47.07°E), 1 ♂ (lectotype, designated here) 1 ♀ (paralectotype), leg. A. Becker, 1872 (probably summer 1871; see Comments), ZISP 171.

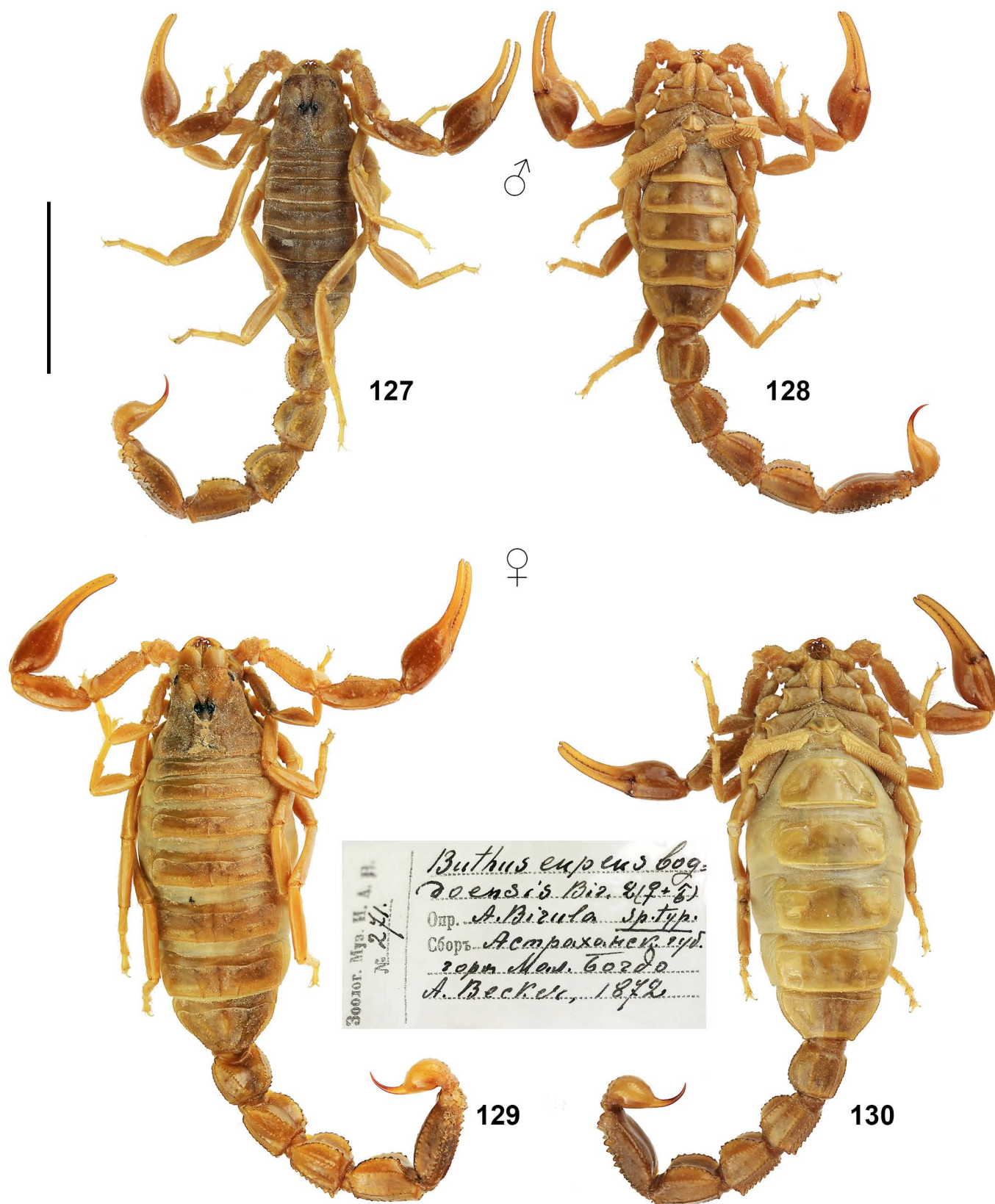
DNA DATA. *Mesobuthus bogdoensis* was represented in our survey by five DNA sequences from Russia (Table 16). DNA

from the type localities of *Buthus eupeus bogdoensis* (Maloe Bogdo) and *B. e. volgensis* (Selitrennoe) was not available.

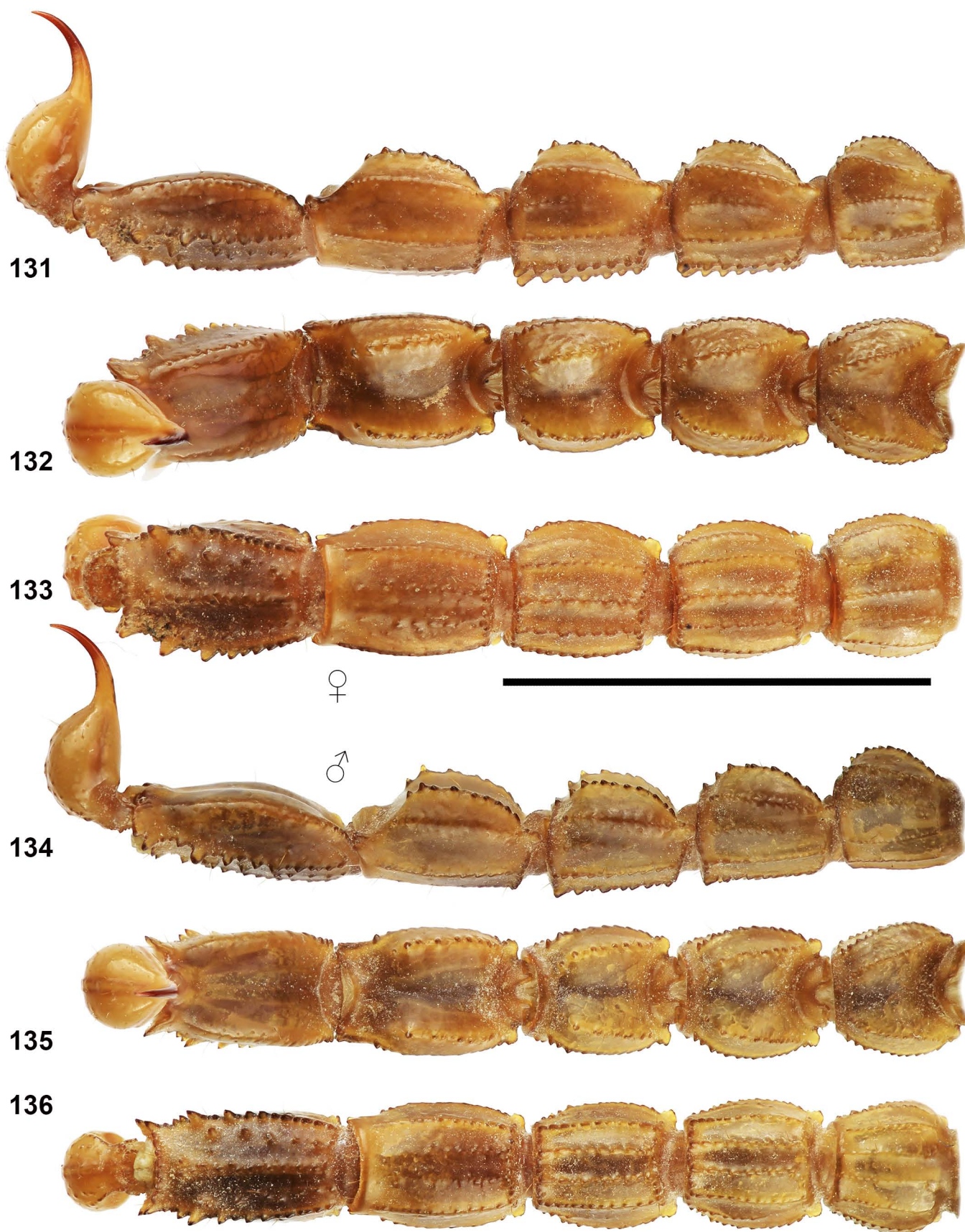
DIAGNOSIS. Total length of adult male 38 mm, female 45.5 mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally a little bit more twisted than female. Pedipalp chela length/width ratio 3.12 in male and 3.37 in female. Pectinal teeth number 25–27 in male, 22 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites yellowish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulate carinae. Patella with 8 granulated or smooth carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII with 4 well marked smooth carinae. Metasomal segment I with 10 carinae; second to fourth with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment IV with 8 carinae; segment V with 5 carinae. Metasoma IV with lateromedian carina smooth, all other carinae granulated. Length to depth ratio of metasoma III 1.21 in male, 1.16 in female, metasoma IV 1.66 in male, 1.45 in female. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi not densely hirsute, adults with 7–9 retroinferior macrosetae on basitarsus III. Pedal spur of legs with solitary setae only. Telson elongated. Anal lobe divided in two parts.

HISTORY OF STUDY. The existence of scorpions in and near the lower Volga River valley has been recorded in Russian literature since the late 18th century. Birula (1917b: I–II) wrote:

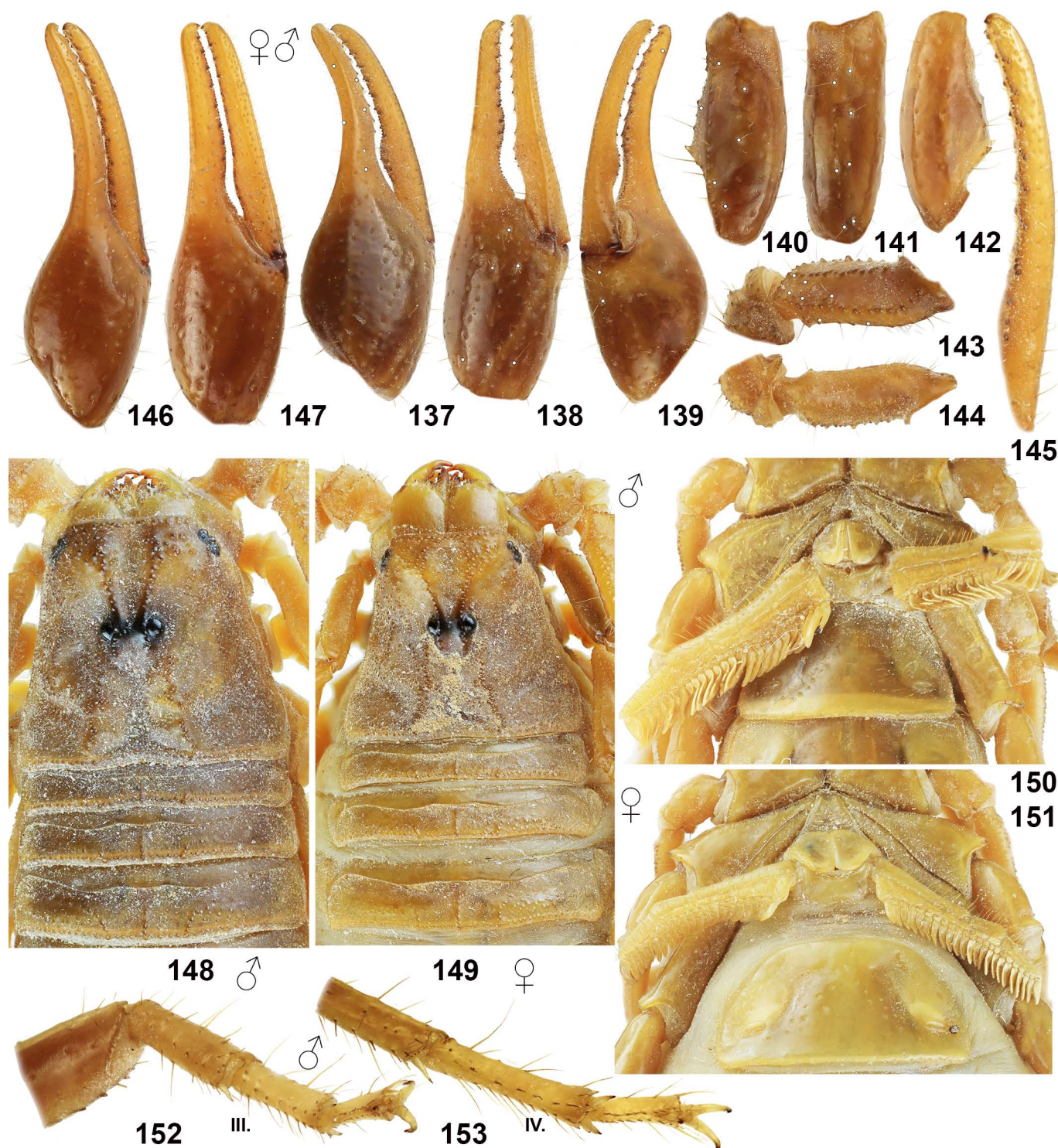
“The first scientific data on scorpions inhabiting the Russian Empire dates from the second half of the 18th century and is taken from the primary source on Russian fauna in general, which is the most important to date – the works of P. S. Pallas. In the travel-notes of this brilliant observer, who journeyed through different southern and southeastern parts of the Empire, which at that time had the novelty and mystery of newly-discovered countries, we find scattered short notes on the distribution and mode of life of various animals and, in particular, of Arthropoda, which are of interest to us, and which can be likened to precious metals sparkling in a rock. These notes are far more accurate in their description and are of greater scientific value than the verbose works of later authors. Much of the data on scorpions collated by Pallas has not lost its originality, and some is still unique. The sections on the geographical distribution and biology of scorpions in the Astrakhan Province can be used to date; they are of value although the author does not describe the scorpions found there, because it is evident that his observations refer to the local race of the widely distributed *Buthus eupeus* (C. Koch).”



Figures 127–130: *Mesobuthus bogdoensis*. **Figures 127–128.** Male lectotype, dorsal (127) and ventral (128) views. **Figures 129–130.** Female paralectotype, dorsal (129) and ventral (130) views. The label (ZISP 271) says, in Russian and Latin: “*Buthus eupeus bogdoensis* Bir. 8 (♀ + ♂) sp [ecimina] typ[ica] Det.: A. Birula. Coll.: Astrakhan Gub [erniya] [= Province], Mts. Maloe Bogdo, A. Becker, 1872”. Scale bar: 10 mm.



Figures 131–136: *Mesobuthus bogdoensis*. **Figures 131–133.** Female lectotype, metasoma and telson, lateral (131), dorsal (132), and ventral (133) views. **Figures 134–136.** Male lectotype, metasoma and telson, lateral (134), dorsal (135), and ventral (136) views. Scale bar: 10 mm.



Figures 137–153: *Mesobuthus bogdoensis*. **Figures 137–145, 148, 150, 152–153.** Male lectotype. Pedipalp chela, dorsal (137), external (138), and ventral (139) views. Pedipalp patella, dorsal (140), external (141) and ventral (142) views. Femur and trochanter, dorsal (143) and ventral (144) views. Movable finger (145). Chelicerae, carapace and tergites I–III (148), sternopectinal region and sternite III (150). Right legs III–IV, retrolateral aspect (152–153). The trichobothrial pattern is indicated in Figures 137–141, 142. **Figures 146–147, 149, 151.** Female paralectotype. Pedipalp chela, dorsal (146) and external (147) views. Chelicerae, carapace and tergites I–III (149), sternopectinal region and sternite III (151).

We found the original work of Pallas (1776) where these scorpions were mentioned. On 29 April (11 May) 1773, the great explorer approached Maloe Bogdo ('Lesser Bogdo'), a small hill (37 m a. s. l.) and a sacred place for the local Kalmyk tribes, now within Kazakhstan. Another such natural

monument, a more impressive Bolshoe Bogdo hill ('Greater Bogdo'), 150 m a. s. l., is located 25 km away, now in the Astrakhan Province of Russia. (Pallas also visited Bolshoe Bogdo a day earlier). It was at Maloe Bogdo that Pallas (1776: 677) obtained ("erhielt") "...[the] first scorpions in

the Russian Empire, which were hiding among dry rocks, small and belonging to a distinct species, though very similar to one I saw from Persia" ("...allerersten Scorpionen im russischen Reich, welche sich zwischen den trocknen Steinen verbergen, klein und von einer besondern Art sind, denenjenigen aber, welche ich aus Persien gesehn habe, vollkommen gleichen").

Scorpions collected by Pallas have not been preserved. The first description of the Maloe Bogdo population was only published a century later by Alexei Birula (1896) as "*Buthus eupeus* forma δ *bogdoënsis*". It was the very first scorpion taxon Birula described in his illustrious career. The type specimens were collected by Alexander Becker, a botanist who worked at Maloe Bogdo in summer 1871; the label date '1872' probably refers to the date of specimens' acquisition by ZISP.

In 1887, A. N. Kharuzin and K. A. Satunin collected scorpions from both Maloe and Bolshoe Bogdo; these specimens are deposited in the Zoological Museum of the Moscow State University and were listed in Birula's review of this collection (Birula, 1900b: 3). Recent DNA data, which are used in our revision, were obtained at Bolshoe Bogdo and other localities in Russia. Existence of the type locality population at Maloe Bogdo has not been confirmed since 1887.

Along with *B. eupeus bogdoënsis*, Birula (1917a) mentioned "*Buthus eupeus volgensis* Birula" that was only described 8 years later (Birula, 1925). The types of this subspecies were collected in 1910 by a young zoologist Vladimir Tchernavin (1887–1949), later one of the few prisoners who managed to escape from Stalin's Gulag (Tchernavin, 1935). Birula himself was arrested in 1930 and spent years in the Gulag.

This taxon has not been recorded in literature for 70 years since Birula (1925, 1928). Scorpions were never again collected in both type localities of Birula (1896, 1925). Existence of several new, disjunct populations along the Volga River was only recently documented (Anikin, 1997; Anikin & Kireev, 1998); the scorpion was first misidentified as *Buthus occitanus*, and later corrected to *Mesobuthus eupeus*. The first DNA data for this species have been recently obtained by N. Poverennyi.

A detailed distribution of the Volga scorpion is under further investigation; several new, disjunct populations were only recently documented by the Saratov zoologists, and some records are still unpublished. Accidental records were documented by local tourists and naturalists including the Stepan Razin Cliff (a historical monument). The species was listed (as either *M. eupeus* or *M. e. volgensis*) in the Red Data Books of endangered species of the Astrakhan, Saratov, and Volgograd Provinces of Russia. It is protected in the Shcherbakovsky Nature Park, Nizhne-Bannovsky Reserve, and Bogdo-Baskunchak Reserve, all three localities represented in our DNA data. Our phylogeny confirms recent suggestions (Poverennyi & Anikin, 2020a, 2020b) that the Volga populations have a species status, likely representing an interesting palaeo-Caspian relict (see Discussion).

DISTRIBUTION. Kazakhstan, Russia (Astrakhan Province, Saratov Province, Volgograd Province, ?Kalmyk Republic) (Figs. 1155, 1158).

Mesobuthus crucittii sp. n.

(Figures 154–195, 1155, 1157, Table 2)

<http://zoobank.org/urn:lsid:zoobank.org:act:AB90C5EF-1EB6-4B98-9A0B-34E4D1AC695D>

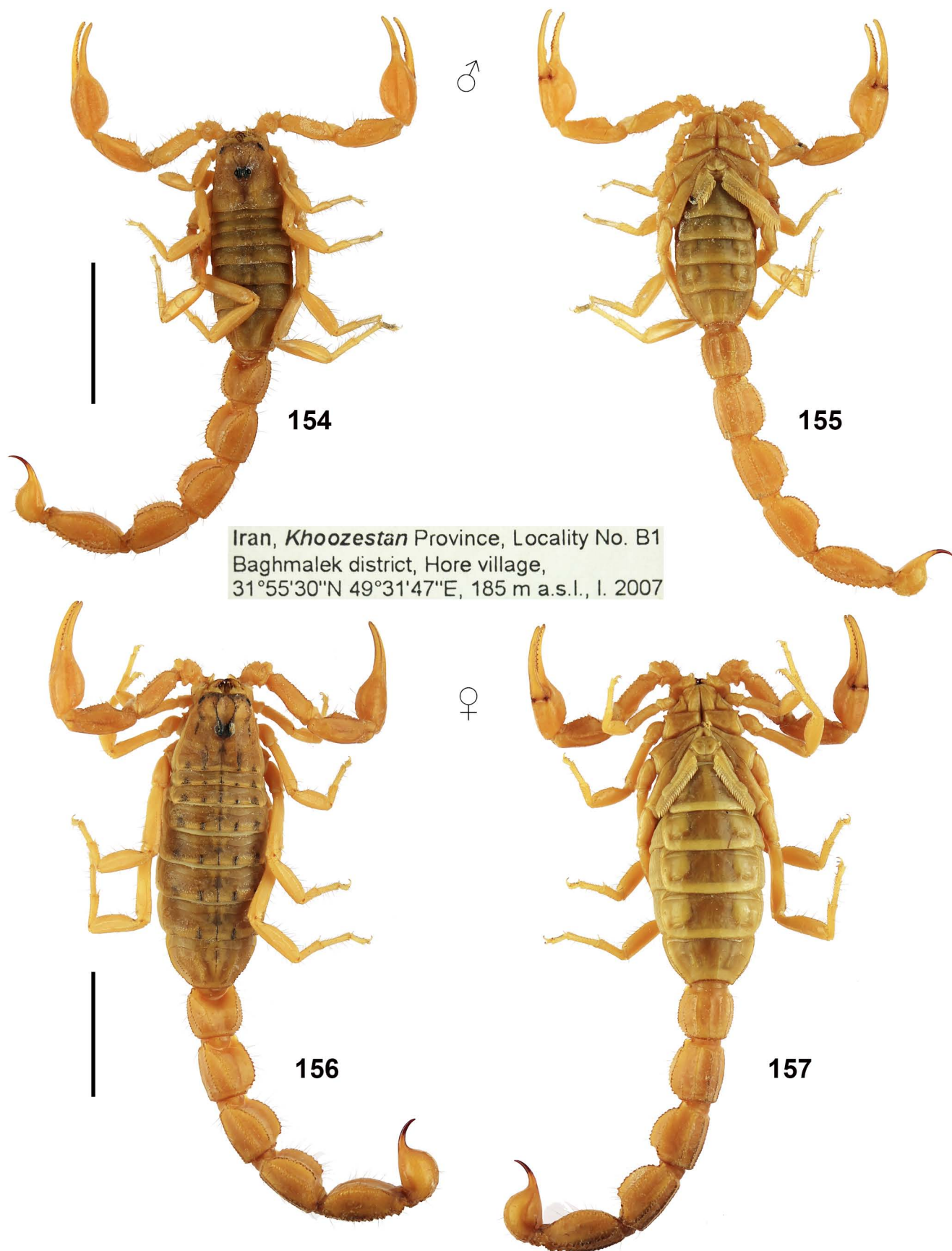
TYPE LOCALITY AND TYPE REPOSITORY. **Iran, Khoozestan Province**, Baghmalek District, Hore Village, 31°55'30"N 49°31'47"E (31.92°N 49.55°E), 185 m a. s. l.; NMPC.

REFERENCES:

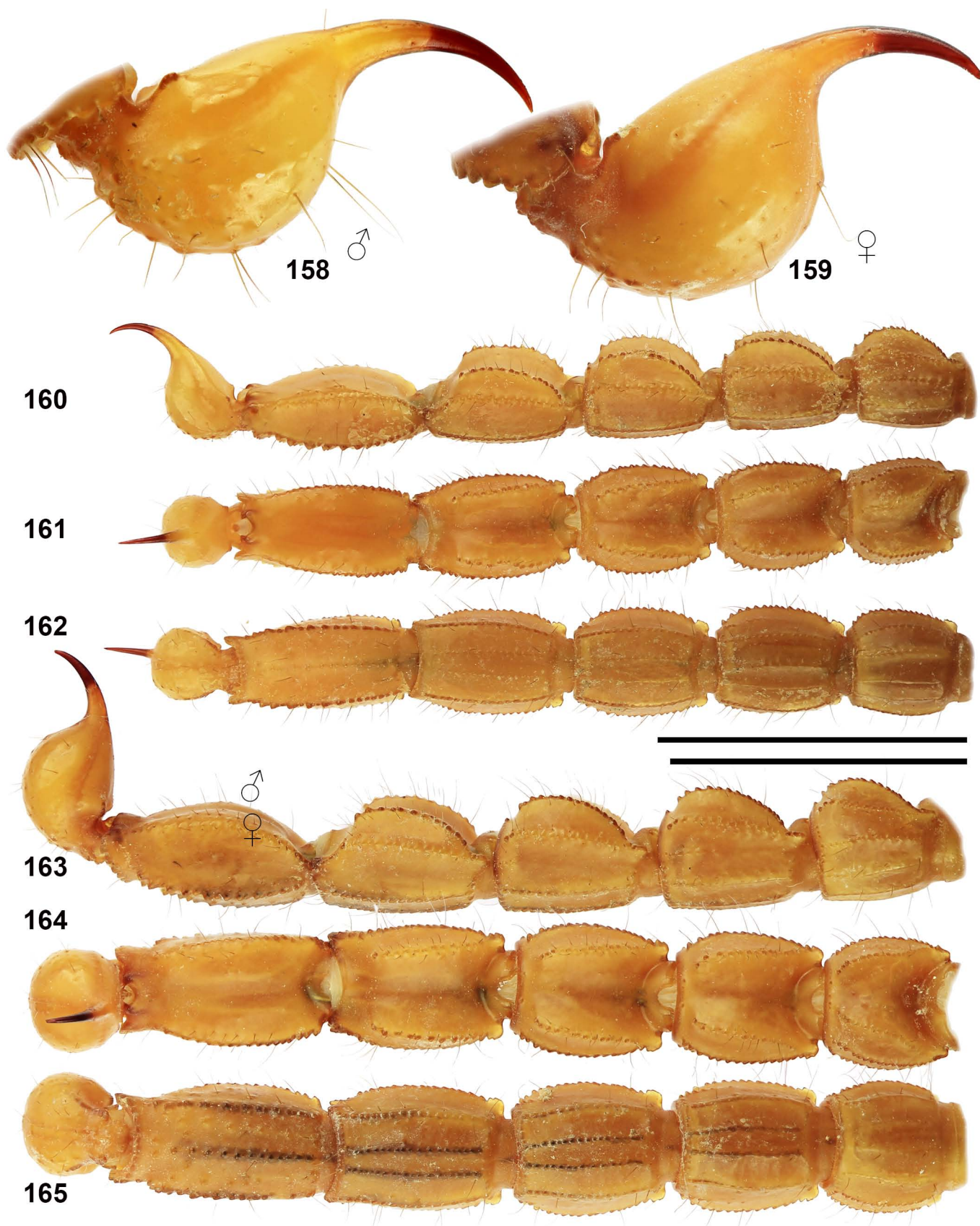
- Mesobuthus eupeus phillipsii*: Navidpour et al., 2008a: 11–13, figs. 22, 81–84.
Mesobuthus eupeus phillipsii: Mirshamsi et al., 2010: 2867 (in part).
Mesobuthus phillipsii: Mirshamsi et al., 2011a: 15–19, figs. 36–43, tables 1–2 (in part); Mirshamsi et al., 2011b: 20 (in part); Barahoei et al., 2020: 398–399, fig. 16 (in part).

TYPE MATERIAL EXAMINED (NMPC). **Iran, Bushehr Province**, Deylam road, 30°26'31"N 49°55'26"E (30.43°N 49.92°E), 85 m a. s. l. (Locality No. OM-D 804), June 2007, 1♀ (paratype), leg. Navidpour, Mashipour & Tofigh; Genaveh, (29.52°N 50.50°E), 227 m a. s. l. (Locality No. Bu-G1), January 2005, 2♀ (paratypes), leg. Hayader & Tofigh; **Ilam Province**, Mehran to Dehloran road, 32°55.42'N 46°41.32'E (32.92°N 46.68°E), 375 m a. s. l. (Locality No. IL-822), October 2007, 2♀1juv. (paratypes), leg. Hayader, Mashipour & Bahrani; **Khoozestan Province**, ca 100 m a. s. l., Chogha Zambil (zikkurat) env., 32°00'N 48°31'E (32.00°N 48.52°E), 5–6 May 1996, 3♂2♀1juv., leg. D. Král & M. Kaftan; Baghmalek District, Hore Village, 31°55'30"N 49°31'47"E (31.92°N 49.55°E), 185 m a. s. l., 2♂ (holotype and paratype) 4♀ (paratypes), February 2007, 2♀, leg. Kazemi; Chogha Zambil (zikkurat), 32°00'55"N 48°31'04"E (32.00°N 48.52°E), 68.5 m a. s. l. (Locality No. Ch-100), June 2007, 4♂ (paratypes), leg. Navidpour & Mashipour; Chogha Zambil (zikkurat), 32°00'55"N 48°31'04"E, 68.5 m a. s. l. (Locality No. Ch-103), VI.2007, 2♂1♀ (paratypes), leg. Navidpour & Mashipour; 45 km NW of Masdjedsoleyman, Lali, 31°18'33"N 49°03'39"E (31.30°N 49.05°E), 329 m a. s. l. (Locality No. La-815-4 and 5), October 2007, 2♀1♀juv. (paratypes), leg. Mashipour & Hayader; **Kohgiluyeh & Boyer-Ahmad Province**, Behbahan to Gachsaran (Dogonbadan) road, 30°28'36"N 50°30'05"E (30.47°N 50.50°E), 498 m a. s. l. (Locality No. Y-1), March 2008, 2♀juvs. (paratypes), leg. Ghafarnia & Habibzadeh; Yasuj, Deelaroo Village, 30°33'44"N 50°44'44"E (30.55°N 50.73°E), 820 m a. s. l. (Locality No. Y-2), March 2008, 1♂1♀2juvs. (♂♀) (paratypes), leg. Navidpour, Ghafarnia & Bahrani.

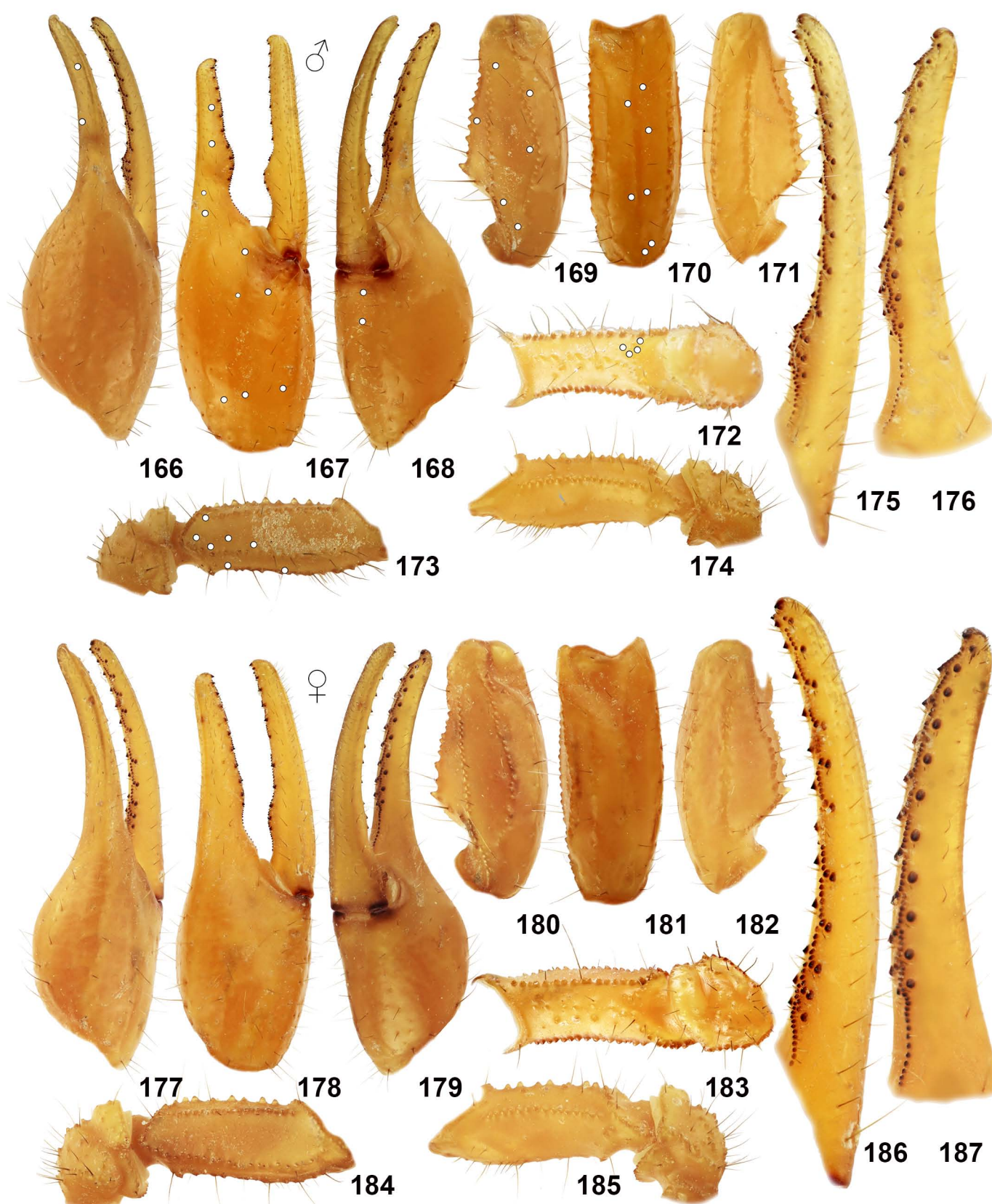
DNA DATA. *Mesobuthus crucittii* sp. n., in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their survey of Iranian *Mesobuthus* (four



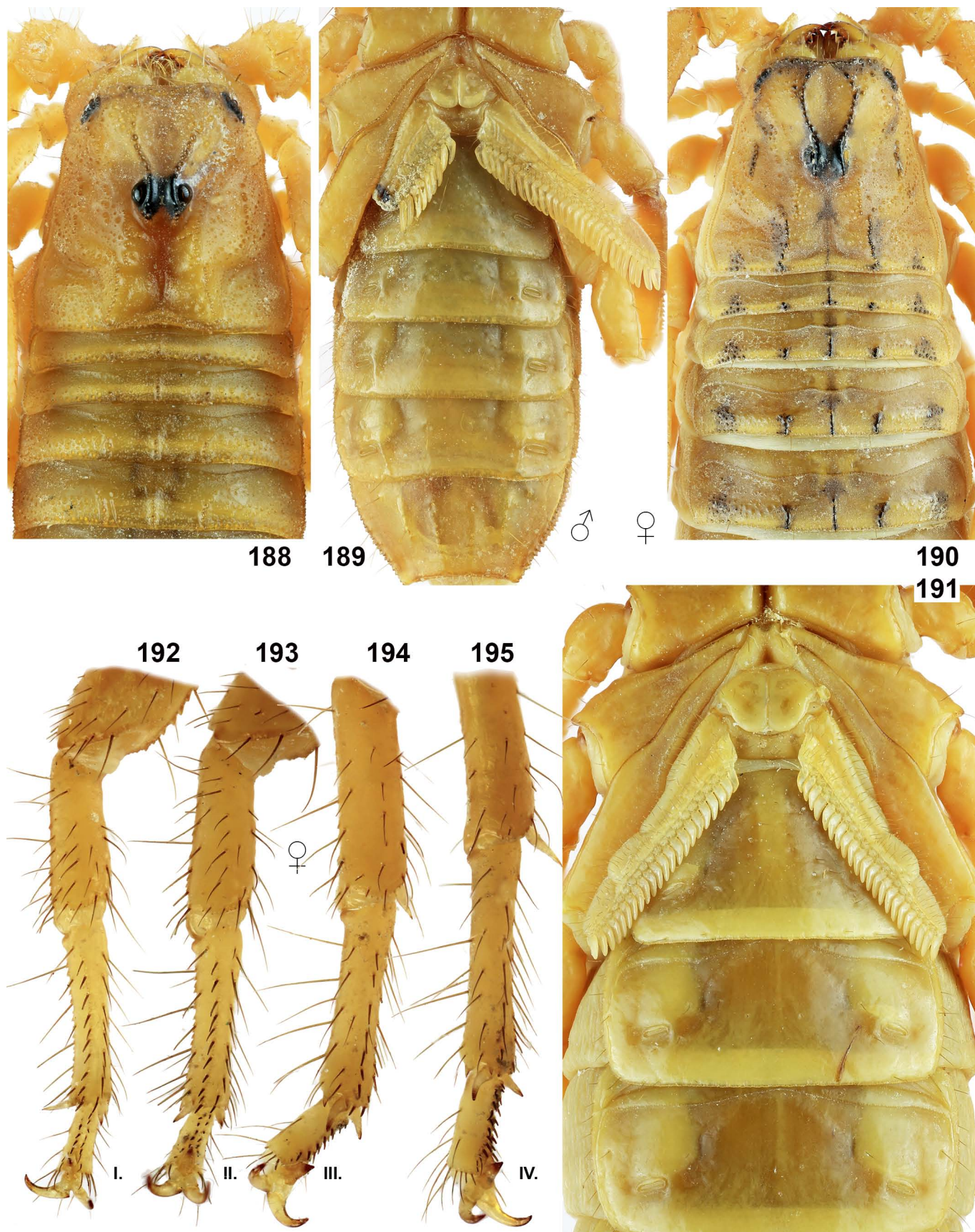
Figures 154–157: *Mesobuthus crucittii* sp. n. **Figures 154–155.** Male holotype, dorsal (154) and ventral (155) views. **Figures 156–157.** Female paratopotype, dorsal (156) and ventral (157) views. Scale bars: 10 mm (154–155, 156–157).



Figures 158–165: *Mesobuthus crucittii* sp. n. **Figures 158, 160–162.** Male holotype, telson lateral (158), metasoma and telson, lateral (160), dorsal (161), and ventral (162) views. **Figures 159, 163–165.** Female paratopotype, telson lateral (159), metasoma and telson, lateral (163), dorsal (164), and ventral (165) views. Scale bars: 10 mm (160–162, 163–165).



Figures 166–187: *Mesobuthus crucittii* sp. n., pedipalp. **Figures 166–176.** Male holotype, chela, dorsal (166), external (167), and ventral (168) views. Patella, dorsal (169), external (170) and ventral (171) views. Femur and trochanter, internal (172), dorsal (173), and ventral (174) views. Movable (175) and fixed (176) fingers. **Figures 177–187.** Female paratopotype, chela, dorsal (177), external (178), and ventral (179) views. Patella, dorsal (180), external (181) and ventral (182) views. Femur and trochanter, internal (183), dorsal (184), and ventral (185) views. Movable (186) and fixed (187) fingers. The trichobothrial pattern is indicated in Figures 166–170, 172–173.



Figures 188–195: *Mesobuthus crucittii* sp. n. **Figures 188–189.** Male holotype, chelicerae, carapace and tergites I–IV (188), sternoplectinal region and sternites (189). **Figures 190–195.** Female paratopotype, chelicerae, carapace and tergites I–IV (190), sternoplectinal region and sternites III–V (191). Left legs I–IV, retrolateral aspect (192–195).

DNA sequences from the Khoozestan Province, Baghmalek, 31.50°N, 49.90°E) (Table 16).

ETYMOLOGY. The new species is named in honor of our colleague Pierangelo Crucitti (Rome, Italy) for his contributions to scorpiology.

DIAGNOSIS. Total length of adults 40 mm (male) to 65 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than female. Pedipalp chela length/width ratio 3.1–3.65 in both sexes. Pectinal teeth number 24–29 in male, 20–23 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma rather densely hirsute, with long setae. Carapace and tergites yellow to reddish brown with pigmentation reduced; metasoma, telson, pedipalps and legs yellow or reddish brown. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually granulated carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII medially smooth, with 4 smooth carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasomal segments smooth. Length to depth ratio of metasoma III 1.2–1.4, metasoma IV 1.55–1.7 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, adults with 5–8 retroinferior macrosetae on basitarsus III. Telson bulbous, mainly in female. Anal lobe divided in three parts.

DESCRIPTION. Total length of adult males 38–45 mm, females 45–65 mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male has the fingers proximally more twisted than female. Female has longer and very slightly narrower chela of pedipalps. For measurements, see Table 2.

Coloration (Figs. 154–157). Carapace and tergites yellow to reddish brown with pigmentation reduced. Chelicerae yellow, without reticulation. Metasoma, telson, pedipalps and legs yellowish brown. Metasomal ventral carinae can be black pigmented. Chelicerae yellow, without reticulation, the tips of teeth on chelical fingers are black.

Mesosoma and carapace (Figs. 188–191). Carapace is carinate and unevenly covered with granules of varying size, usually more in males; much of the granulation is fine, but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and other larger and rounded. Tergite VII is pentacarinat. Pectinal tooth count is 24–29 in males, 20–23 in females. Pectinal marginal tips extend to about one-fourth of the sternite V in males and one-fourth of the sternite IV

in females. Pectines have three marginal lamellae and seven to nine middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. All sternites smooth, sparsely hirsute. Sternite VII with four well marked, usually smooth carinae. Other sternites have two furrows.

Pedipalps (Figs. 166–187). Pedipalps are rather densely hirsute and smooth, only femur is finely granulated dorsally. Femur has four to five granulated carinae, the middle carina on internal surface consists of strong irregular granules. Patella with eight carinae, of which internal and dorsal are always granulated. Chela without carinae. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 192–195). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 5–8 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate to strong on legs III and IV and absent on the other legs.

Metasoma and telson (Figs. 158–165). All metasomal segments are rather densely hirsute with long setae. Metasomal segment I with 10 carinae, segments II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, segment IV with 8 carinae, and segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma smooth. Ventrolateral carinae of metasoma V posteriorly with several large lobate denticles. Telson only sparsely hirsute, bulbous, mainly in female, bumpy and smooth. Anal lobe divided in three parts.

DISTRIBUTION. Iran (Bushehr, Ilam, Khoozestan, and Kohgiluyeh & Boyer Ahmad Provinces) (Figs. 1155, 1157).

***Mesobuthus eupeus* (C. L. Koch, 1839), s.str.**

(Figures 196–243, 1155–1156, 1159–1161, 1167, Tables 3, 15)

<http://zoobank.org/urn:lsid:zoobank.org:act:0FB17935-6429-4CE8-B30E-8D8024F9621F>

Androctonus eupeus C. L. Koch, 1839a: 127–128, pl. CLXXV, fig. 419.

TYPE LOCALITY AND TYPE REPOSITORY. “Caucasus”; types lost. Neotype (designated here): **Georgia**, Tbilisi (41.72°N 44.79°E); NMPC.

SYNONYMS:

= *Androctonus ornatus* Nordmann, 1840: 732, pl. I, fig. 2 (synonymized by Birula, 1896: 238).

<http://zoobank.org/urn:lsid:zoobank.org:act:2C6F7E6C-CA68-48FC-AF7D-EAA698CC1768>

(TYPE LOCALITY AND TYPE REPOSITORY: **Georgia**, *Imereti Region* [no exact locality; estimated at Kutaisi (42.25°N 42.70°E)], MZHF.

Dimensions (mm)		<i>M. eupeus</i> ♂ 1476	<i>M. eupeus</i> ♀ neotype	<i>M. farleyi</i> sp. n. ♂ holotype	<i>M. farleyi</i> sp. n. ♀ paratopotype
Carapace	L / W	5.20 / 5.77	5.34 / 6.44	4.66 / 5.46	5.57 / 6.56
Mesosoma	L	12.10	17.95	10.78	13.89
Tergite VII	L / W	3.39 / 5.46	3.55 / 6.38	2.79 / 5.50	3.87 / 6.75
Metasoma + telson	L	28.40	27.34	25.56	27.50
Segment I	L / W / D	3.50 / 3.61 / 3.35	3.46 / 3.57 / 3.16	3.15 / 3.44 / 3.03	3.49 / 3.49 / 3.44
Segment II	L / W / D	4.08 / 3.55 / 3.26	4.01 / 3.36 / 3.05	3.74 / 3.28 / 3.22	4.07 / 3.40 / 3.38
Segment III	L / W / D	4.22 / 3.51 / 3.37	4.11 / 3.27 / 3.22	3.86 / 3.28 / 3.26	4.07 / 3.31 / 3.17
Segment IV	L / W / D	4.99 / 3.35 / 3.19	5.07 / 3.18 / 3.00	4.52 / 3.23 / 3.10	4.70 / 3.32 / 3.02
Segment V	L / W / D	6.00 / 2.98 / 2.38	5.84 / 3.01 / 2.31	5.08 / 2.73 / 2.47	5.75 / 3.06 / 2.64
Telson	L / W / D	5.61 / 2.22 / 1.97	4.85 / 2.09 / 1.91	4.86 / 1.81 / 2.00	5.42 / 2.36 / 2.04
Pedipalp	L	18.96	19.68	17.19	19.84
Femur	L / W	4.58 / 1.47	4.71 / 1.64	4.23 / 1.13	4.67 / 1.50
Patella	L / W	5.45 / 2.16	5.71 / 2.33	4.92 / 1.86	5.60 / 2.35
Chela	L	8.93	9.26	8.04	9.57
Manus	W / D	2.68 / 2.66	2.39 / 2.56	2.50 / 2.51	2.66 / 2.58
Movable finger	L	5.40	5.88	4.95	6.09
Total	L	45.70	50.63	41.10	46.96

Table 3. Comparative measurements of *Mesobuthus eupeus* and *M. farleyi* sp. n. specimens. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

= *Buthus cognatus* L. Koch, 1878: 58, pl. I, fig. I (synonymized by Birula, 1896: 238).

<http://zoobank.org/urn:lsid:zoobank.org:act:88C80B32-921F-4ADE-B63D-3C805A02BFE2>

(TYPE LOCALITY AND TYPE REPOSITORY: **Georgia, Samtskhe-Javakheti Region**, upper Kura River, environs of Atskuri (Atskur) (41.73°N 43.16°E), type lost.

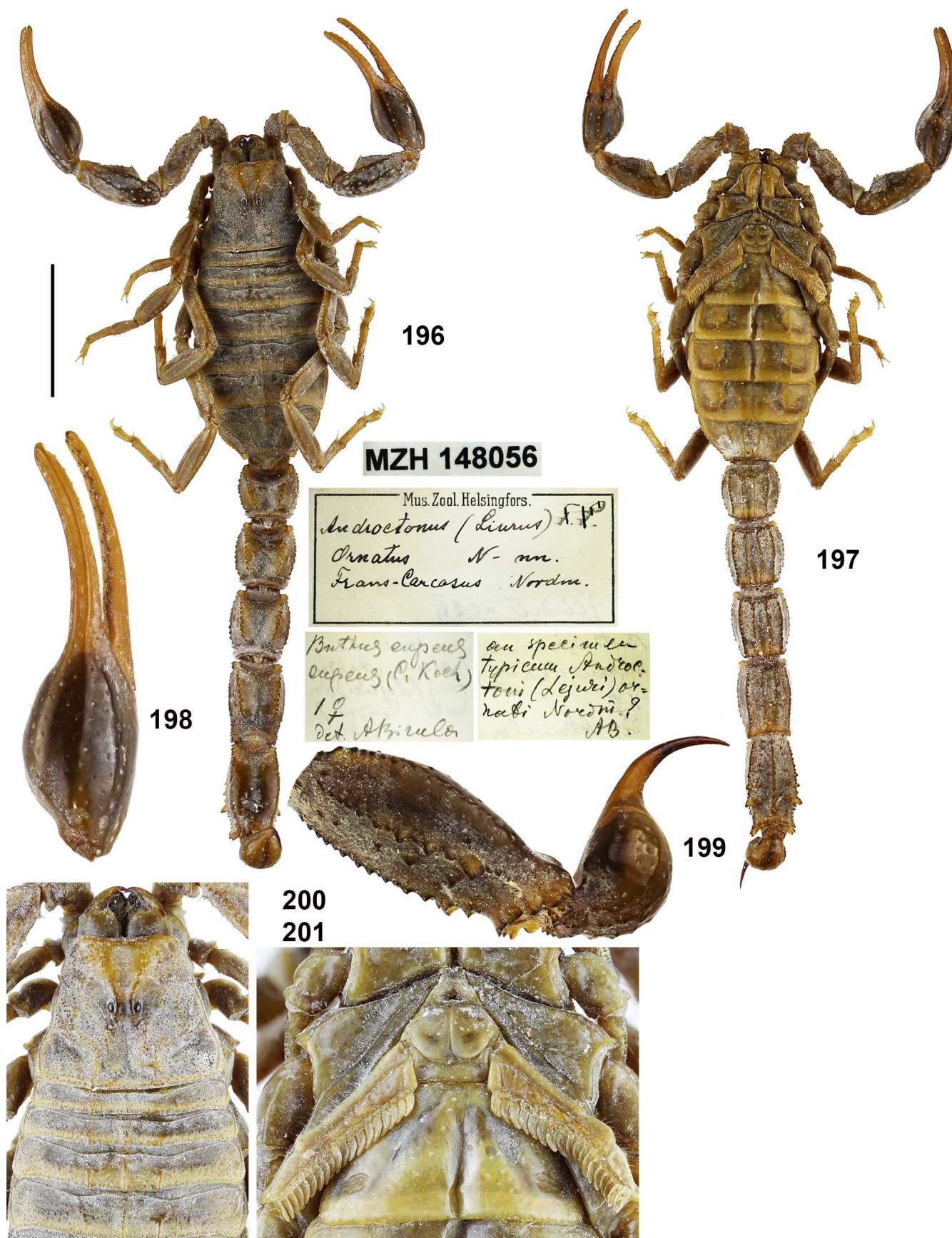
REFERENCES (selected):

Androctonus ornatus: Kessler, 1874: 19 (in part).
Buthus eupeus forma α: Birula, 1896: 239.
Buthus eupeus forma β: Birula, 1896: 240 (in part).
Buthus eupeus: Birula, 1900b: 3.
Buthus eupeus eupeus (in part): Birula, 1904b: 37; Birula, 1905a: 122, 124–125, fig. 1; Birula, 1905b: 122 (in part); Birula, 1911b: 162–164; Birula, 1917a: 24–39, pl. I; Birula, 1918: 9–10; Birula, 1925: 95.
Buthus (Buthus) eupeus: Birula, 1912: 118–121.
Buthus eupeus eupeus natio eupeus: Birula, 1917a: 34.
Buthus eupeus eupeus natio armeniaca: Birula, 1917a: 34.
Mesobuthus eupeus: Vachon, 1950: 152 (in part); Vachon, 1952: 325 (in part); Fet & Lowe, 2000: 171–172 (in part; complete references list until 1998); Crucitti & Cicuzza, 2001a: 3–11, figs. 1–6; Crucitti & Cicuzza, 2001b: 231–232, fig. 5 (in part); Teruel, 2002: 75–76, figs. 1–3 (in part); Karataş & Karataş, 2003: 1–4, figs. 1–2 (in part); Yağmur et al., 2007: 97–98 (in part); Kaltsas et al., 2008: 219 (in part); Mirshamsi et al., 2010: 2867 (in part); Mirshamsi et al., 2011b: 20 (in part); Gharakhloo et al., 2018: 875 (in part); Kovařík, 2019: 17, figs. 134–137, 148, 161–163, 171–172.

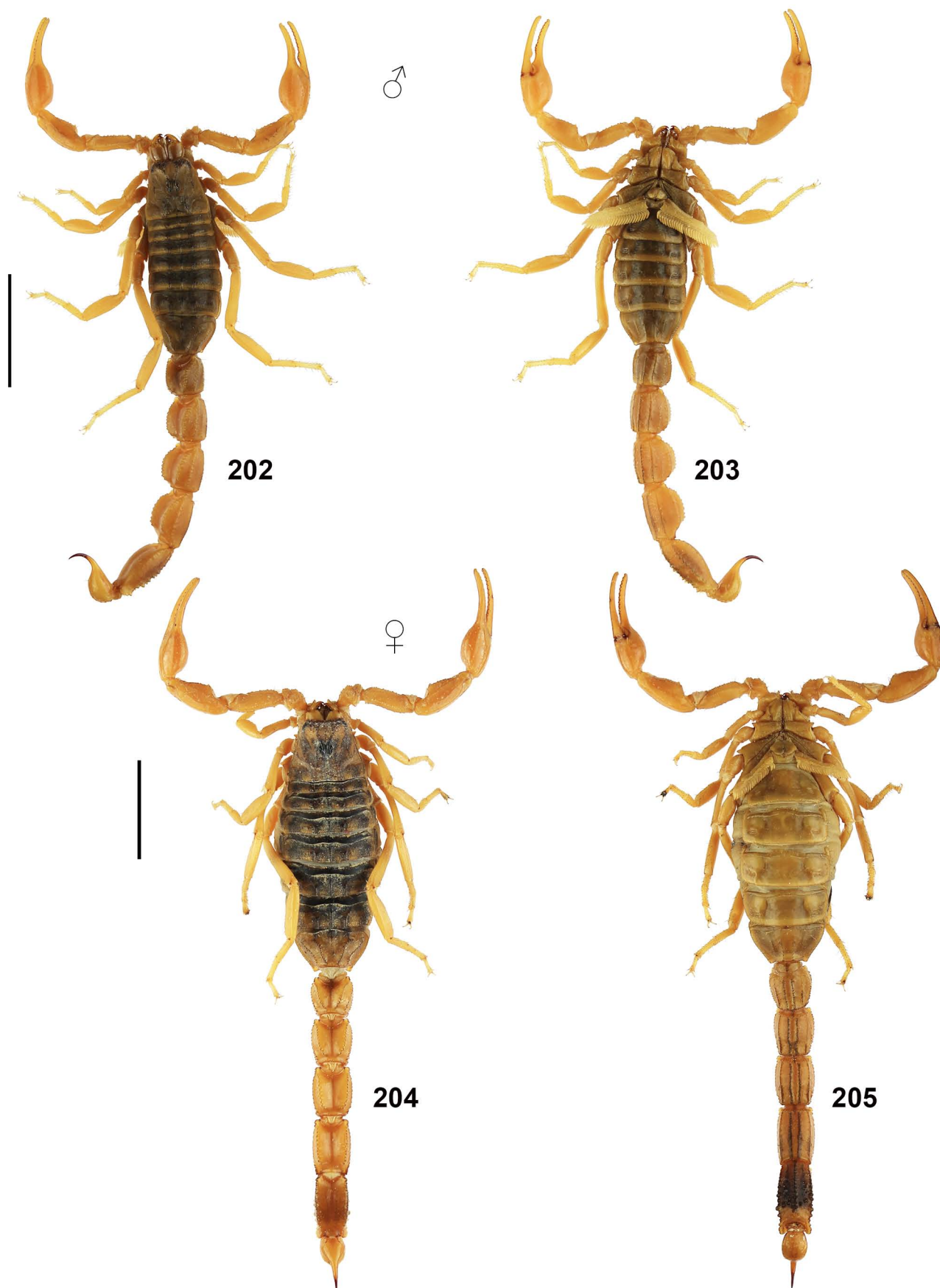
Mesobuthus eupeus eupeus: Vachon, 1958: 155 (“forme typique”); Fet, 1989: 86–91 (in part; complete references list for the former USSR); Fet, 1994: 527; Fet & Lowe, 2000: 171–172 (in part; complete references list until 1998); Mirshamsi et al., 2010: 2867 (in part); Mirshamsi et al., 2011a: 8, fig. 4 (in part); Yağmur et al., 2012: 16–17, figs. 1–3; Moradi et al., 2015: 12–13 (in part); Navidpour et al., 2019: 4–5, fig. 55 (in part).

TYPE MATERIAL EXAMINED. **Georgia**, Tbilisi (41.72°N 44.79°E), 2012, 1♀ (neotype of *Androctonus eupeus*, designated here) (Figs. 204–205, 225–235, 237, 239), NMPC; Georgia, Imereti Region [no exact locality; estimated at Kutaisi (42.25°N 42.70°E)], 1♀ (Figs. 196–201), leg. A. Nordmann, MZHF (holotype of *Androctonus ornatus*).

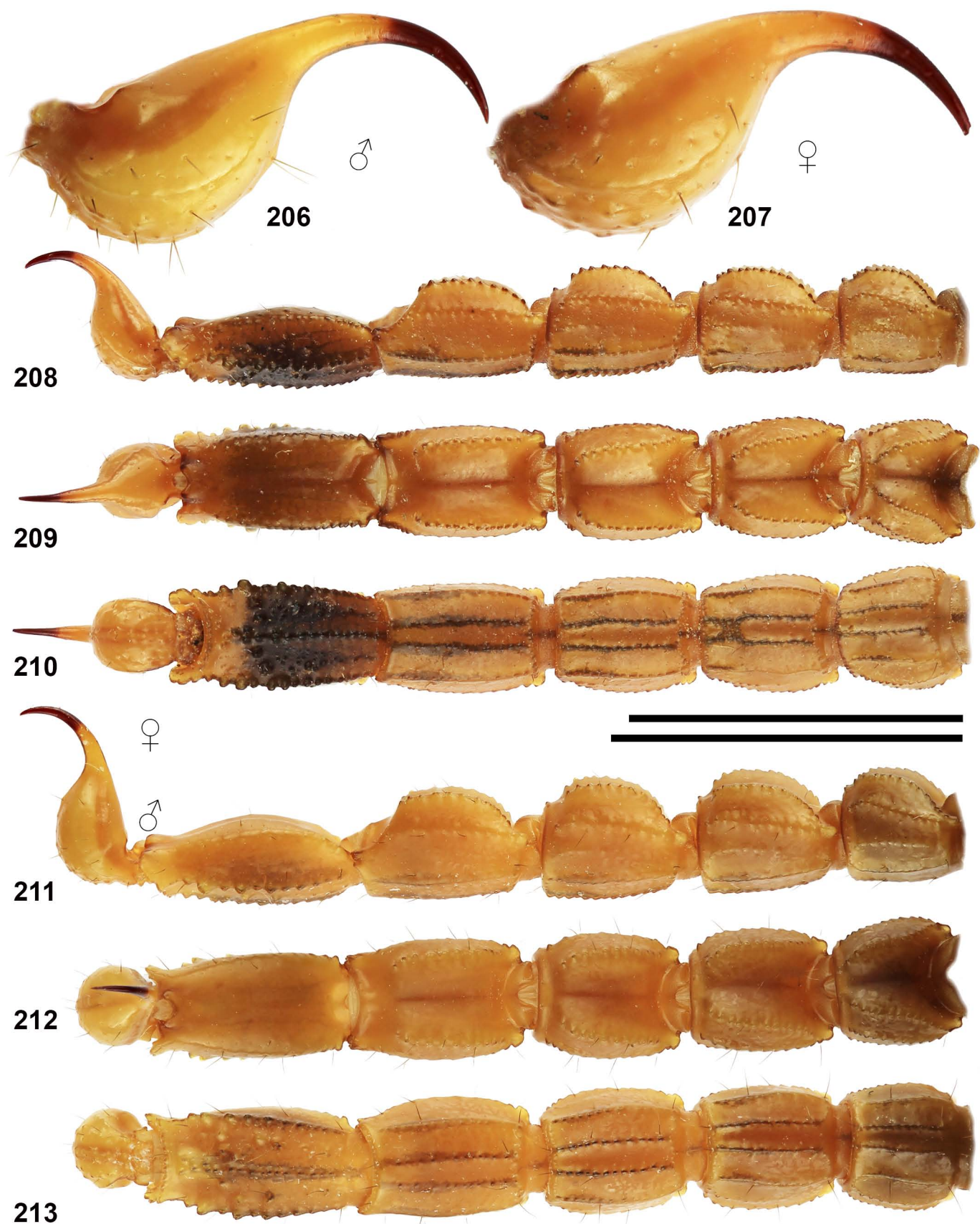
OTHER MATERIAL EXAMINED. **Armenia**, road from Solak to Sevan, 17 June 1981, 3♀, leg. Soukup, FKCP; Little Caucasus Mts., Goght near Geghard (40.15°N 44.79°E), 35 km SE of Yerevan, Azat River valley, 12 June 1988, 2♂2♀1juv., leg. Z. Jindra, FKCP; Lusashog (39.85°N 44.96°E), 1850 m a. s. l., 21 May 2005, 1juv., leg. S. Snäll, NMPC; Gorovan sands, 39°53'N 44°44'E (39.88°N 44.73°E), 970 m a. s. l., 23 May 2007, 1♂2♀4juvs., leg. S. Snäll, NMPC; Gorovan, Vedi env., 39°53'46.33"N 44°37'57.63"E (39.53°N 44.37°E), 929 m a. s. l., 17–20 June 2013, 1♀1juv. (No. 460), leg. J. Rolčík, NMPC; Syunik, Meghri, 38°53'805"N 046°15'468"E (38.88°N 46.25°E), 648 m a. s. l., 6♂ (Figs. 202–203, 206, 211–213, 214–224, 236, 238, 240–243, Table 3, Nos. 1476, 1477, 1478, 1479) 3♀, 9–10 July 2018, leg. D. Hoferek, NMPC; Tavush, Dilijan, Gosch, 40°49'946"N 044°59'781"E (40.82°N



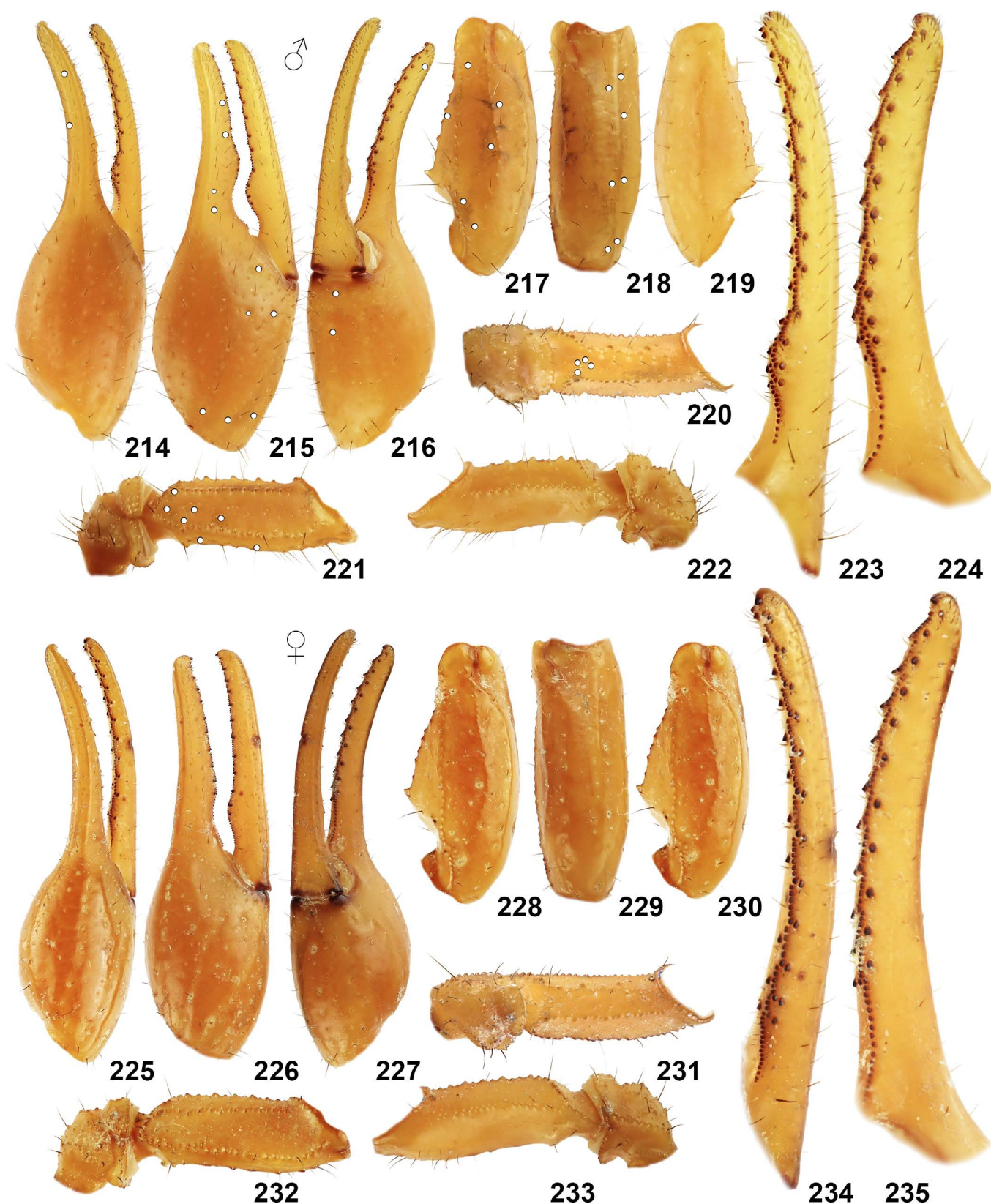
Figures 196–201. *Mesobuthus eupeus*, female holotype of *Androctonus ornatus* Nordmann, 1840. Dorsal (196) and ventral (197) views. Pedipalp chela dorsal (198). Chelicerae, carapace and tergites I–III (200) and sternopectinal region (201). The label say, in Latin: top: “*Androctonus (Liurus) ornatus* N-[ordma]nn Trans-Caucasus Nordm[ann]”; bottom (both in A. Birula’s hand): left, “*Buthus eupeus eupeus* 1 ♀ det. A. A. Birula”; right, “specimen typicum *Androctonus (Lejuri) ornati* Nordm. ? AB”. Scale bar: 10 mm (196–197)



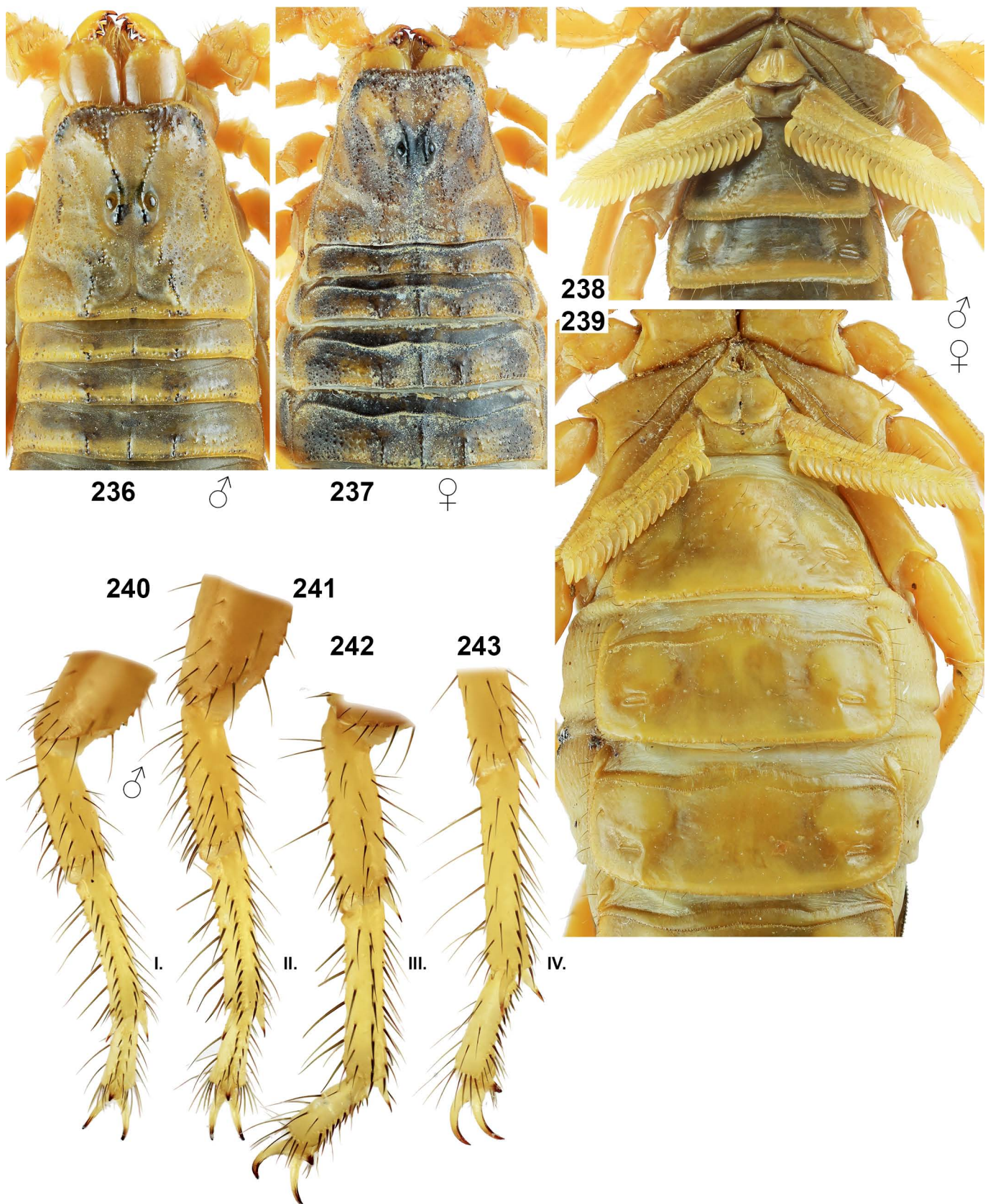
Figures 202–205. *Mesobuthus eupeus*. **Figures 202–203.** Male from Armenia, Syunik, Meghri, NMPC, dorsal (202) and ventral (203) views. **Figures 204–205.** Female neotype, dorsal (204) and ventral (205) views. Scale bars: 10 mm (202–203, 204–205).



Figures 206–213. *Mesobuthus eupeus*. **Figures 206, 211–213.** Male from Armenia, Syunik, Meghri, NMPC, telson lateral (206), metasoma and telson, lateral (211), dorsal (212), and ventral (213) views. **Figures 207–210.** Female neotype, telson lateral (207), metasoma and telson, lateral (208), dorsal (209), and ventral (210) views. Scale bars: 10 mm (208–210, 211–213).



Figures 214–235. *Mesobuthus eupeus*, pedipalp. **Figures 214–224.** Male from Armenia, Syunik, Meghri, NMPC, chela, dorsal (214), external (215), and ventral (216) views. Patella, dorsal (217), external (218) and ventral (219) views. Femur and trochanter, internal (220), dorsal (221), and ventral (222) views. Movable (223) and fixed (224) fingers. **Figures 225–235.** Female neotype, chela, dorsal (225), external (226), and ventral (227) views. Patella, dorsal (228), external (229) and ventral (230) views. Femur and trochanter, internal (231), dorsal (232), and ventral (233) views. Movable (234) and fixed (235) fingers. The trichobothrial pattern is indicated in Figures 214–218, 220–221.



Figures 236–243. *Mesobuthus eupeus*. **Figures 236, 238, 240–243.** Male from Armenia, Syunik, Meghri, NMPC, chelicerae, carapace and tergites I–III (236), sternopectinal region and sternites III–IV (238), left legs I–IV, retrolateral aspect (240–243). **Figures 237, 239.** Female neotype, chelicerae, carapace and tergites I–IV (237) and sternopectinal region and sternites III–V (239).

44.98°E), 1320 m a. s. l., 13 July 2018, 1♀, leg. D. Hoferek, NMPC. **Georgia**, 1♂1juv. (No. 16), NMPC; Dzhvari (42.71°N 42.03°E), 15 km from Tbilisi, 1juv., 7 August 1988, leg. T. Peš, FKCP; Tbilisi, 1♂, 7 June 1959, leg. J. Niedl, FKCP; 2005, 1♀1♀im., NMPC; Vashlovani National Park, 41°13.724'N 046°21.195'E (41.22°N 46.35°E), 322 m a. s. l., 3 June 2019, 2juvs., leg. W. Grosser, NMPC; Karsani env., 41°49.813'N 044°42.109'E (41.82°N 44.70°E), 708 m a. s. l., 25 May 2019, 1♀, leg. W. Grosser, NMPC; Tabakhmela near Tbilisi, 12 June 2013, 1♀2juvs., leg. D. Kasatkin, AZMM; Tbilisi, Mt. Mtatsminda, northern slope, 41°41'47.54"N 44°46'46.83"E (41.68°N 44.77°E), 13 June 2013, 1♂1juv., leg. D. Kasatkin & I. Shokhin, AZMM. **Azerbaijan**, Ağstafa District (41.12°N 45.41°E), Poylu Village, 8 June 2013, 1♂, leg. D. Kasatkin, AZMM. **Turkey**, **Ağrı Province**, Doğubayazıt, Gürbulak Village, 39°25'09"N 44°18'34"E (39.42°N 44.30°E), 1620 m a. s. l., 22 July 2010, 1♂1♀, leg. E. A. Yağmur & H. Koç, AZMM; **Artvin Province**, Yusufeli District, 40°49'N 41°32'E (40.82°N 41.53°E), 740 m a. s. l., 1 July 2008, 1♂1♀, leg. A. Avci, NMPC; **Erzurum Province**, Horasan, Saç Geçidi, 35 km NWW Eleskirt, SE Horasan (39.80°N 42.66°E), 2315 m a. s. l., 9 May 2002, 1♀1juv., leg. P. Kabátek, NMPC; **Iğdır Province**, 5 km SE Tuzluca (near the border with Armenia) (40.04°N 43.64°E), 28 May 2005, 1♂4♀1juv., leg. V. Gvoždík, NMPC; Aralık District, Yenidoğan Village, 39°47'12.3"N 44°23'36.9"E (39.78°N 44.38°E), 1563 m a. s. l., 16 June 2007, 1♂1♀, leg. H. Koç, NMPC; **Kars Province**, Kars town, Kars Castle 40°37'01.7"N 43°05'28"E (40.61°N 43.09°E), August 2014, 1♂1♀ (Nos. 362, 363), leg. Ç. Altın, AZMM; Karakurt, 20 km W of Karakurt town (40.17°N 42.59°E), ca 1500 m a. s. l., 14 May 1996, 1♀1juv., leg. J. Pitulová, NMPC; 1juv., leg. D. Král, NMPC; Central region, Ani ruins, 40°31'N 43°34'E (40.52°N 43.57°E), 1500 m a. s. l., 20 May 1997, 2♂1juv., leg. M. Kaftan, NMPC; **Van Province**, Başkale, Çamlık Village (37.95°N 44.08°E), 1889 m a. s. l., 22 July 2007, 1♂, leg. H. Koç & A. V. Gromov.

DNA DATA. *Mesobuthus eupeus* (s.str.) was represented in our survey by five DNA sequences from Armenia and Turkey (Table 16); no DNA markers from Georgia and Azerbaijan are yet available. The same species was also represented, in our opinion, among the populations studied by Mirshamsi et al. (2010) in their DNA survey of Iranian *Mesobuthus* (two specimens from the West Azerbaijan Province). We did not examine any specimens of *M. eupeus*, s. str., from Iran. Another species in the dataset of Mirshamsi et al. (2010) from West Azerbaijan, in our opinion, is *M. persicus* (see below) (Table 16).

DIAGNOSIS. Total length of adults 39 mm (male) to 60 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est* or with level with *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.2–3.5 in male and 3.7–3.9 in female. Pectinal teeth number 21–25 in male, 18–21 in female. Chelicerae yellow, without reticulation.

Pedipalps and metasoma very sparsely hirsute. Carapace and tergites reddish brown, black pigmented, dark spots and stripes usually present; metasoma, telson, pedipalps and legs reddish brown, only part of metasomal segment V black; metasomal ventral carinae usually dark colored. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 granulated or smooth carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with 4 well marked smooth or granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma IV with lateromedian carina smooth to absent in male but present and usually granulated in female, all other carinae granulated. Intercarinal surfaces on metasoma I laterally usually smooth. Length to depth ratio of metasoma III 1.2–1.35; metasoma IV 1.45–1.70 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–10 retroinferior macrosetae on basitarsus III. Tibial spur on both legs III and IV moderate. Telson elongated. Anal lobe divided into three parts. Tergites III–IV with three straight, parallel carinae.

HISTORY OF STUDY. A renowned German arachnologist Carl L. Koch (1839a; not 1838 as often cited) was the first to describe a species of the future *Mesobuthus*, *Androctonus eupeus*, which also became the type species of this genus. The single type specimen, possibly a female, came from the Nuremberg collection of Jacob Sturm (1771–1848), a famed engraver and insect collector. The provenance of the type was listed by C. L. Koch (1839a) only as “Caucasus”, and the type is long lost (Birula, 1917a: 35).

Next year, Alexander von Nordmann (1840), a Swedish zoologist who worked in Helsingfors (now Helsinki, Finland, then in the Russian Empire) published his extremely brief, and largely unreliable, description of *Androctonus ornatus* from the Imereti Region of Georgia, based on a single female collected in 1836. The holotype still exists in the University of Helsinki Zoological Museum, Finland (MZHF), and was examined by us through a kind loan by Pedro Cardoso (Figs. 196–201).

The first review of scorpions of the Russian Empire was published in 1874 by the famous German-Russian zoologist Karl Kessler (1815–1881). Kessler (1874) used the name *Androctonus ornatus* for a common Caucasian buthid scorpion but conflated under it two independent and very different species, now called *Mesobuthus eupeus* and *Olivierus caucasicus* (Nordmann, 1840). The name *Androctonus ornatus* has been in use by Russian zoologists for years until Birula (1896) corrected it to its senior synonym, then *Buthus eupeus*. Since it was published in Russian language, Kessler’s review remained largely unknown to the European zoologists.

In 1878, Carl Koch’s son Ludwig Koch (1825–1908),

also a famed German arachnologist, published a description of *Buthus cognatus* from Georgia (Koch, 1878: 58, Taf. I, Fig. 7). This specimen was collected in Atskhur (Imereti) on the upper Kura River in 1875 by the German geographer Oscar Schneider (1841–1903) during his six-month expedition, which provided rich zoological materials, mainly from the Caucasus but also from Transcaspia (modern Turkmenistan). Koch noted (p. 59) that this new species was close to *Buthus eupeus*, described also from the Caucasus by his father. The species *Androctonus ornatus* was not mentioned by L. Koch (1878) who therefore likely was not aware of the publications by Nordmann (1840) or Kessler (1874). Birula (1905a: 122; 1917a: 37) examined the type of *Buthus cognatus* and deemed it identical with the “typical race” of *Buthus eupeus eupeus*.

Birula (1896) was the first to synonymize both *Androctonus ornatus* Nordmann, 1840 and *Buthus cognatus* L. Koch, 1878 with *Buthus eupeus* (C. L. Koch, 1839). He also started a long-term tradition of establishing subspecies within this ‘umbrella’ species. In his definitive review of the Caucasian scorpiofauna, Birula (1917a: 24–39) provided a detailed redescription and discussion of *Mesobuthus eupeus* (then *Buthus eupeus*) from the Caucasus, based on a nominotypical subspecies. Birula (1917a: 35) considered Tiflis (now Tbilisi, Georgia) a “typical locality” for this species; however, this designation remained informal as no neotype was ever fixed. In Birula’s view, this taxon was an extremely widespread (from Turkey to China, with the highest diversity in Iran) “polymorphic species” forming more than a dozen of allopatric subspecies.

This opinion was accepted by all scorpologists for the next 100 years (Vachon, 1958; Fet, 1989, 1994; Fet & Lowe, 2000). Recently, Mirshamsi et al. (2011a: 15) split all Iranian *Mesobuthus eupeus* into two species, elevating *M. phillipsii* to the species rank. The splitting trend was continued by Kovařík (2019) who recognized 12 valid species of *Mesobuthus*.

COMMENTS. Here, we limit *M. eupeus* s. str. to populations from the Caucasus. See Fet (1989) for a detailed list of localities from the former USSR (modern boundaries of Armenia, Georgia, and Azerbaijan).

Two local “races” (“Natio”) (*armeniaca* and *talyschensis*) from the modern Armenia and Azerbaijan, respectively, were described as infrasubspecific names of the subspecies *Buthus eupeus eupeus* by Birula (1917a: 34); these names are not available according to the ICZN and do not enter into synonymy.

Presence of *M. eupeus* within Russia (in the North Caucasus) was noted by Fet (1989: 90) only in North Ossetia–Alania (Ordzhonikidze, now Vladikavkaz). Several other new localities are reported north of the Georgian border in North Ossetia–Alania (K. Lotiev, pers. comm). A detailed further study of these populations is needed.

We restrict *M. eupeus* from Turkey to Ağrı, Artvin, Erzurum, Iğdır, Kars, and Van Provinces. We also describe three new species of *Mesobuthus* from Turkey: *M. rahsenae* sp. n., *M. turcicus* sp. n., and *M. yagmuri* sp. n. (see below) within the geographic range earlier reported for *M. eupeus*. In addition, we confirm a wide presence of *M. mesopotamicus* (Penther,

1912), stat. n. in southeastern Turkey; these populations were previously identified as *M. eupeus phillipsii* or *M. phillipsii*.

DISTRIBUTION. Armenia, Azerbaijan, Georgia, Iran (West Azerbaijan Province), Russia, Turkey (Figs. 1155–1156).

Mesobuthus farleyi sp. n.

(Figures 244–285, 1155, 1157, Table 3)

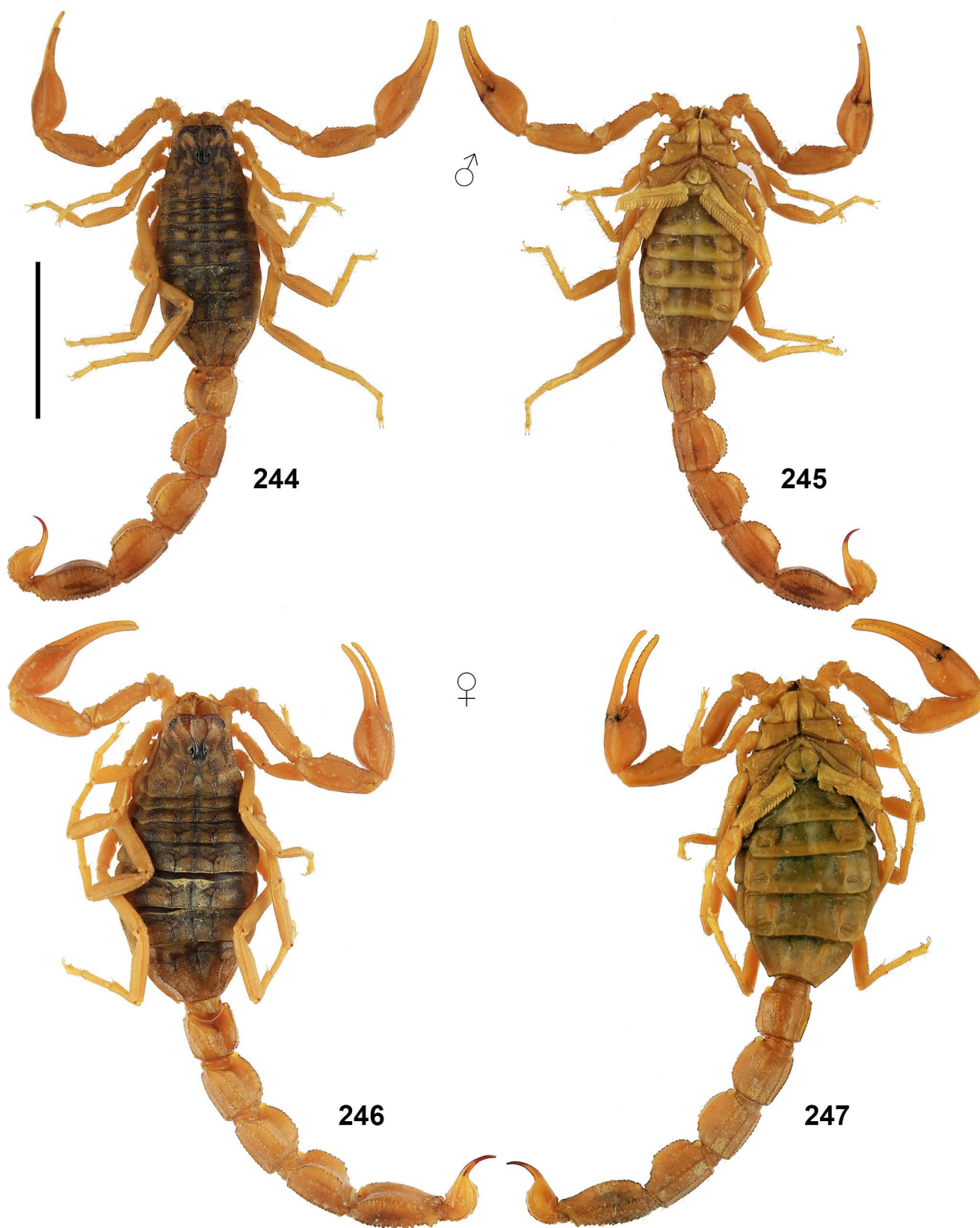
<http://zoobank.org/urn:lsid:zoobank.org:act:77238E6D-756F-47BF-9D3D-4BB5E1F82E56>

TYPE LOCALITY AND TYPE REPOSITORY. **Iran, Mazandaran Province**, Alborz Mts., N slopes, Vali Abad Village env., 36°14'N 51°18'E (36.23°N 51.30°E), 1800–2500 m a. s. l., NMPC.

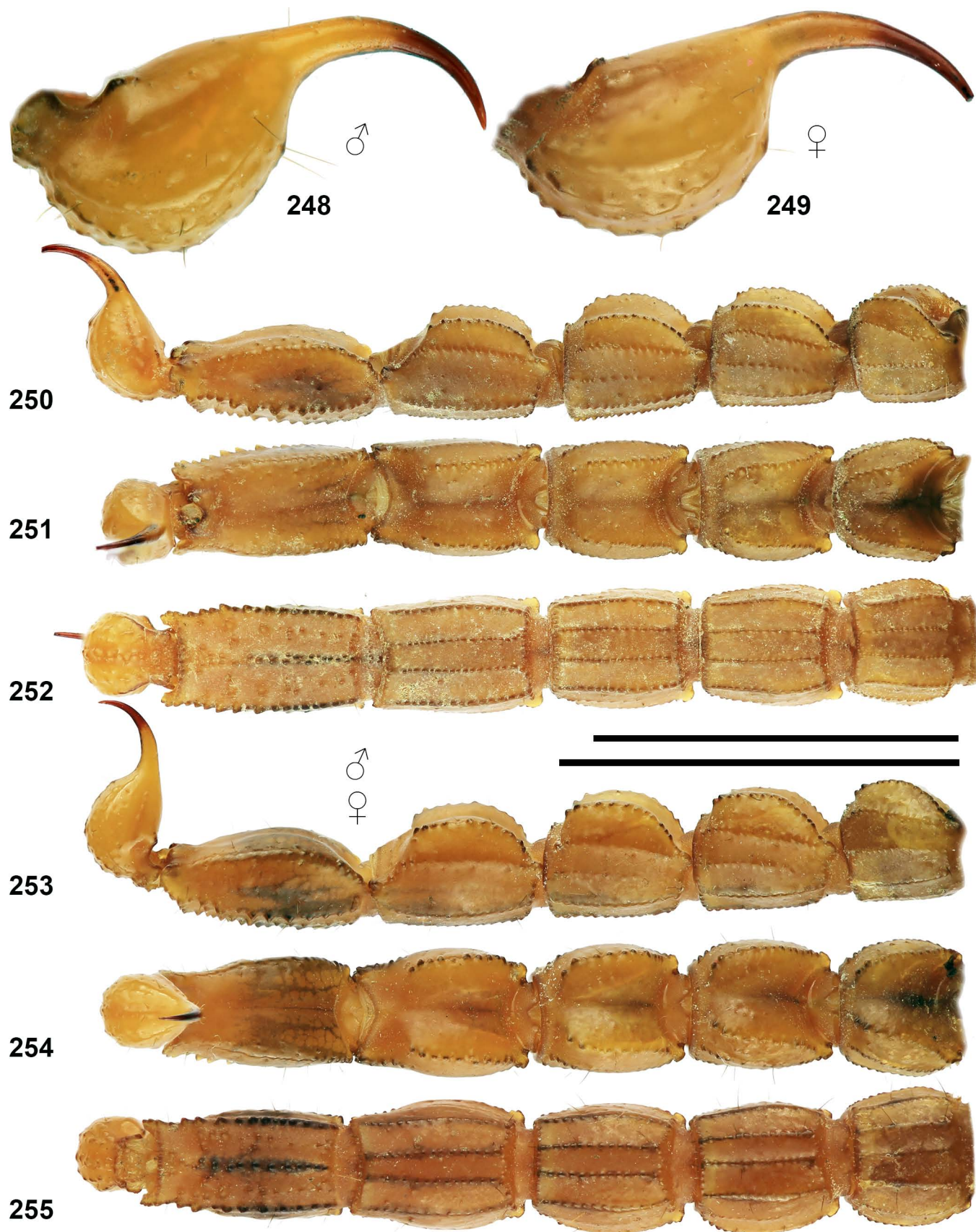
REFERENCES:

- Mesobuthus eupeus philippovitschi*: Mirshamsi et al., 2010: 2867 (in part); Mirshamsi et al., 2011a: 8 (in part).
Mesobuthus eupeus: Mirshamsi et al., 2011b: 20 (in part).
Mesobuthus eupeus eupeus: Navidpour et al., 2019: 4–5, fig. 55 (in part; Alborz and Tehran Provinces).

TYPE MATERIAL (NMPC). **Iran, Alborz Province**, Karaj–Baraghan road, 35°54'36.7"N 50°58'22"E (35.90°N 50.97°E), 770 m a. s. l. (Locality No. Al-101), June 2013, 4♂1♀ (paratypes), leg. Rabiei, Barzegar and Fallahpour; Ateshgah-Baraghan road, 336 m a. s. l., 35°55'52.9"N 50°57'30.6"E (35.92°N 50.95°E) (Locality No. Al-113), June 2013, 1♂ (paratype), leg. Rabiei, Barzegar and Fallahpour, NMPC; Taleghan–Ebrahim Abad, 36°07'21.8"N 50°40'04"E (36.12°N 50.67°E), 2249 m a. s. l. (Locality No. Al-117), June 2013, 1♂1♀ (paratypes), leg. Rabiei, Barzegar and Fallahpour; Taleghan to Gerdab, 36°09'37.1"N 51°08'35.7"E (36.15°N 51.13°E), 2560 m a. s. l. (Locality No. Al-121), June 2013, 1♂1♀ (paratypes), leg. Rabiei, Barzegar and Fallahpour; **Mazandaran Province**, Damavand Polur, 1♀juv. (paratype), 7 April 1995, leg. M. Kafka, NMPC; Chalus–Karaj, Marzan Abad (36.45°N 51.28°E), 1 June 1997, 3♀ (paratypes), leg. M. Kafka, NMPC; 5 km E of Razan, 36°10'N 52°14'E (36.17°N 52.23°E), 14 May 1997, 1000 (1124) m a. s. l., 1♂ (paratype), leg. M. Kaftan; Reyneh, 35°50'N 52°02'E (35.83°N 52.03°E), 2250 m a. s. l., 15 May 1997, 2♂ims.2♀ (paratypes), leg. M. Kaftan; Alborz Mts. N slopes, Vali Abad Village env., 36°14'N 51°18'E (36.23°N 51.30°E), 1800–2500 m a. s. l., 8–10 May 1996, 3♂6♀5juvs. (holotype and paratypes, Figs. 244–285), leg. D. Král, 4♀1juv. (paratypes), leg. V. Šejna; **Semnan Province**, 35°26'25.9"N 53°02'48.1"E (35.43°N 53.03°E), 2015, (SE-91611), 1♂3♀ (paratypes), leg. S. Navidpour et al.; **Tehran Province**, south of Varamin, Hassan Abad road, 35°17'17"N 51°25'18"E (35.28°N 51.42°E), 886 m a. s. l. (Locality No. Teh-119), May 2012, 2♂2♀ (paratypes), leg. Rabiei, Barzegar and Fallahpour, NMPC; Tehran–Jajrood road, 35°43'55"N 51°41'17"E (35.72°N 51.68°E), 1591 m a. s. l. (Locality No. Teh-123), May 2012, 1♂1♀ (paratypes), leg. Rabiei, Barzegar and Fallahpour, NMPC.



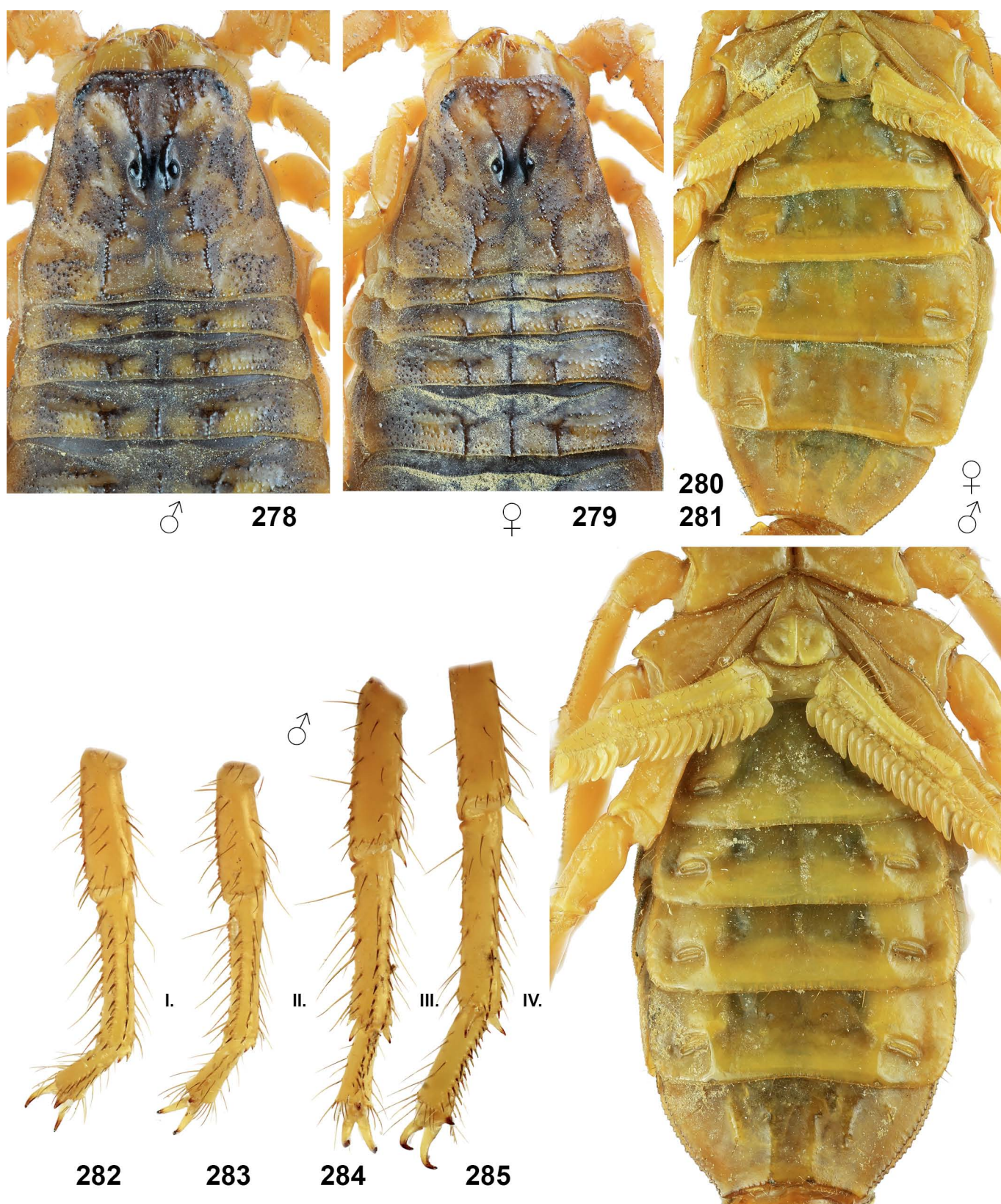
Figures 244–247: *Mesobuthus farleyi* sp. n. Figures 244–245. Male holotype, dorsal (244) and ventral (245) views. Figures 246–247. Female paratopotype, dorsal (246) and ventral (247) views. Scale bar: 10 mm.



Figures 248–255: *Mesobuthus farleyi* sp. n. **Figures 248, 250–252.** Male holotype, telson lateral (248), metasoma and telson, lateral (250), dorsal (251), and ventral (252) views. **Figures 249, 253–255.** Female paratopotype, telson lateral (249), metasoma and telson, lateral (253), dorsal (254), and ventral (255) views. Scale bars: 10 mm (250–252, 253–255).



Figures 256–277: *Mesobuthus farleyi* sp. n., pedipalp. **Figures 256–266.** Male holotype, chela, dorsal (256), external (257), and ventral (258) views. Patella, dorsal (259), external (260) and ventral (261) views. Femur and trochanter, internal (262), dorsal (263), and ventral (264) views. Movable (265) and fixed (266) fingers. **Figures 267–277.** Female paratopotype, chela, dorsal (267), external (268), and ventral (269) views. Patella, dorsal (270), external (271) and ventral (272) views. Femur and trochanter, internal (273), dorsal (274), and ventral (275) views. Movable (276) and fixed (277) fingers. The trichobothrial pattern is indicated in Figures 256–260, 262–263.



Figures 278–285: *Mesobuthus farleyi* sp. n. Figures 278, 281–285. Male holotype, chelicerae, carapace and tergites I–IV (278), sternopectinal region and sternites (281), and left legs I–IV, retrolateral aspect (282–285). Figures 279–280. Female paratopotype, chelicerae, carapace and tergites I–IV (279), sternopectinal region and sternites (280).t

OTHER MATERIAL EXAMINED. **Iran, Mazandaran Province**, Simili, 12 October 1998, 1♂, leg. M. Kaftan, FKCP; **Tehran Province**, Firooz Kooh–Sharabad road, 35°47'42"N 52°43'19"E (35.78°N 52.72°E), 2134 m a. s. l. (Locality No. Teh-112), May 2012, 2♂1♀, leg. Rabiei, Barzegar and Fallahpour, NMPC; Firooz Kooh–Arjand road, 35°45'07"N 52°39'21"E (35.75°N 52.65°E), 1929 m a. s. l. (Locality No. Teh-110), May 2012, 2♂, leg. Rabiei, Barzegar and Fallahpour, NMPC.

DNA DATA. *Mesobuthus farleyi* sp. n., in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their survey of Iranian *Mesobuthus* (five DNA sequences from the Mazandaran Province, Kordichal, 36.51°N, 51.21°E) (Table 16).

ETYMOLOGY. The new species is named in honor of our esteemed colleague Roger D. Farley (Riverside, California, USA) for his great contributions to scorpion biology over many decades, including his mentoring of PhD studies of both Gary Polis and Philip Brownell.

DIAGNOSIS. Total length of adults 35 mm (male) to 50 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est* or in level with *est*. Male with fingers proximally slightly more twisted than female. Pedipalp chela length/width ratio 3.2–3.6 in both sexes. Pectinal teeth number 22–26 in male, 18–21 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites yellowish brown, strongly black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of granules on metasomal segments II and III; segment V with 5 carinae. Metasoma IV with lateromedian carinae smooth or granulated in female and granulated in male, all other carinae granulated. Intercarinal surfaces on metasoma I laterally smooth or finely granulated in male. Length to depth ratio of metasoma III 1.18–1.47 in male, 1.2–1.3 in female; metasoma IV 1.45–1.70 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–9 retroinferior macrosetae on basitarsus III. Telson elongated. Anal lobe divided into three parts.

DESCRIPTION. Total length of adult males 35–45 mm, females 45–50 mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est* or in level with *est*. Male has the fingers proximally slightly more twisted than female. Female has longer and very slightly

narrower chela of pedipalps. For measurements, see Table 3.

Coloration (Figs. 244–247). Carapace and tergites are yellowish brown, strongly black pigmented. Metasoma, telson, pedipalps and legs are yellowish brown. Metasoma ventral, mainly segment V black pigmented. Chelicerae yellow, without reticulation, the tips of denticles on cheliceral fingers are black.

Mesosoma and carapace (Figs. 278–281). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacarinata. Pectinal tooth count is 22–26 in males, 18–21 in females. Pectinal marginal tips extend to about end of sternite IV in males and half of sternite IV in females. Pectines have three marginal lamellae and sixth to eight middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. All sternites are smooth and sparsely hirsute. Sternite VII with four well marked, usually granulated carinae. Other sternites have two furrows.

Pedipalps (Figs. 256–277). Pedipalps sparsely hirsute and smooth, only femur is sparsely granulated. Femur has four to five granulated carinae, the middle carina on internal surface consists of strong irregular granules. Patella with eight carinae, of which internal are always and dorsal are usually granulated. Chela without carinae. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 282–285). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–9 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate on legs III and IV and absent on the other legs.

Metasoma and telson (Figs. 248–252). All metasomal segments only very sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma IV with lateromedian carinae smooth or granulated in female and granulated in male, all other carinae granulated. All other carinae with consistent granules. Intercarinal surfaces on metasoma laterally smooth or finely granulated in male. Ventrolateral carinae of metasoma V posteriorly with several large lobate denticles. Telson is only sparsely hirsute, elongate, bumpy and smooth. Anal lobe divided into three parts.

COMMENTS. Species *M. farleyi* sp. n., *M. eupeus*, *M. iran*, and *M. persicus* are morphologically very similar, cryptic taxa and their validity is confirmed mainly by DNA analysis. Characters used in the key below could show intraspecific variability.

DISTRIBUTION. Iran (Alborz, Mazandaran, Semnan, and Tehran Provinces) (Figs. 1155, 1157).

***Mesobuthus fomichevi* sp. n.**

(Figures 286–325, 1155, 1158, Table 4)

<http://zoobank.org/urn:lsid:zoobank.org:act:1C142653-99E8-4F9D-ADDE-F7516ADA5E15>

TYPE LOCALITY AND TYPE REPOSITORY. **Tajikistan, Khatlon Province**, E foothill of Aruktau Mt. Range, between Khumdon and Sambuli Villages, 37°50.210'N 68°35.872'E (37.83°N 68.60°E), 420 m a. s. l., NMPC.

TYPE MATERIAL. **Tajikistan, Khatlon Province**, E foothill of Aruktau Mt. Range, between Khumdon and Sambuli Villages, 37°50.210'N 68°35.872'E (37.83°N 68.60°E), 420 m a. s. l., 5 April 2019, 1♂ (holotype), leg. A. A. Fomichev, NMPC; Dzhilantau Mt. Range, 2 km E Kuybulon Village, 37°53.970'N 69°23.155'E (37.90°N 69.38°E), 970–1200 m a. s. l., 14 April 2019, 1♀ (paratype), leg. A. A. Fomichev, NMPC. **Uzbekistan, Surxondaryo Province**, Uzun District, Babatag Mts, east slope, 7 km W of Okmachit, 38.0275°N 68.2458°E, 734–763 m a. s. l., 4 May 2002, 3 juvs. (paratypes), leg. V. Fet (NG-009), NMPC.

ETYMOLOGY. The new species is named in honor of our colleague Alexander A. Fomichev (Barnaul, Russia) whose tireless collecting in Asian deserts and mountains allowed to discover many new spider and scorpion taxa.

DNA DATA. *Mesobuthus fomichevi* sp. n. was represented in our survey by a single DNA sequence from the Babatag Mts. in Uzbekistan (Table 16).

DIAGNOSIS. Total length of adults 45 mm (male) to 55 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally slightly more twisted than female. Pedipalp chela length/width ratio 2.66 in male and 3.14 in female. Pectinal teeth number 21–22 in male, 18–20 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites yellowish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae. Chela lacks carinae. Movable fingers of pedipalps with 12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII with 4 well marked smooth or granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma IV with lateromedian carina smooth in male but present and granulated in female, all other carinae granulated. Length to depth ratio of metasoma III 1.12–1.35, metasoma IV 1.52–1.60 in both sexes. Telotarsus III ventral setation represented

by short and strong spiniform setae. Tarsi hirsute, in adults with 6–9 retroinferior macrosetae on basitarsus III. Telson bulbous. Anal lobe divided into two parts.

DESCRIPTION. Total length of adult male 45 mm, 55 female. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally slightly more twisted than female. Female has longer and very slightly narrower chela of pedipalps. For measurements, see Table 4.

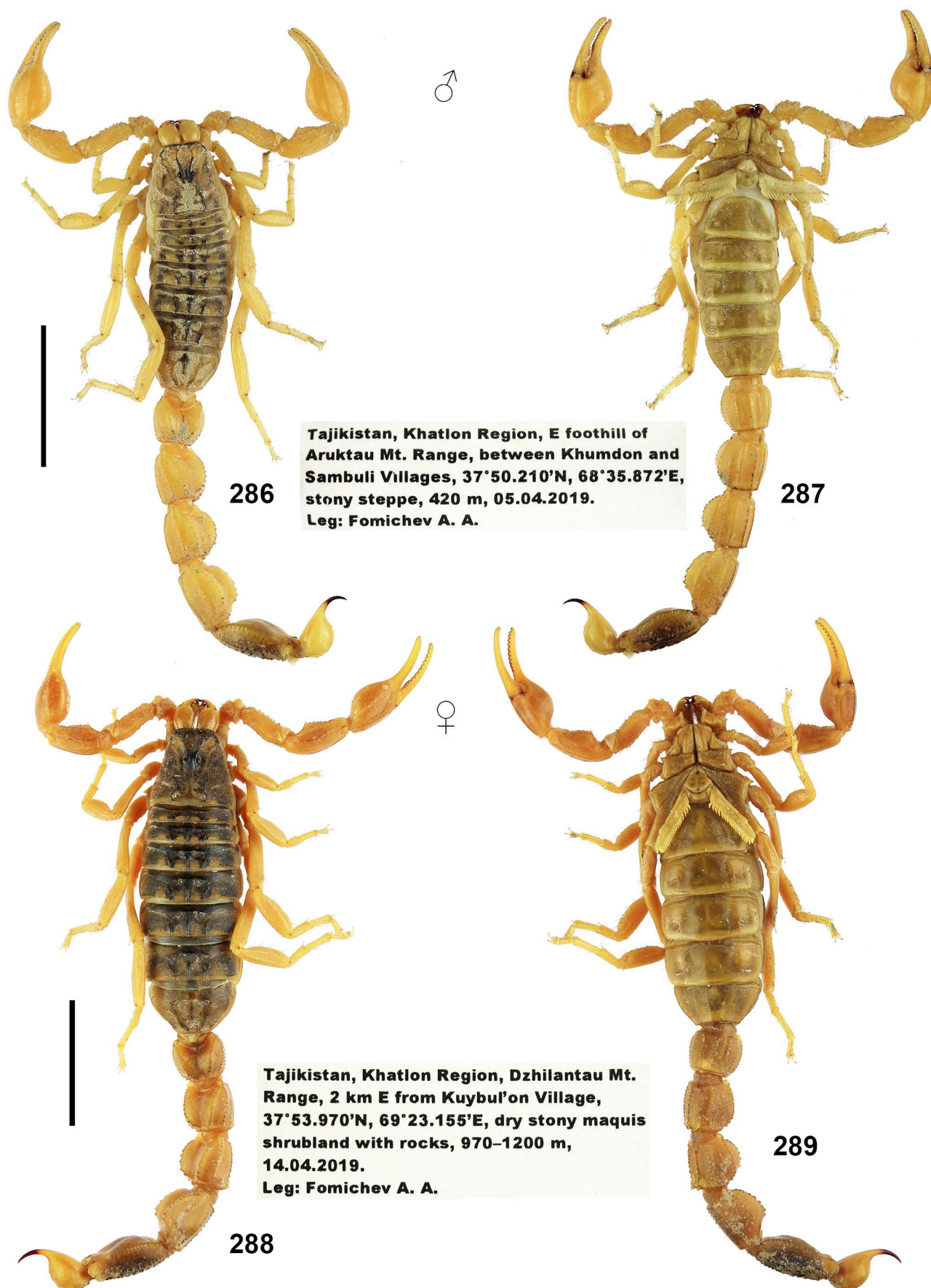
Coloration (Figs. 286–289). Carapace and tergites are yellowish brown, strongly black pigmented. Metasoma, telson, pedipalps and legs are yellowish brown. Metasoma ventral, mainly segment V black pigmented. Chelicerae yellow, without reticulation, the tips of denticles on chelical fingers are black.

Mesosoma and carapace (Figs. 318–321). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacarinata. Pectinal tooth count is 21–22 in male, 18–20 in female. Pectinal marginal tips extend to about third of sternite IV in male and end of the third sternite in females. Pectines have three marginal lamellae and sixth to eight middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. All sternites are smooth and sparsely hirsute. Sternite VII with four well marked, usually granulated carinae. Other sternites have two furrows.

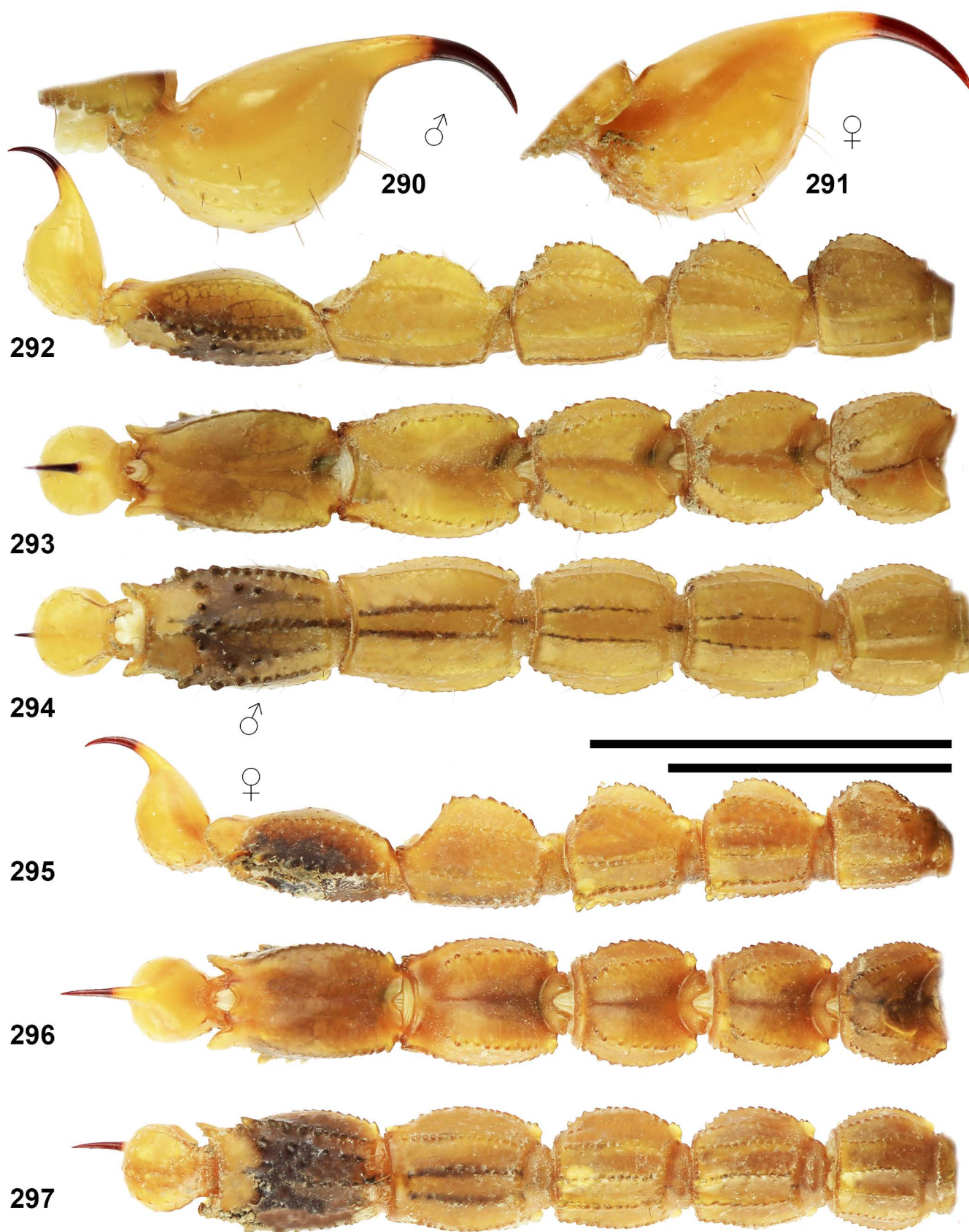
Pedipalps (Figs. 298–317). Pedipalps sparsely hirsute and smooth, only femur is sparsely granulated. Femur has four to five granulated carinae, the middle incomplete carina on internal surface consists of several irregular granules. Patella with eight carinae, of which internal are always and dorsal are usually granulated. Chela without carinae. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 322–325). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 6–9 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate on third and strong on fourth legs and absent on the other legs.

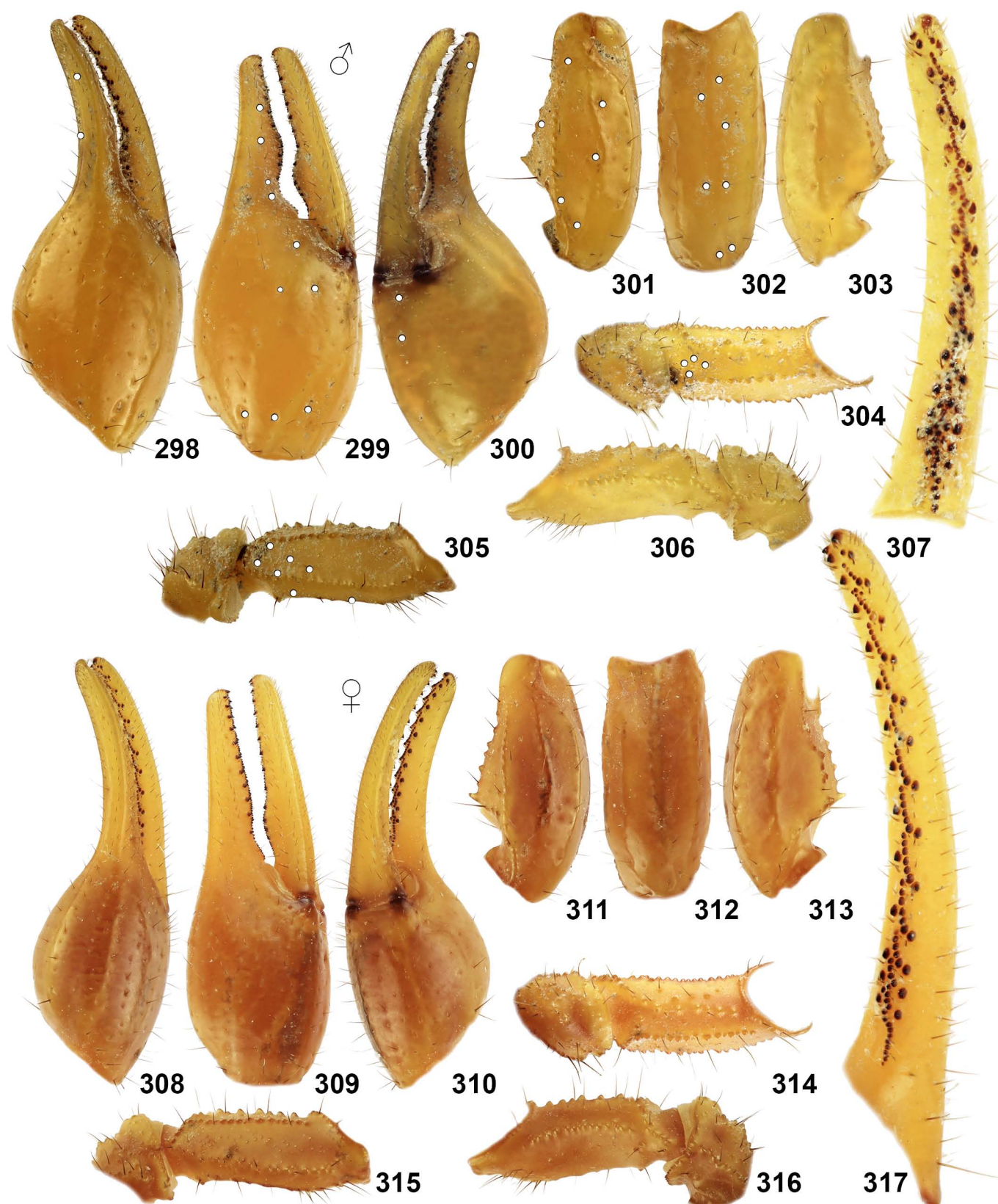
Metasoma and telson (Figs. 290–297). All metasomal segments only very sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma IV with lateromedian carinae smooth in male and granulated in female, all other carinae granulated. All other carinae with consistent granules. Intercarinal surfacess on metasoma smooth in both sexes. Ventrolateral carinae of metasoma V posteriorly with several large lobate denticles. Telson is only sparsely hirsute, bulbous, bumpy and smooth.



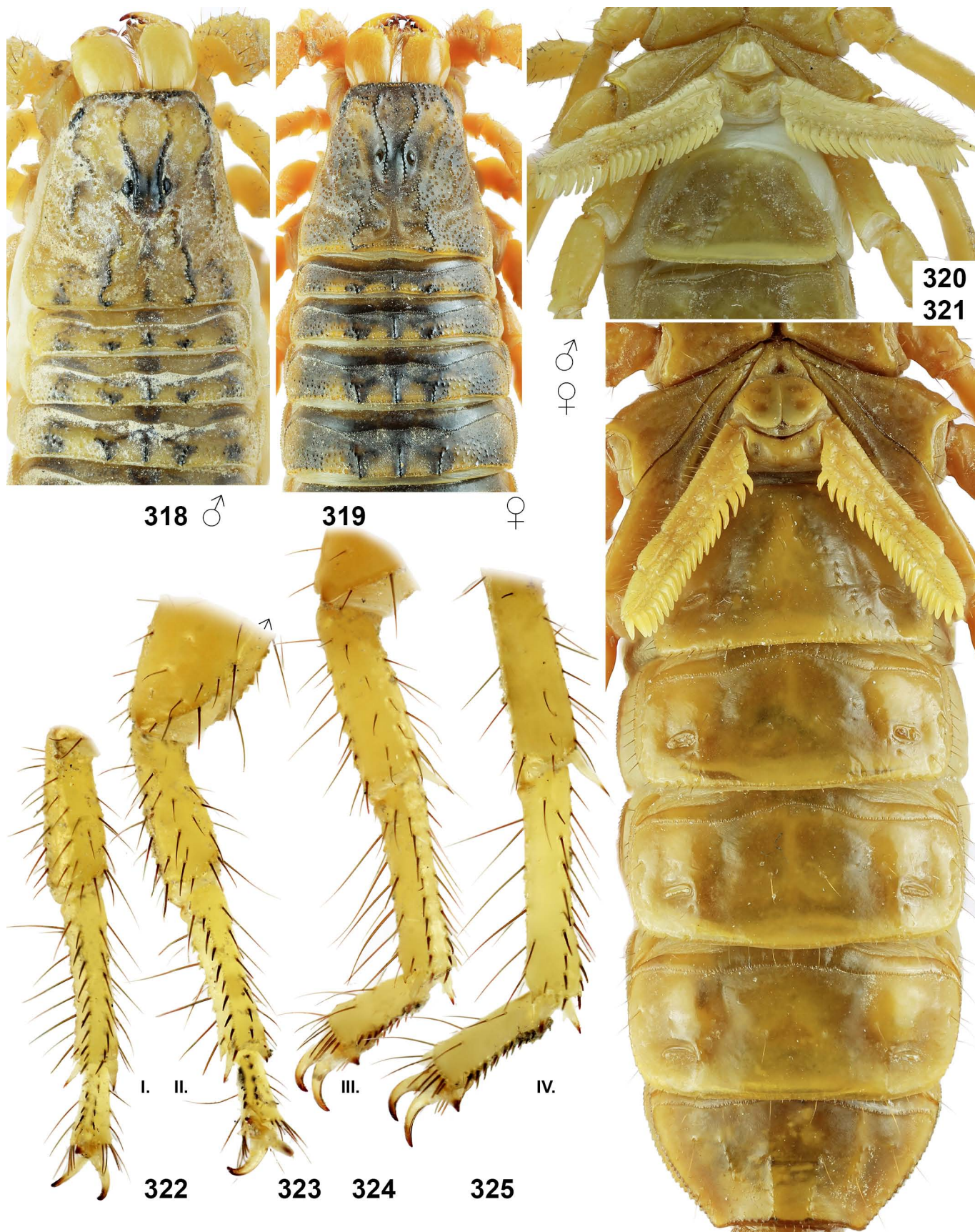
Figures 286–289: *Mesobuthus fomichevi* sp. n. **Figures 286–287.** Male holotype, dorsal (286) and ventral (287) views. **Figures 288–289.** Female paratype, dorsal (288) and ventral (289) views. Scale bars: 10 mm (286–287, 288–289).



Figures 290–297: *Mesobuthus fomichevi* sp. n. **Figures 290, 292–294.** Male holotype, telson lateral (290), metasoma and telson, lateral (292), dorsal (293), and ventral (294) views. **Figures 291, 295–297.** Female paratype, telson lateral (291), metasoma and telson, lateral (295), dorsal (296), and ventral (297) views. Scale bars: 10 mm (292–294, 295–297).



Figures 298–317: *Mesobuthus fomichevi* sp. n., pedipalp. **Figures 298–307.** Male holotype, chela, dorsal (298), external (299), and ventral (300) views. Patella, dorsal (301), external (302) and ventral (303) views. Femur and trochanter, internal (304), dorsal (305), and ventral (306) views. Movable finger (307). **Figures 308–317.** Female paratype, chela, dorsal (308), external (309), and ventral (310) views. Patella, dorsal (311), external (312) and ventral (313) views. Femur and trochanter, internal (314), dorsal (315), and ventral (316) views. Movable finger (317). The trichobothrial pattern is indicated in Figures 298–302, 304–305.



Figures 318–325: *Mesobuthus fomichevi* sp. n. **Figures 318, 320, 322–325.** Male holotype, chelicerae, carapace and tergites I–III (318), sternopectinal region and sternite III (320), and left legs I–IV, retrolateral aspect (322–325). **Figures 319, 321.** Female paratype, chelicerae, carapace and tergites I–IV (319), sternopectinal region and sternites (321).

Dimensions (mm)		<i>M. fomichevi</i> sp. n.	<i>M. fomichevi</i> sp. n.	<i>M. galinae</i> sp. n.	<i>M. galinae</i> sp. n.
		♂ holotype	♀ paratype	♂ holotype	♀ paratype
Carapace	L / W	5.00 / 5.30	6.08 / 6.86	3.93 / 4.22	6.34 / 7.05
Mesosoma	L	12.92	18.14	8.47	14.06
Tergite VII	L / W	3.28 / 5.02	4.09 / 6.88	1.92 / 4.09	3.25 / 7.32
Metasoma + telson	L	26.67	30.11	20.29	31.64
Segment I	L / W / D	3.47 / 3.51 / 3.00	3.73 / 4.19 / 3.82	2.46 / 2.52 / 2.42	3.76 / 4.29 / 3.77
Segment II	L / W / D	3.98 / 3.53 / 2.99	4.10 / 4.06 / 4.02	2.87 / 2.41 / 2.35	4.52 / 4.25 / 3.71
Segment III	L / W / D	4.03 / 3.66 / 3.08	4.38 / 4.23 / 3.89	2.93 / 2.48 / 2.36	4.79 / 4.27 / 3.85
Segment IV	L / W / D	4.69 / 3.50 / 2.94	5.32 / 4.29 / 3.45	3.59 / 2.70 / 2.13	5.73 / 4.28 / 3.79
Segment V	L / W / D	5.58 / 3.30 / 2.46	6.60 / 3.83 / 2.91	4.49 / 2.23 / 1.88	6.87 / 3.89 / 3.14
Telson	L / W / D	4.92 / 2.36 / 2.17	5.98 / 2.85 / 2.59	3.95 / 1.67 / 1.51	5.97 / 3.00 / 2.64
Pedipalp	L	16.54	19.11	13.3	20.44
Femur	L / W	3.98 / 1.42	4.60 / 1.66	3.07 / 1.02	4.95 / 1.74
Patella	L / W	4.76 / 1.92	5.36 / 2.40	3.72 / 1.50	5.78 / 2.43
Chela	L	7.80	9.15	6.51	9.71
Manus	W / D	2.93 / 3.00	2.91 / 3.20	1.75 / 1.77	3.03 / 3.13
Movable finger	L	4.36	5.80	3.56	5.84
Total	L	44.59	54.33	32.69	52.04

Table 4. Comparative measurements of *Mesobuthus fomichevi* sp. n. and *M. galinae* sp. n. types. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

COMMENTS. This species has been collected by V. F. at the eastern slope of the Babatag Mts. in Uzbekistan, very close to the Tajikistan border, where it is sympatric with both *Olivierus kreuzbergi* (Fet et al., 2018) (Buthidae) and a remarkable scorpion relict *Pseudochactas ovchinnikovi* Gromov, 1998 (Pseudochactidae). Within the Babatag Mts., *M. fomichevi* is allopatric with *M. barszczewskii* (Birula, 1904), which is found at the western slope of this mountain range (see above).

So far this is the only *Mesobuthus* confirmed for Tajikistan. We do not have matching specimens for a Tajikistan population from Khujand sequenced by Shi et al. (2013), so we did not include it in our analysis.

DISTRIBUTION. Tajikistan, Uzbekistan (Fig. 1155, 1158).

Mesobuthus galinae sp. n.

(Figures 326–364, 1155, 1158, 1169, Table 4)

<http://zoobank.org/urn:lsid:zoobank.org:act:D625796C-166A-4037-900D-62A53BE66C33>

TYPE LOCALITY AND TYPE REPOSITORY. **Turkmenistan, Akhal Province**, foothills of Kopetdagh Mts., Geoktepe, 38°09'45"N 57°40'05"E (38.16°N 57.79°E); NMPC.

REFERENCES (selected):

Buthus cognatus: Simon, 1889: 386.

Buthus eupeus thersites: Birula, 1905b: 122; Birula, 1917a: 41 (in part).

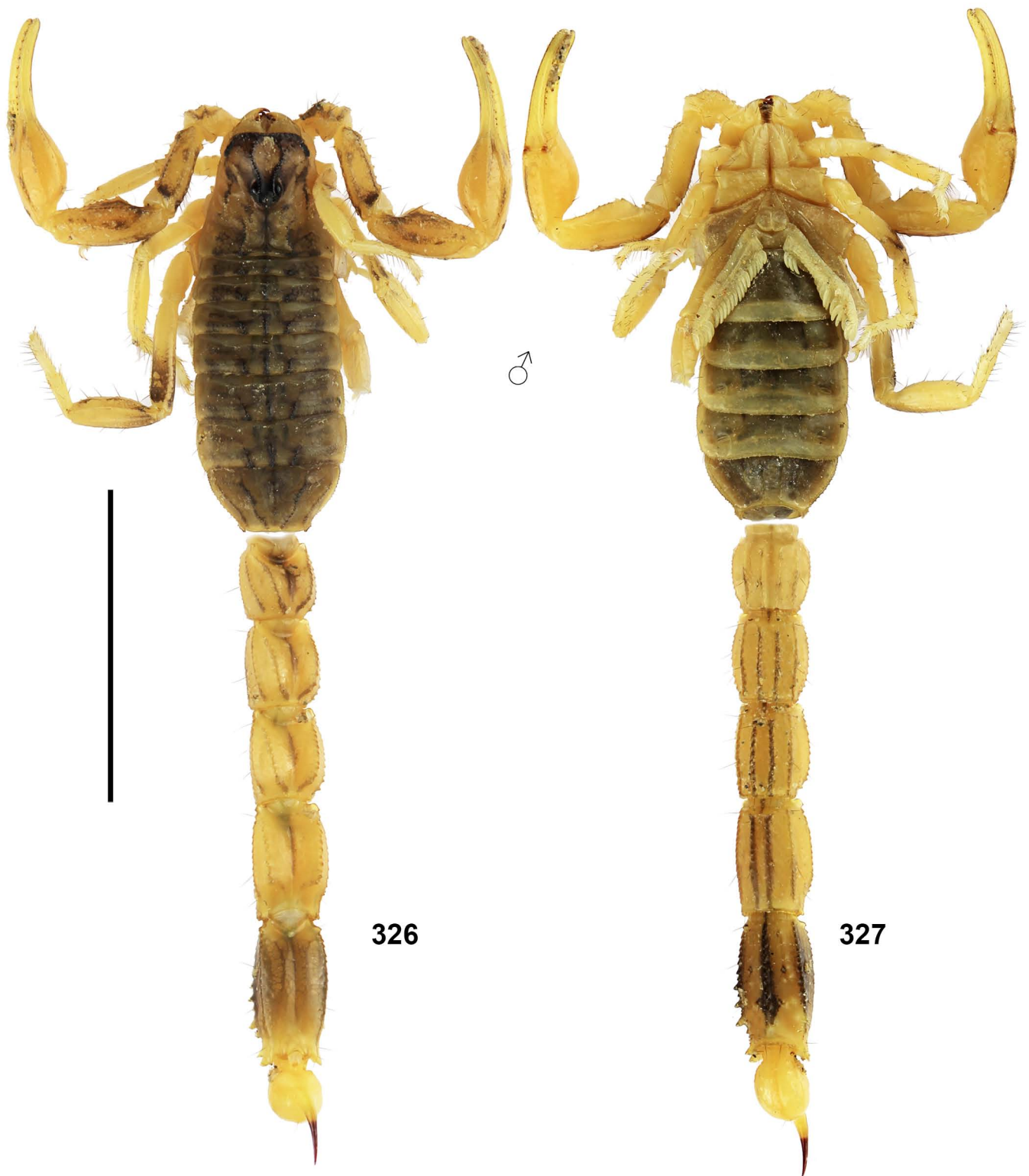
Mesobuthus eupeus thersites: Fet, 1989: 91–99 (in part; complete references list for the former USSR); Fet, 1994:

526 (in part); Fet & Lowe, 2000: 175 (in part; complete references list until 1998).

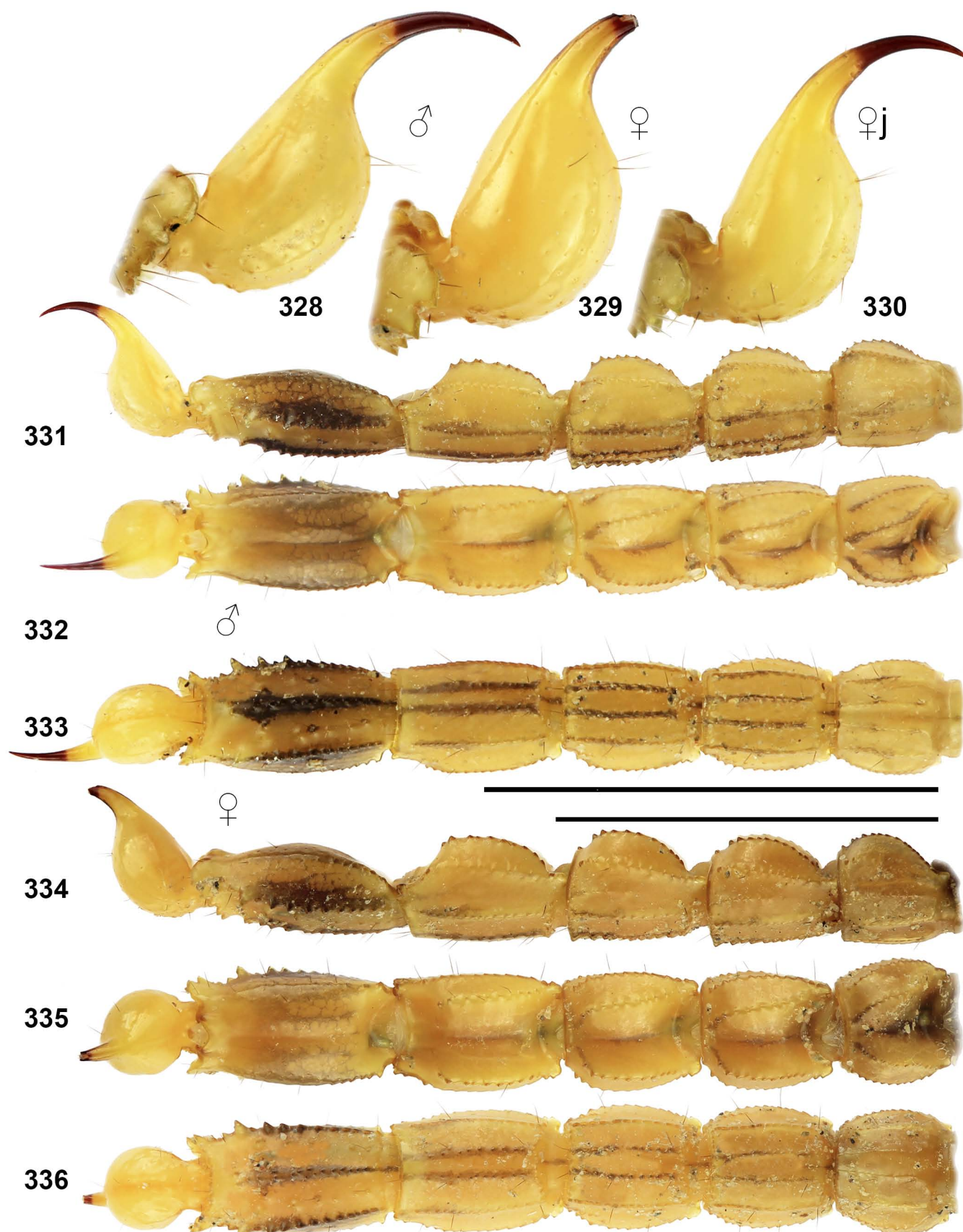
TYPE MATERIAL. **Turkmenistan, Akhal Province**, Bakharden (38.43°N 57.39°E), 1♀ (paratype), 24 June 1992, leg. M. Snížek, FKCP; Chuli (37.97°N 58.02°E), 12–13 April 1990, 2♀1♂ (paratypes), leg. M. Kafka, FKCP; Geoktepe (38.15°N 57.92°E), 1♀ (paratype, Tab. 4), April 1990, leg. A. Shestopalov, FKCP; Geoktepe, 38°09'45"N 57°40'05"E (38.16°N 57.79°E), 30 March 2002, 130 m a. s. l., 1♂ (holotype, Figs. 326–328, 331–333, 337–346, 357–358) 1♀ (paratype, incomplete, Figs. 329, 334–336, 347–356), leg. A. Gromov (NG-093), NMPC; Gyavers District, ca 1 km SSE of Berzengi, N foothills of Central Kopetdagh Mts., 37°52'19"N 58°23'33"E (37.87°N 58.33°E), 423 m a. s. l., 30 March 2002, 2juvs. (paratypes), leg. A. Gromov (NG-067), NMPC; E of Chagaly, 38°08'09"N 58°29'03"E (38.13°N 58.48°E), 129 m a. s. l., 31 March 2002, 1♀juv. (paratype, Figs. 359–364), leg. A. Gromov (NG-081), NMPC; **Balkan Province**, Nebit Dagh (39.53°N 54.27°E), 2♀1♂ (paratypes), May 1989, leg. S. Bečvář, FKCP.

DNA DATA. *Mesobuthus galinae* sp. n. was represented in our survey by two DNA sequences from the Akhal Province in the foothills of the Central Kopetdagh Mts. (Berzengi and Chagaly) (Table 16).

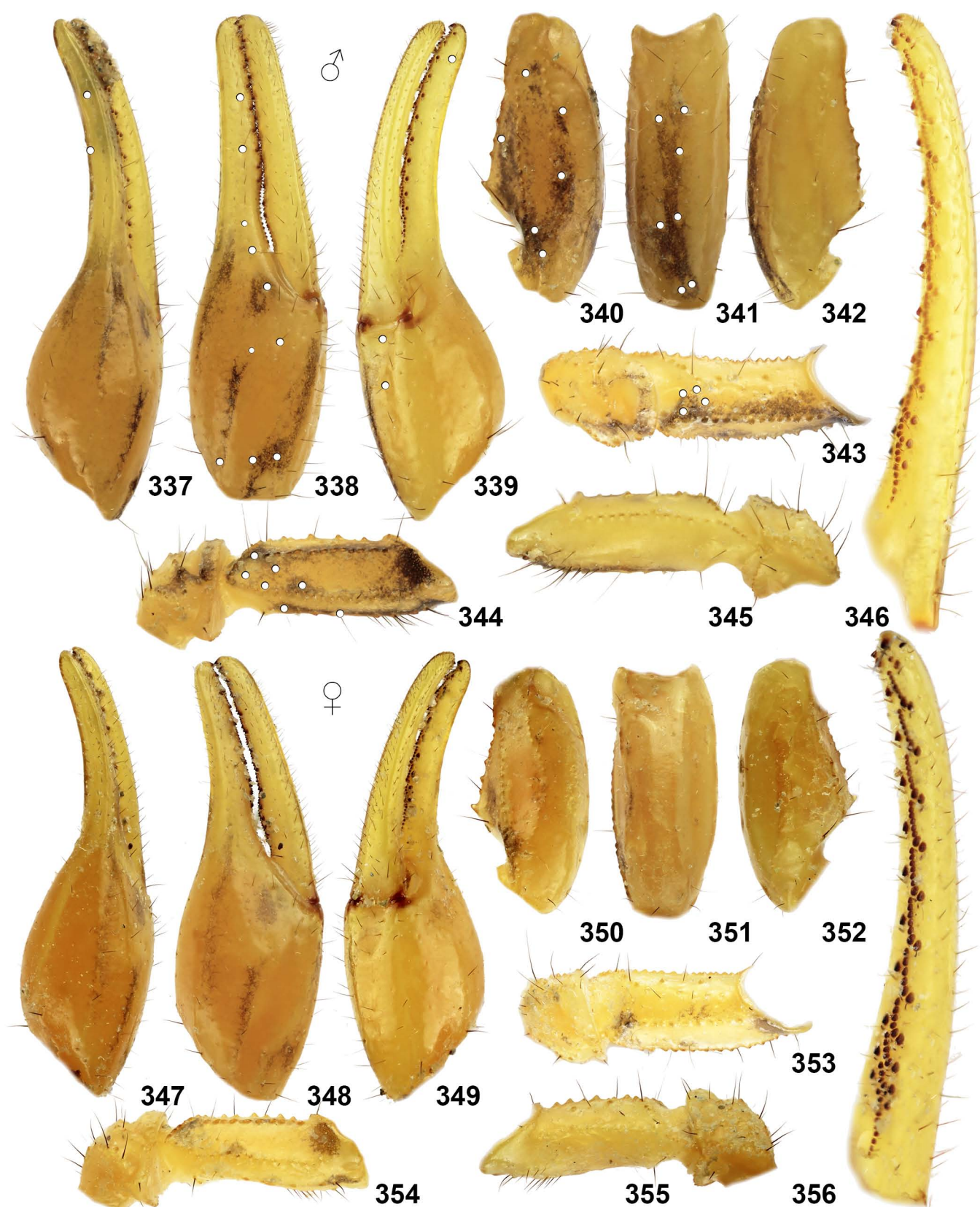
ETYMOLOGY. The new species is named in honor of Galina N. Fet (Huntington, West Virginia).



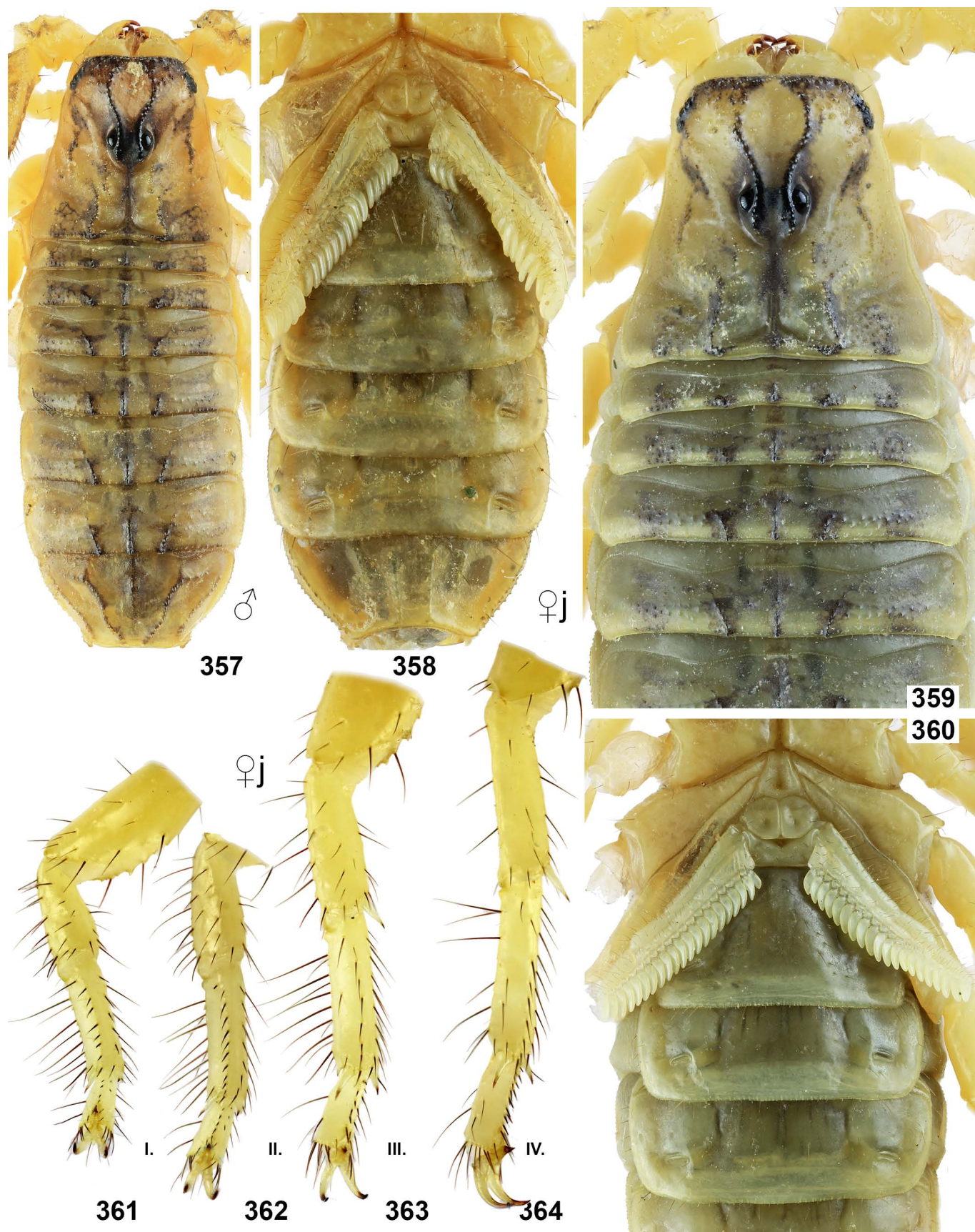
Figures 326–327: *Mesobuthus galinae* sp. n., male holotype, dorsal (326) and ventral (327) views. Scale bar: 10 mm.



Figures 328–336: *Mesobuthus galinae* sp. n. **Figures 328, 331–333.** Male holotype, telson lateral (328), metasoma and telson, lateral (331), dorsal (332), and ventral (333) views. **Figures 329, 334–336.** Female paratype, telson lateral (329), metasoma and telson, lateral (334), dorsal (335), and ventral (336) views. **Figure 330.** Female juvenile paratype, telson lateral. Scale bars: 10 mm (331–333, 334–336).



Figures 337–356: *Mesobuthus galinae* sp. n., pedipalp. **Figures 337–346.** Male holotype, chela, dorsal (337), external (338), and ventral (339) views. Patella, dorsal (340), external (341) and ventral (342) views. Femur and trochanter, internal (343), dorsal (344), and ventral (345) views. Movable finger (346). **Figures 347–356.** Female paratype, chela, dorsal (347), external (348), and ventral (349) views. Patella, dorsal (350), external (351) and ventral (352) views. Femur and trochanter, internal (353), dorsal (354), and ventral (355) views. Movable finger (356). The trichobothrial pattern is indicated in Figures 337–341, 343–344.



Figures 357–364: *Mesobuthus galinae* sp. n. **Figures 357–358.** Male holotype, chelicerae, carapace and tergites (357), sternopectinal region and sternites (358). **Figures 359–364.** Female juvenile paratype, chelicerae, carapace and tergites I–IV (359), sternopectinal region and sternites III–V (360) and left legs I–IV, retrolateral aspect (361–364).

DIAGNOSIS. Total length of adults 32 mm (male) to 53 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, very near to *est*. Both sexes with fingers proximally slightly twisted. Pedipalp chela length/width ratio 3.2 in female and 3.72 in male. Pectinal teeth number 20–22 in male, 19–21 in female. Chelicerae yellow, without reticulation. Metasoma sparsely hirsute. Carapace sparsely granulated. Carapace and tergites yellowish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma I laterally smooth. Length to depth ratio of metasoma III 1.24, metasoma IV 1.5–1.7 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 10–13 retroinferior macrosetae on basitarsus III. Telson elongated. Anal lobe divided into two parts.

DESCRIPTION. Total length of adult males 32–45 mm, 45–55 females. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est* or in level with *est*. Both sexes have the fingers proximally slightly twisted. For measurements, see Table 4.

Coloration (Figs. 326–327). Carapace and tergites are yellowish brown, strongly black pigmented. Telson is yellow. Metasoma, pedipalps and legs are yellowish brown with dark spots. Metasoma ventral, mainly segment V black pigmented. Chelicerae yellow, without reticulation, the tips of denticles on cheliceraral fingers are black.

Mesosoma and carapace (Figs. 357–360). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacarinata. Pectinal tooth count is 20–22 in males, 19–21 in females. Pectinal marginal tips extend to about end of sternite IV in males and half of sternite IV in females. Pectines have three marginal lamellae and sixth to eight middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. All sternites are smooth and sparsely hirsute. Sternite VII with four well marked granulated carinae. Other sternites have two furrows.

Pedipalps (Figs. 337–356). Pedipalps hirsute and smooth or bumpy. Femur has four to five granulated carinae, the middle carina on internal surface consists of strong irregular granules. Patella with eight carinae, of which internal are always and

dorsal are usually granulated. Chela without carinae. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 361–364). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 10–13 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate to strong on legs III and IV and absent on the other legs.

Metasoma and telson (Figs. 328–336). All metasomal segments only sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma I laterally smooth or finely granulated in male. All other Intercarinal surfaces on metasoma smooth and bumpy in both sexes. Ventrolateral carinae of metasoma V and ventromedial carinae of metasoma II–III posteriorly with several large lobate denticles. Telson is only sparsely hirsute, elongate and smooth. Anal lobe divided into two parts.

COMMENTS. This new species is found in southwestern Turkmenistan, including northern foothills of the Kopetdag Mountain Range. Earlier it has not been distinguished from other Turkmenistan populations, all of which commonly were lumped under the subspecies *M. eupeus thersites*. It is possibly the same species as was first collected in Krasnovodsk (now Türkmenbashi) by Gustav Radde in March 1886 and listed under the name *Buthus cognatus* by Simon (1889). Fet (1994) noted existence of differences between the populations of Krasnovodsk and Repetek (the latter we now classify as *M. afghanus*).

DISTRIBUTION. Turkmenistan (Figs. 1155, 1158).

Mesobuthus haarlovi Vachon, 1958

(Figures 2–3, 5, 365–404, 1155, 1157, 1162, Tables 5, 15)
<http://zoobank.org/urn:lsid:zoobank.org:act:F1209912-0829-4C03-AC28-FD2A4712280E>

Mesobuthus eupeus haarlovi: Vachon, 1958: 160–166, figs. 39–46.

TYPE LOCALITY AND TYPE REPOSITORY. **Afghanistan, Bamyan Province**, Puistagoli, 3500 m a. s. l. (35.25°N 70.55°E); MNHN.

REFERENCES (selected):

- Mesobuthus eupeus haarlovi*: Fet, 1994: 527; Fet & Lowe, 2000: 173 (complete reference list until 1998); Kovařík & Whitman, 2005: 110.
Mesobuthus eupeus: Kovařík & Beron, 2015: 39 (in part: Afghanistan).
Mesobuthus haarlovi: Kovařík, 2019: 17.

Dimensions (mm)		<i>M. haarlovi</i> ♂ from Tarin kowt	<i>M. haarlovi</i> ♂ from Tarin kowt	<i>M. iranusi</i> ♂ lectotype	<i>M. iranusi</i> ♀ paralectotype
Carapace	L / W	4.80 / 5.14	5.97 / 6.85	5.02 / 5.35	5.08 / 5.77
Mesosoma	L	9.93	11.02	12.75	13.37
Tergite VII	L / W	2.84 / 5.05	3.21 / 6.60	3.45 / 5.29	3.32 / 5.87
Metasoma + telson	L	25.85	28.04	27.62	25.44
Segment I	L / W / D	3.29 / 3.44 / 3.12	3.57 / 3.95 / 3.43	3.45 / 3.57 / 3.10	3.22 / 3.26 / 2.88
Segment II	L / W / D	3.78 / 3.52 / 3.21	4.01 / 4.01 / 3.51	3.97 / 3.42 / 3.12	3.62 / 3.14 / 2.83
Segment III	L / W / D	4.00 / 3.52 / 3.35	4.08 / 3.92 / 3.60	4.09 / 3.19 / 3.12	3.67 / 3.12 / 2.75
Segment IV	L / W / D	4.46 / 3.42 / 3.15	4.57 / 3.89 / 3.37	4.81 / 3.25 / 3.04	4.33 / 2.98 / 2.61
Segment V	L / W / D	5.51 / 2.97 / 2.47	6.01 / 3.43 / 2.82	5.84 / 3.02 / 2.66	5.33 / 2.46 / 2.26
Telson	L / W / D	4.81 / 2.22 / 2.07	5.80 / 2.88 / 2.48	5.46 / 2.26 / 2.00	5.27 / 2.17 / 1.92
Pedipalp	L	16.62	18.98	18.4	16.53
Femur	L / W	3.97 / 1.41	4.48 / 1.64	4.23 / 1.42	3.89 / 1.35
Patella	L / W	4.77 / 2.01	5.38 / 2.39	5.44 / 2.05	5.04 / 2.15
Chela	L	7.88	9.12	8.73	7.60
Manus	W / D	2.54 / 3.06	2.99 / 3.22	2.81 / 2.88	2.23 / 2.06
Movable finger	L	4.66	4.89	4.96	4.69
Total	L	40.58	45.03	45.39	43.89

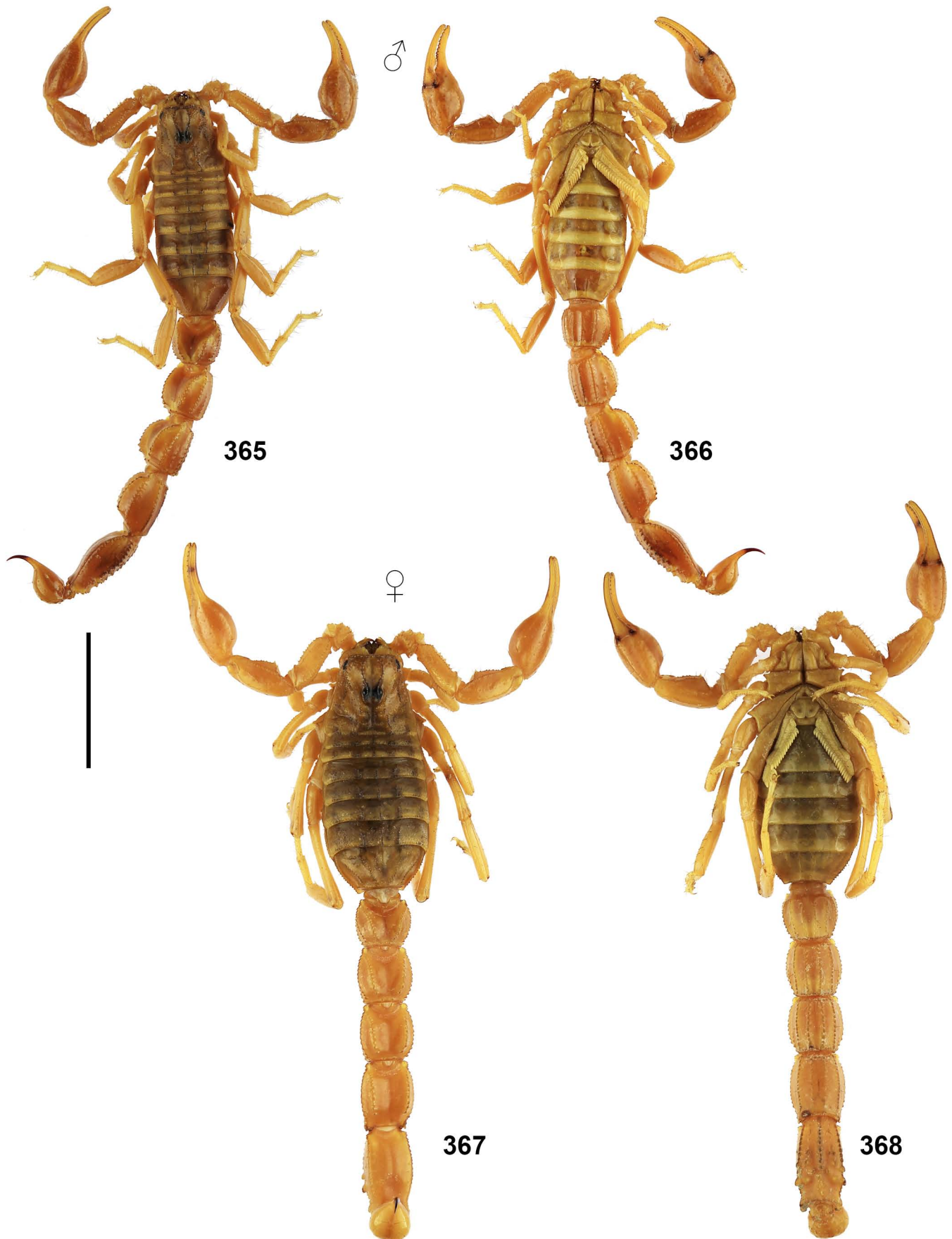
Table 5. Comparative measurements of *Mesobuthus haarlovi* and *M. iranusi* specimens. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

MATERIAL EXAMINED. **Afghanistan, Ghazni Province,** Malistan District (33.34°N 67.11°E), 3300 m a. s. l., 25–29 May 2009, 4♂5♀, leg. A. Stewart, NMPC; **Herat Province,** Bala Murghab (35.65°N 62.96°E), 470 m a. s. l., 4 July–21 September 1964, 1♀5juvs., leg. O. Jakeš, FKCP, MMBC; **Kabul Province,** Kabul (34.55°N 68.92°E), 2011, 1♀, VII.2012, 5♂3♀2juvs., January 2013, 1♀, leg. M. Misch, NMPC; May 2012, 1♂3♀, leg. M. Misch, NMPC; **Nangrahar Province,** Jalalabad (34.42°N 70.44°E), 28 January–30 March 1965, leg. Povolný, 3♂7♀7juvs., MMBC; Jalalabad, January–March 1965, leg. Povolný, 1♀, FKCP, 5♀, NMPC; 2 km SW of Jalalabad, 13 February 1966, 2juvs., leg. Povolný & Tenora, MMBC; Jalalabad, 13 February 1966, 1♀, leg. Povolný & Tenora, FKCP; 8 km ESE of Jalalabad, 16 February 1966, 2♀1juv., leg. Povolný & Tenora, MMBC; 10 km ESE Jalalabad, 620 m a. s. l., 19 February 1966, 3♀, MMBC; same locality, 21 February 1966, leg. Povolný & Tenora, 1♂, FKCP, 1♀2juvs., MMBC; same locality, 23 February 1966, 1♂, FKCP, leg. Povolný & Tenora; Jalalabad, 620 m a. s. l., 26 February 1966, 1♀, leg. Povolný & Tenora, NMPC; 8 km ESE Jalalabad, 620 m a. s. l., 28 February 1966, 1♀, leg. Povolný & Tenora, MMBC; same locality, 1 March 1966, 1♀, leg. Povolný & Tenora, MMBC; 12–20 km ESE Jalalabad, 600 m a. s. l., 7 March 1966, 1♂1♀, leg. Povolný & Tenora, MMBC; same locality, 8 March 1966, leg. Povolný & Tenora, 2♀, MMBC, 2♂1♀, NMPC; same locality, 16 March 1966, leg. Povolný & Tenora, 1♂, MMBC. **Paktika Province,** FOB Curry, Bandar near Gomal, Gowall Village and Surobi Village (32.76°N 69.05°E), 1900–2300 m a. s. l., 2009, 1♂, leg. A. Stewart,

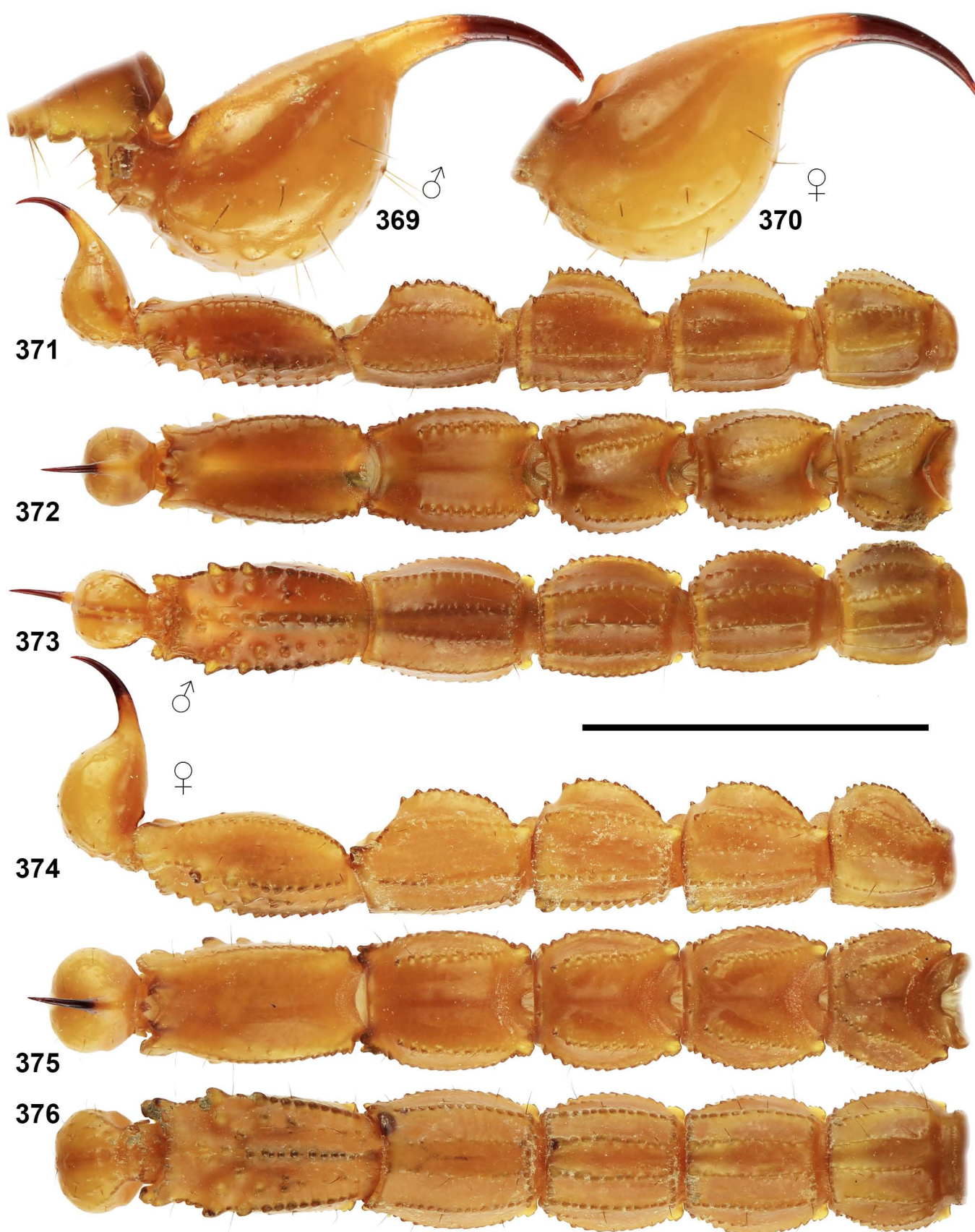
NMPC; Firebase Giro, Pana (33.09°N 68.33°E), 2100 m a. s. l., 13 August 2009, 1♂, leg. A. Stewart, NMPC; same locality, 17 July 2009, 2♂, leg. A. Stewart, NMPC; “Campo” (=base camp) (without data; Czech expedition 1977), 3♂3♀, NMPC; **Uruzgan Province,** Tarin Kowt, 32°37′52.29″N 65°52′06.56″E (32.62°N 65.87°E), 1300 m a. s. l., May 2010, 1♂1♀1♀juv., February 2011, 5♂19♀19juvs., July 2012, 9♂11♀1♀juv. (Figs. 365–404, No.20–23, 52–54), leg. M. Misch, NMPC; Khas (33.00°N 66.69°E), 2013, 2♀, leg. M. Misch, NMPC; Logar (33.98°N 68.74°E), 2♂, leg. M. Misch, NMPC. **Pakistan, Azad Kashmir,** Bagh (33.97°N 73.79°E), 12 June 2008, 1♀, leg. Z. Ahmed, NMPC; **Balochistan Province,** Loralai, Residential College (30.37°N 68.47°E), 27 August 2013, 1♀, leg. Z. Ahmed, NMPC; Quetta (30.18°N 66.88°E), 1 April 1993, 2♂12♀, 30 March–2 April 1993, 2♂5♀, leg. S. Bečvář, NMPC; Quetta, 13 May 2008, 10♂7♀, leg. Z. Ahmed, NMPC.

DNA DATA. *Mesobuthus haarlovi* was represented in our survey by a single DNA sequence from Afghanistan (Uruzgan Province, Tarin Kowt) (Table 16).

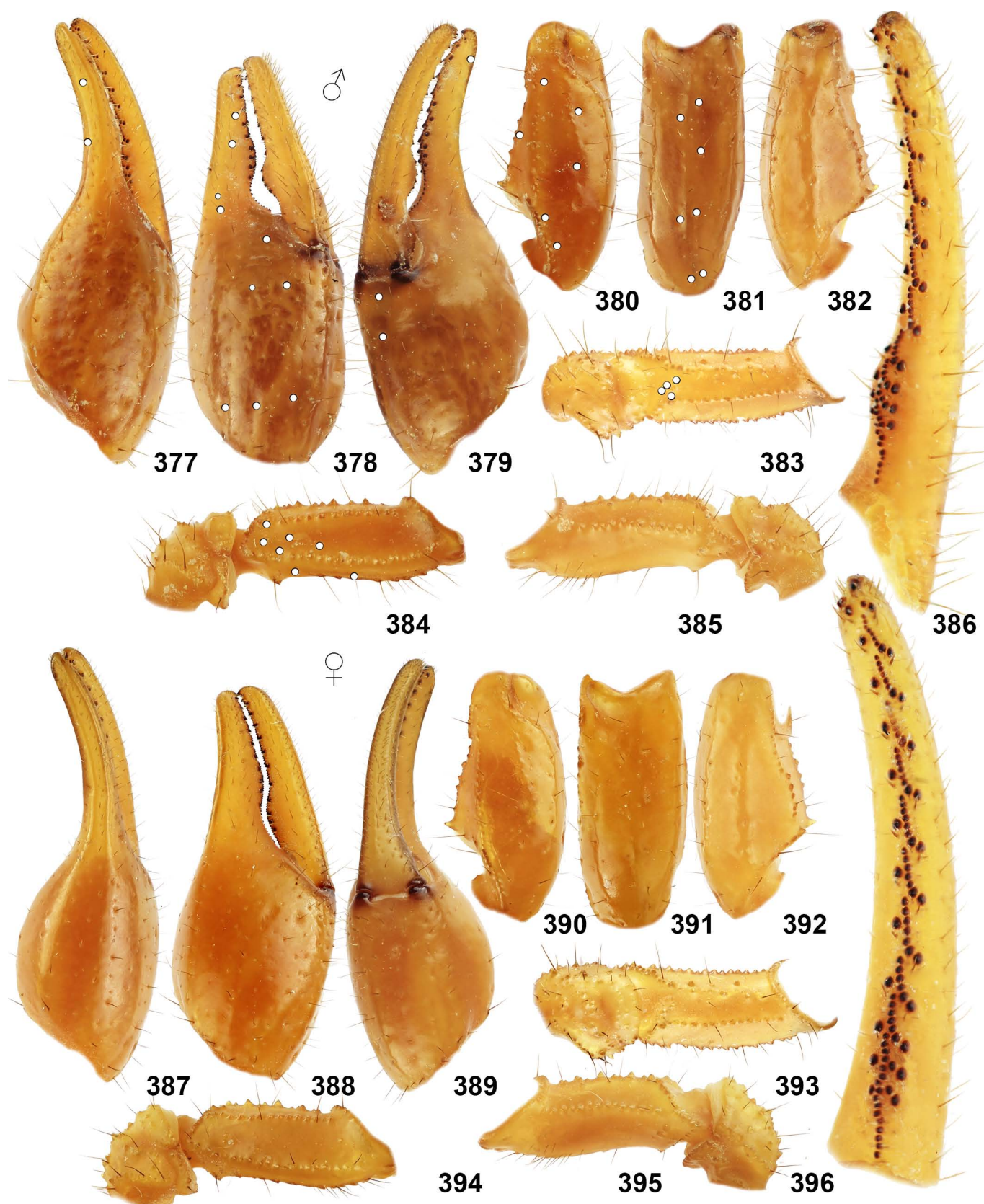
DIAGNOSIS. Total length of adults 38 mm (male) to 50 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.0–3.3 in both sexes. Pectinal teeth number 22–26 in male, 18–21 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites yellowish brown, weakly pigmented;



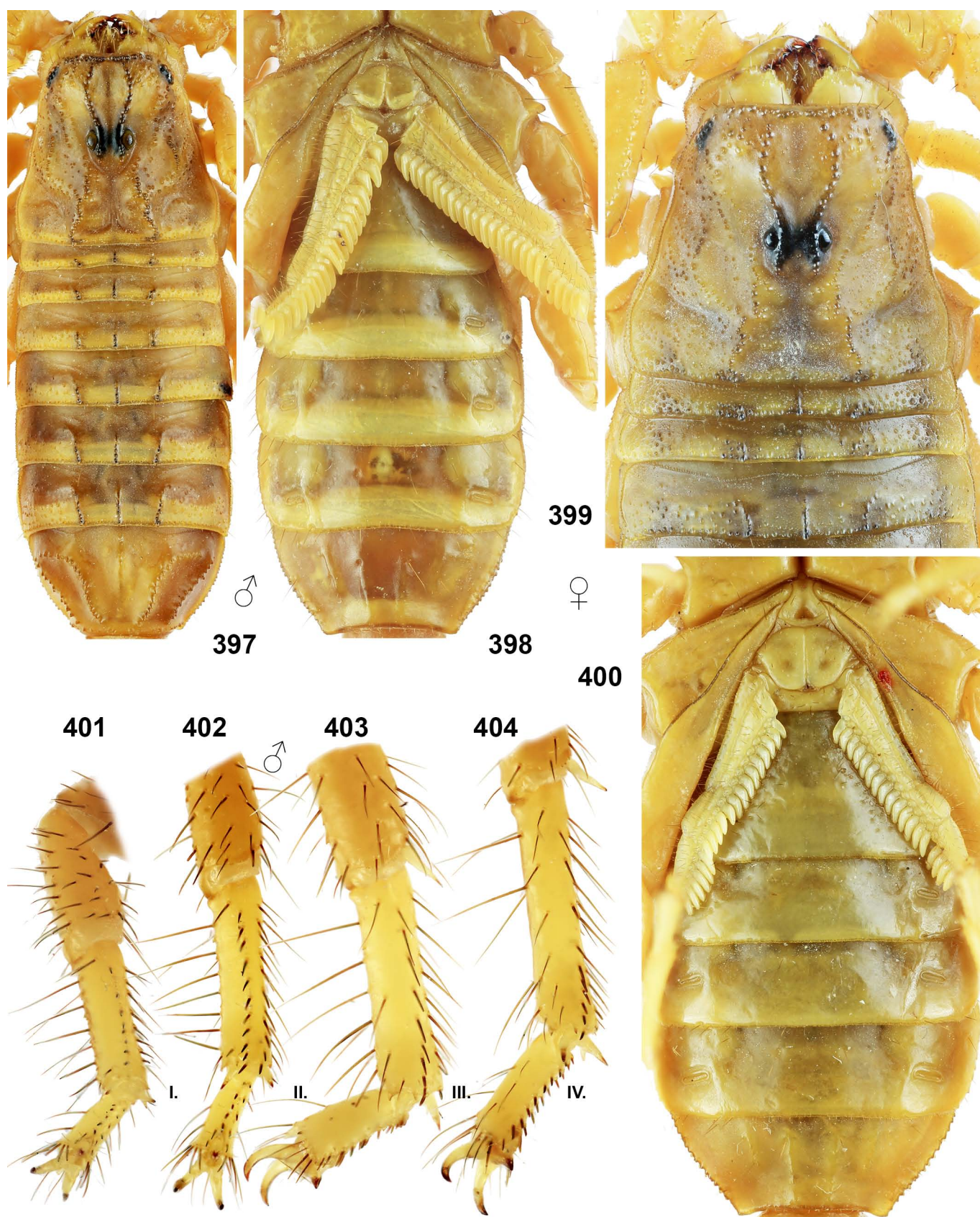
Figures 365–368: *Mesobuthus haarlovi* from Afghanistan, Uruzgan Province, Tarin Kowt, NMPC. **Figures 365–366.** Male, dorsal (365) and ventral (366) views. **Figures 367–368.** Female, dorsal (367) and ventral (368) views. Scale bar: 10 mm.



Figures 369–376: *Mesobuthus haarlovi* from Afghanistan, Uruzgan Province, Tarin Kowt, NMPC. **Figures 369, 371–373.** Male, telson lateral (369), metasoma and telson, lateral (371), dorsal (372), and ventral (373) views. **Figures 370, 374–377.** Female, telson lateral (370), metasoma and telson, lateral (374), dorsal (375), and ventral (376) views. Scale bars: 10 mm (371–376).



Figures 377–396: *Mesobuthus haarlovi* from Afghanistan, Uruzgan Province, Tarin Kowt, NMPC, pedipalp. **Figures 377–386.** Male, chela, dorsal (377), external (378), and ventral (379) views. Patella, dorsal (380), external (381) and ventral (382) views. Femur and trochanter, internal (383), dorsal (384), and ventral (385) views. Movable finger (386). **Figures 387–396.** Female, chela, dorsal (387), external (388), and ventral (389) views. Patella, dorsal (390), external (391) and ventral (392) views. Femur and trochanter, internal (393), dorsal (394), and ventral (395) views. Movable finger (396). The trichobothrial pattern is indicated in Figures 377–381, 383–384.



Figures 397–404: *Mesobuthus haarlovi* from Afghanistan, Uruzgan Province, Tarin Kowt, NMPC. **Figures 397–398, 401–404.** Male, chelicerae, carapace and tergites (397), sternopectinal region and sternites (398), and left legs I–IV, retrolateral aspect (401–404). **Figures 399–400.** Female, chelicerae, carapace and tergites I–III (399), sternopectinal region and sternites (400).

metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V can be black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with 4 well marked, usually granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma I laterally smooth. Length to depth ratio of metasoma III 1.1–1.3, metasoma IV 1.3–1.45 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–9 retroinferior macrosetae on basitarsus III. Telson rather bulbous, telson length to depth ratio is 2.3–2.4 in both sexes. Anal lobe divided into three parts.

HISTORY OF STUDY. *Mesobuthus eupeus haarlovi* was the only taxon of *Mesobuthus* described by the great French scorpologist Max Vachon (1958) who earlier has established the genus *Mesobuthus* Vachon, 1950. Prior to Vachon (1958), the scorpion fauna of Afghanistan remained virtually unknown; neither Pocock nor Birula had access to collections from this country.

COMMENTS. Fet & Lowe (2000: 173), following Vachon (1958), listed the following syntypes from Afghanistan (all in MHNN): 13♂20♀, Puistagoli (Koh-i-Baba), 3500 m; 1♀, Tarapas (Koh-i-Baba); 2♂, Sauzak Pass NE of Herat, 2400 m. However, on the MNHN website, only 21 specimens from Puistagoli (MNHN RS-2386, 30 July–1 August 1948, leg. N. Haarlov) are listed as syntypes. We list Puistagoli as the type locality for this species pending a formal designation of lectotype.

DISTRIBUTION. Afghanistan, Pakistan (Figs. 1155, 1157).

***Mesobuthus iranusi* (Birula, 1917), stat. n.**

(Figures 405–431, 1155, 1157, Table 5)

<http://zoobank.org/urn:lsid:zoobank.org:act:EAB8113C-8314-41F4-A99A-07981E5360B>

Buthus eupeus iranusi Birula, 1917a: 40.

TYPE LOCALITY AND TYPE REPOSITORY. Iran, *Esfahan Province*, Gabr Abad (33.77°N 51.48°E); ZISP.

REFERENCES (selected):

Buthus eupeus persicus: Birula, 1905a: 125–126 (in part).
Mesobuthus eupeus iranusi: Pérez Minnocci, 1974: 26; Fet, 1994: 527; Fet & Lowe, 2000: 173 (complete reference list until 1998).

Mesobuthus eupeus phillipsi: Pirali-Kheirabadi et al., 2009: 6–9, figs. 5, 10, 32–35 (in part); Navidpour et al., 2010: 13–14, fig. 19 (in part).

Mesobuthus eupeus: Mirshamsi et al., 2011b: 20 (in part).

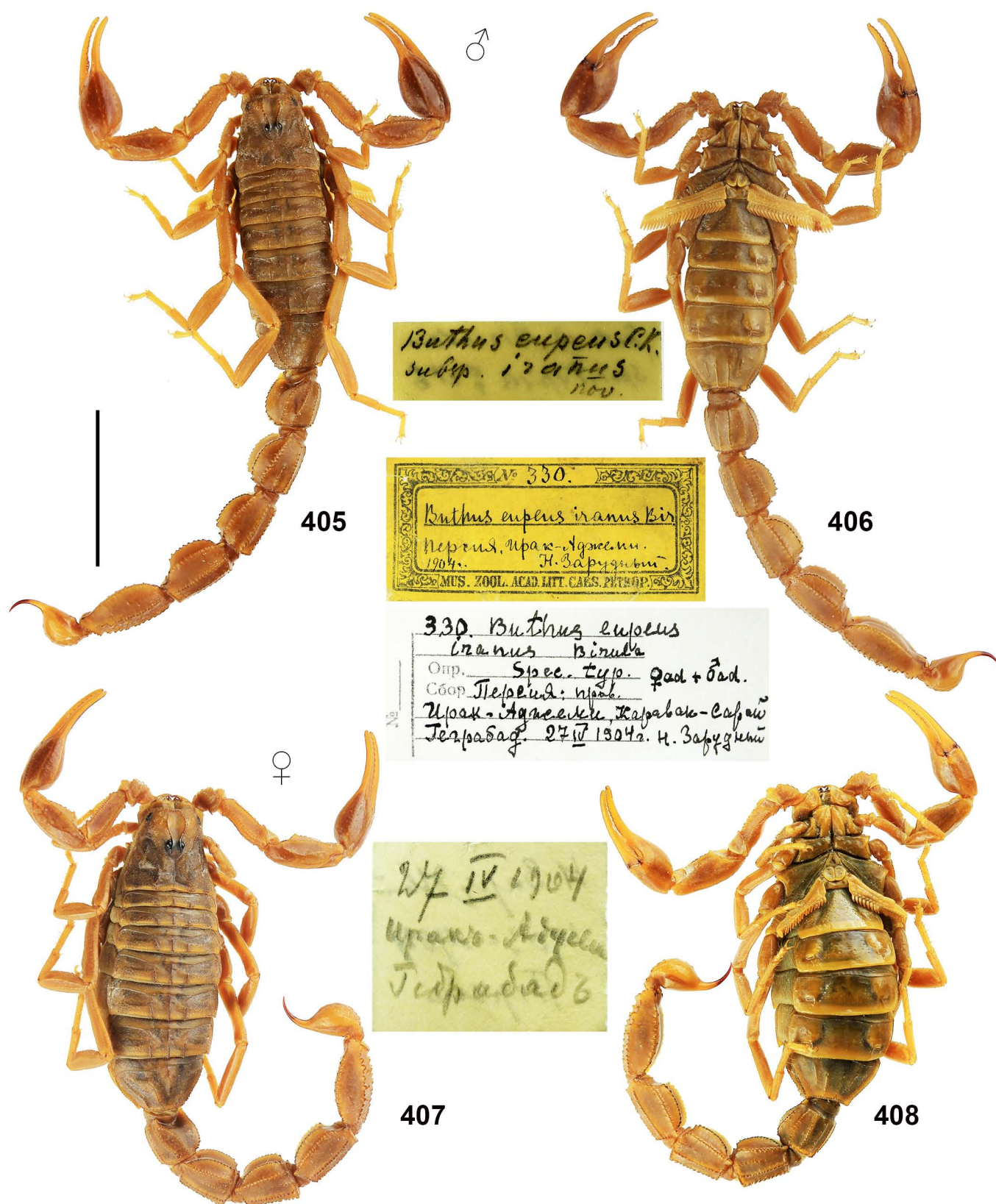
Mesobuthus phillipsi: Mirshamsi et al., 2011b: 20 (in part).

Mesobuthus iranusi: Kovařík, 2019: 17.

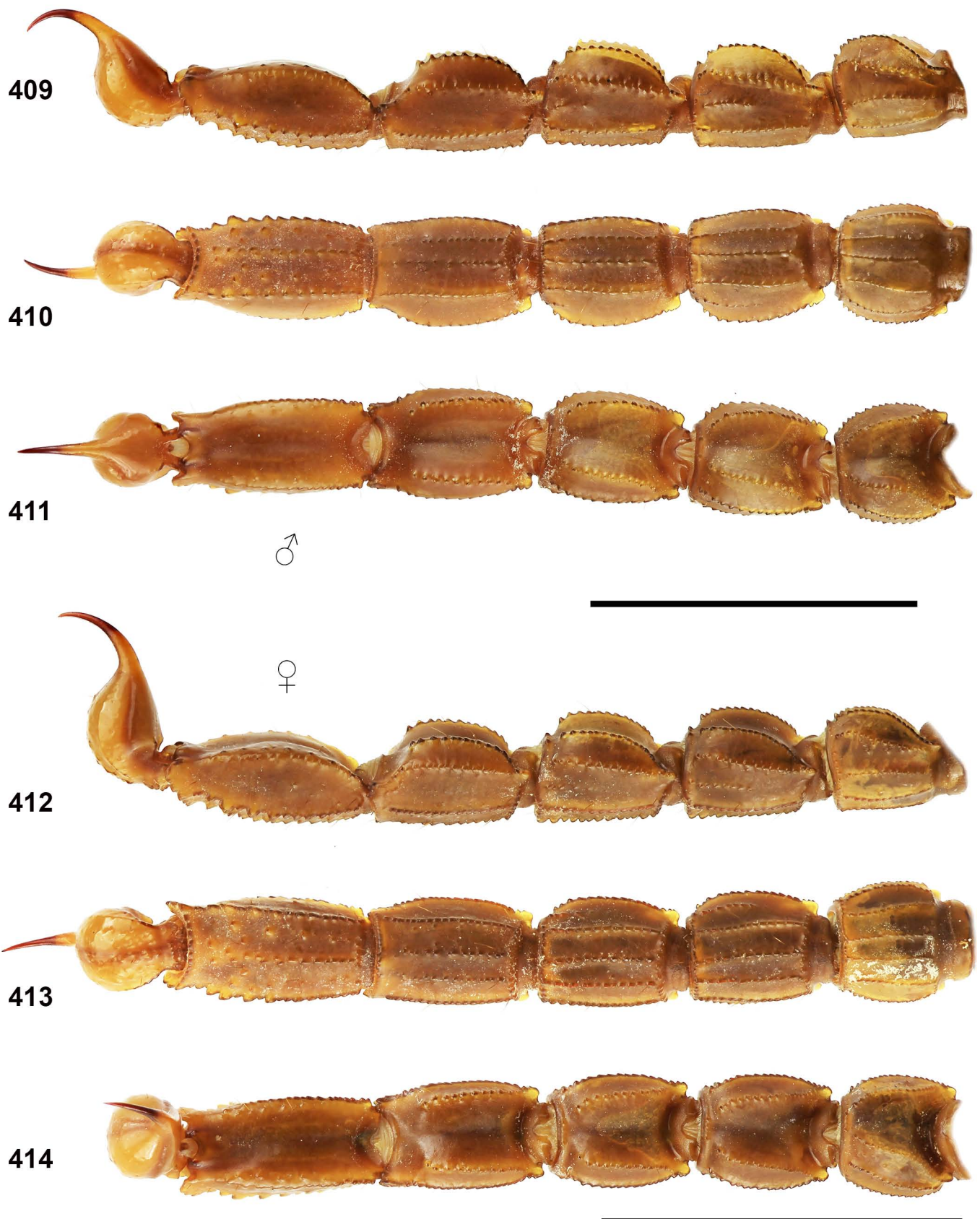
Mesobuthus eupeus eupeus: Navidpour et al., 2019: 4–5, fig. 55 (in part).

TYPE MATERIAL EXAMINED. Iran, Irak-Adjemi (now *Esfahan Province*), Karavan-sarai Gebrabad (= Gabr Abad), (33.77°N 51.48°E), 1♂ (lectotype, designated here, Figs. 405–406, 409–411, 415, 417, 419–420, 423–431), 1♀ (paralectotype, Figs. 407–408, 412–414, 416, 418, 421–422), 27 April [10 May] 1904, leg. N. Zarudny, ZISP 330.

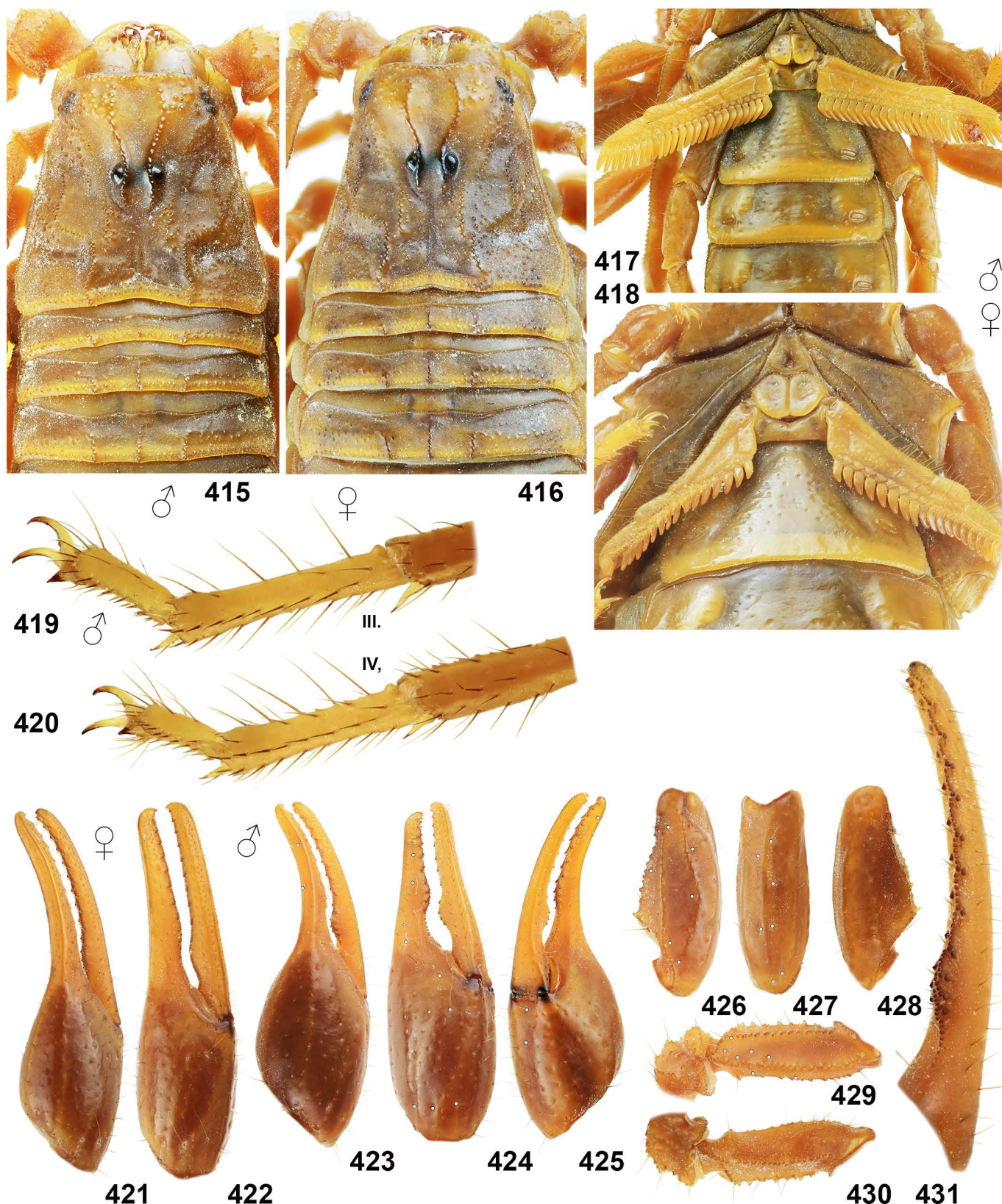
OTHER MATERIAL EXAMINED (NMPC). Iran, *Chahar Mahal & Bakhtiari Province*, Shahrekord (hills of Shahrekord University), 32°21'18"N 50°50'10"E (32.35°N 50.83°E), 2148 m a. s. l. (Locality No. SH-4), May 2007, 4♂1juv., leg. Pirali & Navidpour; Shahrekord, Sarteshniz, 32°08'51"N 50°54'11"E (32.13°N 50.90°E), 2116 m a. s. l. (Locality No. SH-7), May 2008, 2♀1juv., leg. Pirali; *Esfahan Province*, 10 km W of Kashan, 33°59'N 51°17'E (33.98°N 51.28°E), 1100–1170 m a. s. l., 1 May 1997, 2♀, leg. M. Kaftan, NMPC; 5 km N of Natanz, 33°32'N 51°52'E (33.53°N 51.87°E), 1903 m a. s. l., 6 April 2000, 1♂2♀, leg. M. Kaftan and J. Šobotník; Zagros Mts., Qamishlu Village env., 32°02'N 51°29'E (32.03°N 51.48°E) 2000–2200 m a. s. l., 27–28 April 1996, 5♀3juvs., leg. M. Kaftan, D. Král & J. Pitulová; *Lorestan Province*, Dorud, Papiun Village, 33°43'15"N 49°10'21"E (33.72°N 49.17°E), 1653 m a. s. l. (Locality No. LO-1370), October 2009, 1♀, leg. A. Bahreei, M. Bahreei & R. Amraee; Aligudarz, Khyemeh Sofla Village, 33°29'44"N 49°43'33"E (33.48°N 49.72°E), 1956 m a. s. l. (Locality No. LO-1390), October 2009, 2♂, leg. A. Bahreei, M. Bahreei & R. Amraee; Doreh, 33°34'17"N 48°01'00"E (33.57°N 48.02°E), 1333 m a. s. l. (Locality No. LO-1392), October 2009, 1juv., leg. M. H. Kayedi, H. Nayeibzadeh, D. Bahreei & R. Amraee; Aleshtar, Darehtang Village, 33°56'33"N 49°18'59"E (33.93°N 49.31°E), 1813 m a. s. l. (Locality No. LO-1398), October 2009, 1♂1♀, leg. Bahreei & A. Pahlavani; Koramabad, Kamalvand Village, 33°29'13"N 48°25'22"E (33.48°N 48.41°E), 1460 m a. s. l. (Locality No. LO-1401), October 2009, 1♂1♀, leg. H. Nayeibzadeh, A. Bahreei & M. Bahreei; *Markazi Province*, Lajrood village, 34°01'19.2"N 49°18'24.6"E (34.02°N 49.30°E), 1926 m a. s. l. (Locality No. M-102), May 2014, 1♂1♀, leg. Mashipour, Hayader and Behmam; Khomayn, 33°50'13.1"N 49°59'30.4"E (33.83°N 49.98°E), 1971 m a. s. l. (Locality No. M-109), May 2014, 1♂1♀, leg. Mashipour, Hayader and Behmam; *Yazd Province*, 31°36'26"N 54°14'22"E (31.60°N 54.23°E), 1843 m a. s. l., 2015 (Ya-01), 1♀, leg. S. Navidpour et al.; 31°43'52"N 54°17'12"E (31.72°N 54.28°E), 2023 m a. s. l., 2015 (Ya-11), 1♂, leg. S. Navidpour et al.; 31°34'26"N 54°28'30.9"E (31.56°N 54.47°E), 2023 m a. s. l., 2015 (Ya-



Figures 405–408: *Mesobuthus iranensis*. **Figures 405–406.** Male lectotype, dorsal (405) and ventral (406) views. **Figures 407–408.** Female paralectotype, dorsal (407) and ventral (408) views. The labels (ZISP 330) say, in Russian and Latin, from top to bottom: (1) “*Buthus eupeus* C.K[och], ssp. *iranus* nov.”; (2) “*Buthus eupeus iranensis* Bir. Persia, Iraq-Ajemi, 1904, N. Zarudny”; (3) “*Buthus eupeus iranensis* Bir. spec[imina] typ[ica] ♀ ad + ♂ ad. Det.: A. Birula. Coll.: Persia, prov[ince] Iraq-Ajemi, Karavan-sarai Gebrabad, 27.IV.1904, N. Zarudny”; (4) “27.IV.1904, Iraq-Ajemi, Gebrabad”. Labels 3 and 4 are written in A. Birula’s hand. Scale bar: 10 mm.



Figures 409–414: *Mesobuthus iran*. **Figures 409–411.** Male lectotype, metasoma and telson, lateral (409), dorsal (410), and ventral (411) views. **Figures 412–414.** Female paralectotype, metasoma and telson, lateral (412), dorsal (413), and ventral (414) views. Scale bar: 10 mm.



Figures 415–431: *Mesobuthus iranans*. **Figures 415, 417, 419–420, 423–431.** Male lectotype, chelicerae, carapace and tergites I–III, (415), sternopleural region and sternites III–V (417), and left legs III–IV, retrolateral aspect (419–420). Pedipalp chela, dorsal (423), external (424), and ventral (425) views. Patella, dorsal (426), external (427) and ventral (428) views. Femur and trochanter, dorsal (429) and ventral (430) views. Movable finger (431). The trichobothrial pattern is indicated in Figures 423–427, 429. **Figures 416, 418, 421–422.** Female paralectotype, chelicerae, carapace and tergites I–III (416), sternopleural region and sternite III (416). Pedipalp chela, dorsal (421) and external (422).

26), 2♂, leg. S. Navidpour et al.; 31°44'27"N 53°55'47"E (31.73°N 53.92°E), 2135 m a. s. l., 2015 (Ya-27), 1♀, leg. S. Navidpour et al.; 31°43'51"N 54°08'47"E (31.72°N 54.13°E), 1680 m a. s. l., 2015 (Ya-28), 1♂, leg. S. Navidpour et al.

DIAGNOSIS. Total length of adults 40 mm to 58 mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.0–3.2 in male, 3.3–3.5 in female. Pectinal teeth number 22–26 in male, 16–22 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites reddish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish to reddish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae; both dorsal carinae are granulated. Chela lacks carinae. Movable fingers of pedipalps with 12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII with 4 well marked smooth or granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth. Length to depth ratio of metasoma III 1.3–1.4, metasoma IV 1.5–1.7 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 5–9 retroinferior macrosetae on basitarsus III. Telson elongate. Anal lobe divided into three parts.

HISTORY OF STUDY. The type specimens were collected by the famous Russian zoologist Nikolay Zarudny during his last expedition to Persia (now Iran) in Spring 1904. These specimens were briefly described by Birula (1905a: 125) who believed them to be a variety of *Buthus eupeus persicus* Pocock, 1899. Later, Birula (1917a: 40) introduced a "Nomen novum", i.e. a separate name for this population, which is available by indication (a reference to the 1905 description).

Syntypes of *Buthus eupeus iran* included three separate labels (lots) from Iraq-Adjemi (all dates below, Old Style). The syntypes were deposited at ZISP, and were entered into Birula's handwritten catalog, which survives to this day, as: 1♂1♀, Karavan-sarai Gebrabad, 27 April 1904, No. 330; 1♀, Murchikhar Village, 24 April 1904, No. 331; (3) 1♂, Khara-Mahommed-abad Village, 10 May 1904, No. 332. The Gebrabad lot bears a note in Birula's hand "spec. typ."; we designate a lectotype from this locality.

COMMENTS. No DNA data on *Mesobuthus iran* are yet available. This species, in our opinion, was not represented among the populations studied by Mirshamsi et al. (2010) in their DNA survey of Iranian *Mesobuthus*.

DISTRIBUTION. Iran (Chahar Mahal & Bakhtiyari, Esfahan, Lorestan, Markazi, and Yazd Provinces) (Figs. 1155, 1157).

Mesobuthus kaftani sp. n.

(Figures 432–454, 1155, 1157, Table 14)

<http://zoobank.org/urn:lsid:zoobank.org:act:A1C3DA05-7ADF-4C85-A317-21DB661EF581>

TYPE LOCALITY AND TYPE REPOSITORY. Iran, *Razavi Khorasan Province*, Gonabad, 34°26'N 58°40'E (34.43°N 58.66°E), ca. 1000 m a. s. l.; NMPC.

REFERENCES:

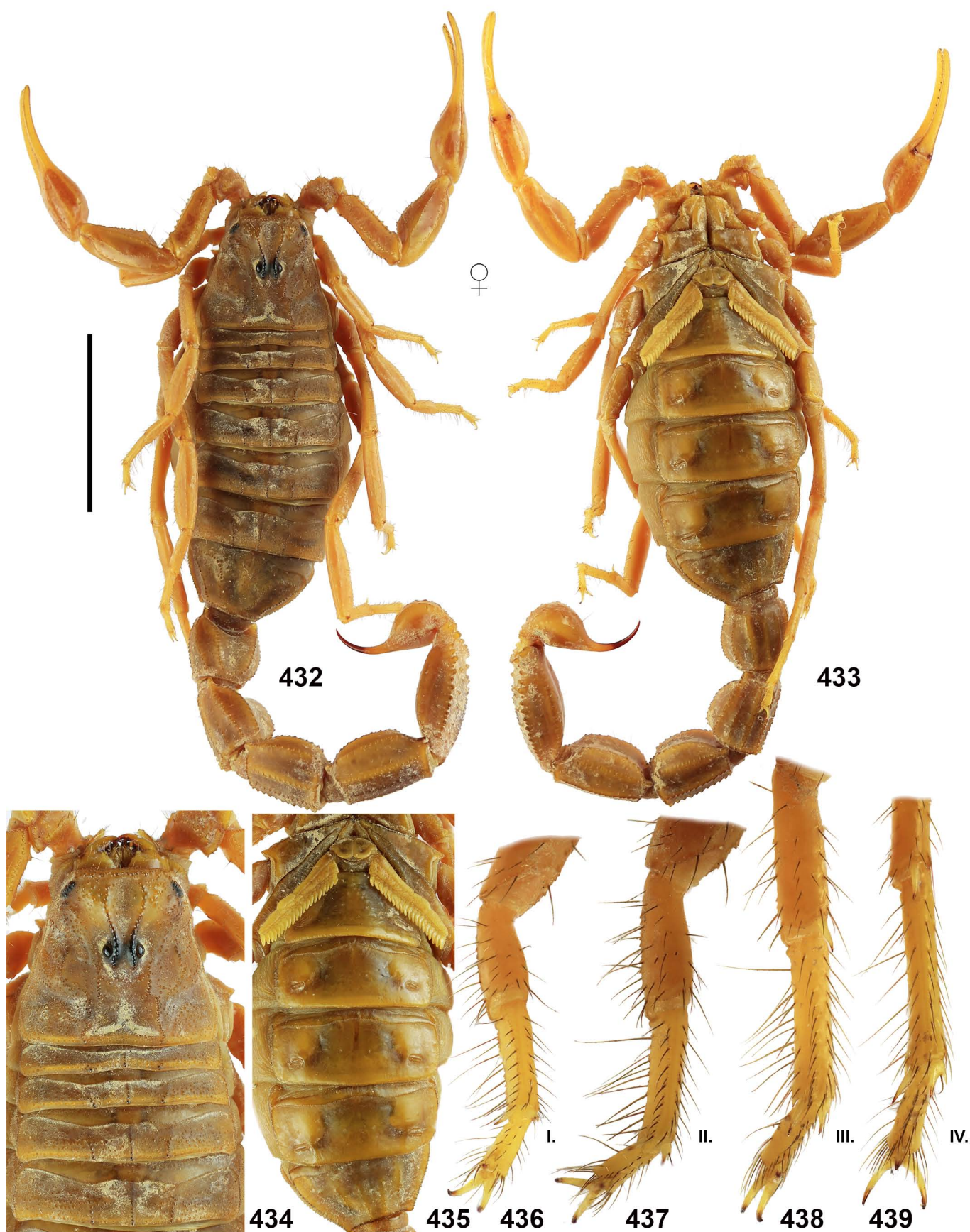
Mesobuthus eupeus afghanus (in part): Mirshamsi et al., 2010: 2867; Mirshamsi et al., 2011a: 8, fig. 6.

TYPE MATERIAL. Iran, *Razavi Khorasan Province*, Gonabad, 34°26'N 58°40'E (34.43°N 58.66°E), ca. 1000 m a. s. l., 9 May 1997, 1♀ (holotype), leg. M. Kaftan, NMPC; 10 km NE of Baghestan, 34°09'N 58°25'E (34.15°N 58.42°E), 1880–1914 m a. s. l., 9 May 1997, 3♀ 1juv. (paratypes), leg. M. Kaftan, NMPC.

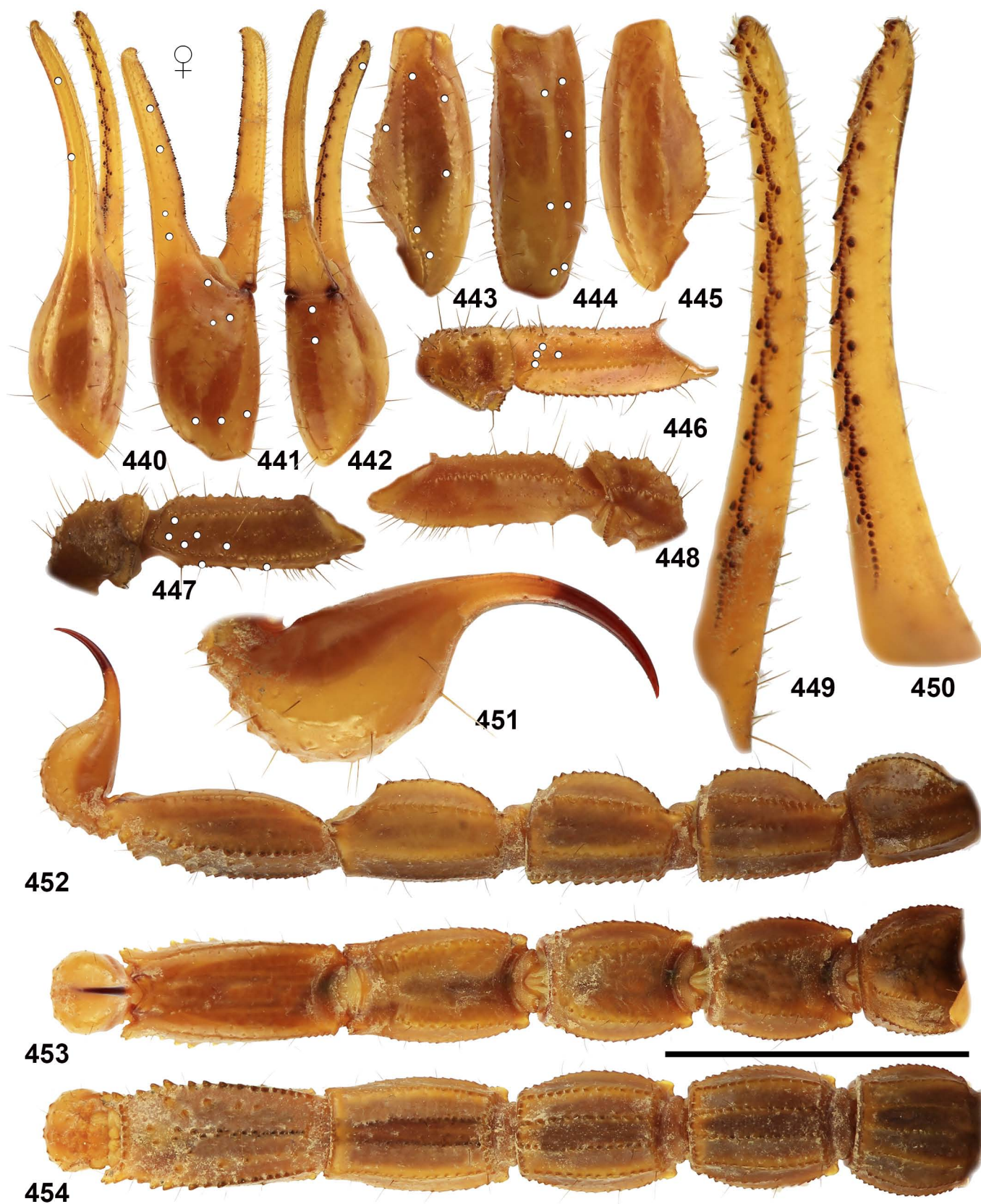
DNA DATA. This new species, in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their survey of Iranian *Mesobuthus* (five DNA sequences from the Razavi Khorasan Province, Gonabad, (34.19°N 58.75°E) (Table 16).

ETYMOLOGY. The species is named in honor of our colleague Milan Kaftan (Czech Republic) who collected the type specimens.

DIAGNOSIS. Total length of female 58 mm; male unknown. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Pedipalp chela length/width ratio 4.4 in female. Pectinal teeth number 19–20 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites reddish brown, black pigmentation reduced; metasoma, telson, pedipalps and legs reddish brown, only part of metasomal segment V can be black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, only dorsal and internal are granulated. Chela lacks carinae. Movable fingers of pedipalps with 11 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma IV with lateromedian carinae granulated in female. Intercarinal surfaces on metasoma I laterally granulated. Length to depth ratio of metasoma III 1.39, metasoma IV 1.89 in female. Telotarsus III ventral setation represented by short



Figures 432–439. *Mesobuthus kaftani* sp. n., female holotype. Dorsal (432) and ventral (433) views. Chelicerae, carapace and tergites I–IV (434), sternopectinal region and sternites (435), and left legs I–IV, retrolateral aspect (436–439).



Figures 440–454: *Mesobuthus kaftani* sp. n., female holotype. **Figures 440–450.** Pedipalp chela, dorsal (440), external (441), and ventral (442) views. Patella, dorsal (443), external (444) and ventral (445) views. Femur and trochanter, internal (446), dorsal (447) and ventral (448) views. Movable (449) and fixed (450) fingers. The trichobothrial pattern is indicated in Figures 440–444, 446–447. **Figures 451–454.** Telson lateral (451), metasoma and telson, lateral (452), dorsal (453), and ventral (454) views. Scale bar: 10 mm (452–454).

and strong spiniform setae. Tarsi hirsute, in adults with 12–16 retroinferior macrosetae on basitarsus III. Telson elongated. Anal lobe divided into three parts.

DESCRIPTION. Total length of adult females 50–58 mm; male unknown. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Female with fingers proximally slightly twisted. For measurements, see Table 13.

Coloration (Figs. 432–433). Carapace and tergites are reddish brown with pigmentation reduced. Chelicerae yellow, without reticulation. Metasoma, telson, pedipalps and legs are reddish brown. Metasoma ventral carinae can be black pigmented. Chelicerae yellow, without reticulation, the tips of denticles on cheliceral fingers are black.

Mesosoma and carapace (Figs. 457–458). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacarinat. Pectinal tooth count is 19–20 in females. Pectinal marginal tips extend to about one-fourth of the sternite IV in females. Pectines have three marginal lamellae and seven to eight middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. All sternites are smooth and sparsely hirsute. Sternite VII with four well marked granulated carinae. Other sternites have two furrows.

Pedipalps (Figs. 440–450). Pedipalps sparsely hirsute and smooth, only femur is finely granulated dorsally and ventrally. Femur has four to five granulated carinae, the middle carina on internal surface consists of several strong irregular granules. Patella with eight carinae, of which internal and dorsal are always granulated. Chela without carinae. Movable fingers of pedipalps have 11 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 436–439). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 12–16 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate to strong on legs III and IV and absent on the other legs.

Metasoma and telson (Figs. 451–454). Metasomal segments are sparsely hirsute. Metasomal segment I with 10 carinae, segments II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, segment IV with 8 carinae, and segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma I granulated with several large granules, other metasomal segments are smooth. Ventrolateral carinae of metasoma V posteriorly and metasoma II–III laterally with several large lobate denticles. Telson is very sparsely hirsute, elongate in female, bumpy and smooth. Anal lobe divided into three parts.

DISTRIBUTION. Iran (Razavi Khorasan Province) (Figs. 1155, 1157).

Mesobuthus kirmanensis (Birula, 1900), **stat. n.**

(Figures 455–521, 1155, 1157, Table 6)

<http://zoobank.org/urn:lsid:zoobank.org:act:45F38FCF-F56F-45CA-83DC-A69770381AF>

Buthus eupeus kirmanensis Birula, 1900a: 364–366.

TYPE LOCALITY AND TYPE REPOSITORY. Iran, *Sistan and Baluchistan Province*, Kaskin (27.50°N 60.33°E, estimated); ZISP.

SYNONYMS:

= *Buthus pachysoma* Birula, 1900a: 370–372 (type locality and type repository: Iran, *Sistan and Baluchistan Province*, Bampur (27.13°N 60.28°E, estimated); ZISP), **syn. n.**

<http://zoobank.org/urn:lsid:zoobank.org:act:3307E190-C14A-46AA-BF2D-54AB7C2FC0BE>

REFERENCES (selected):

Buthus eupeus kirmanensis: Birula, 1903: 69; Birula, 1905a: 122, 124, 129–130; Birula, 1917a: 41.

Buthus eupeus pachysoma: Birula, 1905a: 119, 122–123, 128–131; Birula, 1917a: 42.

Mesobuthus eupeus kirmanensis: Vachon, 1958: 155; Fet, 1994: 527; Fet & Lowe, 2000: 173 (complete references list until 1998); Mirshamsi et al., 2010: 2867 (in part); Mirshamsi et al., 2011a: 9 (in part), fig. 7.

Mesobuthus eupeus pachysoma: Vachon, 1958: 155; Fet, 1994: 527; Fet & Lowe, 2000: 174 (complete references list until 1998).

Mesobuthus eupeus: Mirshamsi et al., 2011b: 20 (in part).

?*Mesobuthus eupeus persicus*: Navidpour et al., 2011: 9–13, figs. 12, 41–42 (in part).

TYPE MATERIAL EXAMINED. Iran, *Sistan and Baluchistan Province* [formerly Kerman Province], Kaskin (27.50°N, 60.33°E, estimated), 6 [18] July 1898, 1♂ (lectotype of *Buthus eupeus kirmanensis* Birula, 1900, designated here, Figs. 455–466), leg. N. A. Zarudny, ZISP No. 333; “Ost Persien, Sarghad Province”, 1♂1♀ (paralectotypes, Figs. 486–495), ZMHB No. 10234 (not mentioned in Moritz & Fischer, 1980); Bampur (27.13°N 60.28°E, estimated), 1♀ (holotype of *Buthus pachysoma* Birula, 1900, Figs. 467–485), leg. N. A. Zarudny, 15–23 July [27 July–5 August] 1898, ZISP No. 364.

OTHER MATERIAL EXAMINED. Iran, *Fars Province*, Rustai Kanj, 28°10'N 55°43'E (28.17°N 55.72°E), 760 m a. s. l., 19 April 2000, 1♀juv., leg. M. Kaftan; pass 140 km NE Siraz, 20–21 April 2002, 1♀1juv., leg. P. Kabátek; *Hormozgan Province*, Hasan Langi, E of Bandar-e-Abbas, 27°23'N 58°50'E (27.38°N 58.83°E), 155 m a. s. l., 1♀, 17–19 July 2004, leg. P. Kabátek; *Kerman Province*, Deh Bahri, 29°05'N 57°55'E (29.08°N 57.92°E), 7 April 2000, 6422 ft., 1♀, leg. M. Kaftan, NMPC; 45 km NNE Sabzvaran (Jiroft), 28°58'N 57°54'E (28.96°N 57.90°E), 2231 m a. s. l., 2♀1juv., 19 July 2004, leg. P. Kabátek, NMPC; Jiroft, Tavakol Abad vil., 28°26'25"N 56°49'37"E

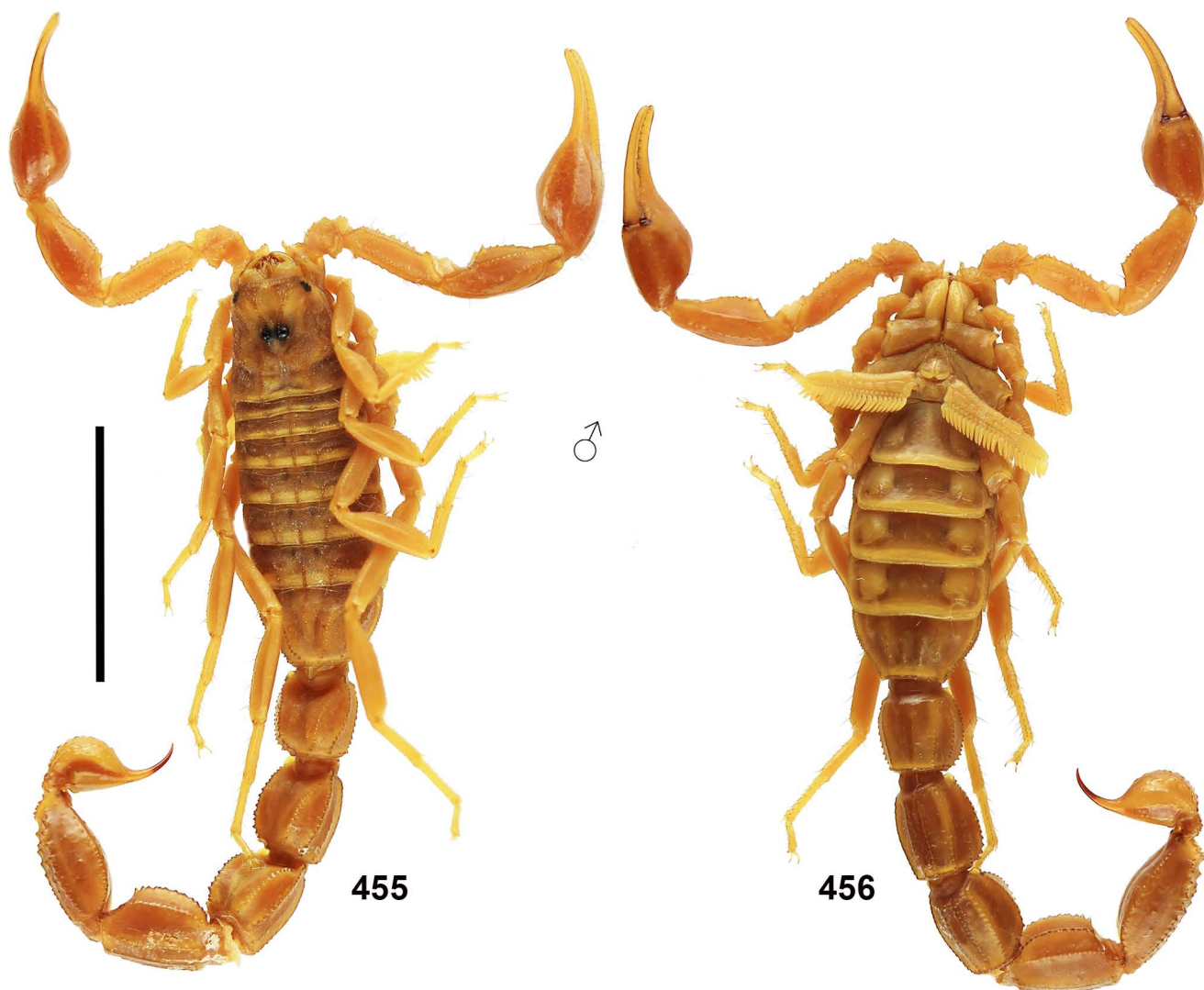
Dimensions (mm)		<i>M. kirmanensis</i> ♂ lectotype	<i>M. kirmanensis</i> ♀ HT of <i>M. pachysoma</i>	<i>M. macmahoni</i> ♂ from Nagar Parkar	<i>M. macmahoni</i> ♀ from Nagar Parkar
Carapace	L / W	4.65 / 4.90	5.42 / 6.01	4.38 / 4.80	5.59 / 6.10
Mesosoma	L	10.16	15.21	11.92	18.37
Tergite VII	L / W	2.85 / 4.91	3.38 / 6.94	3.21 / 4.65	4.21 / 6.73
Metasoma + telson	L	24.86	26.47	24.62	27.68
Segment I	L / W / D	3.32 / 3.28 / 2.93	3.19 / 3.50 / 2.90	3.14 / 2.95 / 2.56	3.48 / 3.40 / 2.88
Segment II	L / W / D	3.72 / 3.19 / 3.00	3.71 / 3.44 / 2.93	3.54 / 2.80 / 2.50	4.01 / 3.17 / 2.97
Segment III	L / W / D	3.66 / 3.13 / 2.98	3.89 / 3.35 / 3.09	3.79 / 2.70 / 2.42	4.14 / 3.07 / 2.74
Segment IV	L / W / D	4.34 / 2.87 / 2.93	4.69 / 3.23 / 2.99	4.25 / 2.42 / 2.30	4.84 / 2.69 / 2.76
Segment V	L / W / D	4.86 / 2.54 / 2.44	5.42 / 2.83 / 2.58	5.06 / 2.48 / 2.13	5.54 / 2.88 / 2.42
Telson	L / W / D	4.96 / 2.28 / 2.12	5.57 / 2.53 / 2.28	4.84 / 1.76 / 1.74	5.67 / 2.24 / 2.24
Pedipalp	L	16.50	16.77	15.57	17.35
Femur	L / W	3.96 / 1.30	4.10 / 1.40	3.72 / 1.16	4.10 / 1.40
Patella	L / W	4.78 / 1.93	4.88 / 2.10	4.53 / 1.77	5.08 / 2.18
Chela	L	7.76	7.79	7.32	8.17
Manus	W / D	2.60 / 2.42	2.27 / 2.41	2.06 / 1.98	2.44 / 2.52
Movable finger	L	4.45	4.47	4.47	5.19
Total	L	39.67	47.10	40.92	51.64

Table 6. Comparative measurements of *Mesobuthus kirmanensis* and *M. macmahoni* specimens. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D), holotype (HT).

(28.43°N 56.82°E, 580 m a. s. l. (Locality No. KE-07), April 2009, 1♂1♀, leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; Jiroft, Rumrez vil., 28°30'03"N 57°47'01"E (28.50°N 56.78°E), 577 m a. s. l. (Locality No. KE-09), April 2009, 1♂1♀ (Figs. 496–521), leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; Ghaleh Ganj, Bolbol Abad vil., 27°38'38"N 57°56'22"E (27.63°N 57.93°E), 419 m a. s. l. (Locality No. KE-15), April 2009, 2♂, leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; Rafsanjan road, Sarcheshmeh (Gode Ahmar), 30°02'53"N 55°53'54"E (30.03°N 55.88°E), 2316 m a. s. l. (Locality No. KE-41), May 2009, 1♂2♀1juv., leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; Shahre Babak, Marza, 30°01'43"N 55°05'41"E (30.02°N 55.08°E), 1789 m a. s. l. (Locality No. KE-54), May 2009, 1♀, leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; Baft-Kerman road, 29°14'31"N 56°40'50"E (29.23°N 56.67°E), 2398 m a. s. l. (Locality No. KE-75), May 2009, 1♂, leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; Baft, Nanook vil., Rabar, 29°20'45"N 56°50'19"E, 2798 m a. s. l. (Locality No. KE-78), May 2009, 1♂1♀, leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; Baft-Orzouyeh road, 29°06'56"N 56°36'52"E (29.10°N 56.60°E), 2228 m a. s. l. (Locality No. KE-79), May 2009, 1♂1♀juv., leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; Baft-Orzouyeh road, 29°08'19"N 56°36'55"E (29.13°N 56.60°E), 2250 m a. s. l. (Locality No. KE-80), May 2009, 2♂, leg. Koohpaye, Jamalizadeh and Ebrahimi; Baft-Orzouyeh road, 29°09'21"N 56°37'14"E (29.15°N 56.62°E), 2174 m a. s. l. (Locality No. KE-81), May 2009, 1♂1♀juv., leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; 8 km N Bardsir (29.95°N 56.58°E), 2050 m a. s. l., 6 June 2010, 1♀2♂juvs., leg. W. Grosser, NMPC.

DNA DATA. This species, in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their DNA survey of Iranian *Mesobuthus*. It corresponds to their three DNA sequences from the Sistan & Baluchistan Province, Bampur, Bampur River (27.17°N 60.46°E) (Bampur is the type locality of *Buthus pachysoma*) as well as to a single DNA sequence from the Kerman Province, vicinity of Jiroft (28.60°N 57°71'E); this point is not far from the type locality of *Buthus eupeus kirmanensis* (Table 16).

DIAGNOSIS. Total length of adults 38 mm (male) to 55 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est* or with level with *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 2.9–3.4 in both sexes. Pectinal teeth number 22–27 in male, 17–21 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites yellowish to reddish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, both dorsal are granulated. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII finely granulated, with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with



Зол. Мян. № 18-1899.
 333. *Buthus eupeus kirmanensis* Bir.
 Опр. А. Бирюль.
 Сбор В. Персид. Вост. Кирман, м. Каскин. 6. VII. 1898 г. Н. Зарудный.

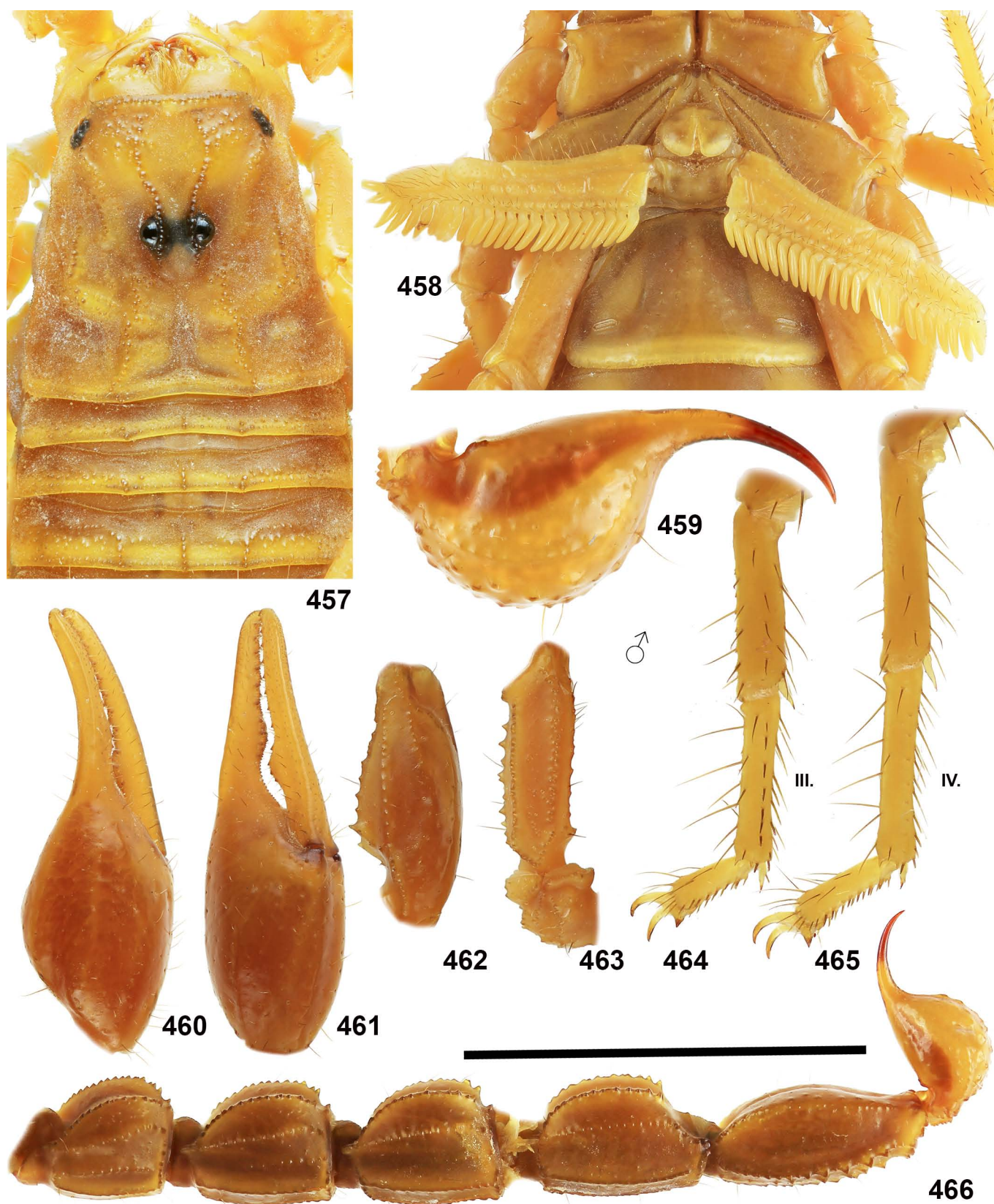
Н. Зарудный
 В. Персид
 6 VII 1898

В. Кирман
 Ур. Каскин
 6 VII 1898

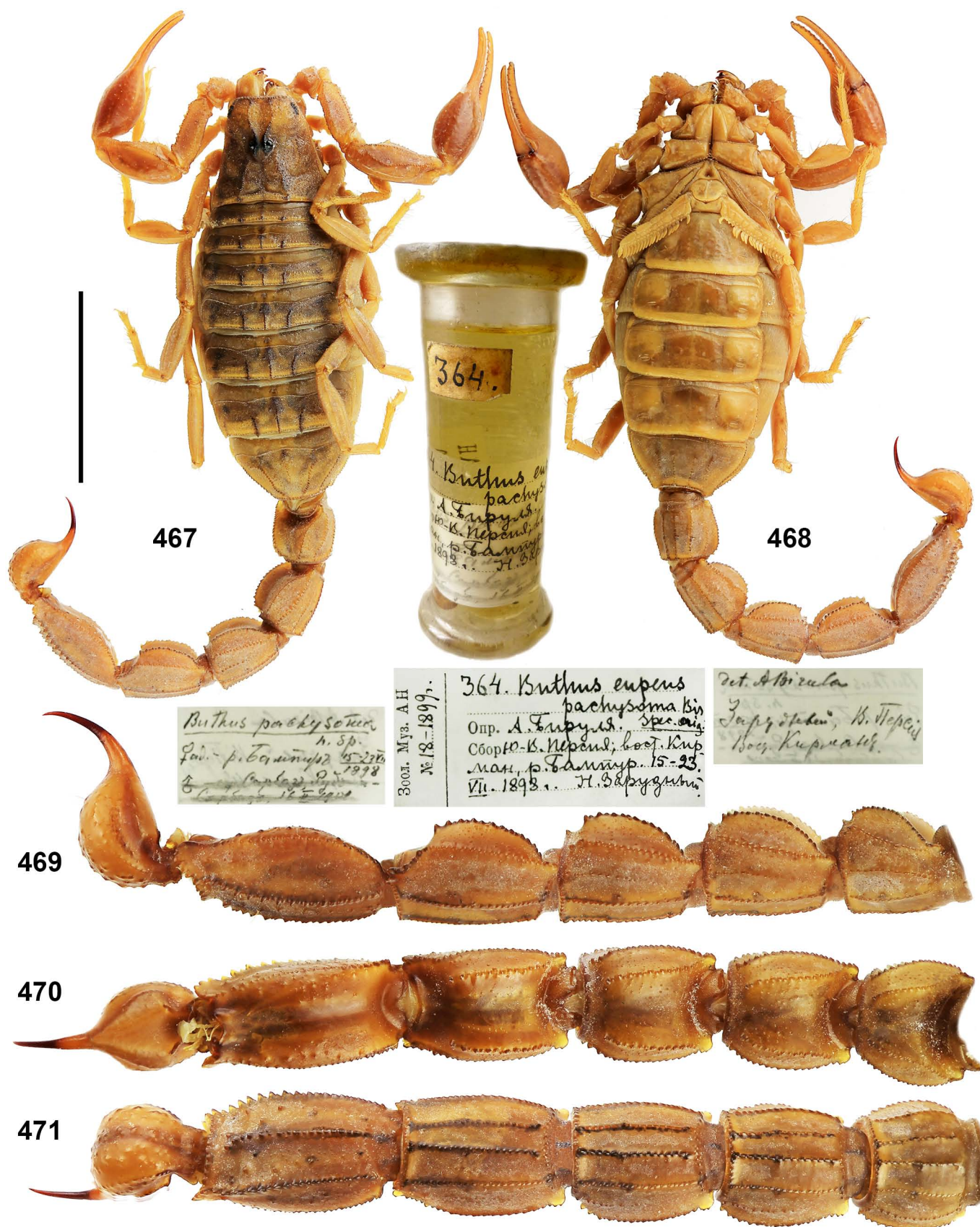
Figures 455–456. *Mesobuthus kirmanensis*, male lectotype. Dorsal (455) and ventral (456) views. The labels (ZISP 333) say, in Russian and Latin, left to right: (1) 333. *Buthus eupeus kirmanensis* Bir. Det.: A. Birula. Coll.: East Persia, East Kirman, Kaskin env., 6.VII.1898, N. Zarudny"; (2) , N. Zarudny, East Persia, 6.VII.1898"; (3) East Kirman, Kaskin env., 6.VII.1898". Scale bar: 10 mm.

8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma I laterally finely granulated. Length to depth ratio of metasoma III 1.2–1.3, metasoma IV 1.45–1.65 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 5–9 retroinferior macrosetae on basitarsus III. Telson rather elongated, mainly in male. Anal lobe divided into three or four parts.

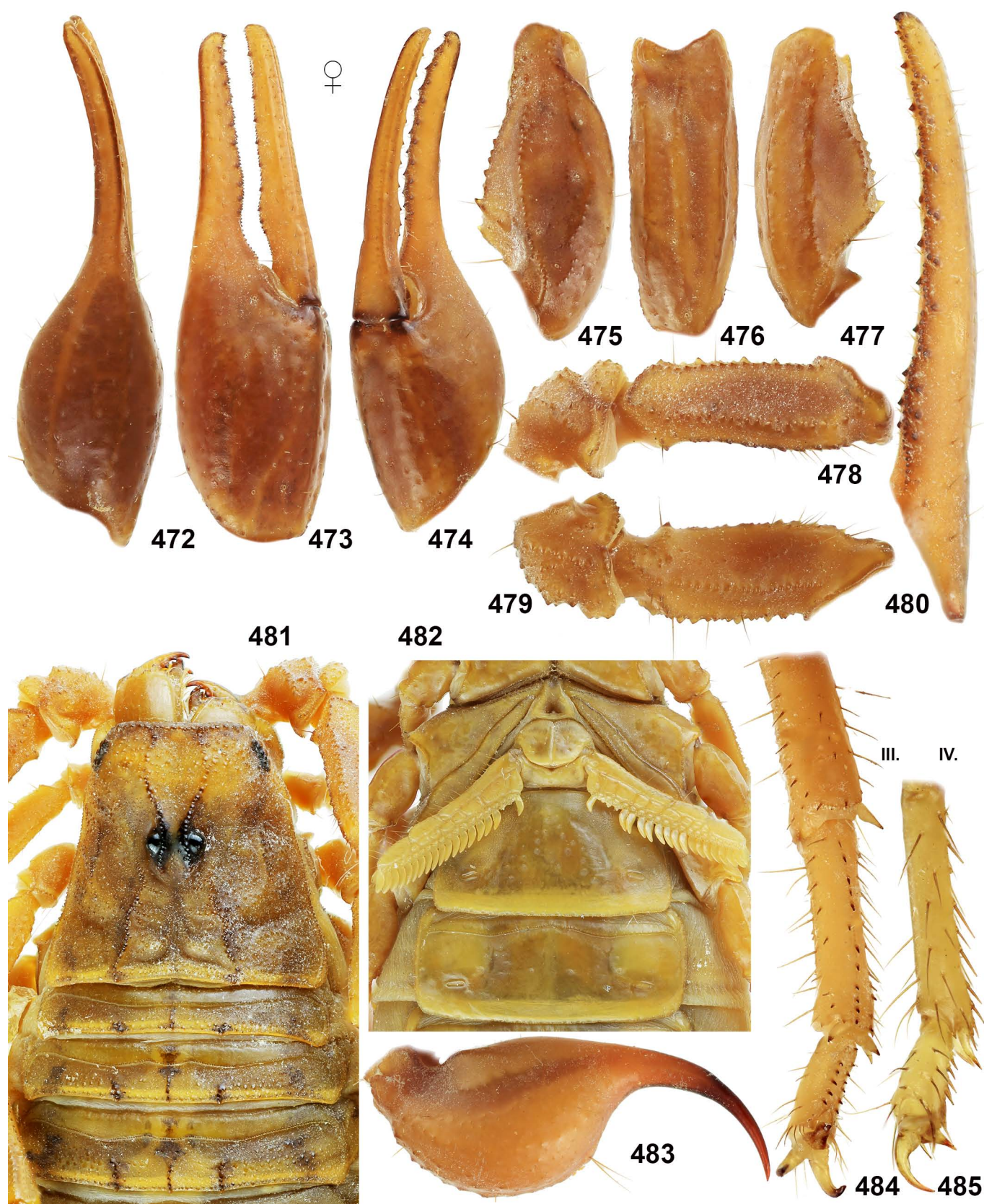
HISTORY OF STUDY. Type specimens of both *Buthus eupeus kirmanensis* Birula, 1900 and *Buthus pachysoma* Birula, 1900 were collected in Iran (then Persia) by the famous Russian ornithologist and traveler Nikolay A. Zarudny (1859–1919) who brought numerous scorpions for A. Birula's ZISP collection. Zarudny visited Persia several times between 1896 and 1904. His travelogues were published in Russian (Zarudny, 1900, 1901, 1916) and analyzed by modern scholars (Roselaar & Aliabadian, 2007); in most instances we can locate, or at least approximate, his collection sites.



Figures 457–466. *Mesobuthus kirmanensis*, male lectotype. Chelicerae, carapace and tergites I–III, (457), sternopectinal region and sternite III (458), telson lateral (459), pedipalp chela, dorsal (460), and external (461) views. Pedipalp patella dorsal (462), and femur and trochanter dorsal (463), left legs III–IV, retrolateral aspect (464–465). Metasoma and telson lateral (466). Scale bar: 10 mm (466).



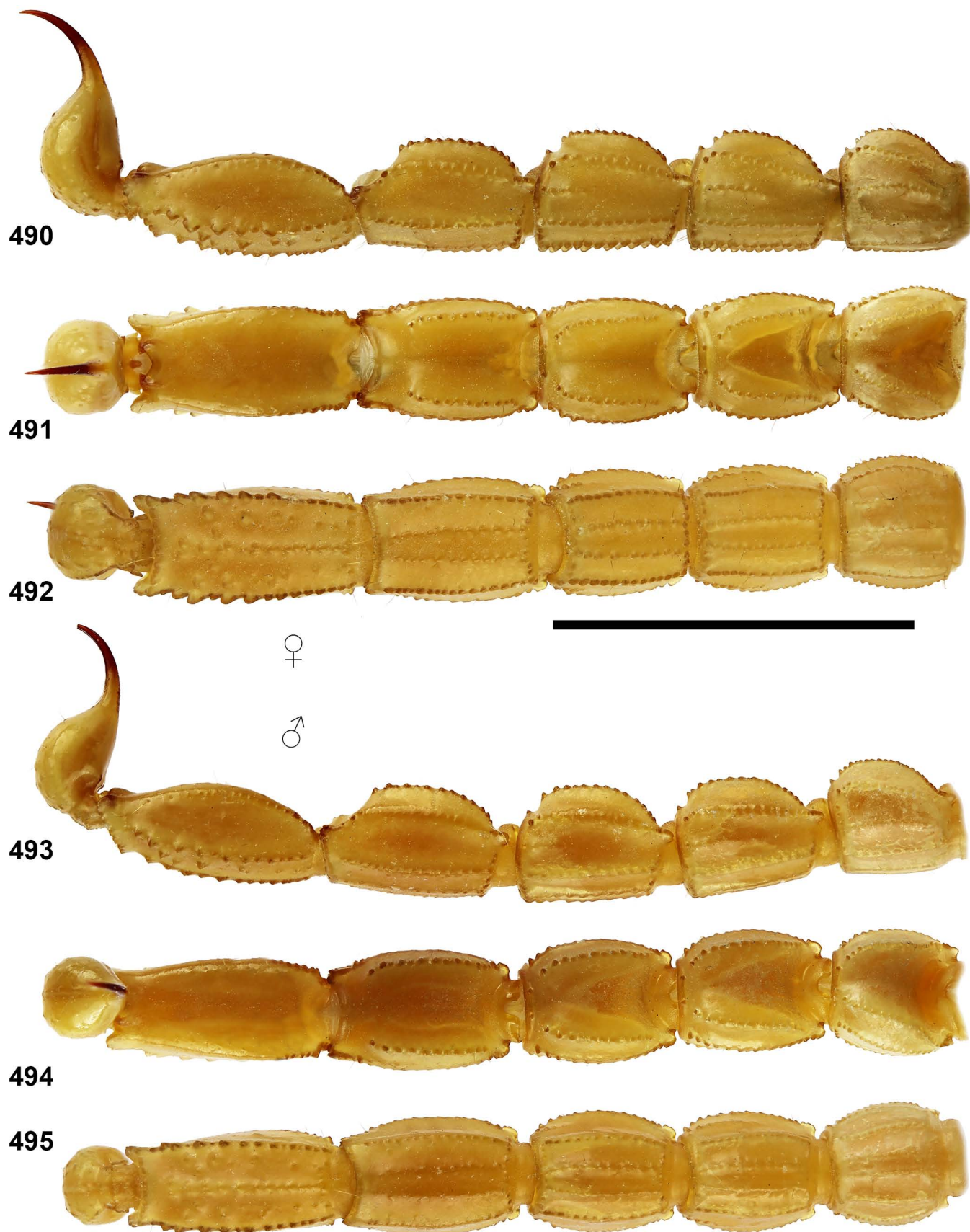
Figures 467–471. *Mesobuthus kirmanensis*, female holotype of *Buthus pachysoma*. Dorsal (467) and ventral (468) views. Metasoma and telson, lateral (469), dorsal (470), and ventral (471) views. The labels (ZISP 364) say, in Russian and Latin, left to right: (1) *Buthus pachysoma* n. sp. ♀ ad., Bampur River, 15–23.VII.1898"; (2) "364. *Buthus eupens pachysoma* Bir. spec. orig. Det.: A. Birula. Coll.: South-East Persia, East Kirman, Bampur River., 15–23.VII.1898, N. Zarudny"; (3) "det. A. Birula, Zarudny, E. Persia, East Kirman". Scale bars: 10 mm (467–468, 469–471).



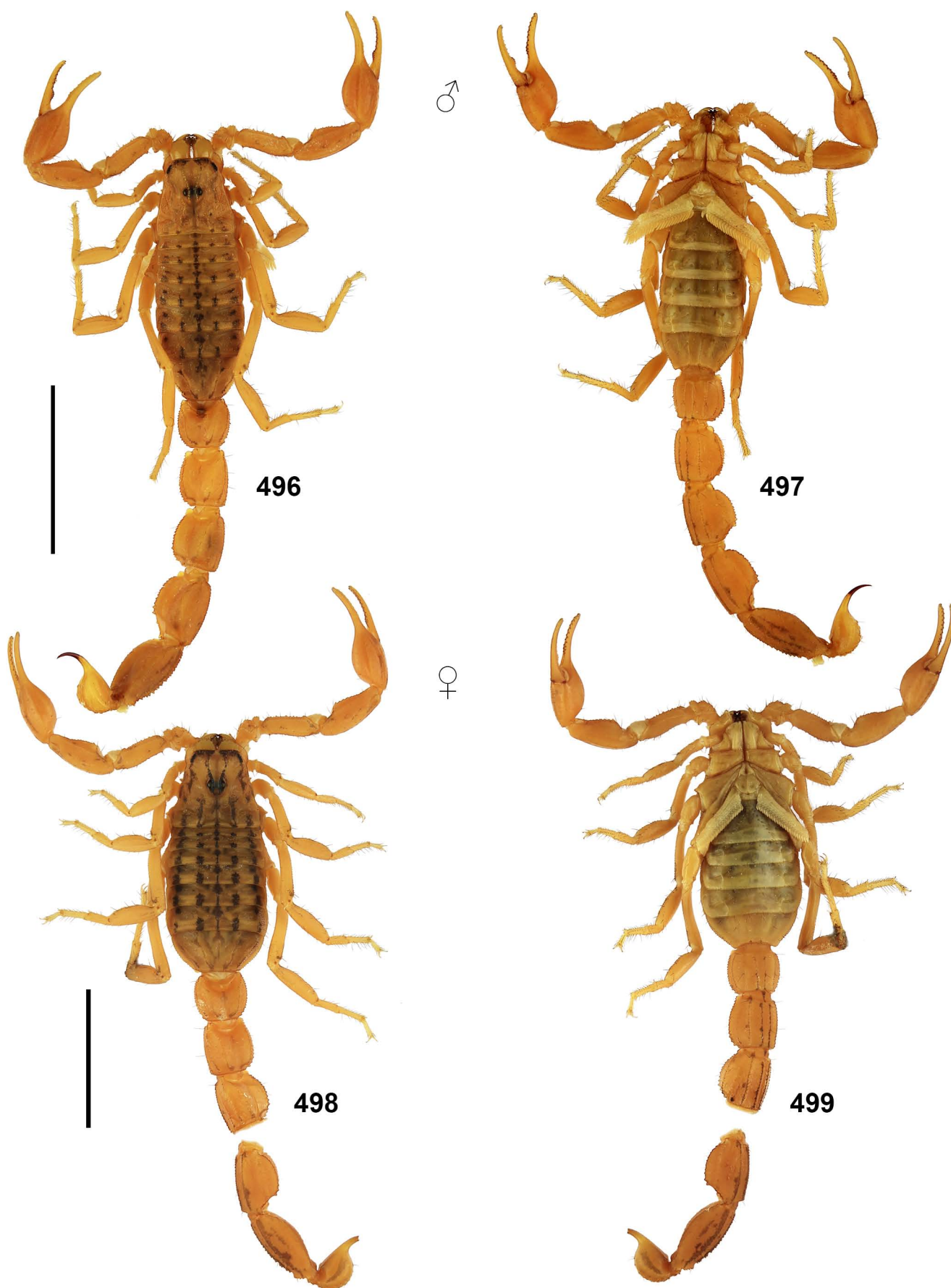
Figures 472–485. *Mesobuthus kirmanensis*, female holotype of *Buthus pachysoma*. Pedipalp chela, dorsal (472), external (473) and ventral (474) views. Patella, dorsal (475), external (476) and ventral (477) views. Femur and trochanter, dorsal (478) and ventral (479) views. Movable finger (480). Chelicerae, carapace and tergites I–III, (481), sternopectinal region and sternites III–IV (482). Telson lateral (483) and left legs III–IV, retrolateral aspect (484–485).



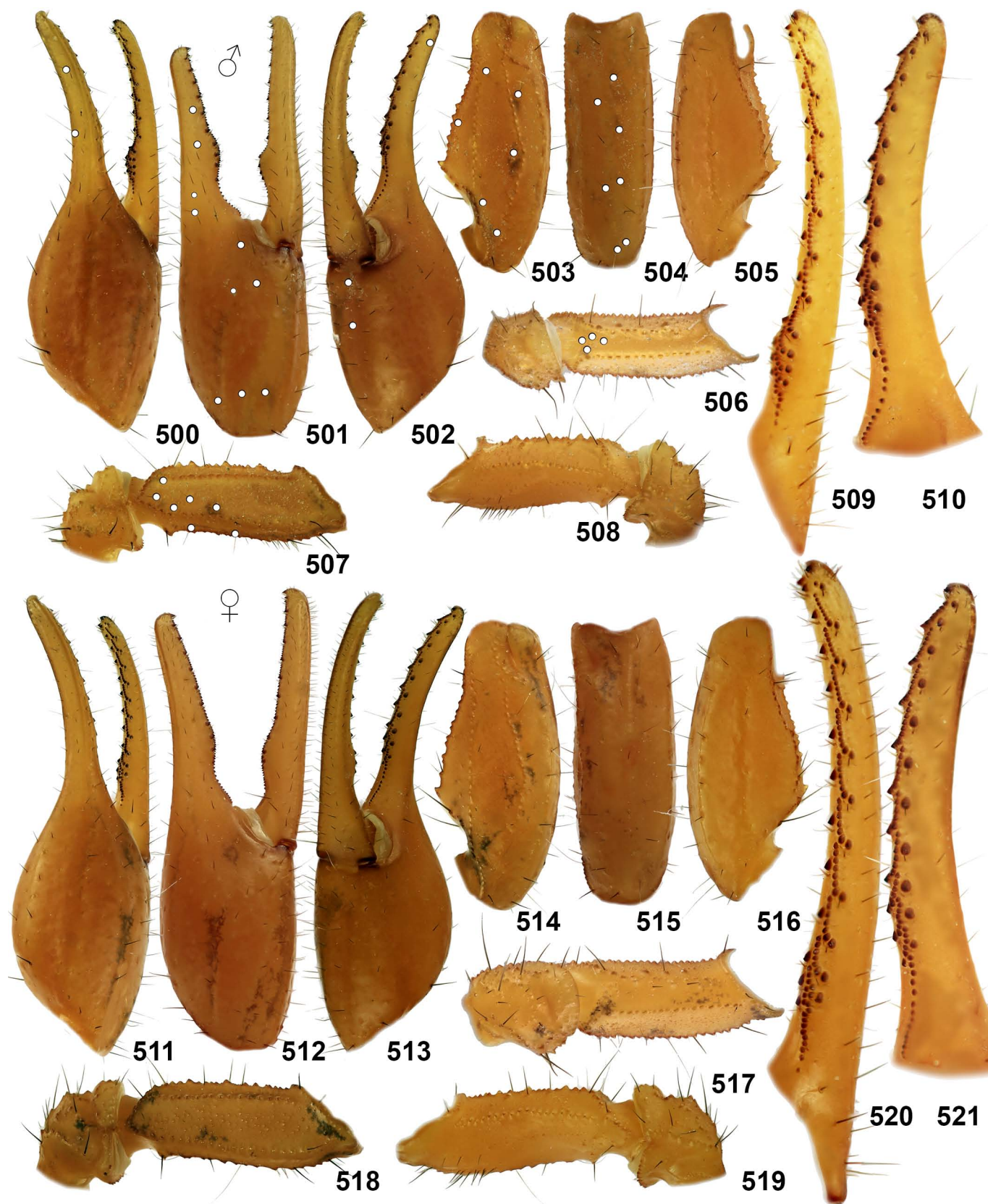
Figures 486–489: *Mesobuthus kirmanensis*, paralectotypes, ZMHB. Figures 486–487. Male paralectotype, dorsal (486) and ventral (487) views. Figures 488–489. Female paralectotype, dorsal (488) and ventral (489) views. Scale bar: 10 mm.



Figures 490–495: *Mesobuthus kirmanensis*, paralectotypes, ZMHB. **Figures 490–492.** Male paralectotype, metasoma and telson, lateral (490), dorsal (491), and ventral (492) views. **Figures 493–495.** Female paralectotype, metasoma and telson, lateral (493), dorsal (494), and ventral (495) views. Scale bar: 10 mm.



Figures 496–499: *Mesobuthus kirmanensis* from Iran, Kerman Province, Jiroft, Rumrez vil., NMPC. **Figures 496–497.** Male, dorsal (496) and ventral (497) views. **Figures 498–499.** Female, dorsal (246) and ventral (247) views. Scale bars: 10 mm.



Figures 500–521: *Mesobuthus kirmanensis* from Iran, Kerman Province, Jiroft, Rumrez vil., NMPC, pedipalp. **Figures 500–510.** Male, chela, dorsal (500), external (501), and ventral (502) views. Patella, dorsal (503), external (504) and ventral (505) views. Femur and trochanter, internal (506), dorsal (507), and ventral (508) views. Movable (509) and fixed (510) fingers. **Figures 511–521.** Female, chela, dorsal (511), external (512), and ventral (513) views. Patella, dorsal (514), external (515) and ventral (516) views. Femur and trochanter, internal (517), dorsal (518), and ventral (519) views. Movable (520) and fixed (521) fingers. The trichobothrial pattern is indicated in Figures 500–504, 506–507.

Syntypes of *Buthus eupeus kirmanensis* published by Birula (1900a: 364) were collected in summer 1898 and deposited at ZISP. The syntype series included five separate labels (lots) (all dates below, Old Style) listed as: "Eastern Kerman (Persian Baluchistan)": (1) 1 ♂, Kaskin, 6 July 1898; (2) 33 ♂♀, Basman town, 8 July 1898; (3) 6 specimens, Basman, Gualgir Pass, 10.5 verst [ca. 10 miles] from Basman, 9 August 1898; and "Sargad [part of eastern Kerman]": (4) 10 specimens, road between Tamin and Ljaadis Villages, 24–28 August 1898; (5) 6 specimens, road between Sia-Kugi Pass and Dusab Village, 30 August–1 September 1898". The syntypes were entered into Birula's handwritten catalog under numbers 333–337, correspondingly. A few other lots from Iran (not types) were added later, among them additional specimens collected by Zarudny in 1901 and 1903.

We designate a ZISP male from Kaskin (No. 333) as a lectotype (Figs. 455–466). In addition, two syntypes from "Sarghad", which were found in ZMHB, are designated here as paralectotypes (Figs. 486–495).

Buthus pachysoma was published in the same paper (Birula, 1900a: 370). Its single type specimen, the holotype ♀ (ZISP 364), was collected by Zarudny in "Eastern Kerman (Persian Baluchistan), excursion along the Bampur River", on 15–23 July 1898. This holotype was never studied by anyone; from the time of Birula to our study in 2019 it was still in the original vial sealed with wax. Additional specimens identified by Birula as *Buthus eupeus pachysoma* were collected by Zarudny in 1901 (Birula, 1905a: 128) and are deposited in ZISP collection (Nos. 375–372). Birula (1917a: 41–42) noted that *B. e. pachysoma* differed from all other "subspecies of *B. eupeus*" by "a coarse granulation of carapace, ocular tubercle, and all the interspaces of metasomal carinae."

Before Birula's type materials became available for our study in 2019, *Buthus eupeus kirmanensis* was tentatively considered a synonym of *Mesobuthus eupeus persicus* (Pocock, 1899) (Navidpour et al., 2011) or *M. persicus* (see Kovařík, 2019). Our current analysis, however, shows that this is a separate, species-level taxon, and that *B. pachysoma* is its synonym.

DISTRIBUTION. Iran (Fars, Hormozgan, Kerman, and Sistan & Baluchistan Provinces) (Figs. 1155, 1157).

Mesobuthus macmahoni (Pocock, 1900)

(Figures 522–566, 1155, 1157, 1163, Tables 6, 15)

<http://zoobank.org/urn:lsid:zoobank.org:act:7AFB5AA7-95FD-45FD-90A0-0AD5AA5FF2BD>

Buthus macmahoni Pocock, 1900: 18–19.

TYPE LOCALITY AND TYPE REPOSITORY. **Pakistan, Balochistan Province**, Ormara (25.21°N 64.63°E); BMNH.

REFERENCES (selected):

Buthus (Buthus) macmahoni: Birula, 1917a: 214.

Buthus (Buthus) zarudnyi macmahoni: Birula, 1917a: 240.

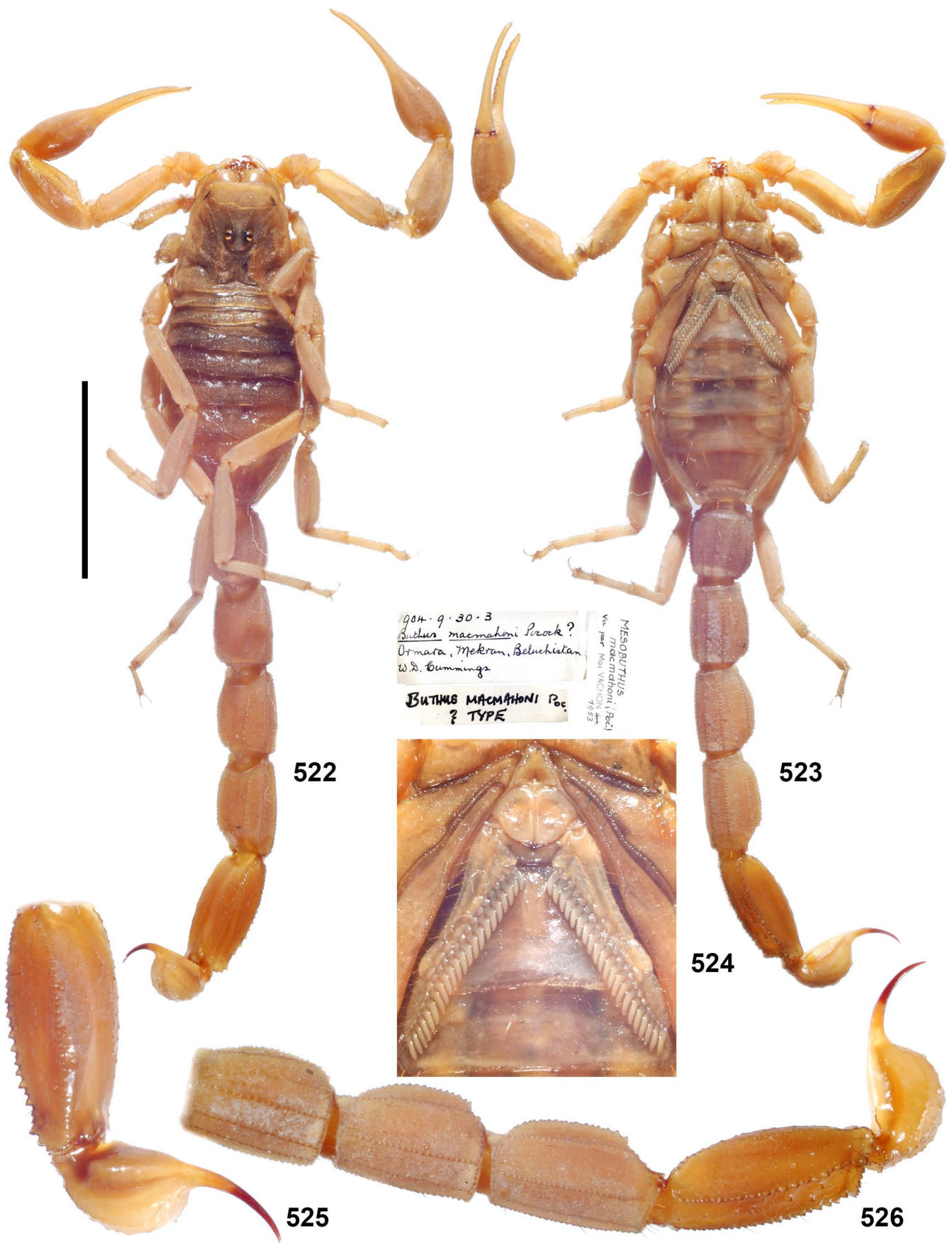
Mesobuthus macmahoni: Vachon, 1950: 153; Vachon, 1952: 325; Vachon, 1958: 146–148, figs. 30–31; Fet & Lowe, 2000: 177 (complete references list until 1998); Mirshamsi et al., 2011b: 20 (in part); Navidpour et al., 2011: 13 (in part); Kovařík, 2019: 17; Barahoei et al., 2020: 397 (in part).

TYPE MATERIAL EXAMINED. **Pakistan, Balochistan Province**, Ormara, 1 ♀ (lectotype, designated here, Figs. 522–526), leg. W. D. Cummings, BMNH 904.9.30.3.

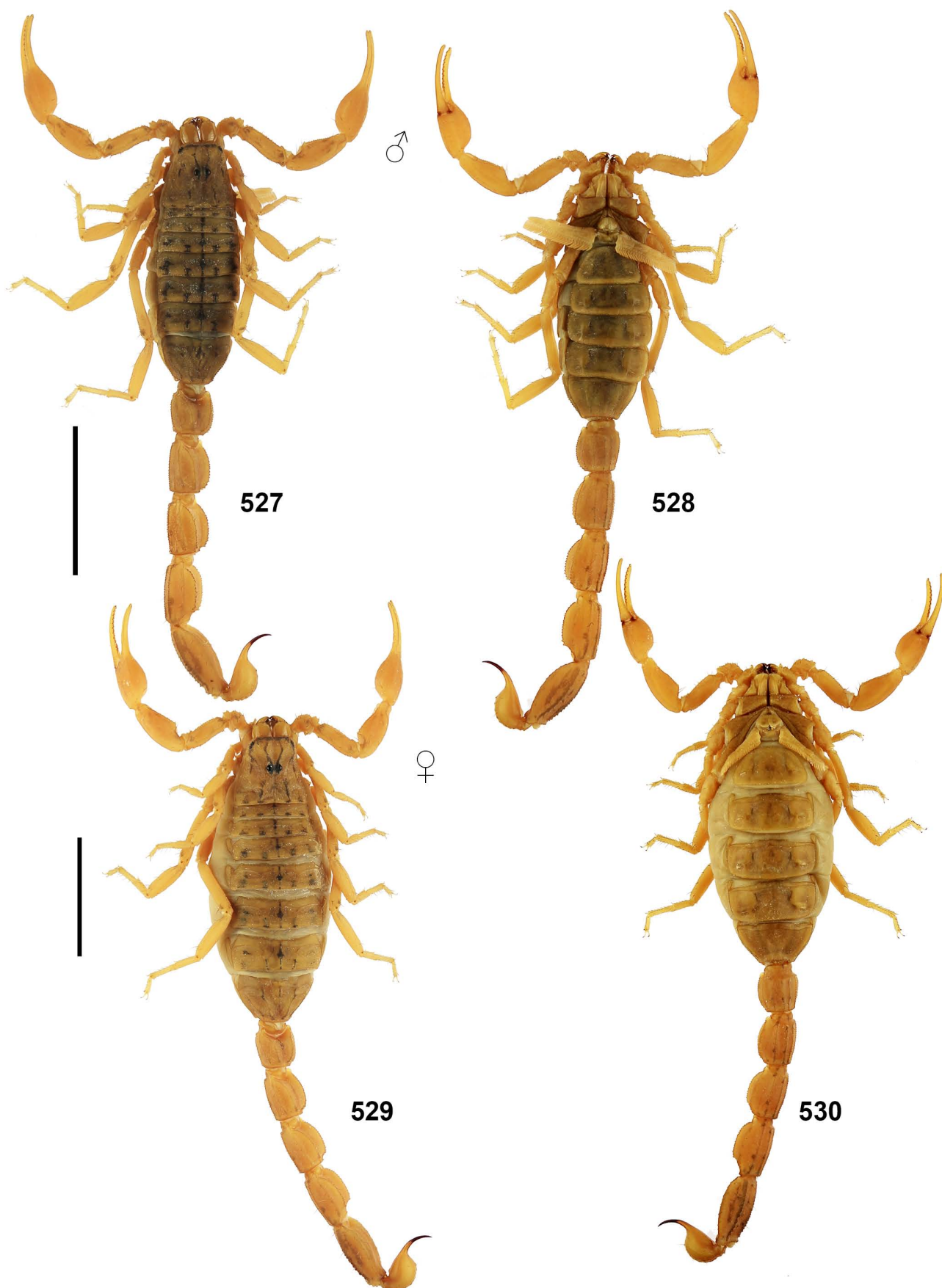
OTHER MATERIAL EXAMINED. **Pakistan, Balochistan Province**, Tump, 90 km W. Turbat (26.00°N 62.96°E), 1 ♂ 1 ♀, 13–15 April 1993, leg. S. Bečvář, FKCP; **Sindh Province**, Mithi (24.74°N 69.77°E), 1 ♂ 1 ♀, 24 June 2007, leg. Z. Ahmed, NMPC; Mithi, Tharpaiker, 25 July 2010, 2 ♀, NMPC; Noker, 1 ♀, 10 July 2007, leg. Z. Ahmed, NMPC; Jamshoro District, Khanot City (25.74°N 68.29°E), Tori Phatak Village, 20 May 2009, 1 ♂, leg. Z. Ahmed, NMPC; Nagar Parkar (24.36°N 70.75°E), 15 September 2010, 2 ♂ 1 ♀ 1 juv. (Figs. 531–566), leg. Z. Ahmed, NMPC; Hyderabad (25.38°N 68.22°E), 2012, 1 ♀, NMPC; 1 ♂ 1 ♀ without exact locality (No. 1947), 2021, NMPC.

DNA DATA. This species is represented in our study by a single DNA sequence from Pakistan (unspecified locality) (Table 16).

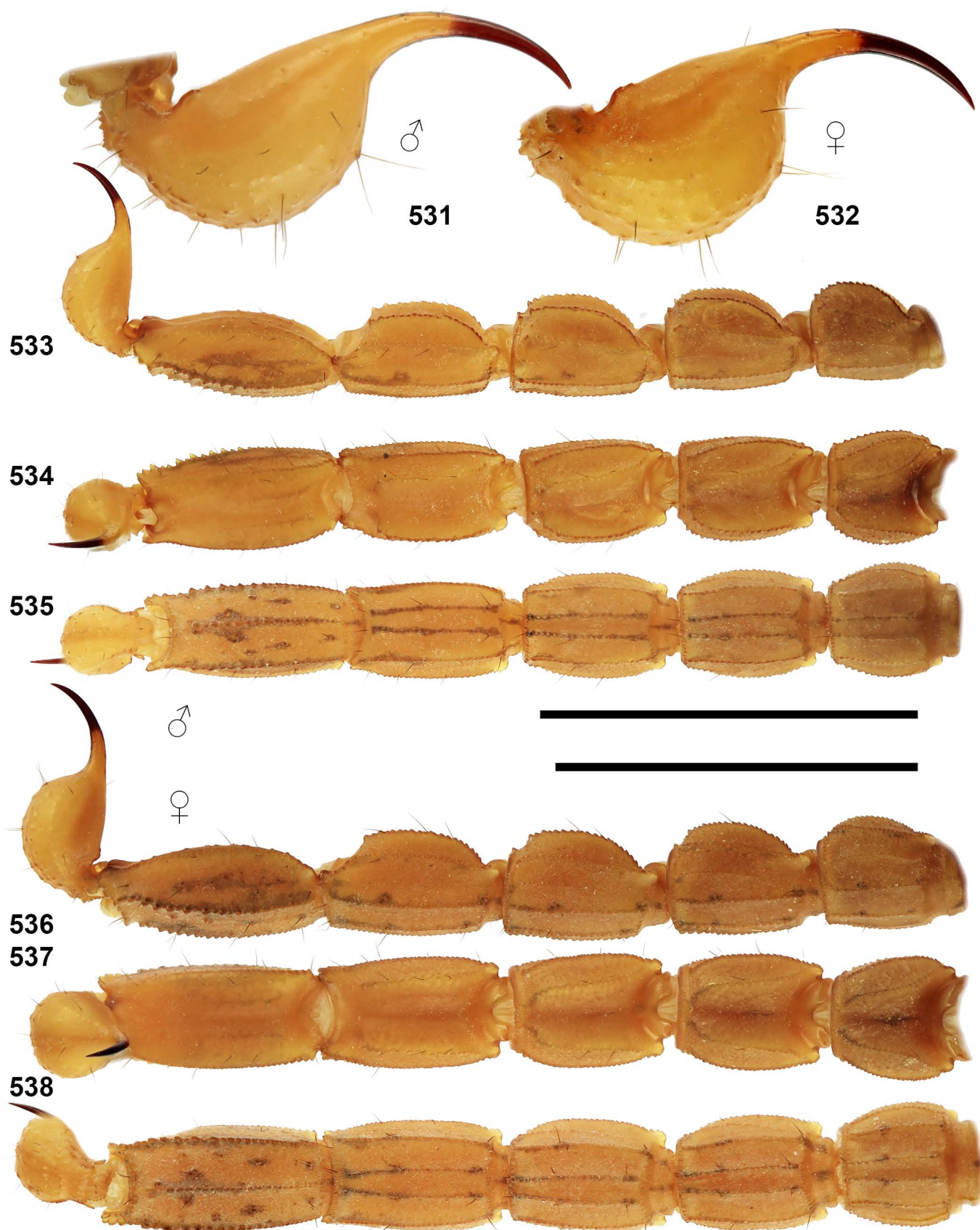
DIAGNOSIS. Total length of adults 38 mm (male) to 55 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est* or with level with *est*. Male with fingers proximally slightly more twisted than in female. Pedipalp chela length/width ratio 3.5–3.7 in male and 3.3–3.5 in female. Pectinal teeth number 23–26 in male, 19–23 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites yellowish to reddish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually granulated carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth to finely granulated, with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally finely granulated. Length to depth ratio of metasoma III 1.5–1.6, metasoma IV 1.7–1.9 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 5–9 retroinferior macrosetae on basitarsus III. Telson elongated, mainly in male. Anal lobe divided into three or four parts.



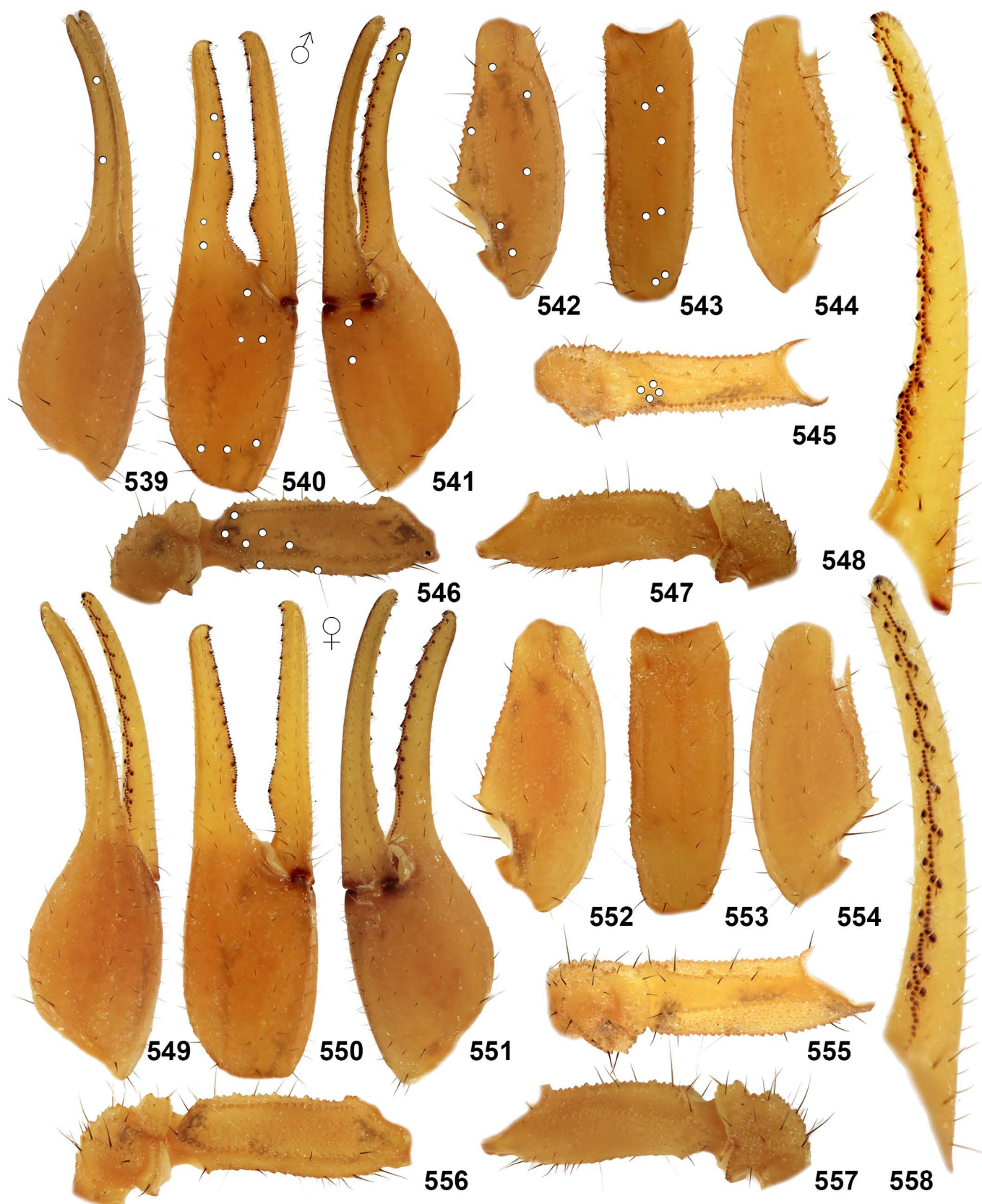
Figures 522–526: *Mesobuthus macmahoni*, female lectotype, dorsal (522) and ventral (523) views, sternopectinal area (524), metasoma V and telson lateral (525), and metasoma II–V and telson lateral (526). Scale bar: 10 mm (522–523).



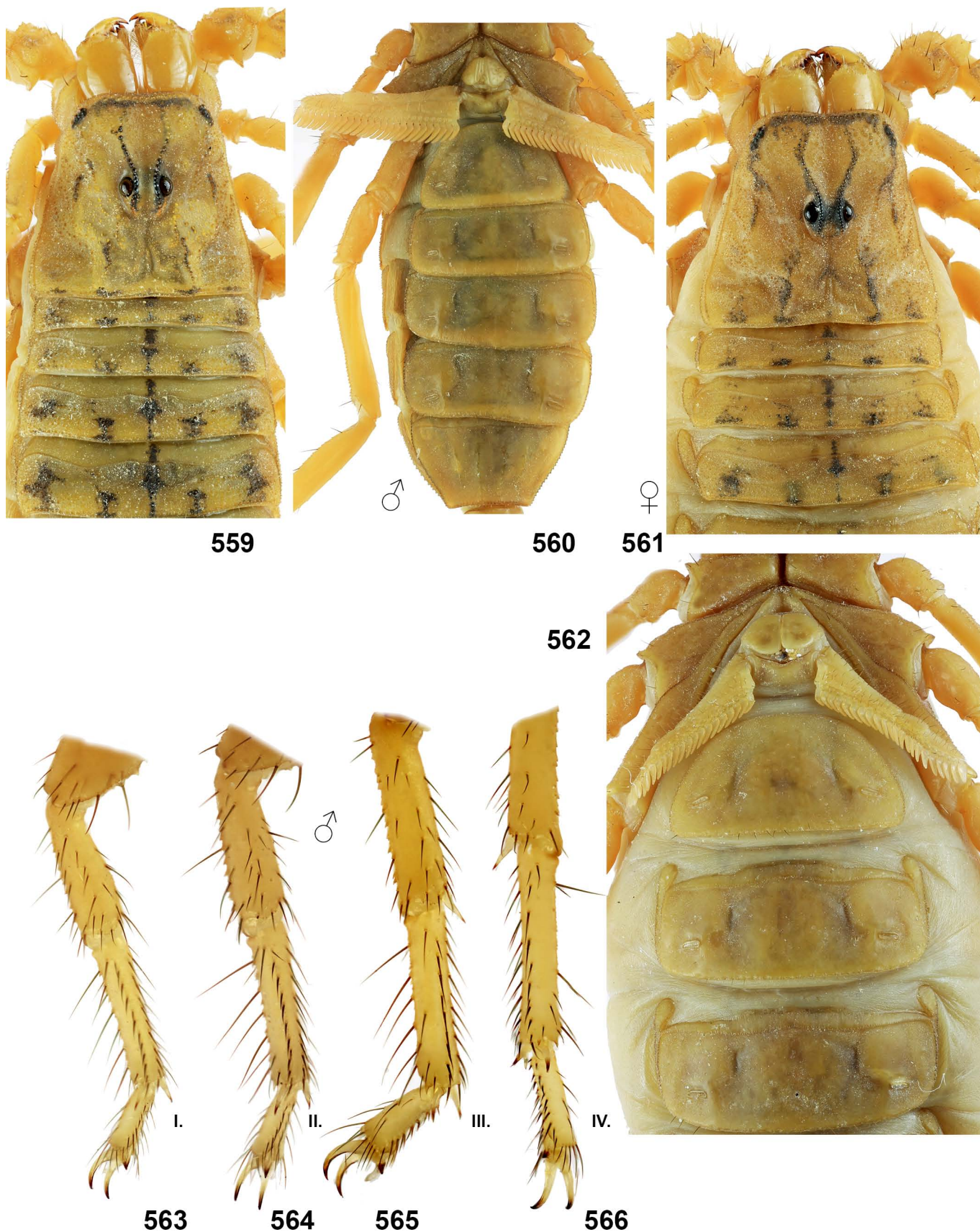
Figures 527–530: *Mesobuthus macmahoni* from Pakistan, Sind, Nagar Parkar, NMPC. **Figures 527–528.** Male, dorsal (527) and ventral (528) views. **Figures 529–530.** Female, dorsal (529) and ventral (530) views. Scale bars: 10 mm (527–528, 529–530).



Figures 531–538: *Mesobuthus macmahoni* from Pakistan, Sind, Nagar Parkar, NMPC. **Figures 531, 533–235.** Male, telson lateral (531), metasoma and telson, lateral (533), dorsal (534), and ventral (535) views. **Figures 532, 536–538.** Female, telson lateral (532), metasoma and telson, lateral (536), dorsal (537), and ventral (538) views. Scale bars: 10 mm (533–535, 536–538).



Figures 539–558: *Mesobuthus macmahoni* from Pakistan, Sind, Nagar Parkar, NMPC, pedipalp. **Figures 539–548.** Male, chela, dorsal (539), external (540), and ventral (541) views. Patella, dorsal (542), external (543) and ventral (544) views. Femur and trochanter, internal (545), dorsal (546), and ventral (547) views. Movable finger (548). **Figures 549–558.** Female, chela, dorsal (549), external (550), and ventral (551) views. Patella, dorsal (552), external (553) and ventral (554) views. Femur and trochanter, internal (555), dorsal (556), and ventral (557) views. Movable finger (558). The trichobothrial pattern is indicated in Figures 539–543, 545–546.



Figures 559–566: *Mesobuthus macmahoni* from Pakistan, Sind, Nagar Parkar, NMPC. **Figures 559–560, 563–566.** Male, chelicerae, carapace and tergites I–IV (559), sternoplectinal region and sternites (560), and left legs I–IV, retrolateral aspect (563–566). **Figures 561–562.** Female, chelicerae, carapace and tergites I–III (561), sternoplectinal region and sternites (562).

Dimensions (mm)		<i>M. marusiki</i> sp. n.	<i>M. marusiki</i> sp. n.	<i>M. mesopotamicus</i>	<i>M. mesopotamicus</i>
		♂ holotype	♀ paratype	♂ lectotype	♀ paralectotype
Carapace	L / W	4.91 / 5.19	5.60 / 6.53	4.90 / 5.28	5.83 / 6.06
Mesosoma	L	12.33	16.97	12.03	19.50
Tergite VII	L / W	3.34 / 5.04	3.93 / 6.80	3.25 / 4.92	4.25 / 7.08
Metasoma + telson	L	25.59	27.63	27.16	29.30
Segment I	L / W / D	3.25 / 3.33 / 2.75	3.54 / 3.55 / 3.10	3.44 / 3.30 / 2.85	3.69 / 3.76 / 3.20
Segment II	L / W / D	3.71 / 3.20 / 2.99	3.86 / 3.52 / 3.15	4.03 / 3.30 / 2.80	4.37 / 3.56 / 3.08
Segment III	L / W / D	3.81 / 3.25 / 2.80	4.05 / 3.54 / 3.11	4.16 / 3.23 / 2.90	4.35 / 3.60 / 3.02
Segment IV	L / W / D	4.45 / 3.15 / 2.65	4.69 / 3.48 / 2.77	4.86 / 3.17 / 2.91	5.15 / 3.35 / 3.01
Segment V	L / W / D	5.52 / 2.89 / 2.21	5.95 / 3.12 / 2.27	5.79 / 2.77 / 2.29	6.26 / 3.13 / 2.76
Telson	L / W / D	4.85 / 2.02 / 1.83	5.54 / 2.39 / 2.12	4.88 / 2.13 / 2.10	5.48 / 2.68 / 2.51
Pedipalp	L	17.74	20.34	17.17	17.96
Femur	L / W	4.12 / 1.18	4.72 / 1.40	3.98 / 1.39	4.41 / 1.65
Patella	L / W	4.84 / 1.82	5.62 / 2.30	4.93 / 1.93	5.26 / 2.22
Chela	L	8.78	10.00	8.26	8.29
Manus	W / D	2.80 / 2.75	2.92 / 2.99	2.55 / 2.63	2.41 / 2.58
Movable finger	L	5.67	6.34	4.80	5.15
Total	L	42.83	50.20	44.09	54.63

Table 7. Comparative measurements of *Mesobuthus marusiki* sp. n. and *M. mesopotamicus* types. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

COMMENTS. We do not confirm this species from Iran. See *M. navidpourii* sp. n. for populations formerly identified as *M. macmahoni* from Iran (Kerman; Sistan & Baluchistan).

DISTRIBUTION. Pakistan (Figs. 1155, 1157).

***Mesobuthus marusiki* sp. n.**

(Figures 567–609, 1155, 1158, Table 7)

<http://zoobank.org/urn:lsid:zoobank.org:act:E81C1A94-70F4-4176-9255-F717E063D1C1>

TYPE LOCALITY AND TYPE REPOSITORY. **Uzbekistan, Karakalpakstan Republic**, Kungrad District, Ustyurt Plateau, 44.34°N 57.35°E; NMPC.

TYPE MATERIAL. **Uzbekistan, Karakalpakstan Republic**, Kungrad District, Ustyurt Plateau, 44.34°N 57.35°E, 2013, 1♂(holotype) 1♀(paratype), NMPC.

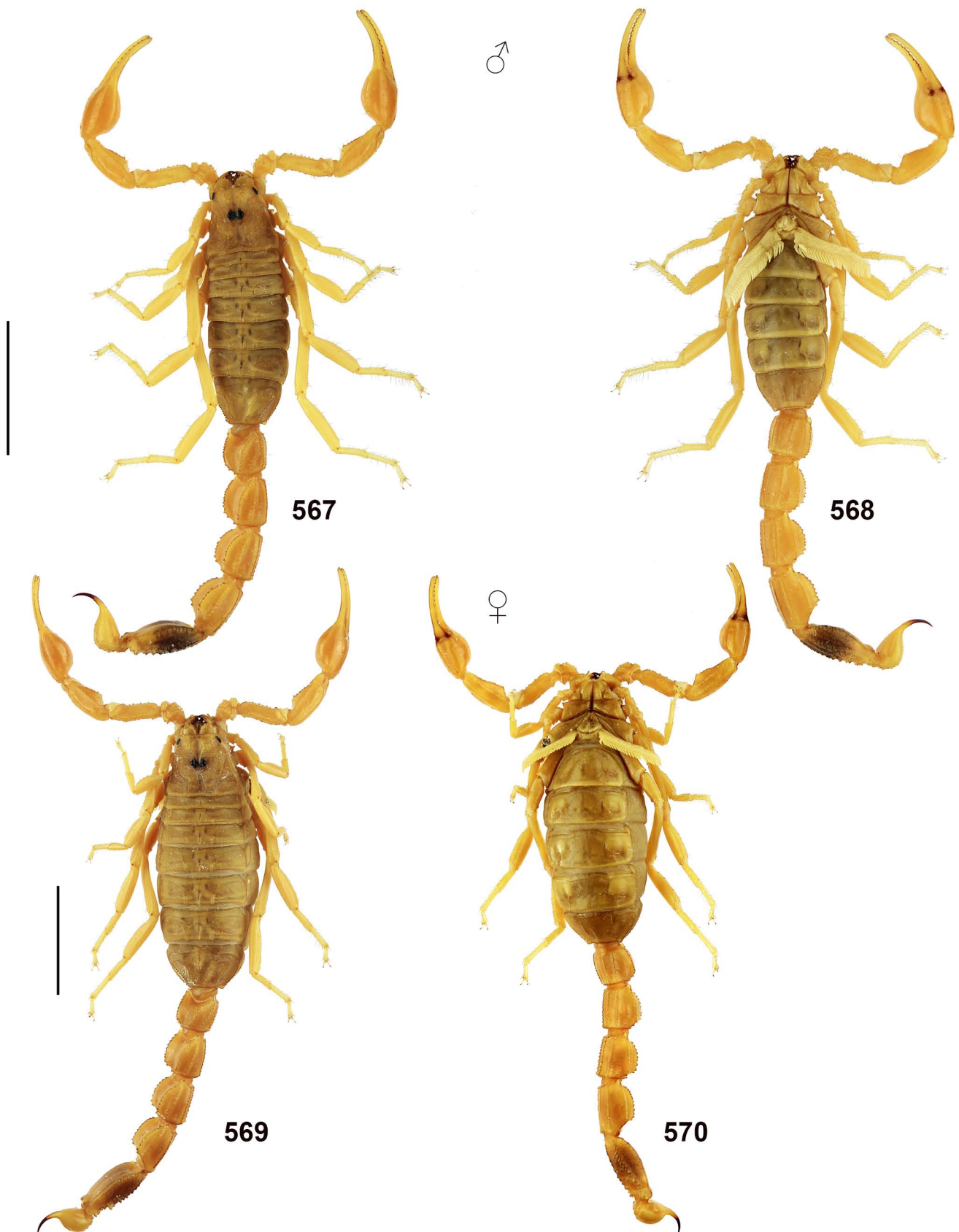
ETYMOLOGY. The species is named in honor of our colleague and friend Yuri Marusik (Magadan, Russia), one of the foremost Russian arachnologists and an enthusiast who wears many hats; Yuri's tireless spider collecting and publishing across the globe greatly enhanced our science.

DIAGNOSIS. Total length of adults 42 mm (male) to 52 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esh*, near to *est*. Male with fingers proximally slightly more twisted than in female. Pedipalp chela length/width ratio 3.1–3.4 in both sexes. Pectinal

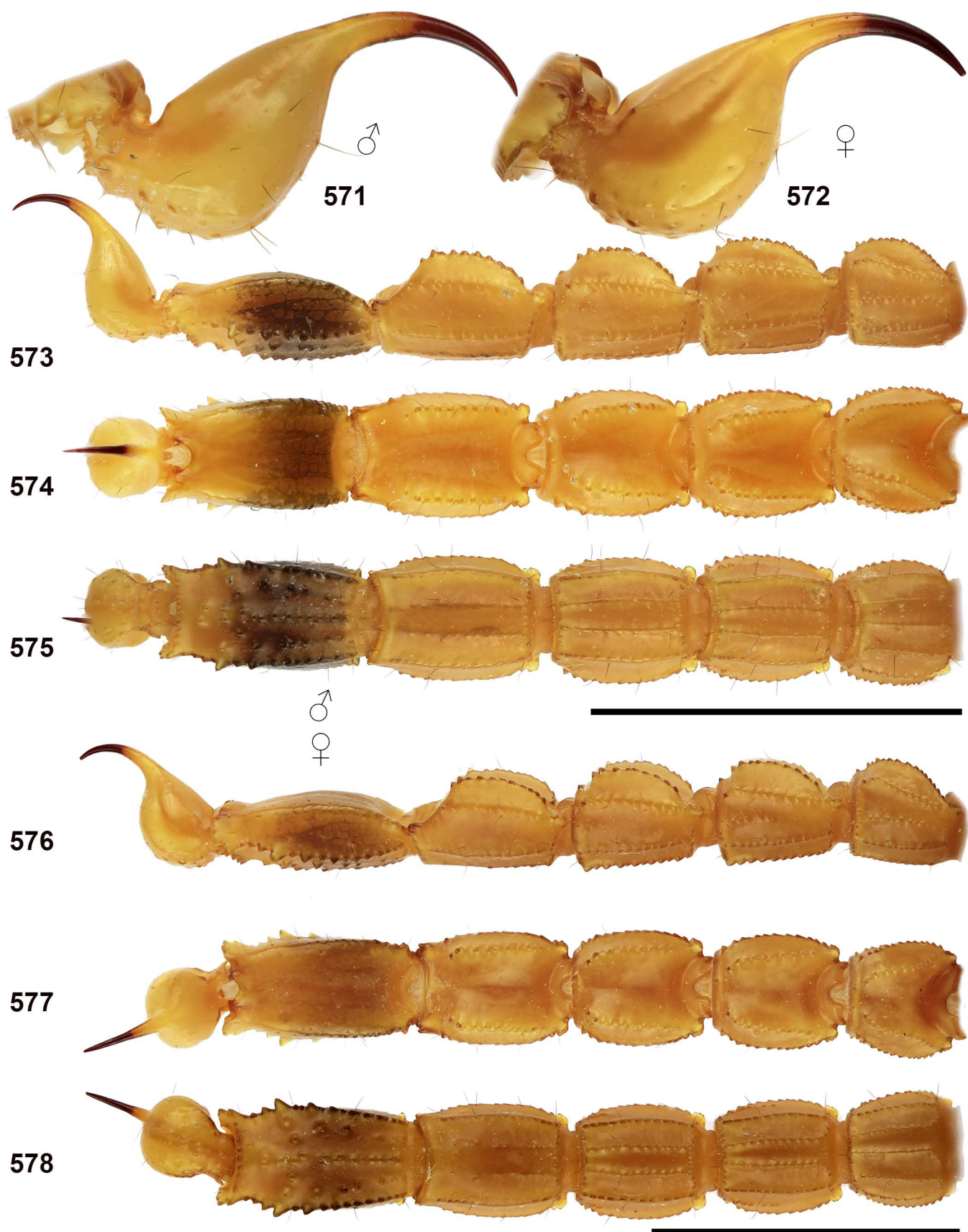
teeth number 29 in male, 22–23 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites yellow to yellowish brown, without dark pigmentation; metasoma, telson, pedipalps and legs yellow, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, dorsolointernal carina granulated. Chela smooth with carinae indicated. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth. Length to depth ratio of metasoma III 1.3–1.4, metasoma IV 1.6–1.7 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–10 retroinferior macrosetae on basitarsus III. Telson elongated. Anal lobe divided into three parts.

DESCRIPTION. Total length of adult male 42 mm, 52 female. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esh*, near to *est*. Male has fingers proximally slightly more twisted than in female. For measurements, see Table 7.

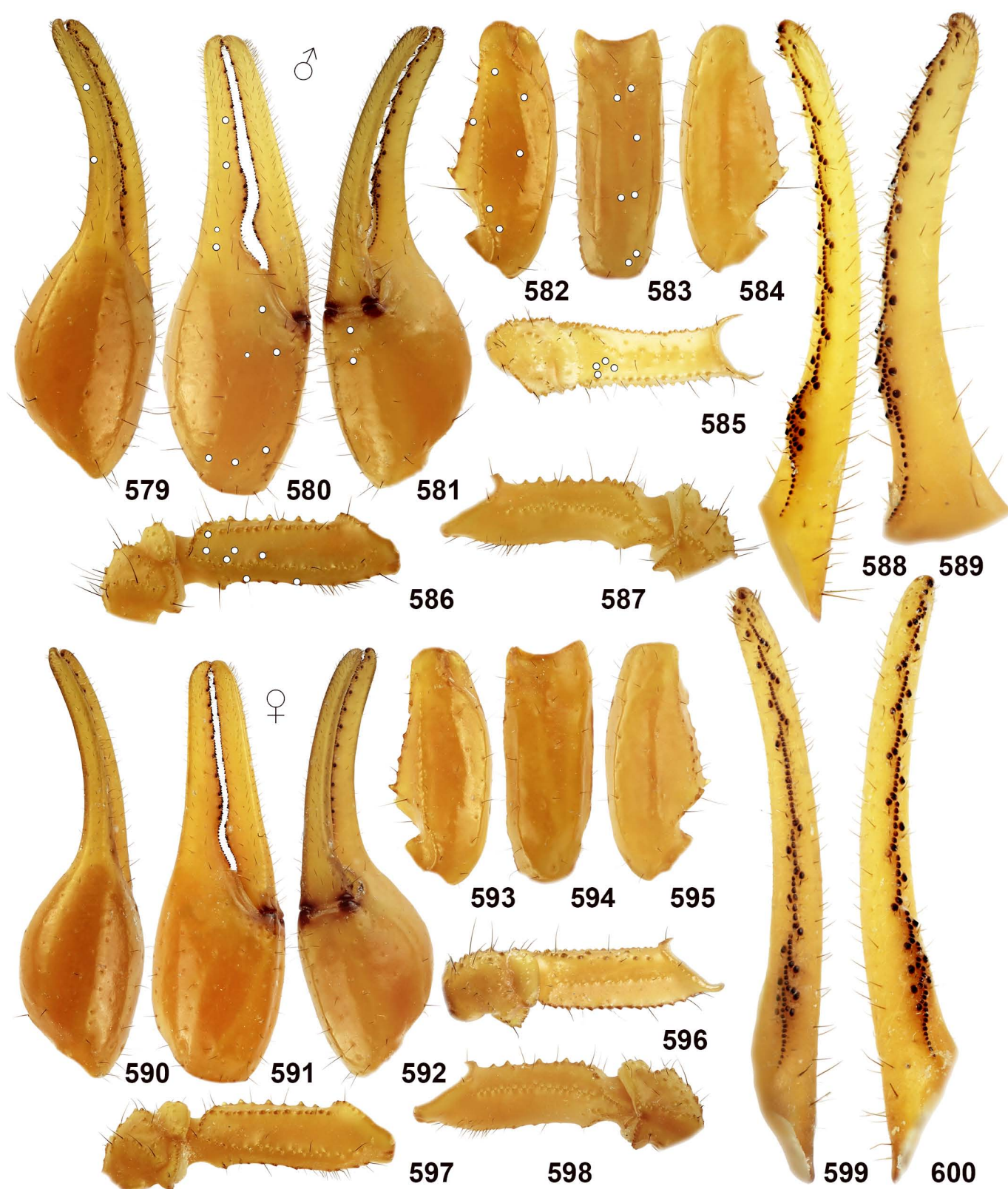
Coloration (Figs. 567–570, 609). Carapace and tergites are yellowish brown without dark pigmentation. Telson is yellow. Metasoma, pedipalps and legs are yellowish brown, only part



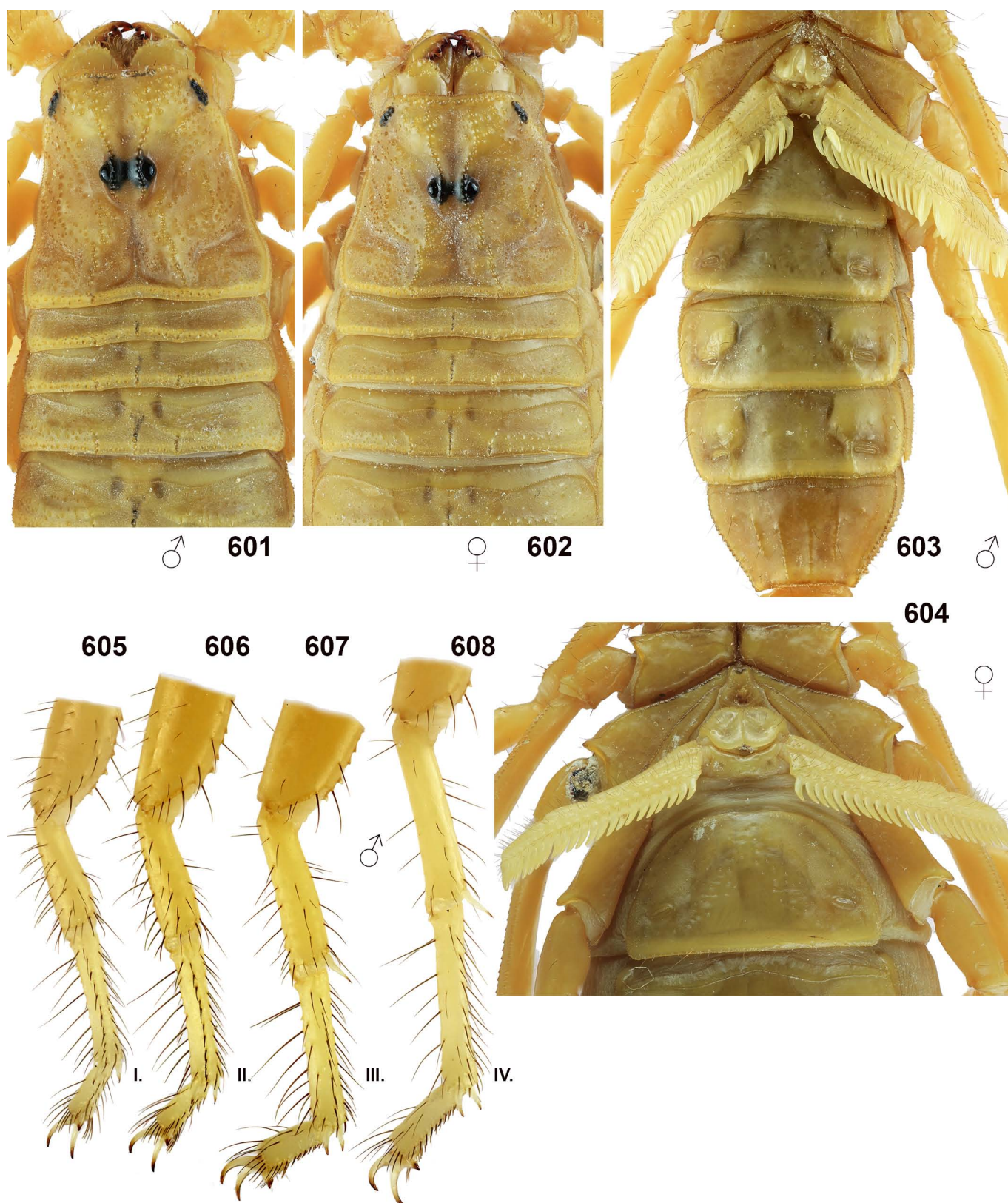
Figures 567–570: *Mesobuthus marusiki* sp. n. **Figures 567–568.** Male holotype, dorsal (567) and ventral (568) views. **Figures 569–570.** Female paratype, dorsal (569) and ventral (570) views. Scale bars: 10 mm (567–568, 569–570).



Figures 571–578: *Mesobuthus marusiki* sp. n. **Figures 571, 573–575.** Male holotype, telson lateral (571), metasoma and telson, lateral (573), dorsal (574), and ventral (575) views. **Figures 572, 576–578.** Female paratype, telson lateral (572), metasoma and telson, lateral (576), dorsal (577), and ventral (578) views. Scale bars: 10 mm (573–575, 576–578).



Figures 579–600: *Mesobuthus marusiki* sp. n., pedipalp. **Figures 579–589.** Male holotype, chela, dorsal (579), external (580), and ventral (581) views. Patella, dorsal (582), external (583) and ventral (584) views. Femur and trochanter, internal (585), dorsal (586), and ventral (587) views. Movable (588) and fixed (589) fingers. **Figures 590–600.** Female paratype, chela, dorsal (590), external (591), and ventral (592) views. Patella, dorsal (593), external (594) and ventral (595) views. Femur and trochanter, internal (596), dorsal (597), and ventral (598) views. Movable (599) and fixed (600) fingers. The trichobothrial pattern is indicated in Figures 579–583, 585–586.



Figures 601–608: *Mesobuthus marusiki* sp. n. **Figures 601, 603, 605–608.** Male holotype, chelicerae, carapace and tergites I–IV (601), sternopectinal region and sternites (603), and left legs I–IV, retrolateral aspect (605–608). **Figures 602, 604.** Female paratype, chelicerae, carapace and tergites I–IV (602), sternopectinal region and sternite III (604).



Figure 609. *Mesobuthus marusiki* sp. n., male (top) and female alive.

of metasomal segment V black. Chelicerae yellow, without reticulation, the tips of denticles on cheliceral fingers are black.

Mesosoma and carapace (Figs. 601–604). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are sparsely granulated. Tergite VII is pentacarinat. Pectinal tooth count is 29 in males, 22–23 in females. Pectinal marginal tips extend to about half of the fifth sternite in male and one-fourth of sternite IV in females. Pectines have three marginal lamellae and seven to nine middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. All sternites are smooth and sparsely hirsute. Sternite VII with four well marked granulated carinae. Other sternites have two furrows.

Pedipalps (Figs. 579–600). Pedipalps hirsute and smooth. Femur has four to five granulated carinae, the middle carina on internal surface consists of strong irregular granules. Patella with eight carinae, of which internal and dorsal are granulated. The chela is with smooth carinae indicated. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 605–608). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–10 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and strong on legs III and IV and absent on the other legs.

Metasoma and telson (Figs. 571–578). All metasomal segments only sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma smooth. Ventrolateral carinae of metasoma V posteriorly with several large lobate denticles. Telson is very sparsely hirsute, elongate and smooth. Anal lobe divided into three parts.

COMMENTS. *M. marusiki* sp. n. morphologically does not appear to be close to its eastern neighbor *M. thersites*, which occupies vast lowland areas of eastern Central Asia, nor to *M. bogdoensis*, which approaches the Caspian area from the northwest. Discovery of a new species in this area east of the Caspian Sea was unexpected.

No DNA data are yet available for this new species.

DISTRIBUTION. Uzbekistan (Figs. 1155, 1158).

***Mesobuthus mesopotamicus* (Penther, 1912), stat. n.**
(Figures 610–649, 1155–1156, 1164, Tables 7, 15)

<http://zoobank.org/urn:lsid:zoobank.org:act:48250000-B2C9-4358-838E-DB90549C064E>

Buthus eupaeus (incorrect spelling) *mesopotamicus* Penther, 1912: 111–112.

TYPE LOCALITY AND TYPE REPOSITORY. **Iraq**, Mosul (36.34°N 43.13°E); NHMW.

REFERENCES (selected):

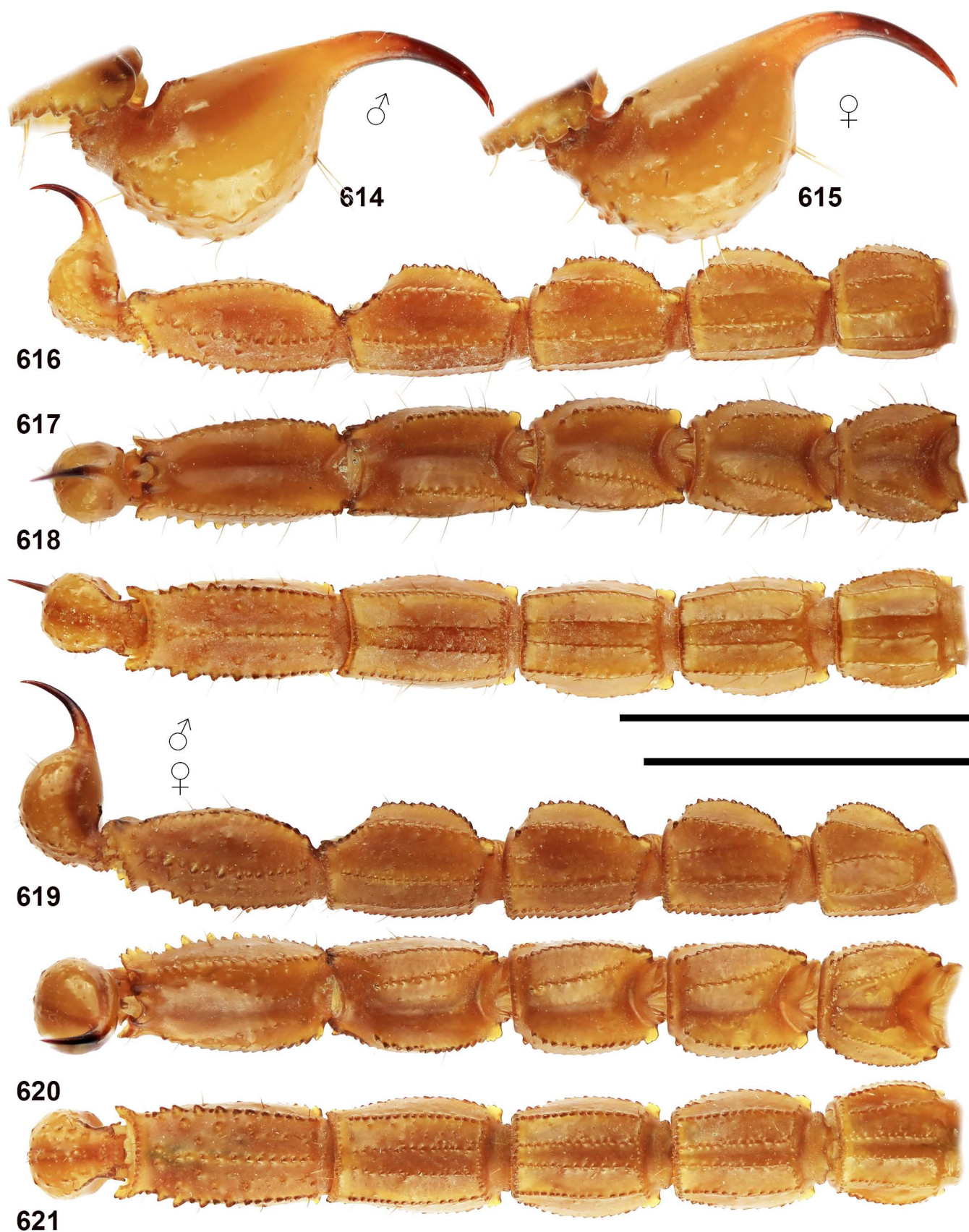
- Buthus eupeus mesopotamicus*: Birula, 1917a: 39, 41, 228; Birula, 1918: 15–24, figs. 3–5.
Mesobuthus eupeus mesopotamicus: Vachon, 1958: 155; Fet, 1994: 527; Fet & Lowe, 2000: 173 (complete references list until 1998).
Mesobuthus eupeus: Crucitti & Cicuzza, 2000: 287; Teruel, 2002: 75–76, figs. 1–3 (in part); Karataş & Karataş, 2003: 1–4, figs. 1–2 (in part); ?Karataş & Çolak, 2005: 3–4, fig. 1; Yağmur et al., 2007: 97–98 (in part).
Mesobuthus eupeus phillipsii: Kovařík et al., 2011: 5–13 (in part), figs. 12–15, 17–18, 21–22, 24–27.
Mesobuthus phillipsii: Hussien & Ahmad, 2020: 6717–6718, figs. 1, 6; Kachel et al., 2021: 4.

TYPE MATERIAL EXAMINED (NHMW). **Iraq** (“Mesopotamien”), Mosul (36.34°N 43.13°E), 1♂ (NMW 2951, lectotype designated here, Figs. 610–611, 614, 616–618, 622–631, 642–643, 646–649), 2♂8♀ (NMW 2951, paralectotypes, Figs. 612–613, 615, 619–621, 632–641, 644–645); 28 May 1910, leg. V. Pietschmann; Kal’at Schergat (= Qal’at Shergat = Assur, 35.46°N 43.26°E), 1♂2♀ (NMW 2953, paralectotypes), 11 May 1910, leg. V. Pietschmann; Assur (= Qal’at Shergat, 35.46°N 43.26°E), 1♂1♀1juv.♂ (NMW 2954, paralectotypes), 19 May 1910, 1♀ (NMW 2955, paralectotype), leg. V. Pietschmann.

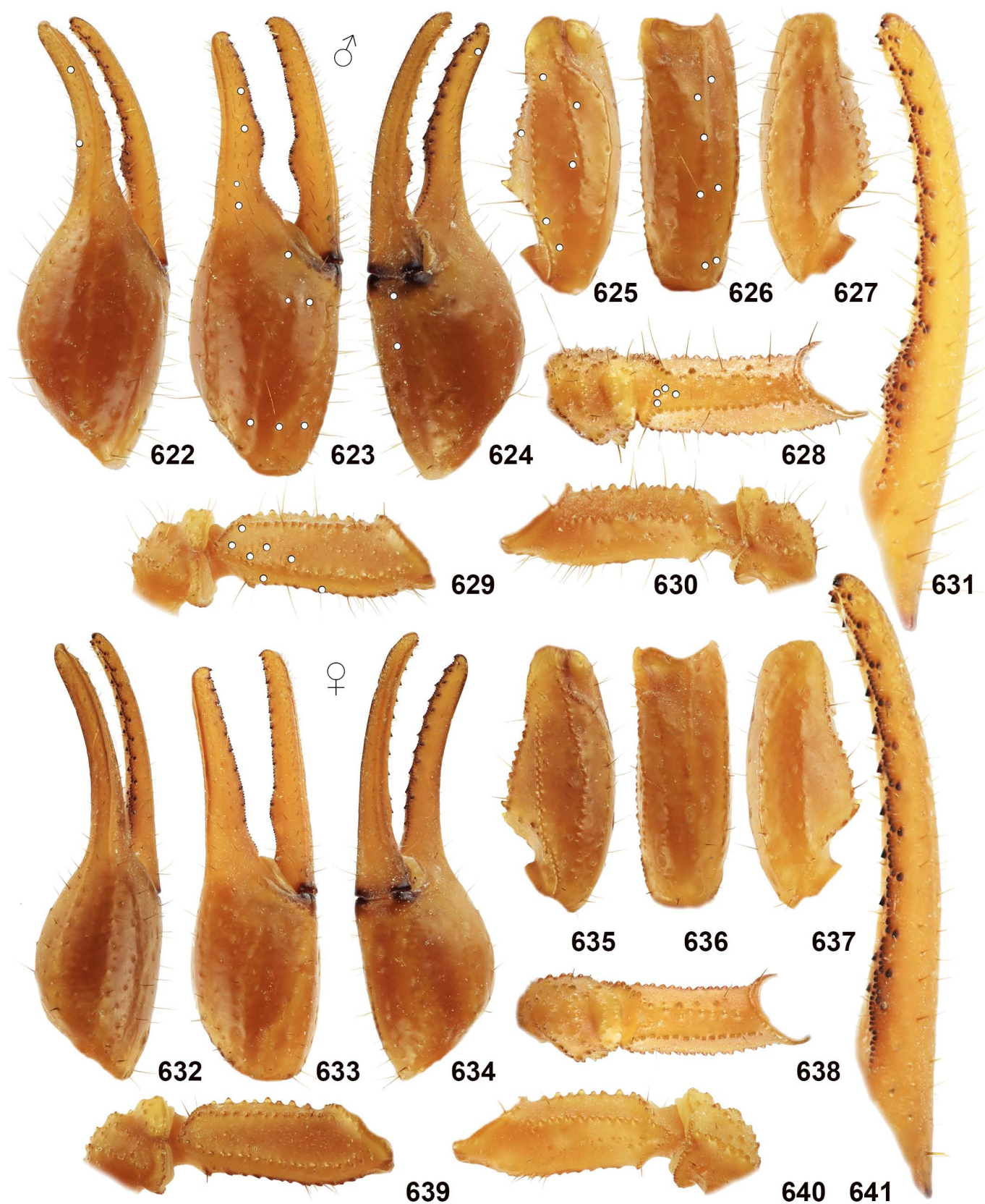
OTHER MATERIAL EXAMINED. **Iraq**, Haditha (34.15°N 42.24°E), 1958, 2juvs., NMPC; Baghdad env. (33.31°N 44.21°E), 17♂44♀88juvs., 1923, leg. Vlasta Kálalová, NMPC. **Syria**, Damascus (33.51°N 36.21°E), 3♀, June 1963, leg. Havlín, NMPC. **Turkey**, **Adıyaman Province**, Nemrut Mountain (37.98°N 38.74°E), 9 June 1996, 1♂, leg. M. Snížek, NMPC; Sincik, Kocahisar Village, 37°56'35"N 38°38'47"E (37.93°N 38.63°E), 625 m a. s. l., 15 July 2020, 5♂, leg. F. Alaca; **Diyarbakır Province**, Ergani District, Tevekli Village, 38°11'54"N 39°51'37"E (38.18°N 39.85°E), 823 m a. s. l., 16 June 2007, 1♀, leg. E. A. Yağmur & M. Yalçın, NMPC; Çermik District, 6 km SW of Petekkaya Village, 38°03'06"N 39°24'17"E (38.05°N 39.40°E), 722 m a. s. l., 11 April 2008, 1♀, leg. E. A. Yağmur, NMPC; **Gaziantep Province**, Şehitkamil, Bedirköy, 37°10'34"N 37°26'57"E (37.17°N 37.43°E), 852 m a. s. l., 29 August 2020, 7♂2♀3juvs., leg. E. A. Yağmur, E. Tezcan & M. Özkörük, AZMM; Şahimbey, Perilikaya, Gaziantep Town, 10 May 2010, 3♂1♀ (Nos. 211, 217, 223), leg. E. A. Yağmur, AZMM; **Kahramanmaraş Province**, Türkoğlu, Evri Village, 37°16'13"N 37°08'33"E (37.27°N 37.13°E), 720 m a. s. l., 23 June 2007, 7♂2♀11juvs. (No. 1897), leg. E. A. Yağmur, AZMM; **Mardin Province**, Yeşilli, Hop Pass, 37°22'20"N 40°51'51"E (37.37°N 40.85°E), 1161 m a. s. l., 14 April 2010, 3♀3juvs, leg. E. A. Yağmur, AZMM; Yeşilli, 37°19'57"N 40°48'33"E (37.33°N 40.81°E), 12 May 2013, 1♀ (No. 370), leg. H. Koç, AZMM; **Şanlıurfa**



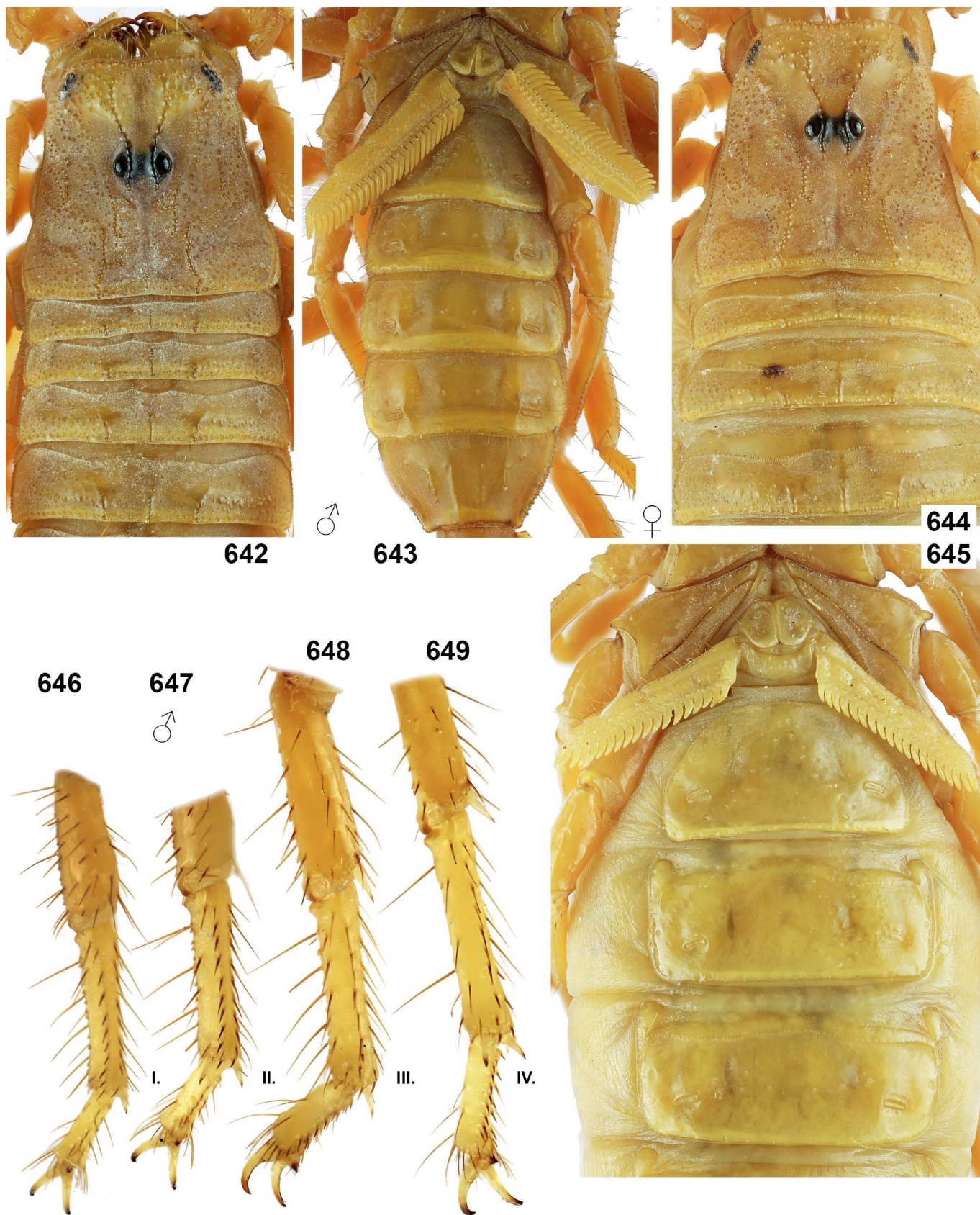
Figures 610–613: *Mesobuthus mesopotamicus*. **Figures 610–611.** Male lectotype, dorsal (610) and ventral (611) views. **Figures 612–613.** Female paralectotype, dorsal (612) and ventral (613) views. Scale bars: 10 mm (610–611, 612–613).



Figures 614–621: *Mesobuthus mesopotamicus*. **Figures 614, 616–618.** Male lectotype, telson lateral (614), metasoma and telson, lateral (616), dorsal (617), and ventral (618) views. **Figures 615, 619–621.** Female paralectotype, telson lateral (615), metasoma and telson, lateral (619), dorsal (620), and ventral (621) views. Scale bars: 10 mm (616–618, 619–621).



Figures 622–641: *Mesobuthus mesopotamicus*, pedipalp. **Figures 622–631.** Male lectotype, chela, dorsal (622), external (623), and ventral (624) views. Patella, dorsal (625), external (626) and ventral (627) views. Femur and trochanter, internal (628), dorsal (629), and ventral (630) views. Movable finger (631). **Figures 632–641.** Female paralectotype, chela, dorsal (632), external (633), and ventral (634) views. Patella, dorsal (635), external (636) and ventral (637) views. Femur and trochanter, internal (638), dorsal (639), and ventral (640) views. Movable finger (641). The trichobothrial pattern is indicated in Figures 622–626, 628–629.



Figures 642–649: *Mesobuthus mesopotamicus*. **Figures 642–643, 646–649.** Male lectotype, chelicerae, carapace and tergites I–IV (642), sternopectinal region and sternites (643), and left legs I–IV, retrolateral aspect (646–649). **Figures 644–645.** Female paralectotype, chelicerae, carapace and tergites I–III (644), sternopectinal region and sternites III–V (645).

Province, Birecik District, Çiçekalan Village, 36°56'74"N 38°01'37"E (36.93°N 38.02°E), 410 m a. s. l., 1 April 2006, 1♂1♀, leg. E. A. Yağmur & M. Z. Yıldız, NMPC; Kelaynak Valley, 2 km N of Birecik District, 37°02'59"N 37°59'07"E (37.03°N 37.98°E), 388 m a. s. l., 1 April 2006, 1♀, leg. E. A. Yağmur & M. Özkörük, NMPC; Birecik District, Çiçekalan Village, 36°56'74"N 38°01'37"E (36.93°N 38.02°E), 410 m a. s. l., 1 April 2008, 1♀2juvs.(♀♂), leg. M. Z. Yıldız, NMPC; Halfeti, Savaşan Village, 1 km S of Halfeti, 37°17'17"N 37°51'49"E (37.28°N 37.85°E), 576 m a. s. l., 30 March 2008, 2♂2♀, leg. E. A. Yağmur, AZMM; Ceylanpınar, 3 km W of Ceylanpınar Town, 36°51'59"N 39°59'59"E (36.87°N 39.99°E), 376 m a. s. l., 1 April 2011, 4♀7juvs., leg. E. A. Yağmur, AZMM; Central, N of Tektek Mountains, 37°10'08"N 35°13'40"E (37.17°N 35.22°E), 555 m a. s. l., 10 June 2007, 2 juvs., leg. E. A. Yağmur & H. Koç, AZMM; **Şırnak Province**, İdil District, Yörük Villag, 37°16'57"N 42°01'07"E (37.27°N 42.02°E), 669 m a. s. l., 21 May 2009, 1♀1juv.♂, leg. E. A. Yağmur, NMPC; İdil, 40 km NW of İdil, 37°18'57"N 41°42'48"E (37.32°N 41.70°E), 828 m a. s. l., 12 April 2011, 2♀2juvs., leg. E. A. Yağmur & M. Özkörük, AZMM; Şırnak, Uludere, Bağlıca Village, 37°27'00"N 42°45'08"E (37.45°N 42.75°E), 931 m a. s. l., 10–15 October 2018, 8♂2♀, leg. D. Türk, AZMM.

DNA DATA. This species was represented in our survey by two DNA sequences from Turkey (Kahramanmaraş and Mardin Provinces) (Table 16).

DIAGNOSIS. Total length of adults 38 mm (male) to 58 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.2–3.45 in both sexes. Pectinal teeth number 21–27 in male, 16–22 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites yellowish to reddish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, both dorsal can be granulated. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with 4 well marked smooth or granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth. Length to depth ratio of metasoma III 1.3–1.45, metasoma IV 1.65–1.8 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–9 retroinferior macrosetae on basitarsus III. Telson bulbous, mainly in female. Anal lobe divided into three or four parts.

HISTORY OF STUDY. This taxon was described, as a subspecies of *Buthus eupeus*, in 1912 by an Austrian naturalist Arnold Penther (1865–1931) from the collections of Victor Pietschmann (1881–1956) in 1910 in Mesopotamia, now in Iraq, then still part of the Ottoman Empire. A few years later, right before the World War I started, a Russian zoologist Petr Nesterov (1883–1941) conducted a detailed exploration of the border region between the Ottoman Empire and Persia (now Iran). Nesterov's collections were brought to ZISP and his scorpions were thoroughly studied by Birula (1918) who confirmed validity of Penther's subspecies. It was recently considered a synonym of *Mesobuthus eupeus phillipsii* (see Kovařík et al., 2011: 5) or *M. phillipsii* (see Kovařík, 2019). Here, we restore it from synonymy and elevate to species status, according to our DNA phylogeny.

DISTRIBUTION. Iraq, Syria, Turkey (Figs. 1155–1156).

Mesobuthus mirshamsii sp. n.

(Figures 650–690, 1155, 1157, Table 8)

<http://zoobank.org/urn:lsid:zoobank.org:act:6560F74F-3E28-44EA-ADC7-4CBE8367E659>

TYPE LOCALITY AND TYPE REPOSITORY. Iran, **Hormozgan Province**, Lengeh Port, 26°45'5"N 54°53'46.6"E (26.75°N 54.88°E), 94 m a. s. l.; NMPC.

REFERENCES:

- Mesobuthus eupeus persicus*: Navidpour et al., 2013: 8–11, figs. 3, 7–9 (in part).
Mesobuthus phillipsii: Navidpour et al., 2013: 11, figs. 4, 9, 37 (in part).

TYPE MATERIAL (NMPC). Iran, **Hormozgan Province**, 15 km S Minab (27.13°N 57.01°E), (E Bandar-e Abbas), 25 April 2002, 1♀ (paratype), leg. P. Kabátek; 35 km SE Minab, 26 April 2002, 1♂ (paratype), leg. P. Kabátek; 26°51'57.3"N 57°19'13.8"E (26.85°N 57.32°E), 112 m a. s. l. (Locality No. HO-113), April 2008, 1♂ (paratype), leg. Mashipour, Bahrani & Habibzadeh, NMPC; Minab-Radan road, 27°24'08"N 56°56'31.9"E (27.40°N 56.93°E), 75 m a. s. l. (Locality No. HO-116), April 2008, 1juv. (paratype), leg. Mashipour, Bahrani & Habibzadeh, NMPC; Shahre Babak, Jask to Bashagard road, 25°50'53.1"N 57°50'40.7"E (25.83°N 57.48°E), 178 m a. s. l. (Locality No. HO-120), May 2008, 1♂1♀ (paratypes), leg. Mashipour, Bahrani & Habibzadeh, NMPC; Jask to Bashagard road, 25°55'18.4"N 57°49'42.3"E (25.92°N 57.82°E), 274 m a. s. l. (Locality No. HO-121), May 2008, 2juvs. (paratypes), leg. Mashipour, Bahrani & Habibzadeh, NMPC; Jask to Minab road, 25°52'34.9"N 57°29'47.4"E (25.86°N 57.48°E), 46 m a. s. l. (Locality No. HO-126), May 2008, 1♀ (paratype), leg. Mashipour, Bahrani & Habibzadeh, NMPC; Bandar Abbas to Bastak road, 27°12'01.4"N 55°40'04.3"E (27.20°N 55.40°E), 20 m a. s. l. (Locality HO-131), May 2008, 2♀ (paratypes), leg. Mashipour, Bahrani & Habibzadeh, NMPC; Bandar Abbas

Dimensions (mm)		<i>M. mirshamsii</i> sp. n.	<i>M. mirshamsii</i> sp. n.	<i>M. navidpouri</i> sp. n.	<i>M. navidpouri</i> sp. n.
		♂ holotype	♀ paratype	♂ holotype	♀ paratype
Carapace	L / W	4.02 / 4.73	5.37 / 6.05	4.70 / 4.49	6.35 / 6.82
Mesosoma	L	8.65	12.96	11.17	12.99
Tergite VII	L / W	2.63 / 4.48	3.48 / 5.73	3.08 / 4.63	3.83 / 6.72
Metasoma + telson	L	22.99	26.43	26.85	32.61
Segment I	L / W / D	2.94 / 2.76 / 2.57	3.43 / 3.49 / 2.85	3.17 / 2.61 / 2.20	4.14 / 3.56 / 3.22
Segment II	L / W / D	3.44 / 2.61 / 2.57	3.78 / 3.37 / 2.81	3.62 / 2.49 / 2.18	4.72 / 3.28 / 3.03
Segment III	L / W / D	3.43 / 2.67 / 2.45	3.94 / 3.31 / 2.87	3.84 / 2.33 / 2.20	4.88 / 3.15 / 2.92
Segment IV	L / W / D	3.82 / 2.59 / 2.34	4.61 / 3.16 / 2.68	4.29 / 2.28 / 2.05	5.47 / 3.00 / 2.83
Segment V	L / W / D	4.82 / 2.22 / 2.04	5.36 / 2.66 / 2.50	5.17 / 2.00 / 1.75	6.58 / 2.72 / 2.45
Telson	L / W / D	4.54 / 1.94 / 1.82	5.31 / 2.44 / 2.28	6.76 / 1.73 / 2.22	6.82 / 2.44 / 2.39
Pedipalp	L	14.68	17.04	16.05	20.81
Femur	L / W	3.66 / 1.14	4.09 / 1.33	3.62 / 1.90	4.77 / 1.68
Patella	L / W	4.13 / 1.66	4.85 / 2.04	4.89 / 1.78	6.32 / 2.44
Chela	L	6.89	8.10	7.54	9.72
Manus	W / D	2.00 / 2.18	2.29 / 2.33	1.65 / 1.67	2.33 / 2.49
Movable finger	L	3.93	4.79	4.93	6.53
Total	L	35.66	44.76	42.72	51.95

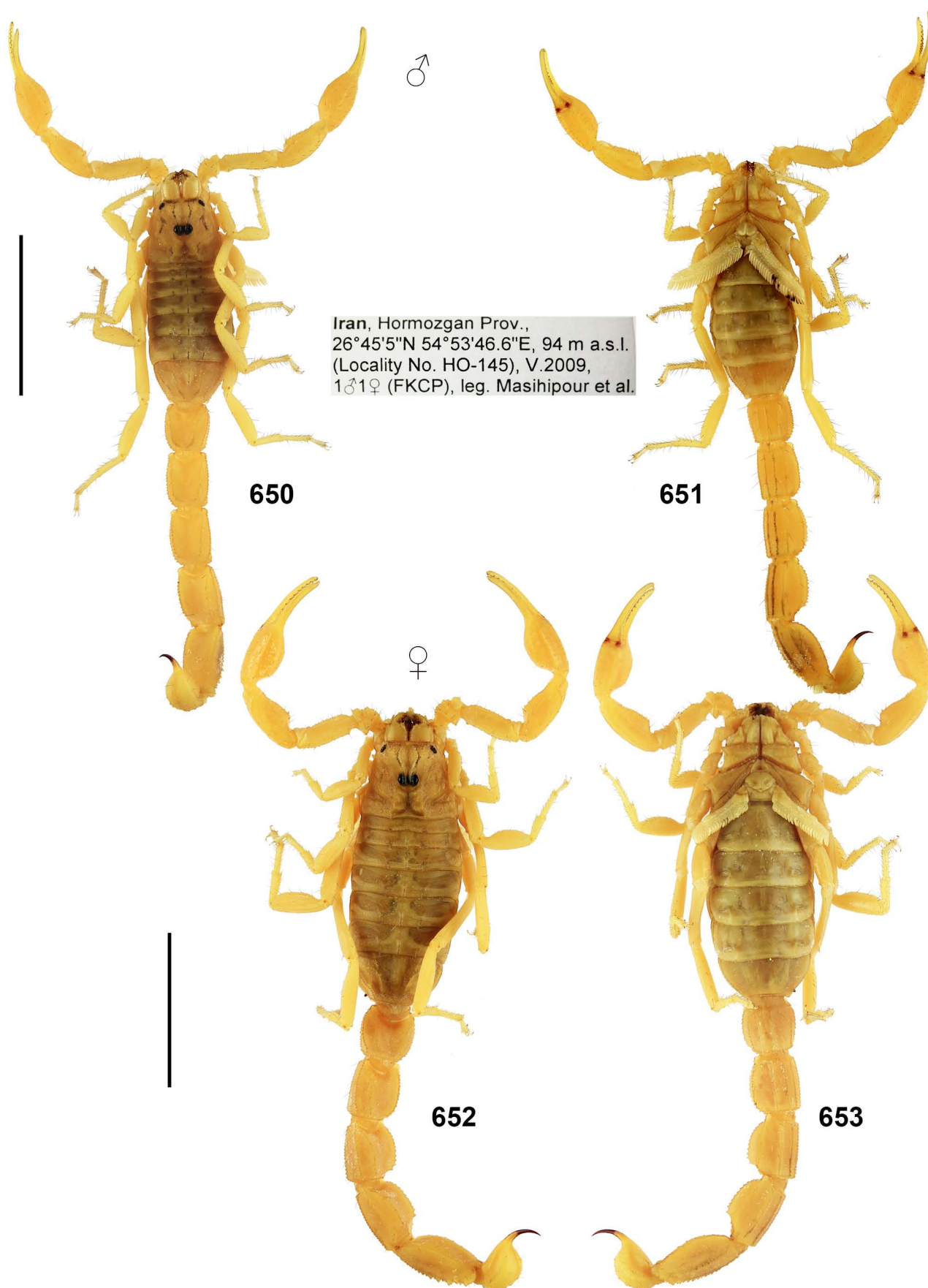
Table 8. Comparative measurements of *Mesobuthus mirshamsii* sp. n. and *M. navidpouri* sp. n. types. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

to Bandar Lengeh road, 27°09'55.6"N 56°11'08.8"E (27.15°N 56.18°E), 3 m a. s. l. (Locality HO-140), May 2008, 1♂ (paratype), leg. Mashipour, Bahrani & Habibzadeh, NMPC; Lengeh Port, 26°44'46.8"N 54°53'01.7"E (26.73°N 54.88°E), 30 m a. s. l. (Locality No. HO-144), May 2009, 1♂ (paratype), leg. Mashipour, Hayader and Habibzadeh; 26°45'5"N 54°53'46.6"E (26.75°N 54.88°E), 94 m a. s. l. (Locality No. HO-145), May 2009, 1♂ (holotype) 1♀ (paratype), leg. Mashipour, Hayader and Habibzadeh; 26°45'57.3"N 54°46'31.4"E (26.75°N 54.77°E), 18 m a. s. l. (Locality No. HO-148), November 2008, 2♂2♀ (paratypes), leg. Mashipour & Hayader; Bandar Abbas to Lengeh Port road, 26°40'40.2"N 55°04'07.4"E (26.67°N 55.07°E), 17 m a. s. l. (Locality No. HO-150), November 2008, 1juv. (paratype), leg. Mashipour & Bahrani; 26°46'36.6"N 55°13'59.2"E (26.77°N 55.22°E), 5 m a. s. l. (Locality No. HO-152), November 2008, 1♀ (paratype), leg. Mashipour, Hayader & Habibzadeh; 27°04'41.0"N 55°29'54.3"E (27.07°N 55.48°E), 219 m a. s. l. (Locality No. HO-155), November 2008, 1♀2juvs. (paratypes), leg. Mashipour, Hayader & Habibzadeh; Parsian to Lamerd road, 27°05'15.7"N 53°29'26.2"E (27.08°N 53.48°E), 235 m a. s. l. (Locality No. HO-156), November 2008, 2♂ (paratypes), leg. Mashipour, Hayader & Habibzadeh; Parsian to Lamerd road, 27°05'52.3"N 53°23'23.2"E (27.08°N 53.38°E), 168 m a. s. l. (Locality No. HO-158), November 2008, 1♂1♀ (paratypes), leg. Mashipour, Hayader & Habibzadeh; Radan to Bandar Abbas road, 27°22'50.7"N 56°50'07.8"E (27.36°N 56.83°E), 36 m a. s. l. (Locality No. HO-130), V.2008, 1♂1♀ (paratypes), leg. Mashipour, Bahrani & Habibzadeh; Hassan Langi env., 60 km E Bandar Abbas, 27°22'28"N 56°46'18"E

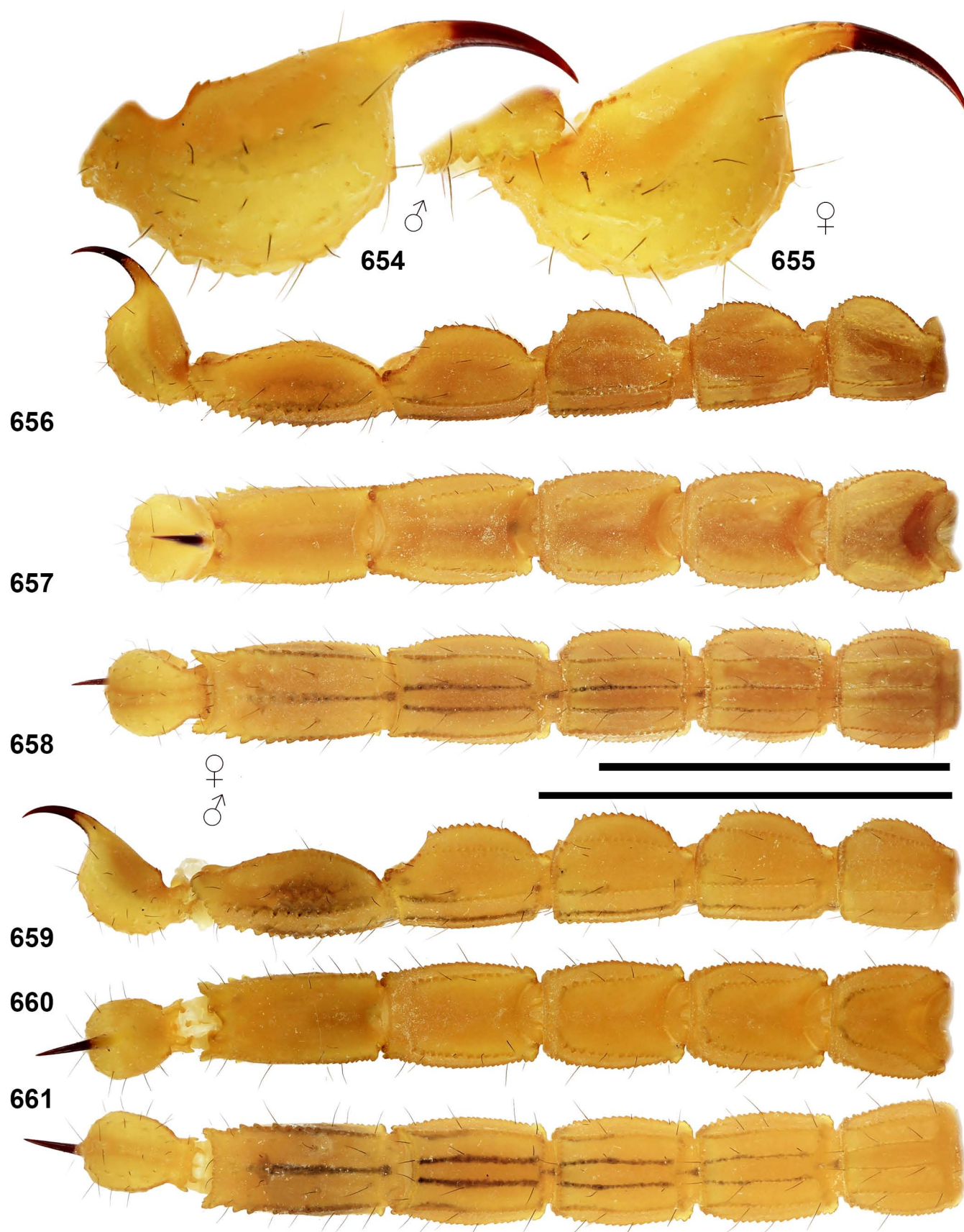
(27.39°N 56.76°E), 124 m a. s. l., 25 May 2014, 3♂1♀ (paratypes), leg. P. Kučera.

ETYMOLOGY. The new species is named in honor of our colleague Omid Mirshamsi who conducts the Iranian scorpion taxonomy research for many years, including important work published on *Mesobuthus*.

DIAGNOSIS. Total length of adults 35 mm (male) to 55 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est* or with level with *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.4–3.6 in both sexes. Pectinal teeth number 21–27 in male, 18–22 in female. Chelicerae yellow, without reticulation. Pedipalps densely hirsute and metasoma hirsute with long setae. Carapace and tergites yellow with reduced pigmentation; metasoma, telson, pedipalps and legs yellow, only part of metasomal segment V can be black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, both dorsal carinae are granulated. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII finely granulated on margins with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma I



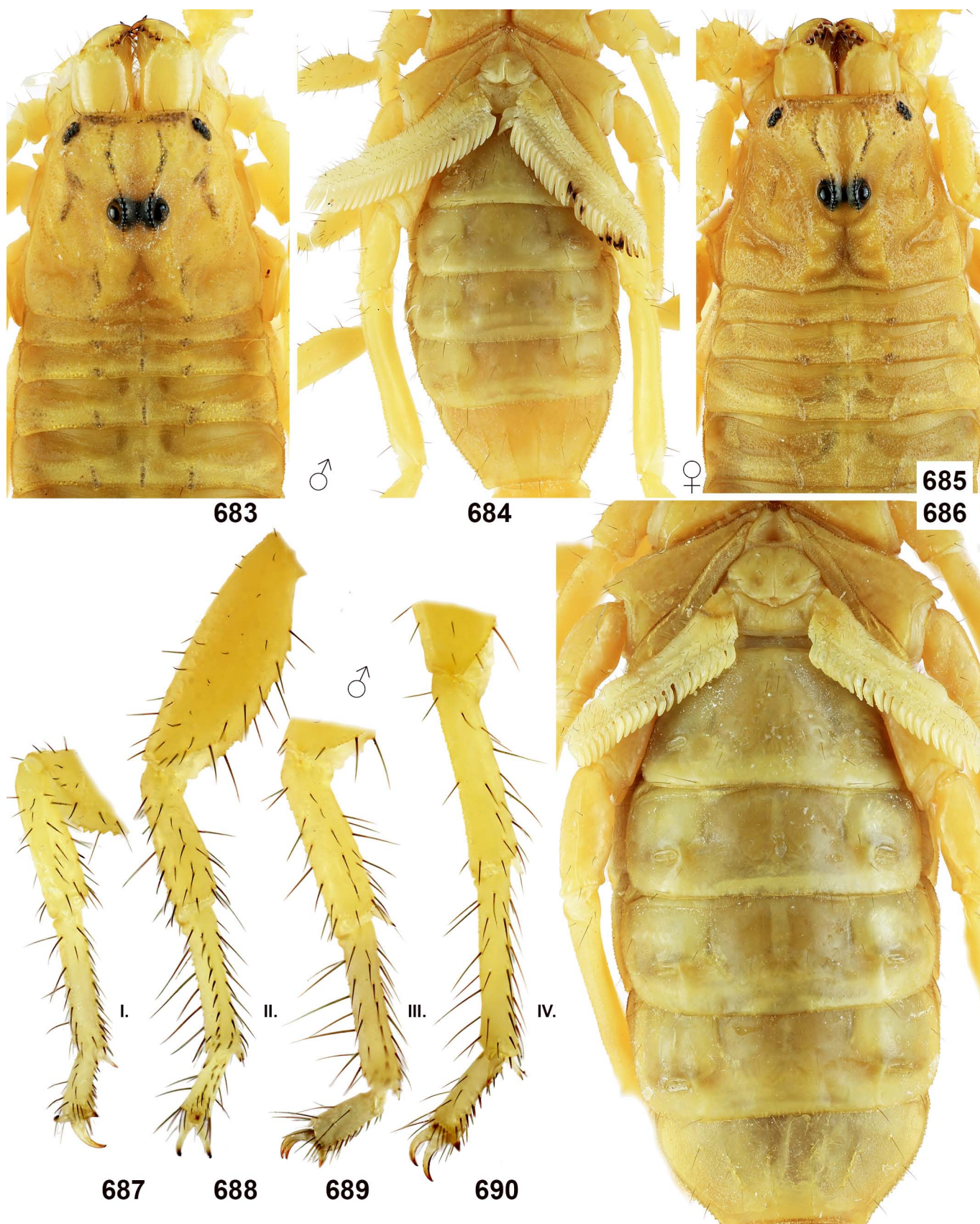
Figures 650–653: *Mesobuthus mirshamsii* sp. n. **Figures 650–651.** Male holotype, dorsal (650) and ventral (651) views. **Figures 652–653.** Female paratopotype, dorsal (652) and ventral (653) views. Scale bars: 10 mm (650–651, 652–653).



Figures 654–661: *Mesobuthus mirshamsii* sp. n. **Figures 654, 656–658.** Male holotype, telson lateral (654), metasoma and telson, lateral (656), dorsal (657), and ventral (658) views. **Figures 655, 659–661.** Female paratopotype, telson lateral (655), metasoma and telson, lateral (659), dorsal (660), and ventral (661) views. Scale bars: 10 mm (656–658, 659–661).



Figures 662–682: *Mesobuthus mirshamsii* sp. n., pedipalp. **Figures 662–672.** Male holotype, chela, dorsal (662), external (663), and ventral (664) views. Patella, dorsal (665), external (666) and ventral (667) views. Femur and trochanter, internal (668), dorsal (669), and ventral (670) views. Movable (671) and fixed (672) fingers. **Figures 673–682.** Female paratopotype, chela, dorsal (673), external (674), and ventral (675) views. Patella, dorsal (676), external (677) and ventral (678) views. Femur and trochanter, internal (679), dorsal (680), and ventral (681) views. Movable finger (682). The trichobothrial pattern is indicated in Figures 662–666, 668–669.



Figures 683–690: *Mesobuthus mirshamsii* sp. n. **Figures 683–684, 687–690.** Male holotype, chelicerae, carapace and tergites I–IV (683), sternopectinal region and sternites (684), and left legs I–IV, retrolateral aspect (687–690). **Figures 685–686.** Female paratopotype, chelicerae, carapace and tergites I–IV (685), sternopectinal region and sternites (686).

laterally finely granulated. Length to depth ratio of metasoma III 1.3–1.45, metasoma IV 1.6–1.8 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 5–9 retroinferior macrosetae on basitarsus III. Telson bulbous, mainly in female. Anal lobe divided into three or four parts.

DESCRIPTION. Total length of adult males 35–40 mm, 38–55 females. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est* or in level with *est*. Male has the fingers proximally more twisted than in female. For measurements, see Table 8.

Coloration (Figs. 650–653). Carapace and tergites are yellow with reduced pigmentation. Telson is yellow. Metasoma, pedipalps and legs are yellow without dark spots, only part of metasomal segment V can be black. Chelicerae yellow, without reticulation, the tips of denticles on cheliceral fingers are black.

Mesosoma and carapace (Figs. 683–686). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacardinate. Pectinal tooth count is 21–27 in males, 18–22 in females. Pectinal marginal tips extend to about half of the fifth sternite in males and half of sternite IV in females. Pectines have three marginal lamellae and seven to nine middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. Sternites are smooth and sparsely hirsute. The sternite VII finely granulated on margins with four well marked granulated carinae. Other sternites have two furrows.

Pedipalps (Figs. 662–682). Pedipalps densely hirsute. Femur has four to five granulated carinae, the middle carina on internal surface consists of strong irregular granules. Patella with eight carinae, of which internal and dorsal are granulated. The chela is with smooth carinae only indicated. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 687–690). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 5–9 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate on legs III and IV and absent on the other legs.

Metasoma and telson (Figs. 654–661). All metasomal segments only sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally finely granulated. Ventrolateral carinae of metasoma V posteriorly with several large lobate denticles. Telson is only sparsely hirsute, bulbous and smooth. Anal lobe divided into three or four parts.

COMMENTS. No DNA data on *M. mirshamsii* sp. n. are yet available. This new species, in our opinion, was not represented among the populations studied by Mirshamsi et al. (2010) in their DNA survey of Iranian *Mesobuthus*.

DISTRIBUTION. Iran (Hormozgan Province) (Figs. 1155, 1157).

***Mesobuthus navidpourii* sp. n.**

(Figures 691–730, 1155, 1157, Table 8)

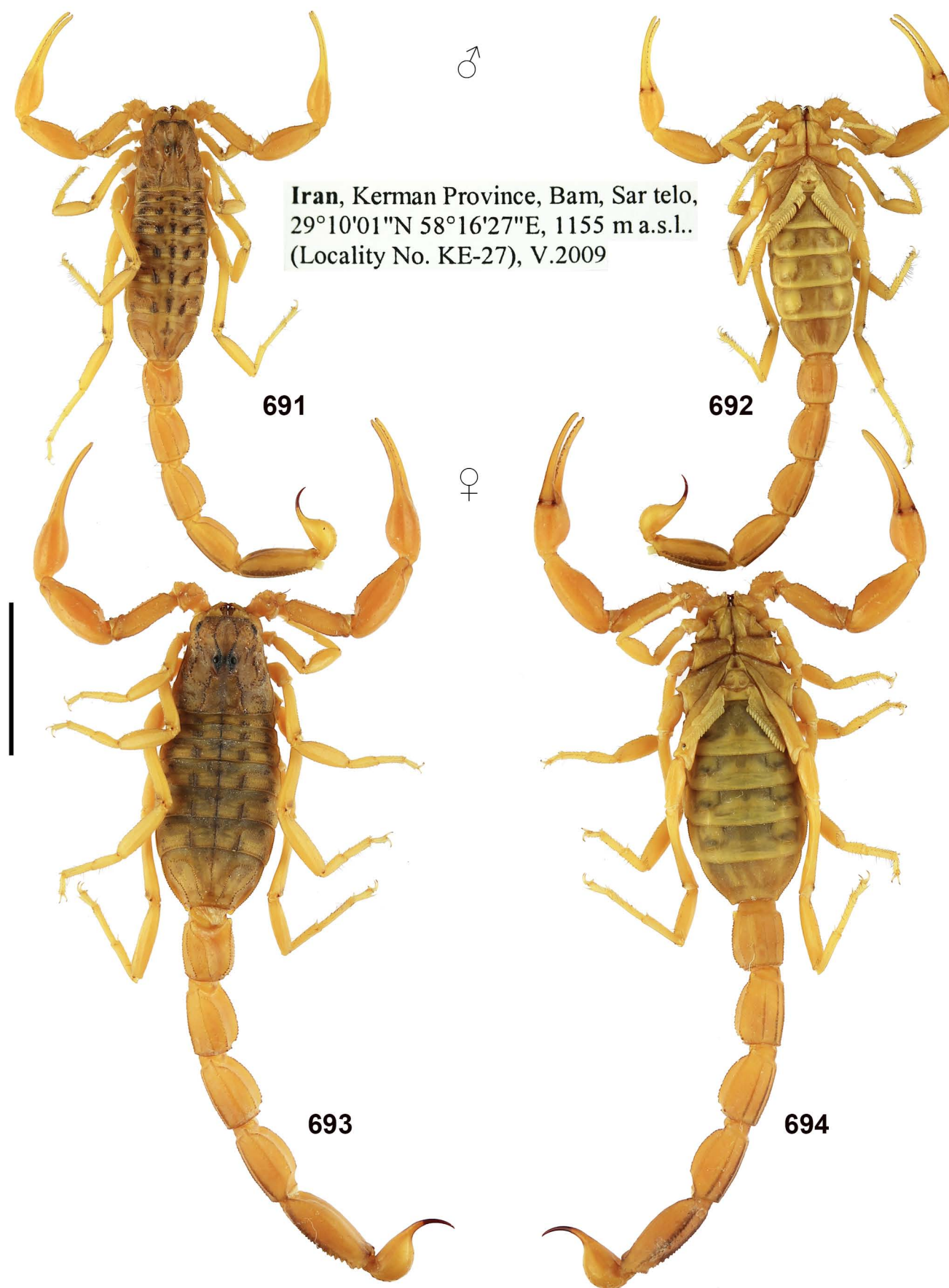
<http://zoobank.org/urn:lsid:zoobank.org:act:B2043A81-30E4-4EBC-A0A8-66A7E20DBF56>

TYPE LOCALITY AND TYPE REPOSITORY. Iran, **Kerman Province**, Bam, Sar Telo, Khajeh Askar Village, 29°10'01"N 58°16'27"E (29.16°N 58.27°E), 1155 m a. s. l. (Locality No. KE-27), NMPC.

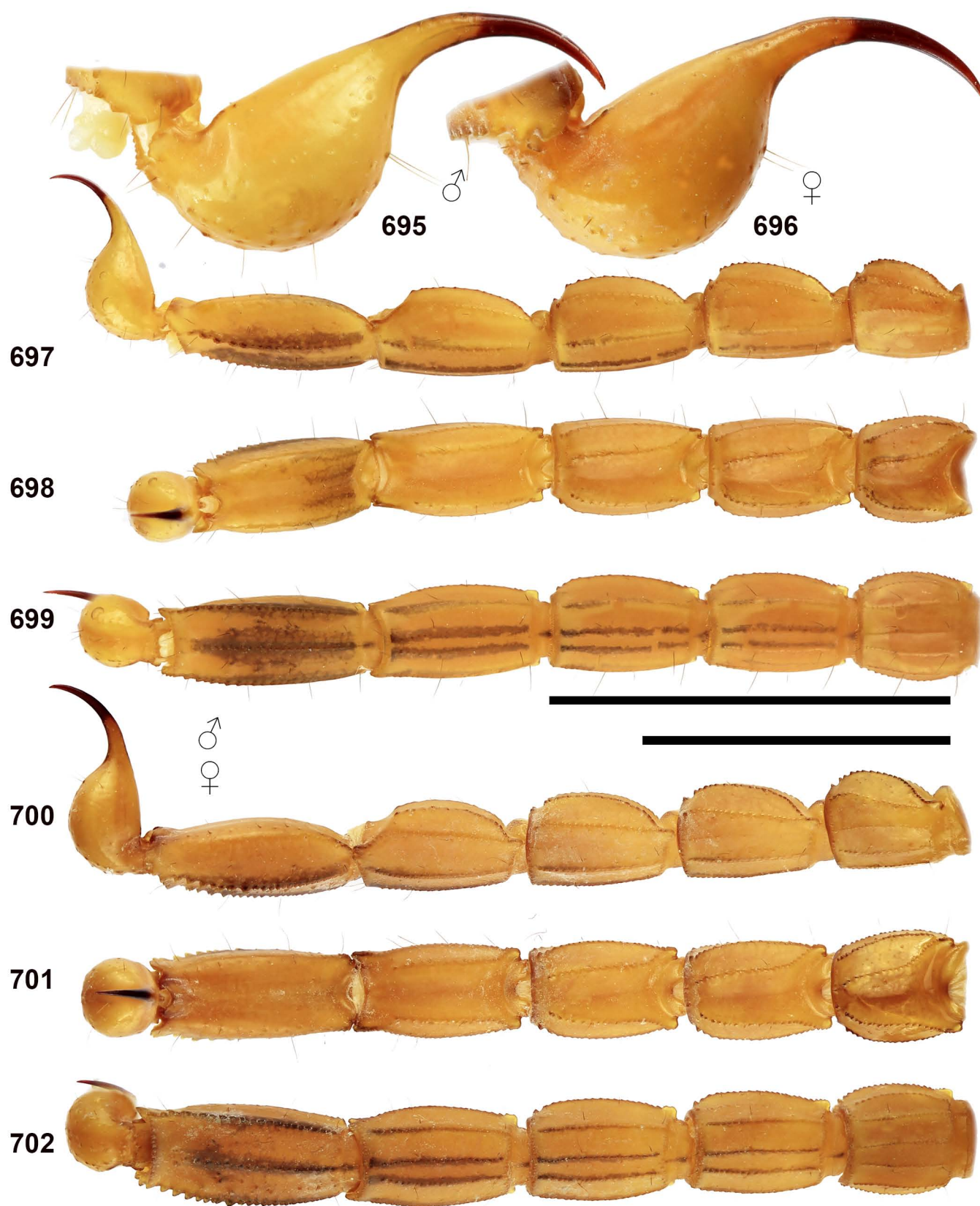
REFERENCES:

- Mesobuthus eupeus kirmanensis* (in part): Mirshamsi et al., 2010: 2867; Mirshamsi et al., 2011a: 9.
Mesobuthus macmahoni (in part): Mirshamsi et al., 2011b: 20; Navidpour et al., 2011: 13, figs. 12, 37–40.

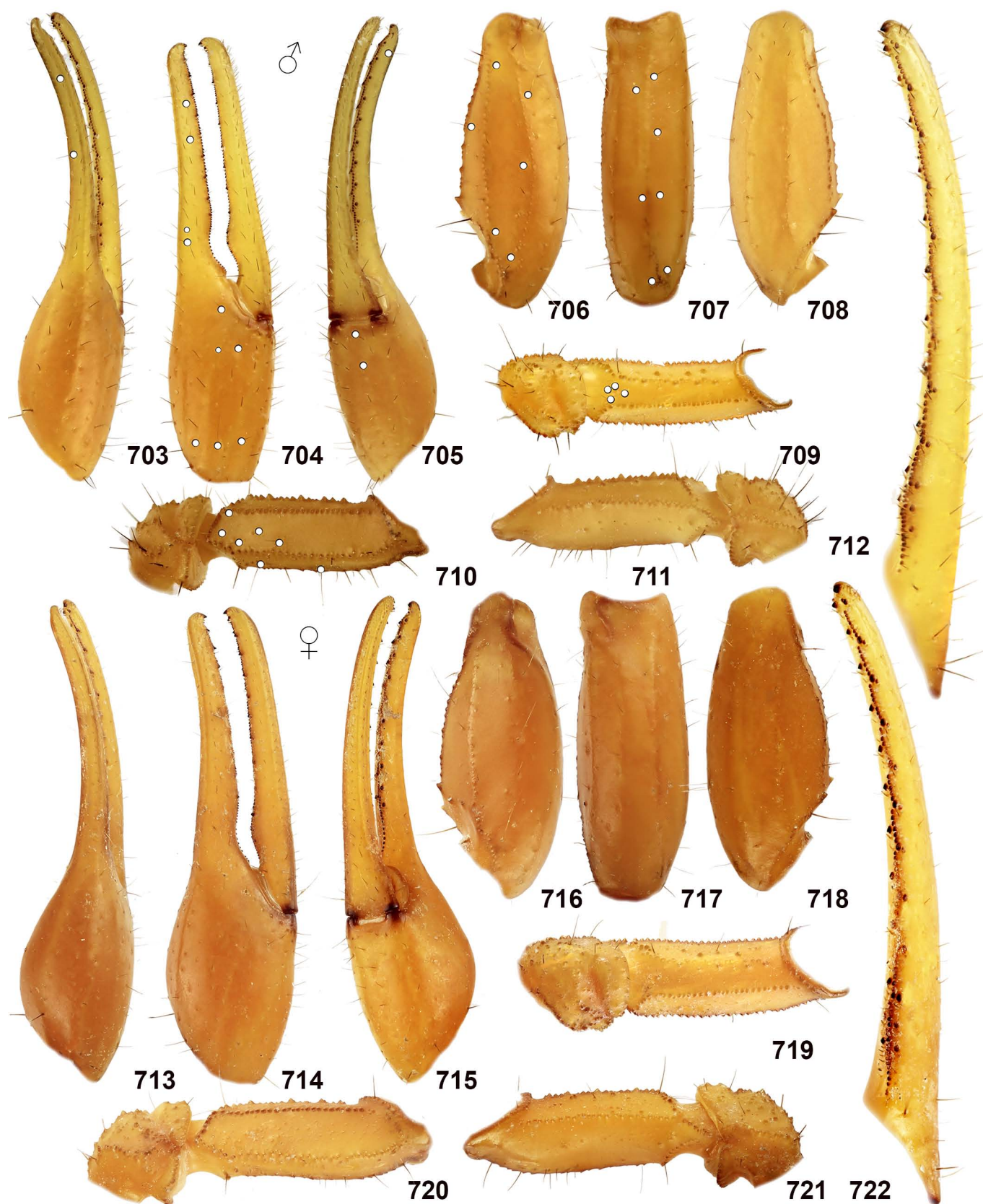
TYPE MATERIAL (NMPC). Iran, **Kerman Province**, Bam, Sar Telo, Khajeh Askar Village, 29°10'01"N 58°16'27"E (29.16°N 58.27°E), 1155 m a. s. l. (Locality No. KE-27), May 2009, 1♂ (holotype) 3♀1♀juv. (paratypes), leg. Koohpaye, Jamalizadeh and Ebrahimi; Bam-Fahraj road, 28°56'05"N 58°52'48"E (28.93°N 58.87°E), 688 m a. s. l. (Locality No. KE-23), April 2009, 3♀ (paratypes), leg. Koohpaye, Jamalizadeh and Ebrahimi; Bam, Badr abad, Abuzari vil., 28°54'05"N 58°41'05"E (28.90°N 58.63°E) 785 m a. s. l. (Locality No. KE-25), April 2009, 1♂ (paratype), leg. Koohpaye, Jamalizadeh and Ebrahimi; Zarand, 30°49'59"N 56°37'31"E (30.83°N 56.62°E), 1775 m a. s. l. (Locality No. KE-30), May 2009, 1♂1♀ (paratypes), leg. Koohpaye, Jamalizadeh and Ebrahimi; Dehdasht, Pabdana, 30°57'24"N 56°32'23"E (30.95°N 56.53°E), 1975 m a. s. l. (Locality No. KE-34), May 2009, 1♀ (paratype), leg. Koohpaye, Jamalizadeh and Ebrahimi; Zarand-Kerman road, 30°48'38"N 56°55'30"E (30.80°N 56.92°E), 1688 m a. s. l. (Locality No. KE-37), May 2009, 1♂ (paratype), leg. Koohpaye, Jamalizadeh and Ebrahimi; Rafsanjan road, Zarand, 30°32'22"N 56°04'42"E (30.53°N 56.07°E), 1547 m a. s. l. (Locality No. KE-46), May 2009, 1♂ (paratype), leg. Koohpaye, Jamalizadeh and Ebrahimi; Baft, Nanook vil., 29°20'28"N 56°50'20"E (29.33°N 56.83°E), 2748 m a. s. l. (Locality No. KE-77), May 2009, 2♂ (paratypes), leg. Koohpaye, Jamalizadeh and Ebrahimi, NMPC; Ravar-Mashhad road, 31°21'44"N 56°50'08"E (31.35°N 56.83°E), 1100 m a. s. l. (Locality No. KE-84), May 2009, 1♂ (paratype), leg. Koohpaye, Jamalizadeh and Ebrahimi; Shahdad, 30°29'06"N 57°48'28"E (30.48°N 57.80°E), 331 m a. s. l. (Locality No. KE-116), May 2009, 1♀ (paratype), leg. Koohpaye, Jamalizadeh and Ebrahimi.



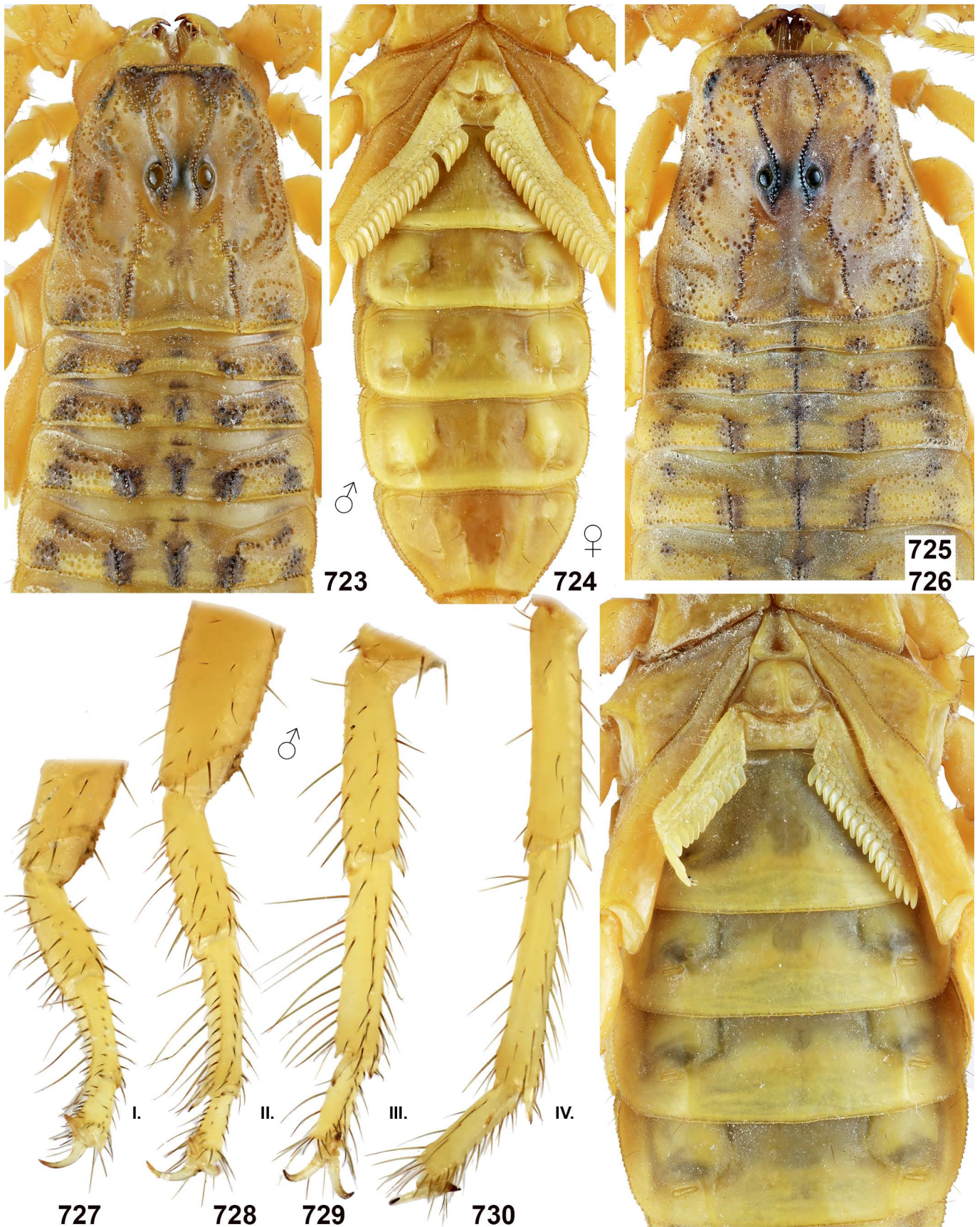
Figures 691–694: *Mesobuthus navidpouri* sp. n. **Figures 691–692.** Male holotype, dorsal (691) and ventral (692) views. **Figures 693–694.** Female paratopotype, dorsal (693) and ventral (694) views. Scale bar: 10 mm.



Figures 695–702: *Mesobuthus navidpouri* sp. n. **Figures 695, 697–699.** Male holotype, telson lateral (695), metasoma and telson, lateral (697), dorsal (698), and ventral (699) views. **Figures 696, 700–702.** Female paratopotype, telson lateral (696), metasoma and telson, lateral (700), dorsal (701), and ventral (702) views. Scale bars: 10 mm (697–699, 700–702).



Figures 703–722: *Mesobuthus navidpouri* sp. n., pedipalp. **Figures 703–712.** Male holotype, chela, dorsal (703), external (704), and ventral (705) views. Patella, dorsal (706), external (707) and ventral (708) views. Femur and trochanter, internal (709), dorsal (710), and ventral (711) views. Movable finger (712). **Figures 713–722.** Female paratopotype, chela, dorsal (713), external (714), and ventral (715) views. Patella, dorsal (716), external (717) and ventral (718) views. Femur and trochanter, internal (719), dorsal (720), and ventral (721) views. Movable finger (722). The trichobothrial pattern is indicated in Figures 703–707, 709–710.



Figures 723–730: *Mesobuthus navidpouri* sp. n. **Figures 723–724, 727–630.** Male holotype, chelicerae, carapace and tergites I–IV (723), sternopectinal region and sternites (724), and left legs I–IV, retrolateral aspect (727–730). **Figures 725–726.** Female paratopotype, chelicerae, carapace and tergites I–IV (725), sternopectinal region and sternites (726).

DNA DATA. This new species, in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their survey of Iranian *Mesobuthus* (one DNA sequence from Sistan & Baluchistan Province, 90 km S of Zahedan, 28.74°N 60.77°E; Table 16).

ETYMOLOGY. The new species is named in honor of our colleague Shakhrokh Navidpour, whose research group collected most impressive materials of scorpions from Iran over the years.

DIAGNOSIS. Total length of adults 38 mm (male) to 55 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally slightly more twisted than in female. Pedipalp chela length/width ratio 4.17–4.57 in both sexes. Pectinal teeth number 20–26 in male, 15–22 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites yellowish to reddish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, only dorsal carinae can be granulated. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth to finely granulated with 4 well marked smooth or granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth. Length to depth ratio of metasoma III 1.7–1.9, metasoma IV 1.9–2.2 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 10–15 retroinferior macrosetae on basitarsus III. Telson elongated in both sexes. Telson elongate, telson length to depth ratio is 2.85–3.05 (female) to 3.00–3.15 (male). Anal lobe divided into three or four parts.

DESCRIPTION. Total length of adult males 38–45 mm, 42–55 females. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male has the fingers proximally a slightly more twisted than in female. For measurements, see Table 8.

Coloration (Figs. 691–694). Carapace and tergites are yellowish to reddish brown with dark pigmentation. Telson, metasoma, pedipalps and legs are yellow without dark spots, only metasomal ventral carinae and part of metasomal segment V are black. Chelicerae yellow, without reticulation, the tips of denticles on cheliceraral fingers are black.

Mesosoma and carapace (Figs. 723–726). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly

rounded. Central lateral and posterior lateral carinae of carapace joined to form a continuous linear series of granules to posterior margin. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacarinat. Pectinal tooth count is 20–26 in males, 15–22 in females. Pectinal marginal tips extend to about half of sternite IV in males and one-fourth of sternite IV in females. Pectines have three marginal lamellae and eight to nine middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. Sternites are smooth and sparsely hirsute. Sternite VII smooth to finely granulated, with four well marked smooth or granulated carinae. Other sternites have two furrows.

Pedipalps (Figs. 703–722). Pedipalps hirsute and smooth, only femur is sparsely finely granulated. Femur has four to five granulated carinae, the middle carina on internal surface consists of strong irregular granules. Patella with eight carinae, of which internal and dorsal can be granulated. Chela without carinae. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 727–730). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 10–15 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate on legs III and IV and absent on the other legs.

Metasoma and telson (Figs. 695–702). All metasomal segments only sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth. Ventrolateral carinae of metasoma V posteriorly with several lobate denticles. Telson is only sparsely hirsute, elongate and smooth. Anal lobe divided into three or four parts.

DISTRIBUTION. Iran (Kerman and Sistan & Baluchistan Provinces) (Figs. 1155, 1157).

Mesobuthus persicus (Pocock, 1899)

(Figures 731–771, 1155–1157, Table 9)

<http://zoobank.org/urn:lsid:zoobank.org:act:F39A833B-A5BC-4D92-8A36-EB013F12FD7D>

Buthus persicus Pocock, 1899: 404–405.

TYPE LOCALITY AND TYPE REPOSITORY. Iran, *West Azerbaijan Province*, near Orumuyeh, Seir (37.55°N 45.07°E); BMNH.

REFERENCES (selected):

- Buthus eupeus persicus*: Birula, 1905a: 119, 122, 124–126 (in part); Birula, 1917a: 40; Birula, 1918: 10–13, fig. 1–2, 6.
?Buthus eupeus eupeus natio talyschensis: Birula, 1917a: 34.
Buthus eupeus eupeus: Birula, 1917a: 40 (in part).

Dimensions (mm)		<i>M. persicus</i> ♂ from Rahmanlu	<i>M. persicus</i> ♀ from Yele Qarshu	<i>M. philippovitschi</i> ♂ lectotype	<i>M. philippovitschi</i> ♀ paralectotype
Carapace	L / W	4.74 / 5.23	6.09 / 6.79	5.99 / 6.86	6.26 / 7.58
Mesosoma	L	11.67	15.67	14.90	17.38
Tergite VII	L / W	3.17 / 5.13	3.20 / 6.93	3.80 / 6.99	3.49 / 7.87
Metasoma + telson	L	25.42	30.98	32.99	31.73
Segment I	L / W / D	3.25 / 3.38 / 3.04	3.76 / 3.91 / 3.38	4.07 / 4.86 / 4.48	3.86 / 4.53 / 3.82
Segment II	L / W / D	3.73 / 3.21 / 3.21	4.29 / 3.87 / 3.60	4.71 / 4.84 / 4.66	4.46 / 4.42 / 3.82
Segment III	L / W / D	3.75 / 3.14 / 3.22	4.41 / 3.81 / 3.77	5.01 / 5.04 / 4.53	4.55 / 4.58 / 3.80
Segment IV	L / W / D	4.39 / 3.08 / 2.87	5.41 / 3.73 / 3.65	5.92 / 5.02 / 4.34	5.44 / 4.57 / 3.84
Segment V	L / W / D	5.36 / 2.73 / 2.27	6.64 / 3.36 / 2.82	6.88 / 4.07 / 3.37	6.75 / 3.88 / 3.14
Telson	L / W / D	4.94 / 2.09 / 1.90	6.37 / 2.74 / 2.45	6.40 / 2.72 / 2.44	6.67 / 2.69 / 2.48
Pedipalp	L	16.99	20.86	21.95	21.54
Femur	L / W	4.11 / 1.43	4.90 / 1.72	5.16 / 1.62	5.04 / 1.84
Patella	L / W	4.75 / 1.96	5.77 / 2.35	6.28 / 2.51	6.00 / 2.77
Chela	L	8.13	10.19	10.51	10.50
Manus	W / D	2.49 / 2.64	2.81 / 2.71	3.36 / 3.56	3.39 / 3.42
Movable finger	L	5.01	6.20	6.58	6.99
Total	L	41.83	52.74	53.88	55.37

Table 9. Comparative measurements of *Mesobuthus persicus* and *M. philippovitschi* specimens. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

Mesobuthus eupeus persicus: Vachon, 1958: 155; Fet, 1994: 527; Fet & Lowe, 2000: 174 (complete references list until 1998); Navidpour et al., 2011: 9–13, figs. 12, 43–44 (in part); Navidpour et al., 2012: 10–12, fig. 10 (in part); Navidpour et al., 2013: 8–11, figs. 3, 7–9 (in part).

Mesobuthus eupeus eupeus (in part): Fet & Lowe, 2000: 174; Mirshamsi et al., 2010: 2867; Mirshamsi et al., 2011a: 8, fig. 4 (in part); Moradi et al., 2015: 12–13 (in part).

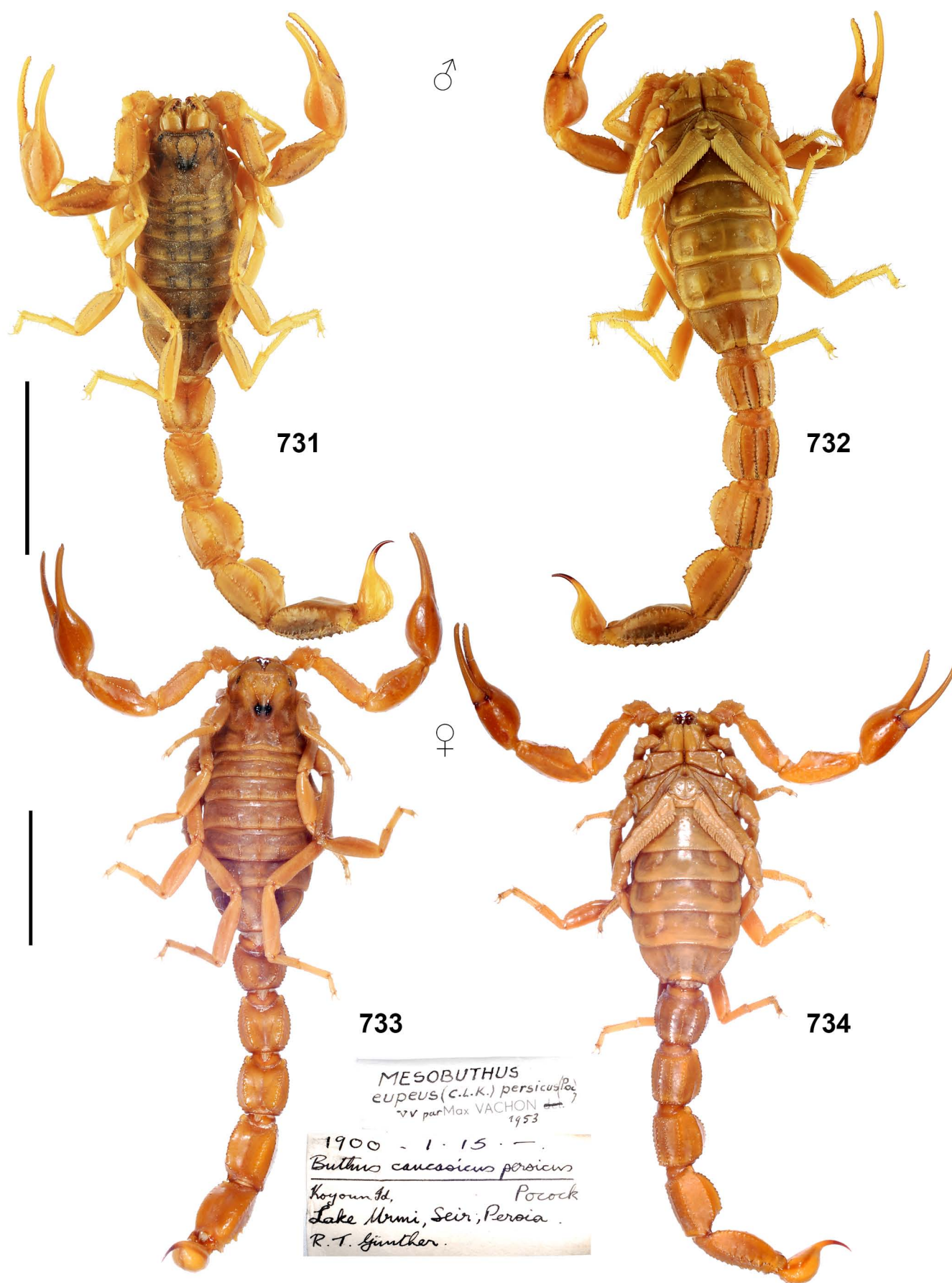
Mesobuthus eupeus: Mirshamsi et al., 2011b: 20 (in part).

Mesobuthus persicus: Kovařík, 2019: 17.

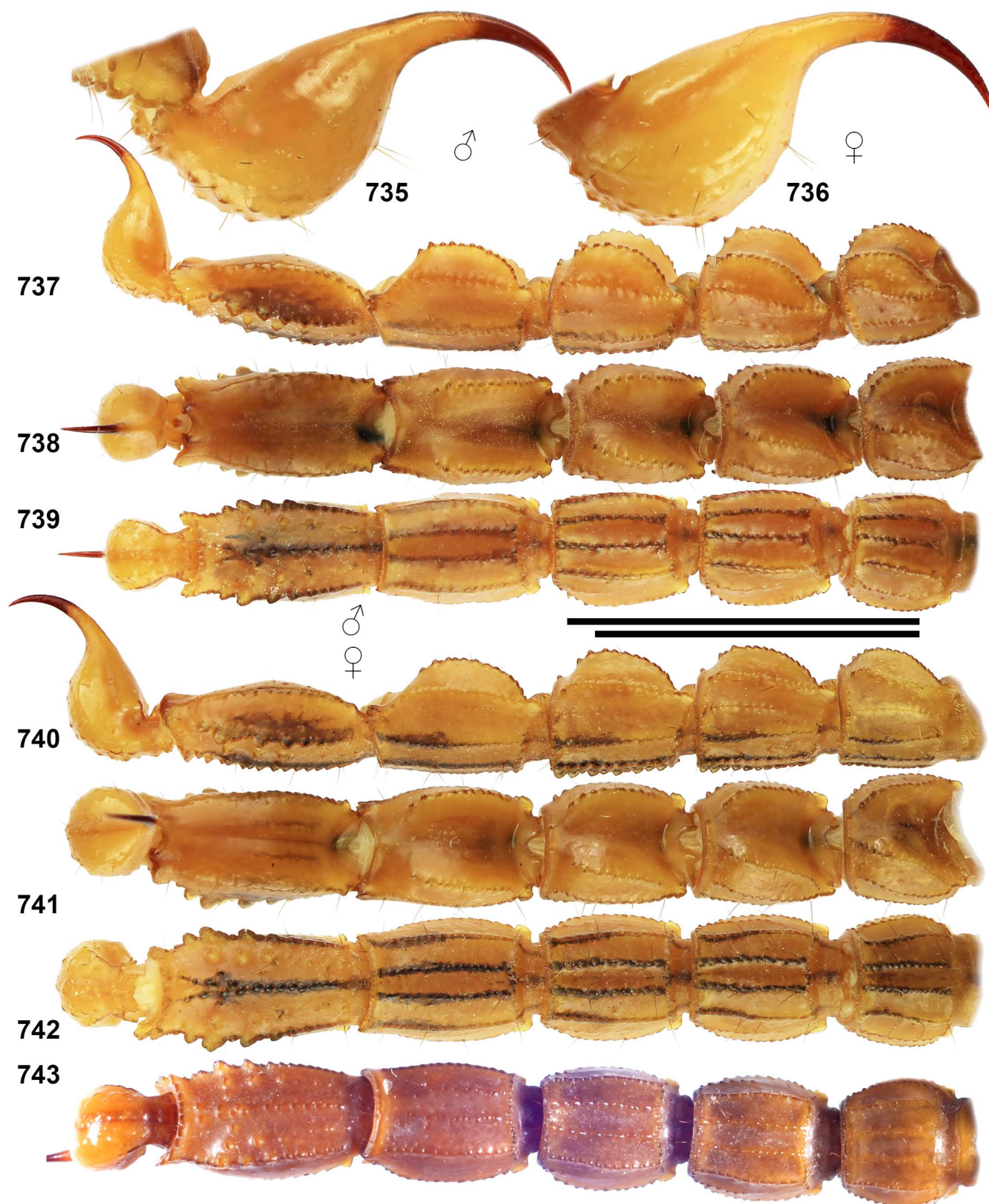
TYPE MATERIAL EXAMINED. **Iran** (Persia), **West Azerbaijan Province**, near Orumuyeh, Seir, ♀ (lectotype designated here, Figs. 733–734, 743, 767), leg. R. T. Günther, BMNH 1900.1.15.

OTHER MATERIAL EXAMINED. **Azerbaijan**, Talysh, Lerik (38.69°N 48.29°E), 25 September 2021, 1♀1juv., leg. N. Novruzov, NMPC. **Iran**, **Ardabil Province**, 3 km E of Sorkheh Dizaj (Zanjan), 36°49'N 48°58'E (36.82°N 48.97°E), 580 m a. s. l., 17 May 1997, 2♀juvs., leg. M. Kaftan, NMPC; **East Azerbaijan Province**, 8 km N of Ev Oghli, Markan Village env., ca. 1000 m a. s. l., 13 May 1996, 1juv., leg. V. Šejna, NMPC; 37°48'06"N 46°14'14"E (37.80°N 46.23°E), 2150 m a. s. l., 1–2 October 1998, 2♀, leg. P. Kabátek; Torkaman, 37°32'N 47°21'E (37.53°N 47.35°E), 1747 m a. s. l., 4 April 2000, 1juv., leg. J. Šobotník, NMPC; Bastan, Garbi, Serou 50 km NW Orumuyeh, 37°39'N 44°45'E (37.65°N 44.75°E), 10 June 2000, 1♂2♀1♀juv., leg. P. Kabátek, NMPC; Sharqi, Yele Qarshu, 30 km NE Miyane (37.42°N 47.69°E), 5 May

2002, 2♀ (Figs. 736, 740–742, 754–763, 766, Table 9), leg. P. Kabátek, NMPC; Sharqi Pass, 7 km SWW Nir (SW Ardabil) (38.03°N 47.99°E), 6 May 2002, 1♀juv., leg. P. Kabátek, NMPC; Sharqi Marand (38.42°N 45.73°E), 8 May 2002, 1♀, leg. P. Kabátek, NMPC; Tabriz, Miyaneh (38.08°N 46.15°E), 18 May 2006, 1♂1♀, NMPC; **Hamadan Province**, 35 km SE of Hamadan, Gonbad Village env. (34.80°N 48.44°E), ca 2000 m a. s. l., 7–8 May 1996, 1juv., leg. D. Král, NMPC; Alandje, 34°44'54"N 47°57'52"E (34.73°N 47.95°E), 1700 m a. s. l., 3♀1juv., 5–6 October 1998, leg. P. Kabátek & M. Kaftan, NMPC; 35°11'38"N 48°47'19"E (35.18°N 48.47°E), 1661 m a. s. l., 2015, (Ha-03), 2♀, leg. S. Navidpour et al., NMPC; 34°53'34"N 48°33'12"E (34.88°N 48.55°E), 1730 m a. s. l., 2015, (Ha-03), 3♂, leg. S. Navidpour et al., NMPC; 34°51'18"N 48°33'46"E (34.85°N 48.55°E), 1816 m a. s. l., 2015, (Ha-20-10), 1♂2♀, leg. S. Navidpour et al., NMPC; 34°50'41"N 48°25'38"E (34.83°N 48.42°E), 2020 m a. s. l., 2015, (Ha-66-3), 1♂, leg. S. Navidpour et al., NMPC; 34°38'13.5"N 48°39'30"E (34.63°N 48.65°E), 2360 m a. s. l., 2015, (Ha-68-3), 2♀, leg. S. Navidpour et al., NMPC; **Kermanshah Province**, Nejuran (34.46°N 45.60°E), 1♀, NMPC; **Qazvin Province**, Takestan (36.07°N 49.66°E), 15 May 2006, 2♂2♀, NMPC; 36°40'09"N 49°25'50"E (36.67°N 49.42°E), 800 m a. s. l., 2015, (Q-121), 1♂1♀, leg. S. Navidpour et al., NMPC; **West Azerbaijan Province**, 38°54'40"N 44°59'39"E (38.90°N 44.98°E), 1270 m a. s. l., 1♀, 30 September–1 October 1998, leg. P. Kabátek, NMPC; Rahmanlu, 37°31'05"N 45°47'42"E (37.52°N 45.78°E), 1230 m a. s. l., 1♂ (Figs. 731–732, 735, 737–739, 744–753, 764–765, 768–771, Table 9), 2 October 1998, leg. P. Kabátek, NMPC; Tahkt-e Suleiman, 36°36'12"N



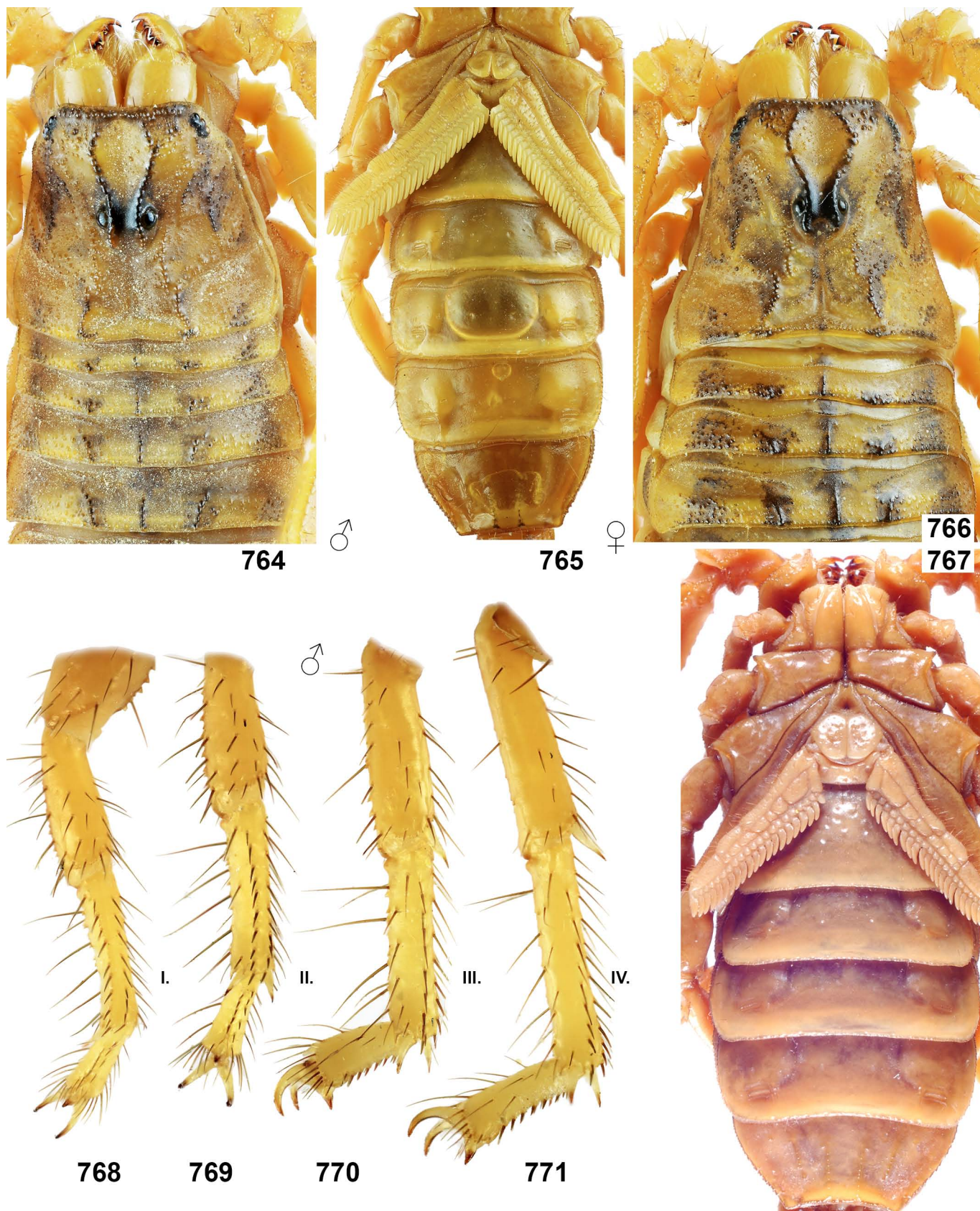
Figures 731–734: *Mesobuthus persicus*. **Figures 731–732.** Male from Iran, West Azarbaijan Province, Rahmanlu, NMPC, dorsal (731) and ventral (732) views. **Figures 733–734.** Female lectotype, dorsal (733) and ventral (734) views. Scale bars: 10 mm (731–732, 733–734).



Figures 735–743: *Mesobuthus persicus*. **Figures 735, 737–739.** Male from Iran, West Azarbaijan Province, Rahmanlu, NMPC, telson lateral (735), metasoma and telson, lateral (737), dorsal (738), and ventral (739) views. **Figures 736, 740–742.** Female from Iran, East Azarbayejan Province, Sharqi, NMPC, telson lateral (736), metasoma and telson, lateral (740), dorsal (741), and ventral (742) views. **Figure 743.** Female lectotype, metasoma and telson, ventral view. Scale bars: 10 mm (737–739, 740–742).



Figures 744–763: *Mesobuthus persicus*, pedipalp. **Figures 744–753.** Male from Iran, West Azarbaijan Province, Rahmanlu, NMPC, chela, dorsal (744), external (745), and ventral (746) views. Patella, dorsal (747), external (748) and ventral (749) views. Femur and trochanter, internal (750), dorsal (751), and ventral (752) views. Movable finger (753). **Figures 754–763.** Female from Iran, East Azarbaijan Province, Sharqi, NMPC, chela, dorsal (754), external (755), and ventral (756) views. Patella, dorsal (757), external (758) and ventral (759) views. Femur and trochanter, internal (760), dorsal (761), and ventral (762) views. Movable finger (763). The trichobothrial pattern is indicated in Figures 744–748, 750–751.



Figures 764–771: *Mesobuthus persicus*. **Figures 764–765, 768–771.** Male from Iran, West Azarbaijan Province, Rahmanlu, NMPC, chelicerae, carapace and tergites I–IV (764), sternopectinal region and sternites (765), and left legs I–IV, retrolateral aspect (768–771). **Figure 766.** Female from Iran, East Azarbaijan Province, Sharqi, NMPC, chelicerae, carapace and tergites I–III. **Figure 767.** Female lectotype, sternopectinal region and sternites.

47°13'59"E (36.60°N 47.22°E), 2190 m a. s. l., 1♂2♀3juvs., 3–4 October 1998, leg. P. Kabátek, NMPC; 12 km E Qareh Ziya Eddin, 30 May 2005, 1juv., leg. V. Gvoždík, NMPC; Orumuyeh, Takab (37.55°N 44.98°E), 25 May 2006, 1♂1♀, NMPC; **Zanjān Province**, Aveg, 80 km SW Takestan, 29 May 2003, 1♀, leg. P. Kabátek, NMPC; Kaydar, 12 June 2006, 2♂2♀, NMPC.

DNA DATA. *Mesobuthus persicus*, in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their survey of Iranian *Mesobuthus* (Table 16) by a single DNA sequence from the West Azerbaijan Province (Buralan-Poldasht Road, 39.30°N 44.92°E). Another species from West Azerbaijan present in the dataset of Mirshamsi et al. (2010) is clearly *M. eupeus* s.str. (see above).

DIAGNOSIS. Total length of adults 38 mm (male) to 60 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est* or with level with *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.2–3.5 in male and 3.6–3.9 in female. Pectinal teeth number 21–28 in male, 17–21 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites reddish brown, black pigmented, metasoma, telson, pedipalps and legs reddish brown, only part of metasomal segment V black; metasomal ventral carinae usually dark colored. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, both dorsal are usually granulated. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma I laterally smooth. Length to depth ratio of metasoma III 1.1–1.3, metasoma IV 1.4–1.6 in males in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–10 retroinferior macrosetae on basitarsus III. Tibial spur on both legs III and IV moderate. Telson elongated. Anal lobe divided into three parts.

HISTORY OF STUDY. Pocock (1899) described this species based on specimens collected by a British naturalist Robert Theodore Günther (1869–1940), the future founder of the Museum of the History of Science (Oxford, UK) In 1898, Günther explored natural history of the hypersaline Lake Urmia (or Urmi) in the northwestern Persia.

The type locality, Mount Seir, south of Lake Urmia, was a summer residence of the American missionaries at 1000 ft a. s. l. less than 4 miles from the city of Urmia (now Orumiyeh). It was also the birthplace of the heroic American missionary William A. Shedd (1865–1918) (Shedd, 1922).

The validity and identity of *M. persicus* was unclear until the present study. Earlier, we applied this name (as a subspecies) to a number of Iranian populations (Navidpour et al., 2011, 2012, 2013); currently, we limit it to several provinces in the northern Iran.

COMMENTS. Novruzov et al. (2022) recorded this species for the first time for Azerbaijan, from where it was earlier identified as *M. eupeus eupeus*. Two local “races” (“Natio”) (*armeniaca* and *talyschensis*) from the modern Armenia and Azerbaijan, respectively, were described as infrasubspecific names of the subspecies *Buthus eupeus eupeus* by Birula (1917a: 34); these names are not available according to the ICZN and do not enter into synonymy. Yusubov (1985) studied the distribution of “*M. eupeus*” in Azerbaijan and concluded that four allopatric geographic groups of populations existed: Apsheron-Shirvan, Talysh, Nakhichevan, and island populations; their status requires a further DNA study.

DISTRIBUTION. Azerbaijan, Iran (Ardabil, East Azerbaijan, Hamadan, Kermanshakh, Qazvin, West Azerbaijan, and Zanjan Provinces) (Figs. 1155–1157).

***Mesobuthus philippovitschi* (Birula, 1905), stat. n.**

(Figures 772–801, 1155, 1157, Table 9)

<http://zoobank.org/urn:lsid:zoobank.org:act:DE6B21C0-6F06-469D-8596-9EBE3D5B942F>

Buthus eupeus philippovitschi Birula, 1905a: 122–123, 125, 127–128, fig. 2.

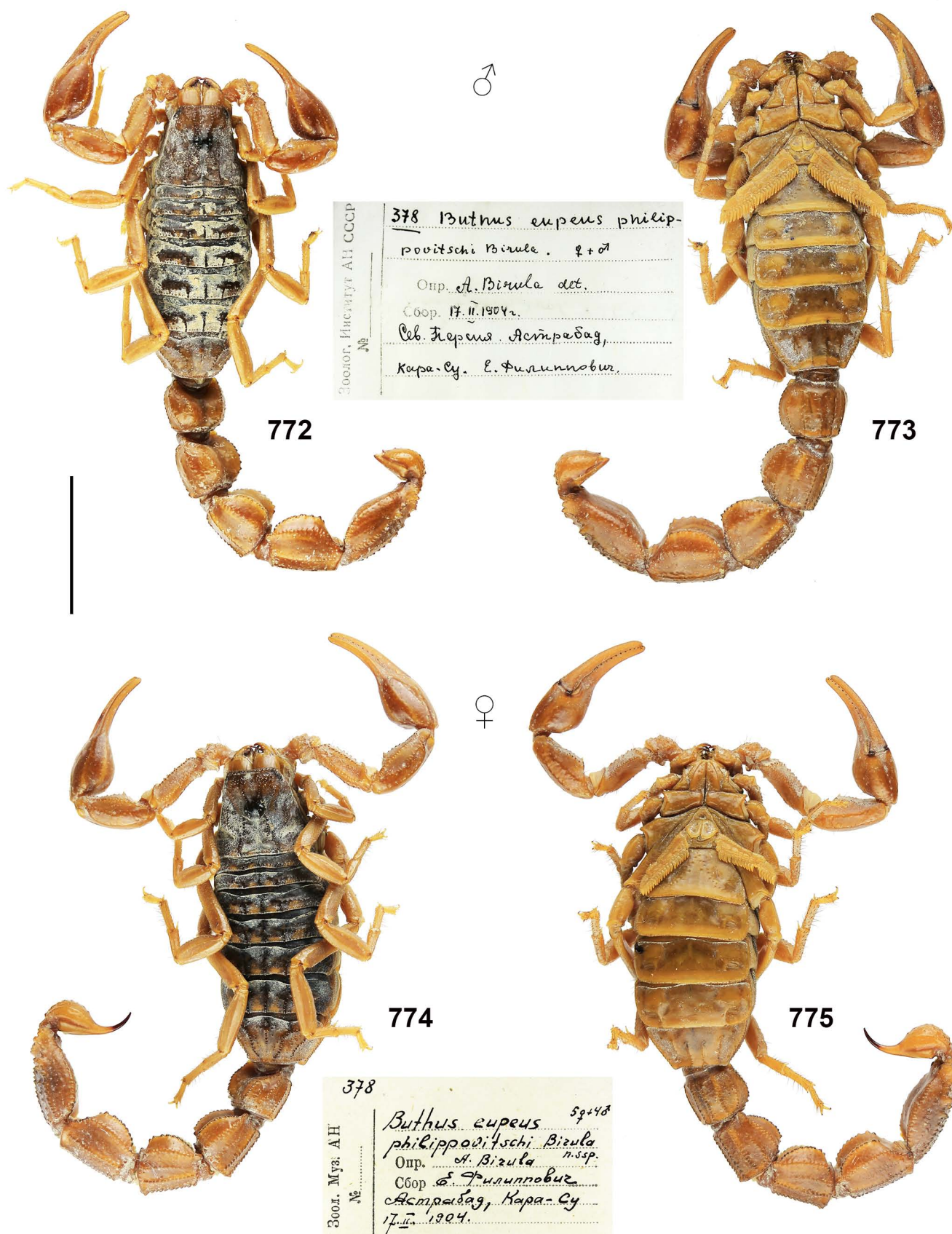
TYPE LOCALITY AND TYPE REPOSITORY. **Iran, Gorgan Province**, Qarasu River [estimated at Gorgan] (36.84°N 54.43°E); ZISP.

REFERENCES (selected):

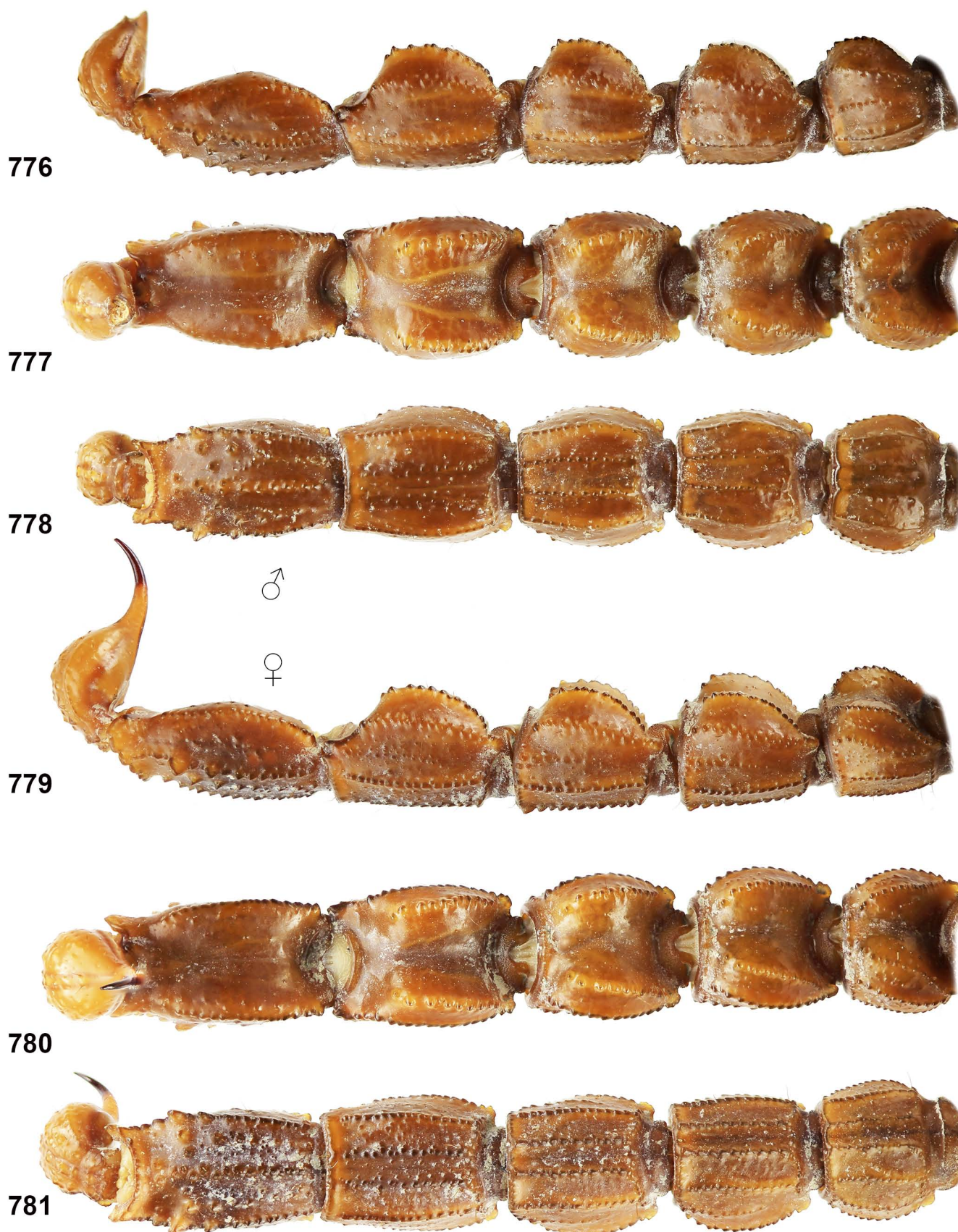
- Buthus eupeus philippovitschi* (incorrect spelling): Birula, 1911b: 165.
Buthus eupeus philippovitschi: Birula, 1917a: 35; Birula, 1918: 13–14.
Mesobuthus eupeus philippovitschi (incorrect spelling): Vachon, 1958: 155.
Mesobuthus eupeus philippovitschi: Fet, 1989: 100; Fet, 1994: 527; Fet & Lowe, 2000: 174 (complete references list until 1998); Mirshamsi et al., 2010: 2867 (in part); Mirshamsi et al., 2011a: 8 (in part).
Mesobuthus eupeus: Mirshamsi et al., 2011b: 20 (in part).
Mesobuthus eupeus eupeus: Kovařík et al., 2011: 1–5, figs. 1–11, 16, 19, 23 (in part).

TYPE MATERIAL EXAMINED. **Iran (Persia), Gorgan (former Astrabad) Province**, Qarasu River 1♂ (lectotype, designated here) 1♀ (paralectotype), 17 February [1 March] 1904, leg. E. M. Philippovitsch, ZISP No. 378.

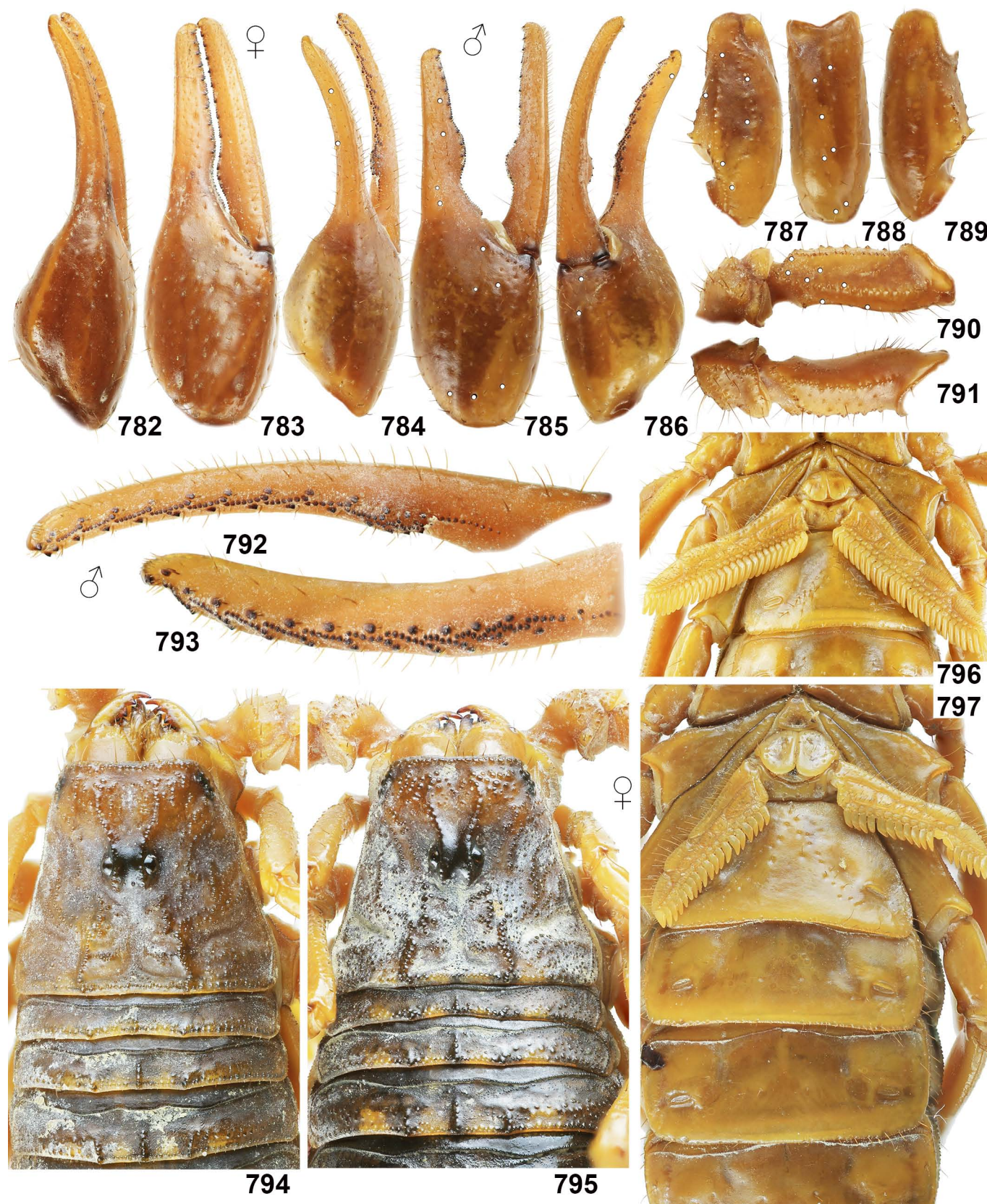
OTHER MATERIAL EXAMINED. **Iran, Razavi Khorasan Province**, Golestan Forest, 55 km NE Minudast, 37°20'N 56°00'E



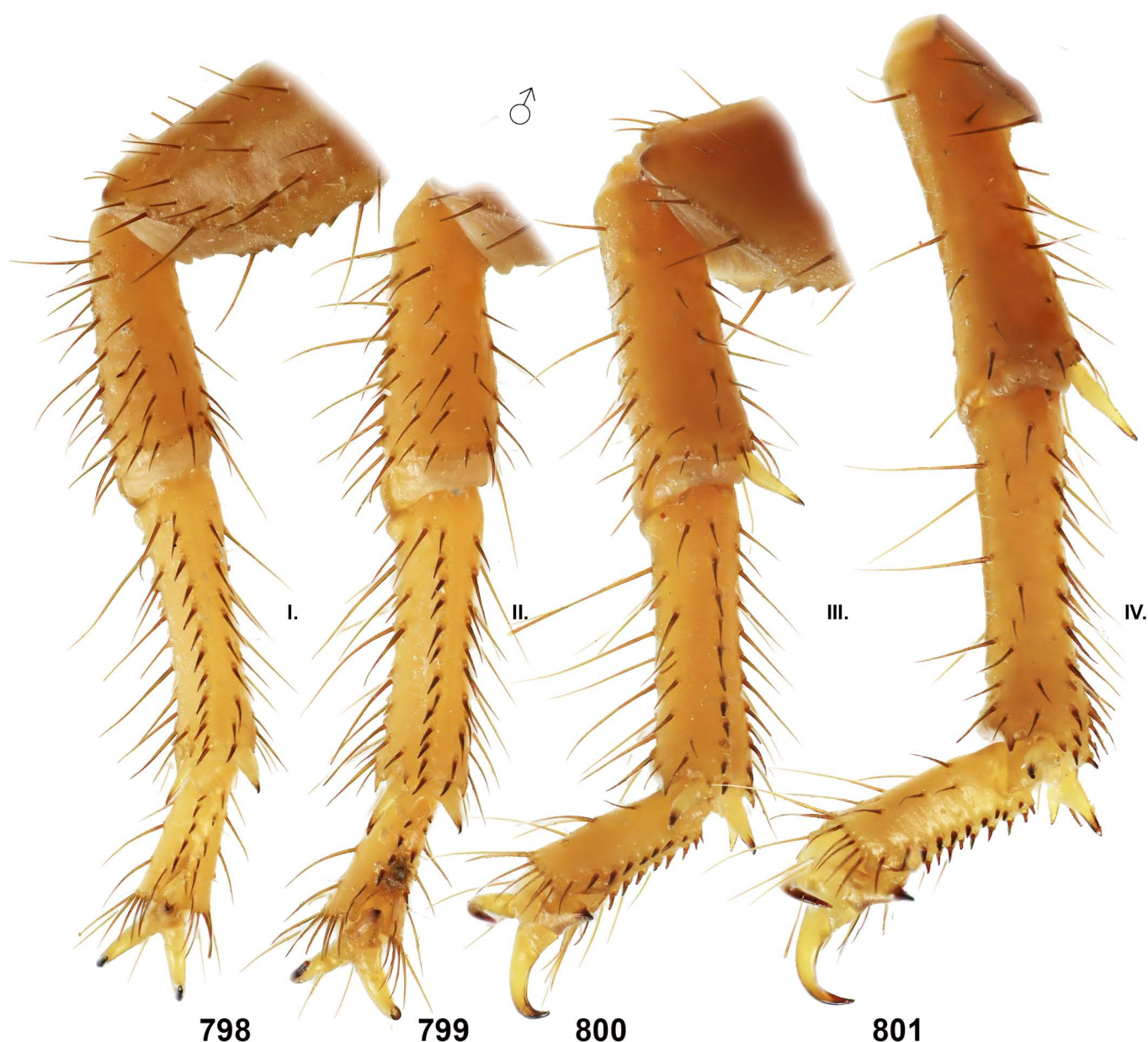
Figures 772–775: *Mesobuthus philippovitschi*. **Figures 772–773.** Male lectotype, dorsal (772) and ventral (773) views. **Figures 774–775.** Female paralectotype, dorsal (774) and ventral (775) views. The labels (ZISP 378) say, in Russian and Latin: top, “*Buthus eupeus philippovitschi* Birula ♀ + ♂. Det.: A. Birula. Coll.: 17.II.1904, North Persia, Astrabad, Kara-Su, E. Filippovich”; bottom, the same, indicating “5♀ + 4♂”. Scale bar: 10 mm.



Figures 776–781: *Mesobuthus philippovitschi*. **Figures 776–778.** Male lectotype, metasoma and telson, lateral (776), dorsal (777), and ventral (778) views. **Figures 779–781.** Female paralectotype, metasoma and telson, lateral (779), dorsal (780), and ventral (781) views.



Figures 782–797: *Mesobuthus philippovitschi*. **Figures 782–783, 795, 797.** Female paralectotype, pedipalp chela, dorsal (782) and external (783). Chelicerae, carapace and tergites I–III (795) and sternopectinal region and sternites III–V (797). **Figures 784–794, 796.** Male lectotype, chela, dorsal (784), external (785), and ventral (786) views. Patella, dorsal (787), external (788) and ventral (789) views. Femur and trochanter, dorsal (790), and ventral (791) views. Movable (792) and fixed (793) fingers. Chelicerae, carapace and tergites I–III (794) and sternopectinal region and sternite III (796). The trichobothrial pattern is indicated in Figures 784–788, 790.



Figures 798–801. *Mesobuthus philippovitschi*, male lectotype, left legs I–IV, retrolateral aspect.

(37.33°N 56.00°E), 840 m a. s. l., 19 June .2000, 1♂, leg. P. Kabátek, NMPC; 37°28'N 56°47'E (37.47°N 56.78°E), 909 m a. s. l., 17–18 May 2003, 1♂2♀5juvs., leg. P. Kabátek, NMPC; 10 km E of Teng Rah, 37°23'N 55°50'E (37.38°N 55.83°E), 13 May 1997, 400–660 m a. s. l., 1♀, leg. M. Kaftan, NMPC.

DNA DATA. This species, in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their survey of Iranian *Mesobuthus* (five DNA sequences from the Mazandaran Province, Savasareh, 36.23°N 53.54°E; Table 16).

DIAGNOSIS. Total length of adults 38 mm (male) to 60 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esh*, near to *est*.

Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.1–3.3 in male and 3.0–3.2 in female. Pectinal teeth number 23–26 in male, 18–20 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites reddish brown, black pigmented, metasoma, telson, pedipalps and legs reddish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, only dorsal carinae can be granulated. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII medially smooth with margins granulated and with 4 well marked smooth or granulated carinae. Metasomal

Dimensions (mm)		<i>M. phillipsii</i> ♂ Bu-31	<i>M. phillipsii</i> ♀ Bu-31	<i>M. rahsenae</i> sp. n. ♂ holotype	<i>M. rahsenae</i> sp. n. ♀ paratype
Carapace	L / W	5.07 / 5.31	5.57 / 6.24	5.08 / 5.48	5.94 / 6.69
Mesosoma	L	11.09	14.11	11.96	13.95
Tergite VII	L / W	3.28 / 5.26	3.75 / 6.24	3.19 / 5.45	3.19 / 6.42
Metasoma + telson	L	29.80	29.55	29.30	30.22
Segment I	L / W / D	3.91 / 3.76 / 3.36	3.75 / 3.83 / 3.27	3.52 / 3.50 / 3.35	3.78 / 3.96 / 3.51
Segment II	L / W / D	4.57 / 3.60 / 3.39	4.36 / 3.58 / 3.45	4.24 / 3.31 / 3.20	4.35 / 3.83 / 3.46
Segment III	L / W / D	4.58 / 3.57 / 3.39	4.44 / 3.58 / 3.27	4.46 / 3.29 / 3.14	4.50 / 3.59 / 3.54
Segment IV	L / W / D	5.21 / 3.47 / 3.03	4.97 / 3.45 / 3.00	5.21 / 3.20 / 2.98	5.14 / 3.64 / 3.23
Segment V	L / W / D	6.10 / 3.29 / 2.68	6.08 / 2.91 / 2.76	6.31 / 2.79 / 2.37	6.46 / 3.33 / 2.65
Telson	L / W / D	5.43 / 2.40 / 2.12	5.95 / 2.51 / 2.26	5.56 / 2.17 / 2.09	5.99 / 2.75 / 2.40
Pedipalp	L	18.15	18.57	19.90	20.45
Femur	L / W	4.18 / 1.36	4.39 / 1.56	4.71 / 1.35	4.75 / 1.73
Patella	L / W	5.42 / 2.01	5.42 / 2.12	5.66 / 2.16	5.90 / 2.45
Chela	L	8.55	8.76	9.53	9.80
Manus	W / D	2.69 / 2.85	2.61 / 2.66	2.72 / 2.75	2.66 / 2.57
Movable finger	L	5.01	5.27	5.74	5.81
Total	L	45.96	49.23	46.34	50.11

Table 10. Comparative measurements of *Mesobuthus phillipsii* and *M. sari* sp. n. specimens. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated Intercarinal surfaces on metasomal segments ventral and lateral granulated, more in female. Length to depth ratio of metasoma III 1.1–1.3, metasoma IV 1.3–1.5 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–10 retroinferior macrosetae on basitarsus III. Tibial spur on both legs III and IV moderate. Telson elongated. Anal lobe divided into three parts.

HISTORY OF STUDY. Syntypes of *Buthus eupeus philippovitschi* published by Birula (1905a: 127) were collected in 1903 by N. A. Zarudny and in 1904 by E. M. Philippovich, and deposited at ZISP. The syntype series included four separate labels (lots) (all dates below, Old Style) from then Astrabad Province listed in Birula's handwritten catalog as: No. 377, 2♂4 juv. env. of Astrabad, 1–4 October 1903; No. 378, 1♂5♀, Karasu, 17 February 1904; No. 379 and 380, 6♂6♀, env. of Astrabad, 18 February and May 1904; No. 381, Tokhlok on Gurgan [Gorgan] River, 9–10 February 1904. We designated a lectotype from Karasu (now Qarasu).

This taxon was synonymized with *Mesobuthus eupeus eupeus* by Kovařík et al. (2011: 17), and with *M. eupeus* by Kovařík (2019). Here, we restore it from synonymy and elevate to species status, according to our DNA phylogeny.

DISTRIBUTION. Iran (Gorgan, Mazandaran, and Razavi Horasan Provinces) (Figs. 1155, 1157).

***Mesobuthus phillipsii* (Pocock, 1889), s. str.**

(Figures 802–842, 1155, 1157, Table 10)

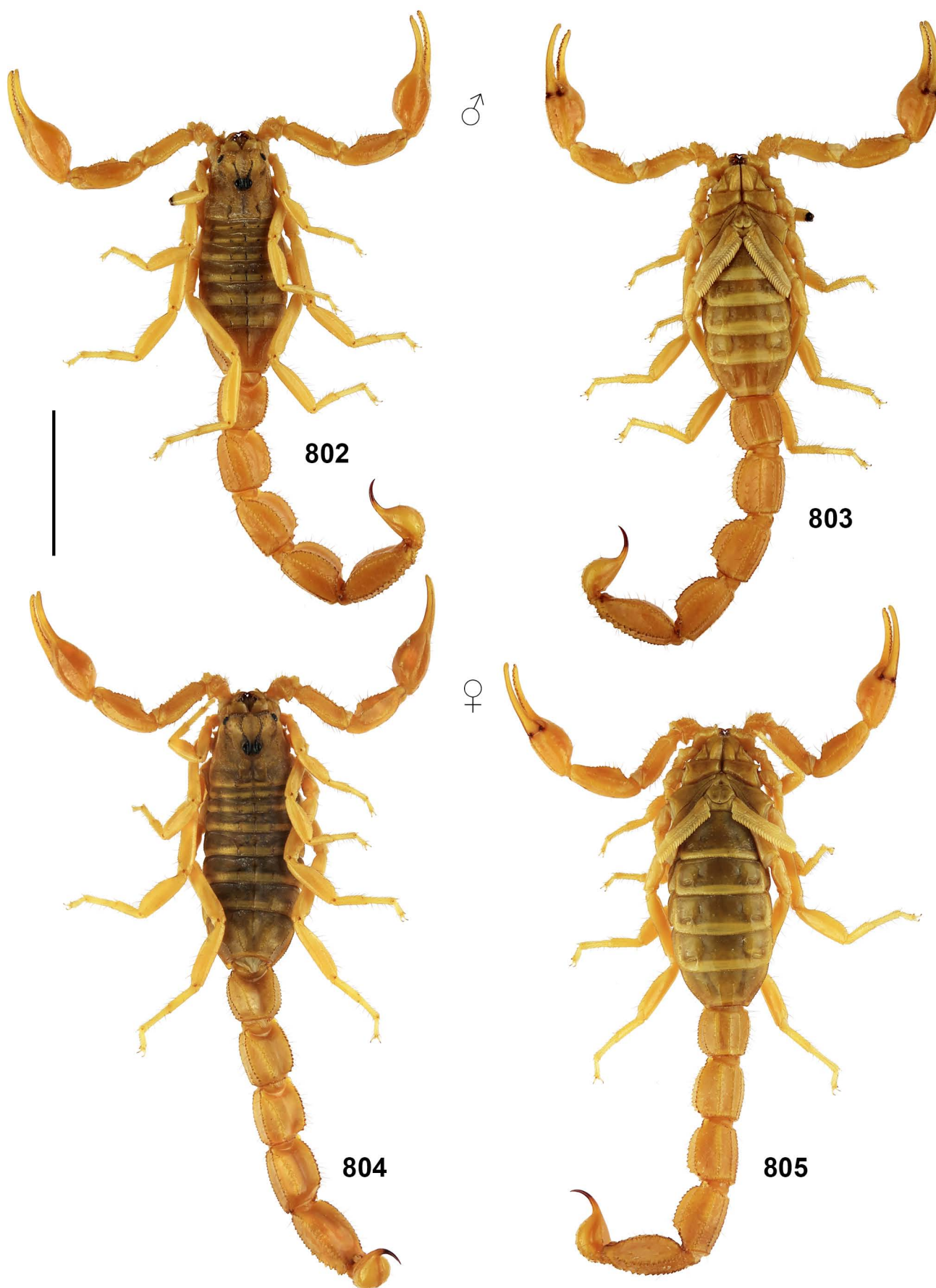
<http://zoobank.org/urn:lsid:zoobank.org:act:4A525552-1114-4E33-86E2-D6FE48928103>

Buthus phillipsii Pocock, 1889a: 341–343, pl. XV, fig. 6.

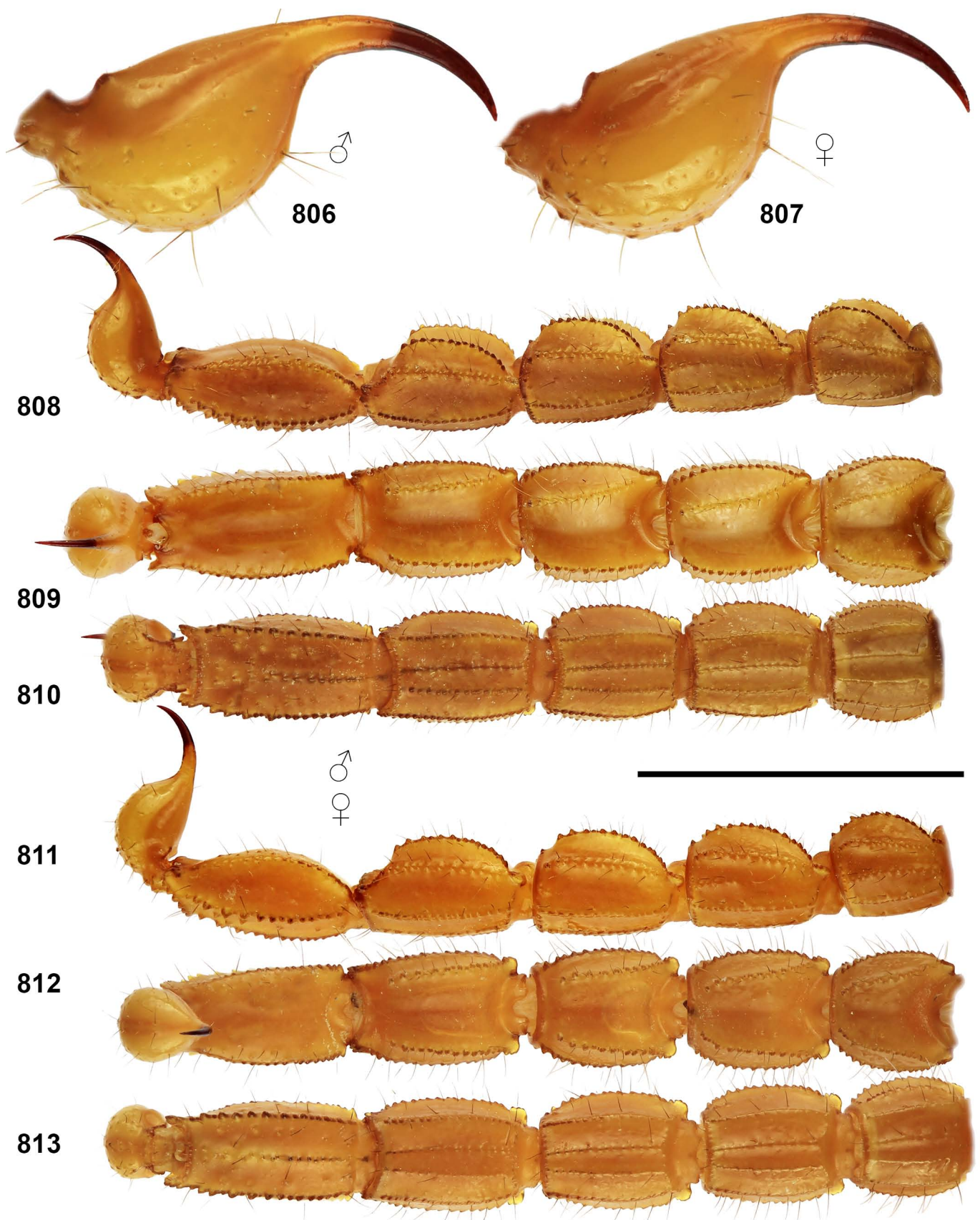
TYPE LOCALITY AND TYPE REPOSITORY. Iran, **Bushehr Province**, Bushehr (=Bushir) (28.97°N 50.83°E); BMNH.

REFERENCES (selected):

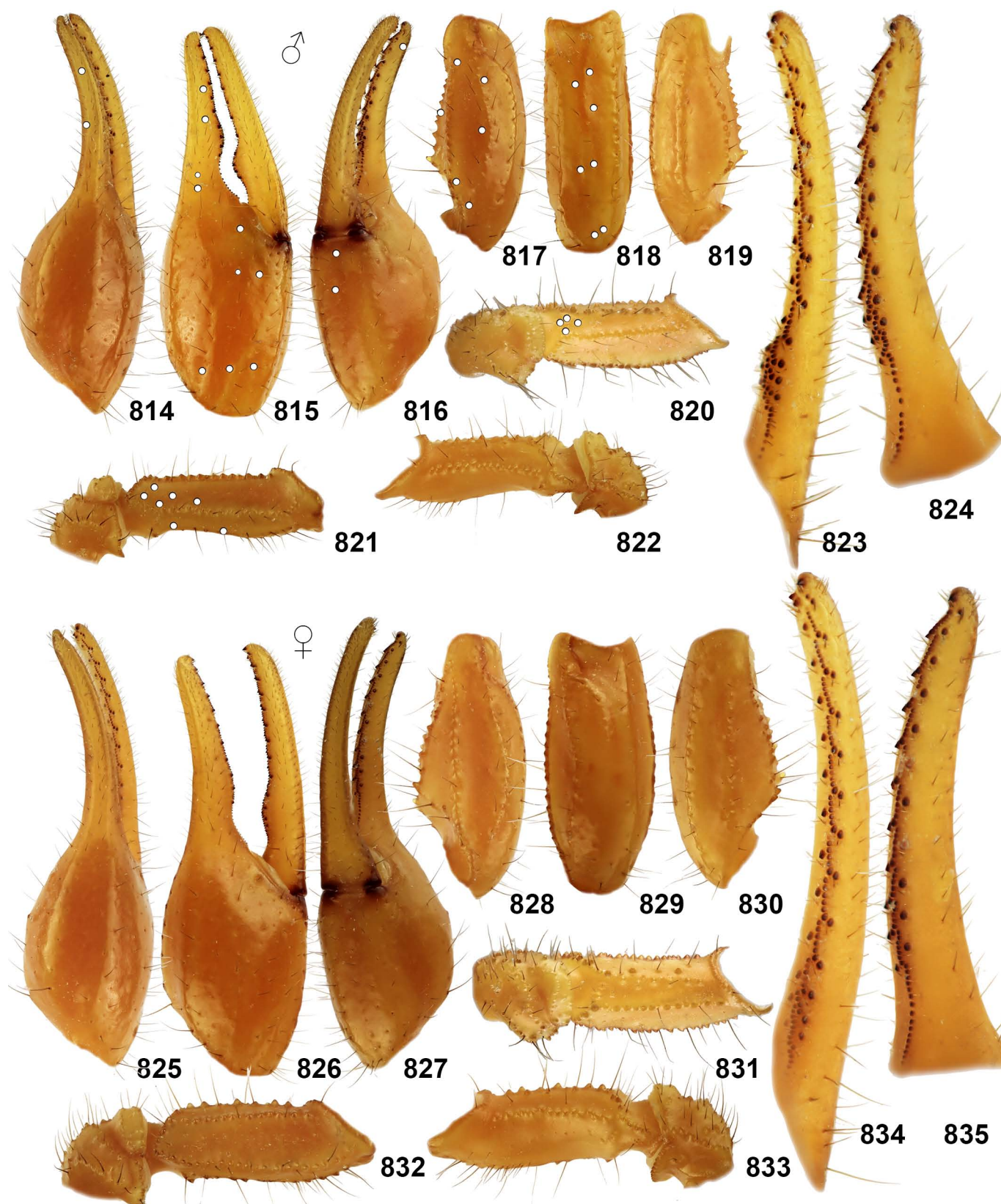
- Buthus phillipsii*: Birula, 1905a: 120, 124, 131–134 (in part).
Buthus (Buthus) phillipsii: Birula, 1917a: 23, 43.
Mesobuthus phillipsii: Vachon, 1950: 153; Vachon, 1952: 325; Mirshamsi et al., 2011a: 15–19, figs. 36–43, tables 1–2 (in part); Mirshamsi et al., 2011b: 20 (in part).
Mesobuthus eupeus phillipsii: Vachon, 1958: 155; Vachon, 1966: 213; Fet, 1994: 527.
Mesobuthus eupeus phillipsii: Fet & Lowe, 2000: 175 (in part; complete references list until 1998); Navidpour et al., 2008a: 11–13, figs. 22, 81–84; Navidpour et al., 2008b: 13–15, figs. 2–3, 5, 21–22, 49–52; Navidpour et al., 2008c: 11, figs. 4, 7–9, 37–40; Navidpour et al., 2008d: 5–7, figs. 2–3, 5–9, 35–38; Pirali-Kheirabadi et al., 2009: 6–9, figs. 5, 10, 32–35 (in part); Navidpour et al., 2010: 13–14, fig. 19 (in part).
Mesobuthus eupeus persicus: Navidpour et al., 2012: 10–12, fig. 10 (in part).
Mesobuthus phillipsii: Navidpour et al., 2012: 12, fig. 10 (in part); Navidpour et al., 2013: 11, figs. 4, 9, 37 (in part); Barahoei et al., 2020: 398–399, fig. 16 (in part); Kovařík, 2019: 17.



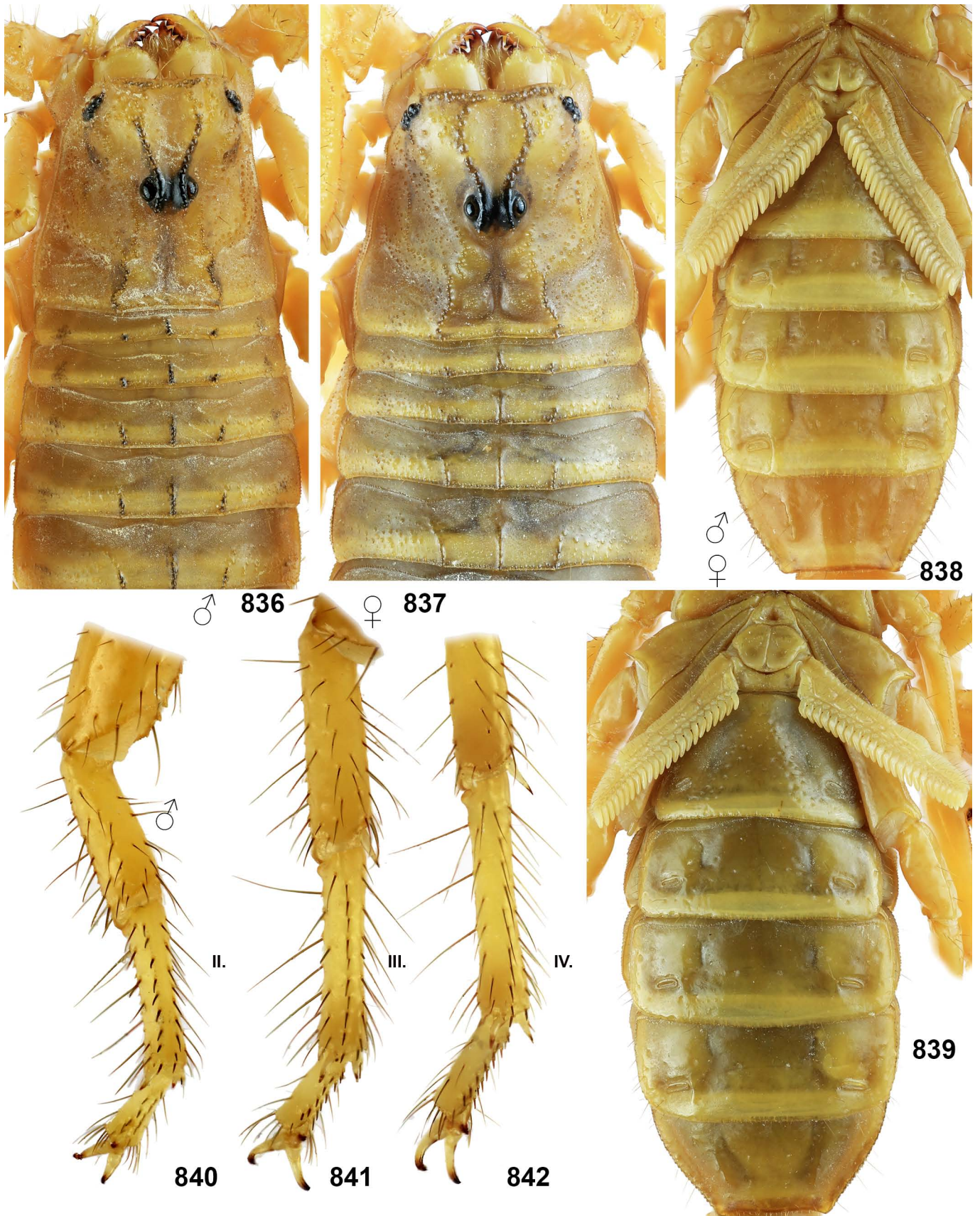
Figures 802–805: *Mesobuthus phillipsii*, topotypes. **Figures 802–803.** Male, dorsal (802) and ventral (803) views. **Figures 804–805.** Female, dorsal (804) and ventral (805) views. Scale bar: 10 mm.



Figures 806–813: *Mesobuthus phillipsii*, topotypes. **Figures 806, 808–810.** Male, telson lateral (806), metasoma and telson, lateral (808), dorsal (809), and ventral (810) views. **Figures 807, 811–813.** Female, telson lateral (807), metasoma and telson, lateral (811), dorsal (812), and ventral (813) views. Scale bar: 10 mm (808–813).



Figures 814–835: *Mesobuthus phillipsii*, topotypes, pedipalp. **Figures 814–824.** Male, chela, dorsal (814), external (815), and ventral (816) views. Patella, dorsal (817), external (818) and ventral (819) views. Femur and trochanter, internal (820), dorsal (821), and ventral (822) views. Movable (823) and fixed (824) fingers. **Figures 825–835.** Female, chela, dorsal (825), external (826), and ventral (827) views. Patella, dorsal (828), external (829) and ventral (830) views. Femur and trochanter, internal (831), dorsal (832), and ventral (833) views. Movable (834) and fixed (835) fingers. The trichobothrial pattern is indicated in Figures 814–818, 820–821.



Figures 836–842: *Mesobuthus phillipsii*, topotypes. **Figures 836, 838, 840–842.** Male, chelicerae, carapace and tergites I–V (836), sternopectinal region and sternites (838), and left legs II–IV, retrolateral aspect (840–842). **Figures 837, 839.** Female, chelicerae, carapace and tergites I–IV (837), sternopectinal region and sternites (839).

MATERIAL EXAMINED (NMPC). **Iran, Bushehr Province**, 15 km NW of Bandar-e-Gonaveh, Chahak, ca. 50 m a. s. l., 3–5 May 1996, 3♂, leg. M. Kaftan, 2juvs., leg. V. Šejna; Dayer road, village, 29°28'12"N 51°07'40"E (29.47°N 51.12°E), 405 m a. s. l. (Locality No. Bu-21), September 2007, 1♂juv., leg. Masihipour, Bahrani & Hayader; Khormuj, 28°41'46"N 51°21'49"E (28.69°N 51.35°E), 83 m a. s. l. (Locality No. Bu-31), October 2007, 1♂1♀ (topotypes, Figs. 802–842), leg. Masihipour & Habibzadeh; Borazjan, 29°16'56"N 51°15'26"E (29.27°N 51.25°E), 200 m a. s. l. (Locality No. Bu-18.2), February 2007, 4juvs., leg. Masihipour, Bahrani & Habibzadeh; Behbahan–Genaveh road, 29°40.71'N 51°24.04'E (29.67°N 51.40°E), 16 m a. s. l. (Locality No. B6), July 2007, 1♀2♂, leg. Navidpour & Masihipour; **Fars Province**, Zagros Mts., Abshar Village env., 30°23'N 51°30'E (30.38°N 51.30°E) ca 1000 m a. s. l., 2–3 May 1996, 1♀, leg. J. Pitulová; 10 km S of Firuz Abad, 28°55'N 52°31'E (28.92°N 52.52°E), 1412 m a. s. l., 20–21 April 2000, 1♀, leg. J. Šobotník; Kazeroon, 29°42'03"N 51°41'24"E (29.70°N 51.68°E), 772 m a. s. l. (Locality No. Fa-843), September 2008, 1♀juv., leg. Habibzadeh, Hayader & Masihipour; Kazeroon–Farashband, Safar Hussain village, 29°00'28"N 52°22'21"E (29.00°N 52.36°E), 761 m a. s. l. (Locality No. Fa-845), September 2008, 3♂1♂juv., leg. Bahrani, Habibzadeh, Masihipour & Hayader; Kazeroon–Farshband road, 29°10'32"N 52°00'57"E (29.17°N 52.00°E), 871 m a. s. l. (Locality No. Fa-846), September 2008, 2♀1♂juv., leg. Habibzadeh, Hayader & Masihipour; Parishan, 29°20'10"N 51°49'54"E (29.33°N 51.82°E), 867 m a. s. l. (Locality No. Fa-848), September 2008, 1♂1♀, leg. Habibzadeh, Hayader & Masihipour; Pasargad, Saadat Shahr, 30°17'59"N 52°10'29"E (30.28°N 52.16°E), 1862 m a. s. l. (Locality No. Fa-859), September 2008, 2♂, leg. Masihipour, Hayader, Bahrani; Gheer-Khonj, Kahnnooyeh village, 29°07'55"N 53°08'22"E (29.12°N 53.13°E), 578 m a. s. l. (Locality No. Fa-865), October 2008, 2♀, leg. Bahrani, Habibzadeh, Masihipour & Hayader; Gheer-Khonj, Oskooyeh village, 29°06'03"N 53°12'39"E (29.10°N 53.20°E), 581 m a. s. l. (Locality No. Fa-866), October 2008, 1♀1juv., leg. Bahrani, Habibzadeh, Masihipour & Hayader; Gheer-Khonj, 28°14'34"N 53°06'41"E (28.23°N 53.10°E), 638 m a. s. l. (Locality No. Fa-867), October 2008, 1♂3♀1juv., leg. Hayader, Bahrani, Masihipour & Habibzadeh; Gheer-Khonj, Mozafary village, 29°24'21"N 53°03'04"E (29.40°N 53.05°E), 581 m a. s. l. (Locality No. Fa-869), October 2008, 5♀, leg. Bahrani, Habibzadeh, Masihipour & Hayader; Gheer-Hengam road, 28°32'36"N 52°47'54"E (28.53°N 52.78°E), 1173 m a. s. l. (Locality No. Fa-871), October 2008, 1♂juv., leg. Bahrani, Habibzadeh, Masihipour & Hayader; Gheer-Hengam road, 29°31'07"N 52°52'02"E (29.52°N 52.87°E), 987 m a. s. l. (Locality No. Fa-875), October 2008, 1♀1♀juv., leg. Bahrani, Habibzadeh, Masihipour & Hayader; Juym-Lar, Banaruyeh, 29°05'39"N 54°06'16"E (29.08°N 54.10°E), 864 m a. s. l. (Locality No. Fa-878), October 2008, 1♀juv., leg. Habibzadeh, Hayader & Masihipour; Bastak-Lar road, 27°30'40"N 54°13'55"E (27.50°N 54.22°E), 779 m a. s. l. (Locality No. Fa-884), October 2008, 1♀juv., leg. Bahrani, Habibzadeh,

Masihipour; Lar, 27°40'06"N 54°19'36"E (27.67°N 54.32°E), 917 m a. s. l. (Locality No. Fa-886), October 2008, 1♂2♀, leg. Bahrani, Habibzadeh & Masihipour; Mehr-Galedar, Chahoo village, 27°34'27"N 52°50'36"E (27.57°N 52.83°E), 434 m a. s. l. (Locality No. Fa-887), September 2008, 1♂, leg. Bahrani, Habibzadeh, Masihipour & Hayader; 10 km E of Sivand Village, 30°05'N 52°55'E (30.08°N 52.91°E), 1700 m a. s. l., 29–30 April 1996, 1♀, leg. M. Kaftan; **Kohgiluyeh & Boyer-Ahmad Province**, Zagros Mts., Kuh-e-Dinar ridge, 10 km NE of Yasuj, by road (Baba Hasan Village env.), 30°39'N 51°36'E (30.65°N 51.36°E), 1800–2500 m a. s. l., 1–2 May 1996, 1♀juv.1juv., leg. J. Pitulová; Dena, Yasuj to Sisakht road, 30°48'15"N 51°28'54"E (30.80°N 51.47°E), 2000 m a. s. l. (Locality No. Y-3), March 2008, 1♂2juvs., leg. Ghafarnia, Habibzadeh & Bahrani.

DNA DATA. *Mesobuthus phillipsii*, in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their survey of Iranian *Mesobuthus* (six DNA sequences from the Fars Province, localities Kazeroon 29.58°N 51.51°E) and Ghir-o Karzin (28.32°N 52.92°E); Table 16).

DIAGNOSIS. Total length of adults 38 mm (male) to 55 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.1–3.4 in both sexes. Pectinal teeth number 22–29 in male, 18–24 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma hirsute with long setae rather densely. Carapace and tergites yellow to reddish brown with pigmentation reduced; metasoma, telson, pedipalps and legs yellow or reddish brown. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually granulated carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII medially smooth with 4 smooth carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasomal segments smooth. Length to depth ratio of metasoma III 1.2–1.4, metasoma IV 1.6–1.8 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–9 retroinferior macrosetae on basitarsus III. Tibial spur on both legs III and IV moderate. Telson elongated. Anal lobe divided into three parts.

HISTORY OF STUDY. This taxon, described by Pocock from the southern Iran (Bushehr), has been treated as a valid species but rarely collected. It was treated as a subspecies for a long time until Mirshamsi et al. (2011a) elevated it to species level. However, its scope was unclear until the

present study. Earlier, we applied this name (as a subspecies) to a number of populations from Iran (Pirali-Kheirabadi et al., 2009; Navidpour et al., 2010) as well as Iraq, Syria, and Turkey (Kovařík et al., 2011). Currently, we limit *Mesobuthus phillipsii* to the southern Iran.

DISTRIBUTION. Iran (Bushehr, Fars, and Kohgiluyeh & Boyer Ahmad Provinces) (Figs. 1155, 1157).

***Mesobuthus rahsenae* sp. n.**

(Figures 843–882, 1155–1156, 1165, Tables 10, 15)

<http://zoobank.org/urn:lsid:zoobank.org:act:349B1277-250E-47A1-AFB8-5FFF16D9EA4F>

Mesobuthus eupeus eupeus: Kovařík et al., 2011: 1–5, figs. 4–7, 27 (in part Erzincan Province).

TYPE LOCALITY AND TYPE REPOSITORY. **Turkey, Erzincan Province**, Kemaliye, Kemaliye Town, Zincirli Kaya area, 39°15'37"N 38°29'41"E (39.25°N 38.43°E), 555 m a. s. l.; AZMM.

TYPE MATERIAL. **Turkey, Erzincan Province**, Kemaliye, Kemaliye Town, Zincirli Kaya area, 39°15'37"N 38°29'41"E (39.25°N 38.43°E), 555 m a. s. l., 11 July 2008, 2♂ (holotype and paratype, Figs. 843–844, 847, 849–851, 855–864, 875–876, 879–882), leg. E. A. Yağmur, AZMM; Merkez/Erzincan, 1 km from Günebank Village, 39°44'06.4"N 39°37'14.1"E (39.74°N 39.62°E), August 2014, 1♂1♀ (paratypes, Nos. 364, 365), leg. Ç. Altın, AZMM.

ETYMOLOGY. The new species name honors our colleague Dr. Rahşen S. Kaya (Bursa, Turkey), for her great contributions to the field of arachnology.

DNA DATA. *Mesobuthus rahsenae* sp. n. is represented in our survey by one DNA sequence from Turkey (Erzincan Province) (Table 16).

DIAGNOSIS. Total length of adults 38 mm (male) to 62 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.5–3.7 in both sexes. Pectinal teeth number 22–28 in male, 18–22 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites yellow, usually black pigmented; metasoma, telson, pedipalps and legs yellow with dark spots. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, both internal and dorsal can be granulated. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5–6 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, finely granulated on margins with 4 well

marked smooth or granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth. Length to depth ratio of metasoma III 1.2–1.45, metasoma IV 1.5–1.8 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–9 retroinferior macrosetae on basitarsus III. Telson rather bulbous in female. Telson length to depth ratio is 2.4–2.5 in female. Anal lobe divided into three parts.

DESCRIPTION. Total length of adult males 38–45 mm, 42–62 females. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male has the fingers proximally more twisted than in female. For measurements, see Table 10.

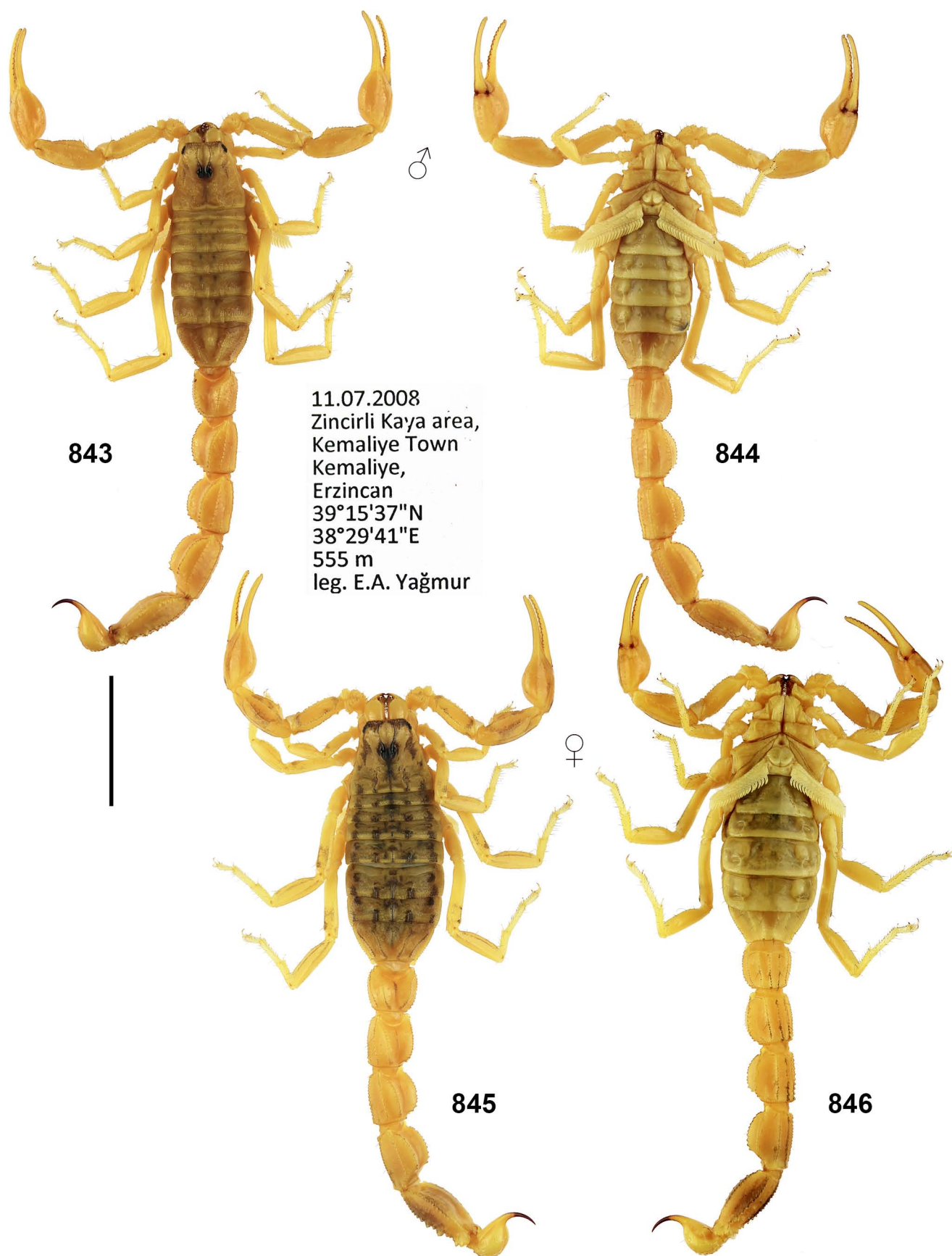
Coloration (Figs. 843–846). Carapace and tergites are yellow with dark pigmentation usually reduced. Telson, metasoma, pedipalps and legs are yellow usually with dark spots, part of metasomal segment V can be black. Chelicerae yellow, without reticulation, the tips of denticles on cheliceral fingers are black.

Mesosoma and carapace (Figs. 875–878). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacarinata. Pectinal tooth count is 22–28 in males, 18–22 in females. Pectinal marginal tips extend to about quarter of the fifth sternite in males and end of sternite IV in females. Pectines have three marginal lamellae and seven to eight middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. Sternites are smooth and sparsely hirsute. The sternite VII smooth, finely granulated on margins with four well marked smooth or granulated carinae. Other sternites have two furrows.

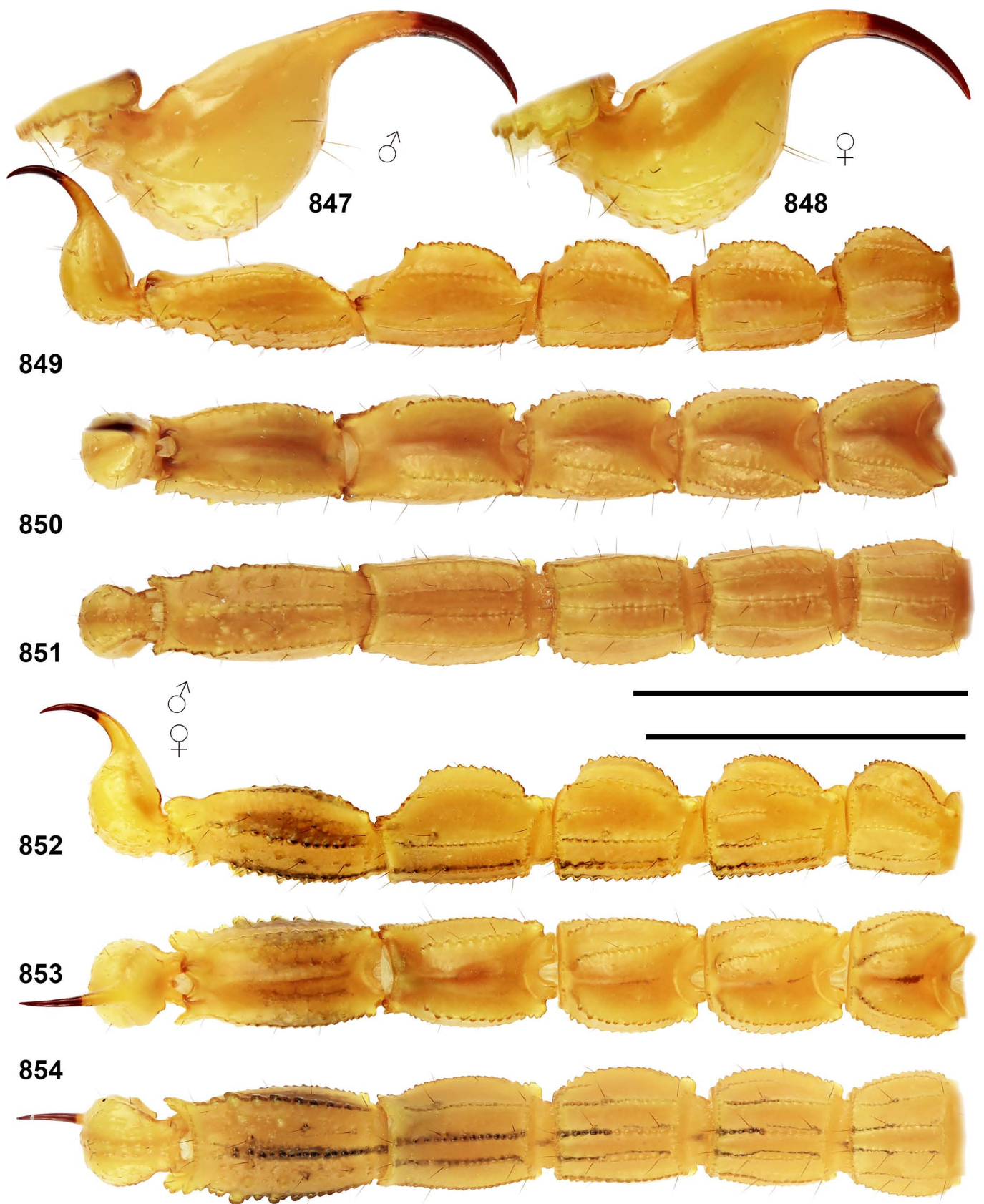
Pedipalps (Figs. 855–874). Pedipalps hirsute and smooth, only femur is sparsely finely granulated. Femur has four to five granulated carinae, the middle carina on internal surface consists of irregular granules. Patella with eight carinae, of which internal and dorsal can be granulated. Chela without carinae. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 879–882). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–9 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate on legs III and IV and absent on the other legs.

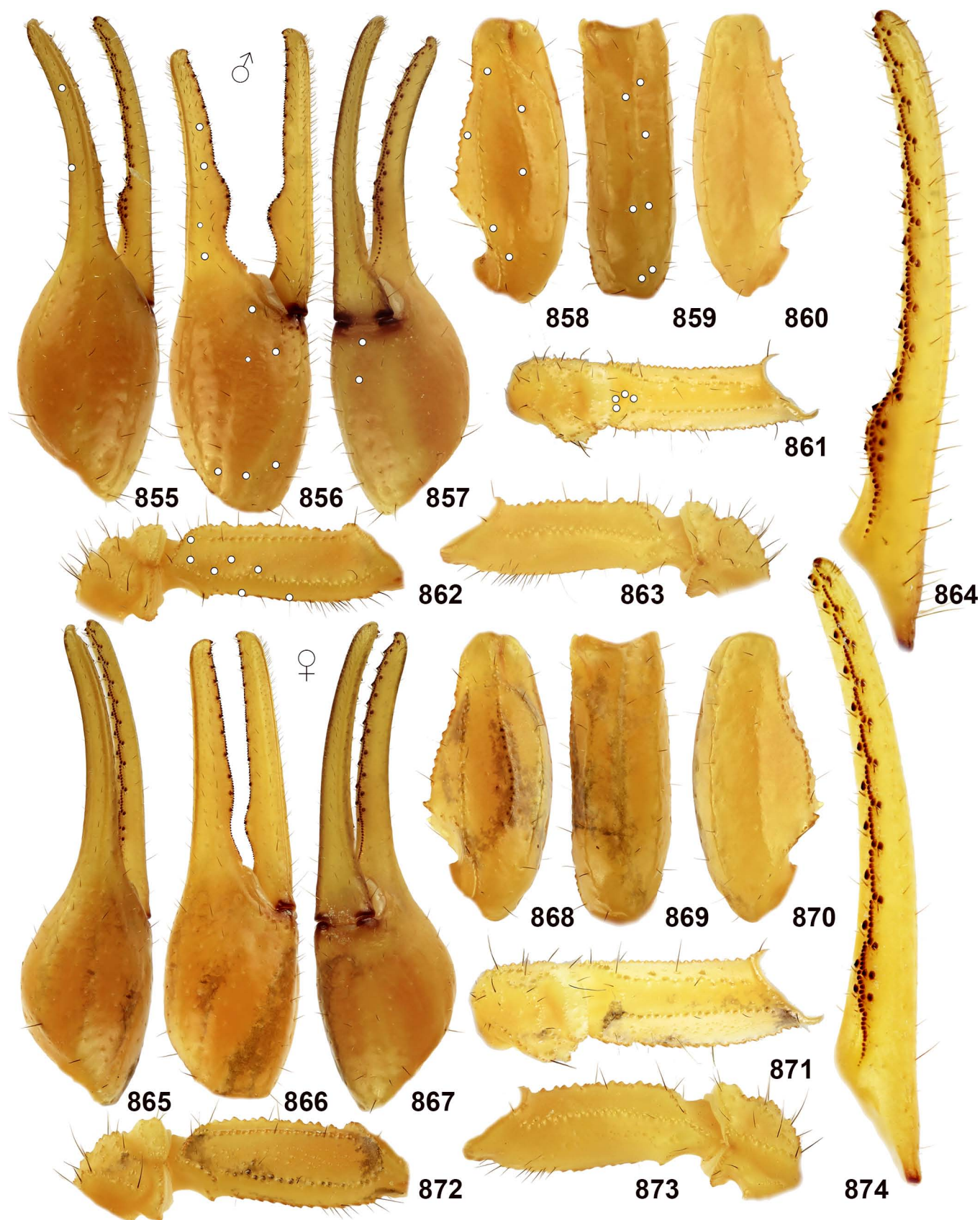
Metasoma and telson (Figs. 847–854). All metasomal segments are sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with



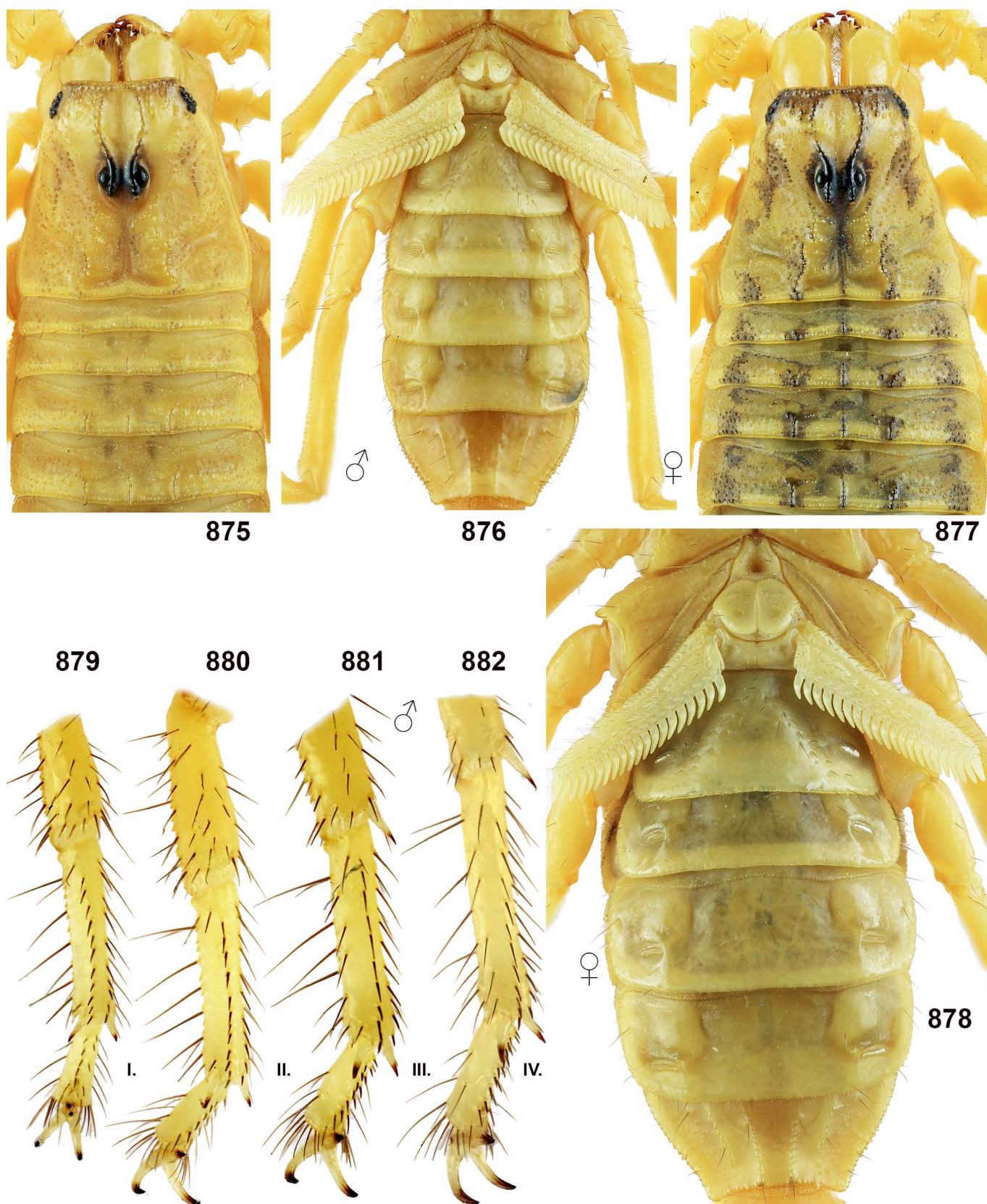
Figures 843–846: *Mesobuthus rahsenae* sp. n. **Figures 843–844.** Male holotype, dorsal (843) and ventral (844) views. **Figures 845–846.** Female paratype, dorsal (845) and ventral (846) views. Scale bar: 10 mm.



Figures 847–854: *Mesobuthus rahsenae* sp. n. **Figures 847, 849–851.** Male holotype, telson lateral (847), metasoma and telson, lateral (849), dorsal (850), and ventral (851) views. **Figures 848, 852–854.** Female paratype, telson lateral (848), metasoma and telson, lateral (852), dorsal (853), and ventral (854) views. Scale bars: 10 mm (849–851, 852–854).



Figures 855–874: *Mesobuthus rahsenae* sp. n., pedipalp. **Figures 855–864.** Male holotype, chela, dorsal (855), external (856), and ventral (857) views. Patella, dorsal (858), external (859) and ventral (860) views. Femur and trochanter, internal (861), dorsal (862), and ventral (863) views. Movable finger (864). **Figures 865–874.** Female paratype, chela, dorsal (865), external (866), and ventral (867) views. Patella, dorsal (868), external (869) and ventral (870) views. Femur and trochanter, internal (871), dorsal (872), and ventral (873) views. Movable finger (874). The trichobothrial pattern is indicated in Figures 855–859, 861–862.



Figures 875–882: *Mesobuthus rahsenae* sp. n. **Figures 875–876, 879–882.** Male holotype, chelicerae, carapace and tergites I–IV (875), sternopectinal region and sternites (876), and left legs I–IV, retrolateral aspect (879–882). **Figures 877–878.** Female paratype, chelicerae, carapace and tergites I–IV (877), sternopectinal region and sternites (878).

Dimensions (mm)		<i>M. thersites</i> ♂ neotype	<i>M. thersites</i> ♀ from Kazakhstan	<i>M. thersites</i> ♂ LT of <i>B. mongolicus</i>	<i>M. thersites</i> ♀ PLT of <i>B. mongolicus</i>
Carapace	L / W	4.48 / 4.74	5.47 / 6.20	4.69 / 4.93	5.72 / 5.80
Mesosoma	L	10.71	14.95	12.42	16.01
Tergite VII	L / W	2.66 / 4.79	3.60 / 6.25	3.13 / 4.71	3.44 / 6.19
Metasoma + telson	L	23.04	25.99	22.92	25.72
Segment I	L / W / D	2.96 / 3.18 / 2.79	3.31 / 3.73 / 3.45	2.94 / 3.24 / 2.97	3.02 / 3.53 / 2.92
Segment II	L / W / D	3.24 / 3.16 / 2.63	3.52 / 3.65 / 3.44	3.40 / 3.20 / 3.09	3.41 / 3.46 / 2.93
Segment III	L / W / D	3.39 / 3.30 / 2.56	3.69 / 3.61 / 3.44	3.30 / 3.11 / 3.22	3.54 / 3.40 / 3.18
Segment IV	L / W / D	3.95 / 2.86 / 2.49	4.55 / 3.60 / 3.24	4.19 / 3.02 / 2.69	4.52 / 3.33 / 3.12
Segment V	L / W / D	5.03 / 2.69 / 2.05	5.79 / 3.34 / 2.54	5.04 / 2.97 / 2.12	5.79 / 3.32 / 2.53
Telson	L / W / D	4.47 / 2.00 / 1.69	5.13 / 2.49 / 2.20	4.05 / 1.76 / 1.75	5.44 / 2.41 / 2.15
Pedipalp	L	15.03	17.53	14.97	18.27
Femur	L / W	3.48 / 1.17	4.11 / 1.40	3.50 / 1.19	4.41 / 1.45
Patella	L / W	4.19 / 1.73	4.81 / 2.16	4.36 / 1.66	4.99 / 2.07
Chela	L	7.36	8.61	7.11	8.87
Manus	W / D	2.23 / 2.37	2.81 / 3.01	2.45 / 2.59	2.50 / 2.72
Movable finger	L	4.36	5.33	4.39	5.26
Total	L	38.23	46.41	40.03	47.45

Table 11. Comparative measurements of *Mesobuthus thersites* specimens. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D), lectotype (LT), paralectotype (PLT).

8 carinae, and V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma smooth. Ventrolateral carinae of metasoma V posteriorly with several lobate denticles. Telson is sparsely hirsute, rather bulbous and smooth. Anal lobe divided into three or four parts.

DISTRIBUTION. Turkey (Erzincan Province) (Figs. 1155–1156).

***Mesobuthus thersites* (C. L. Koch, 1839)**

(Figures 883–950, 1155, 1158, 1168, Table 11)

<http://zoobank.org/urn:lsid:zoobank.org:act:FFA27933-C18B-4928-80A3-E4269B4272BA>

Androctonus thersites C. L. Koch, 1839b: 51–52, pl. CXCI, fig. 466.

TYPE LOCALITY AND TYPE REPOSITORY. Koch's type is lost and type locality unclear (see History of Study below). Neotype (designated here): **Kazakhstan, Kyzylorda Province**, S of Kyzylorda, 44°39'25"N 66°01'36"E (44.66°N 66.02°E), 127–135 m a. s. l.; NMPC.

SYNONYMS:

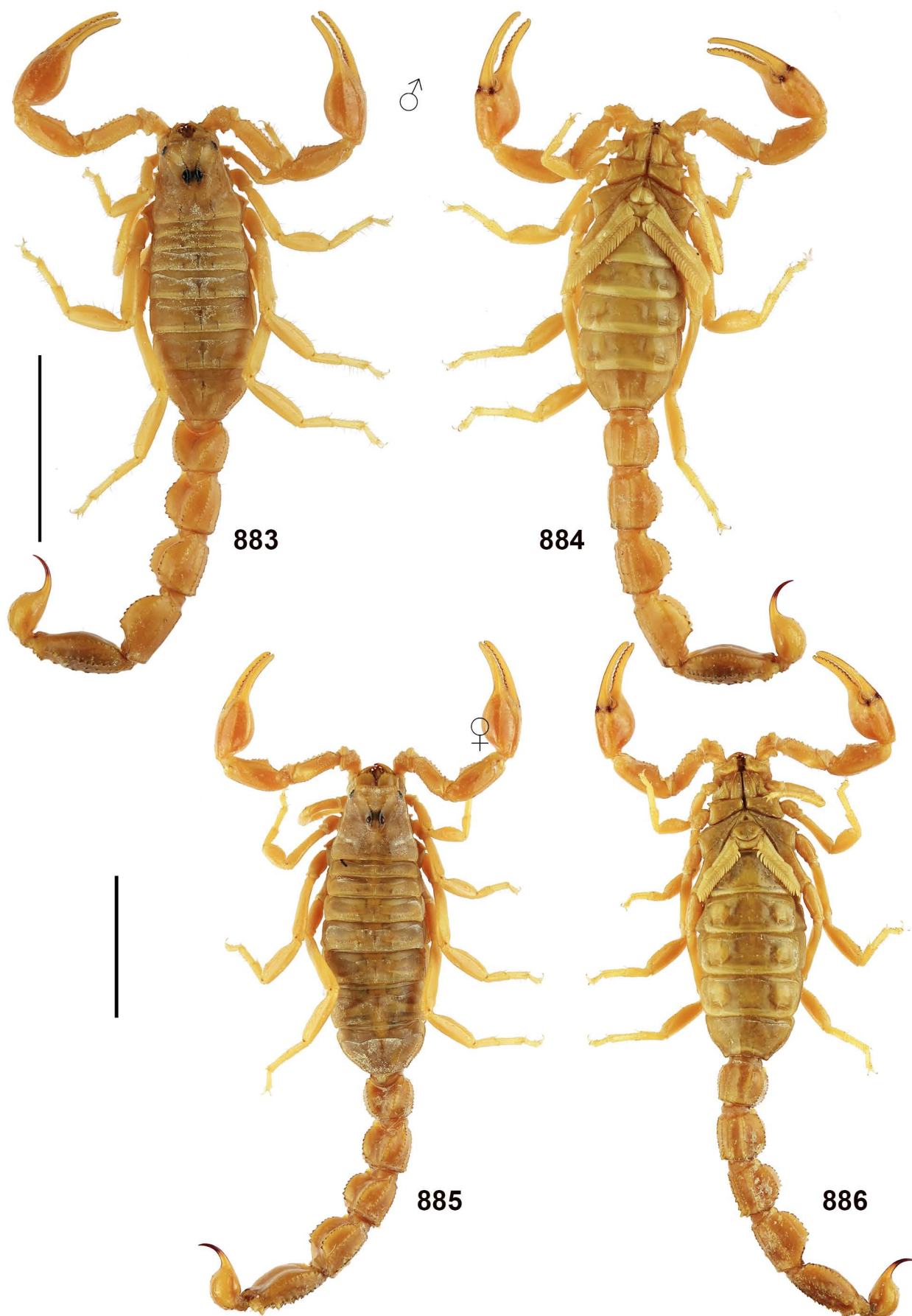
Buthus eupeus mongolicus Birula, 1911a: 195–199. **Syn. n.**

<http://zoobank.org/urn:lsid:zoobank.org:act:EDBCD86-7D10-4FD6-AAEF-90CBD121B1A1>

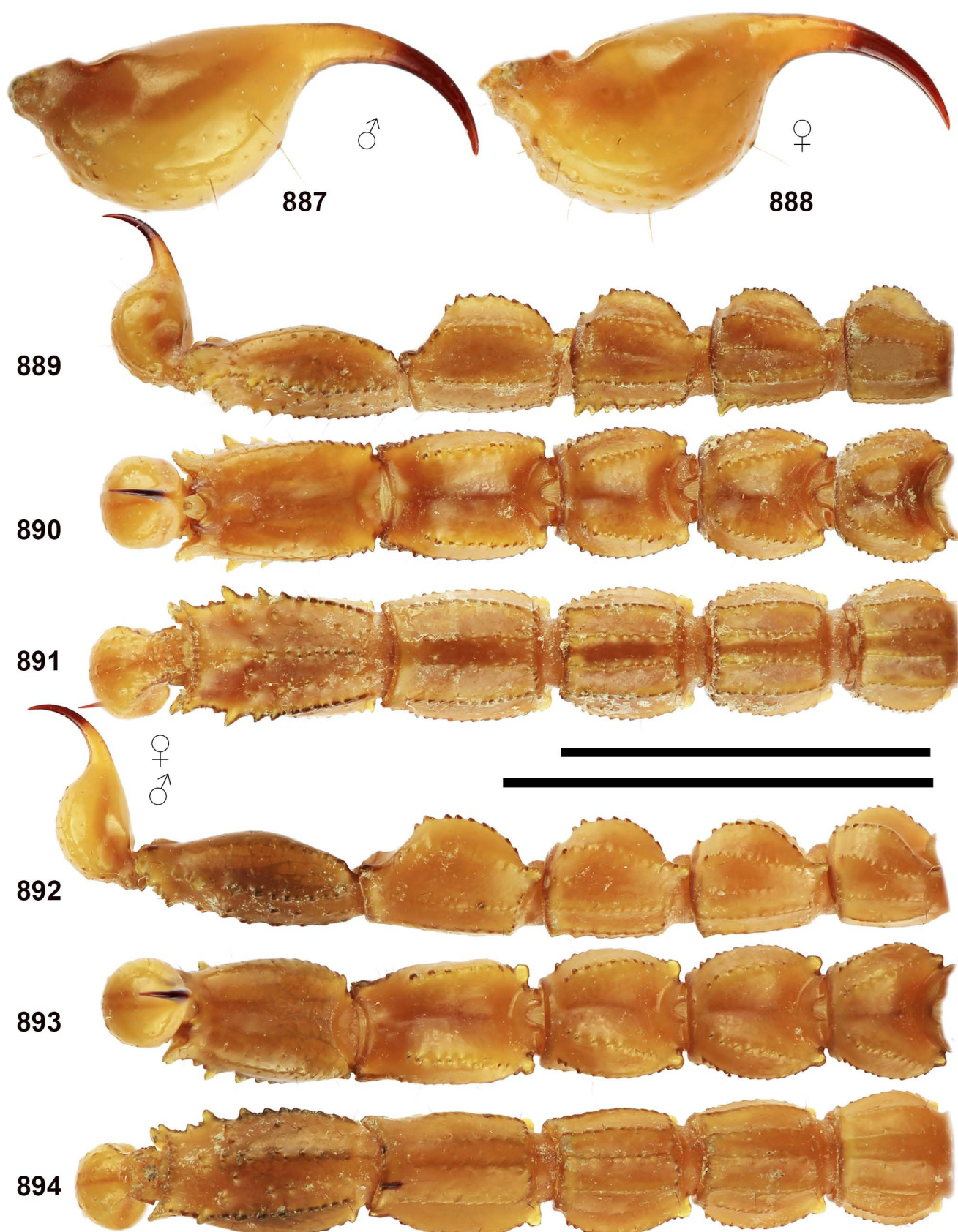
(TYPE LOCALITY AND TYPE REPOSITORY. **China, Inner Mongolia Autonomous Region**, Alxa League (Alashan Prefecture), Ting-yuan-ying (Bayanhot) (38.83°N 105.66°E); ZISP.

REFERENCES (selected):

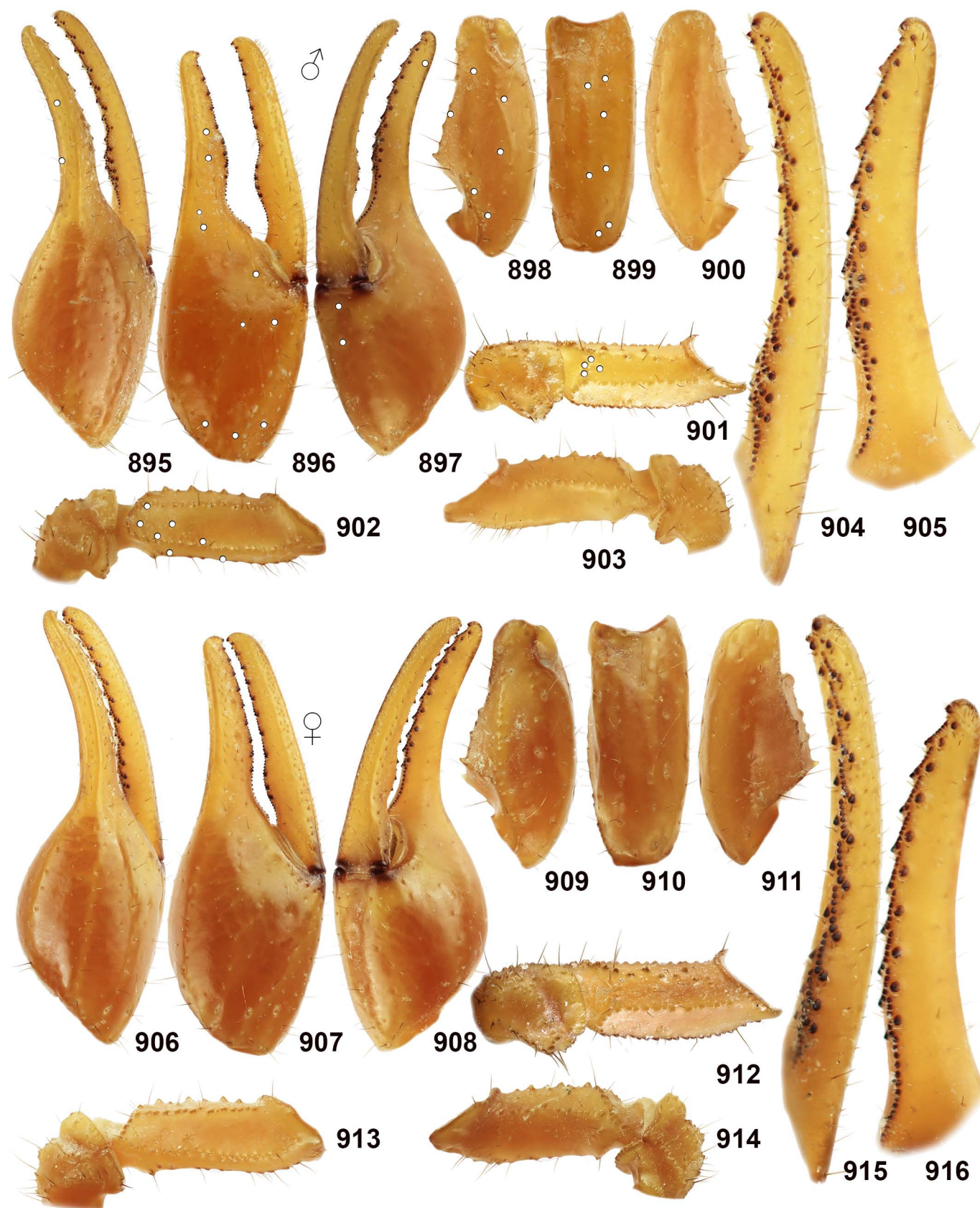
- ?“[a variety of] *Scorpio occitanus*”: Liechtenstein, 1823: 149.
Androctonus ornatus: Kessler, 1874: 19 (in part).
Buthus eupeus forma γ : Birula, 1896: 240 (in part).
Buthus eupeus thersites: Birula, 1904a: 20; Birula, 1904b: 29 (in part); Birula, 1905a: 122–123, fig. 3; Birula, 1911a: 198–199; Birula, 1911b: 165–167 (in part); Pavlovsky, 1916b: 35; Birula, 1917a: 29, 35, 41 (in part); Birula, 1925: 95; Pavlovsky, 1934: 200.
Buthus eupeus mongolicus: Birula, 1917a: 42; Birula, 1925: 96; Birula, 1927: 202.
Mesobuthus eupeus thersites: Vachon, 1958: 155 (in part); Fet, 1989: 91–99 (in part; complete references list for the former USSR); Gromov & Kopdykbaev, 1994: 20; Fet & Lowe, 2000: 175 (in part; complete references list until 1998); Gantenbein et al., 2003: 413 (in part: Kazakhstan); Shi et al., 2007: 216; Fomichev, 2011: 1–3, figs. 1–5; Sun & Sun, 2011: 70–71, fig. 10; Bragina & Yağmur, 2014: 1.
Mesobuthus eupeus mongolicus: Vachon, 1958: 155; Stahnke, 1967: 61–68, fig. 1–5, tab. I–II; Fet, 1994: 527; Fet & Lowe, 2000: 174; Gantenbein et al., 2003: 413; Shi et al., 2007: 216; Sun & Sun, 2011: 67–70, figs. 7–8, 10; Shi et al., 2015: 339–347; Heddergott et al., 2016: 147–154, figs. 1–4, 7, tabs. 1–2 (complete list of records from Mongolia).
Mesobuthus eupeus: Fet et al., 2003: 3; Shi et al., 2007: 215–224, figs. 1–3; Shi et al. et al. 2013: 1703; Zhang et al., 2020: 87 (in part).
Mesobuthus mongolicus: Kovařík, 2019: 17; Shi et al., 2021: 1.
Mesobuthus thersites: Kovařík, 2019: 17.



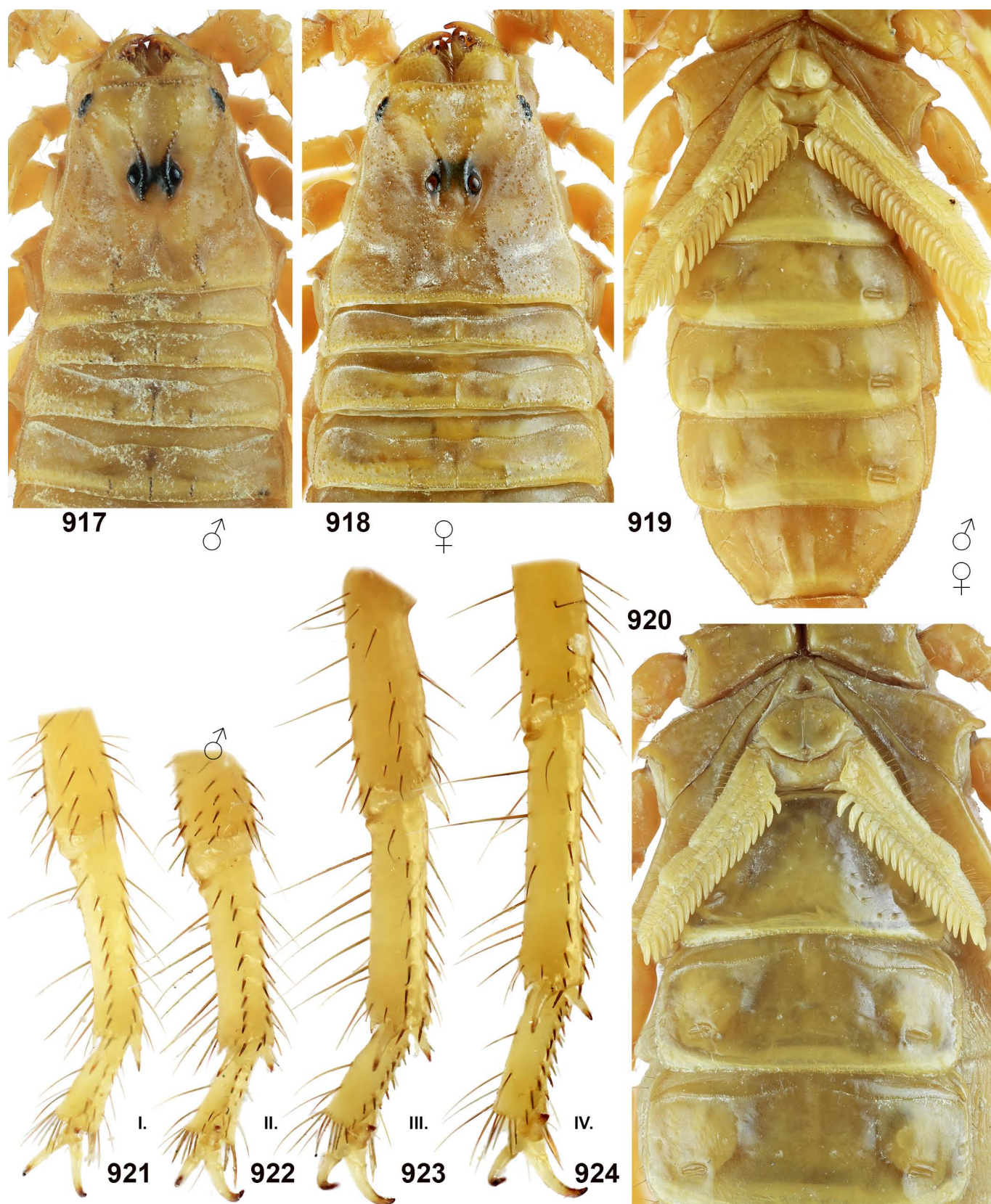
Figures 883–886: *Mesobuthus thersites* from Kazakhstan, Kyzylorda Province, S of Kyzylorda. **Figures 883–884.** Male neotype, dorsal (883) and ventral (884) views. **Figures 885–886.** Female, dorsal (885) and ventral (886) views. Scale bars: 10 mm (883–884, 885–886).



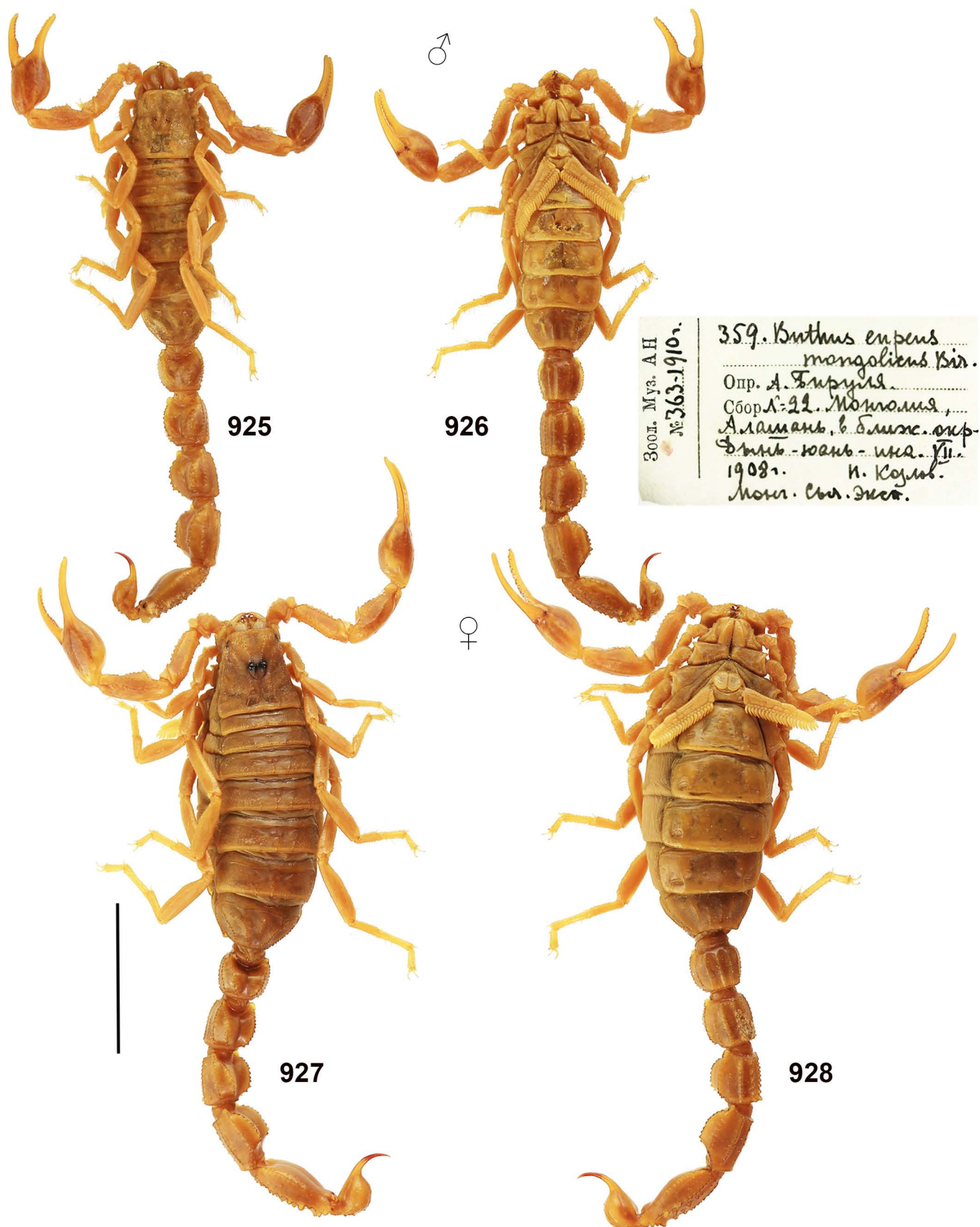
Figures 887–894: *Mesobuthus thersites* from Kazakhstan, Kyzylorda Province, S of Kyzylorda. **Figures 887, 889–891.** Male neotype, telson lateral (887), metasoma and telson, lateral (889), dorsal (890), and ventral (891) views. **Figures 888, 892–894.** Female, telson lateral (888), metasoma and telson, lateral (892), dorsal (893), and ventral (894) views. Scale bars: 10 mm (889–891, 892–894).



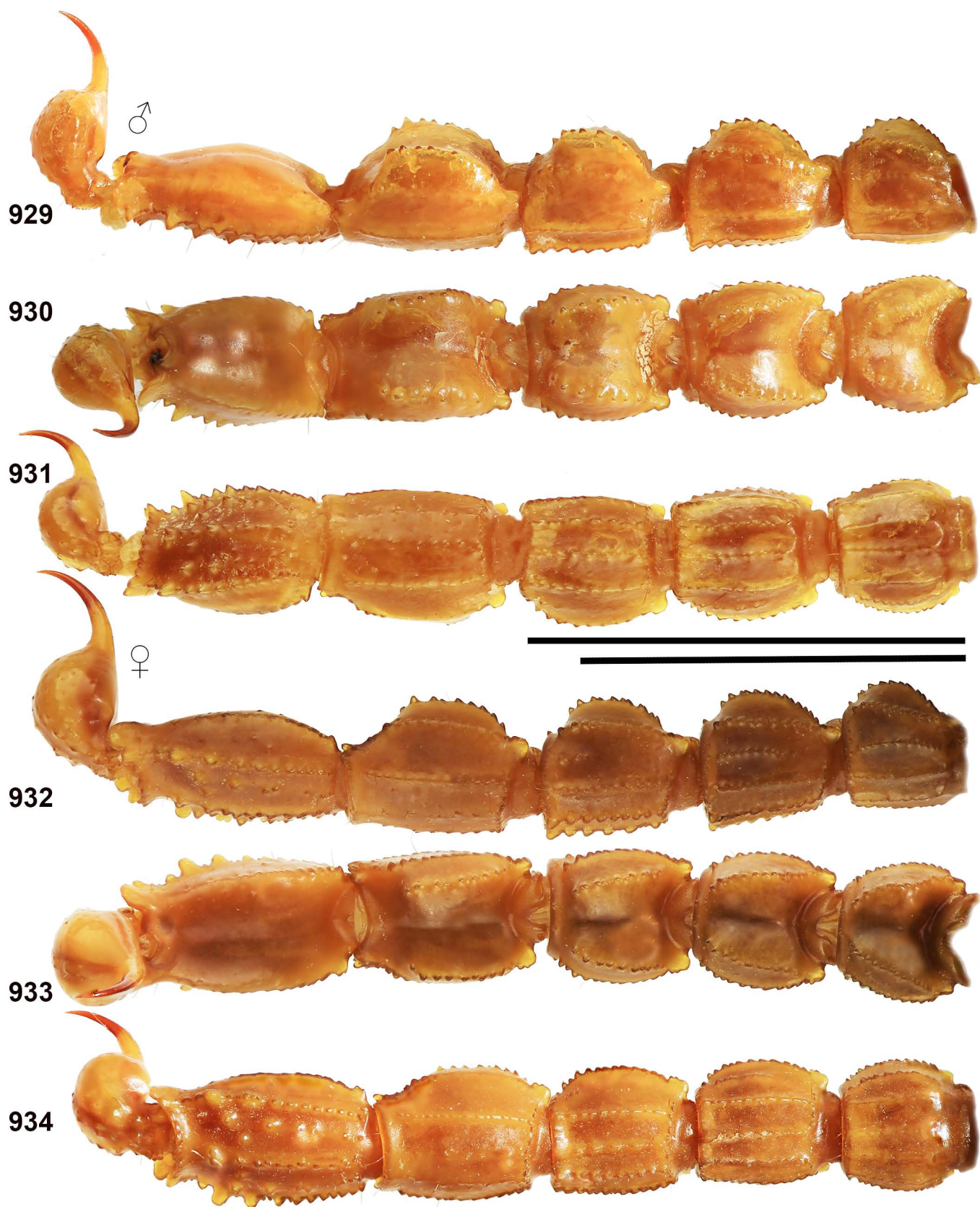
Figures 895–916: *Mesobuthus thersites* from Kazakhstan, Kyzylorda Province, S of Kyzylorda, pedipalp. **Figures 895–905.** Male neotype, chela, dorsal (895), external (896), and ventral (897) views. Patella, dorsal (898), external (899) and ventral (900) views. Femur and trochanter, internal (901), dorsal (902), and ventral (903) views. Movable (904) and fixed (905) fingers. **Figures 906–916.** Female, chela, dorsal (906), external (907), and ventral (908) views. Patella, dorsal (909), external (910) and ventral (911) views. Femur and trochanter, internal (912), dorsal (913), and ventral (914) views. Movable (915) and fixed (916) fingers. The trichobothrial pattern is indicated in Figures 895–899, 901–902.



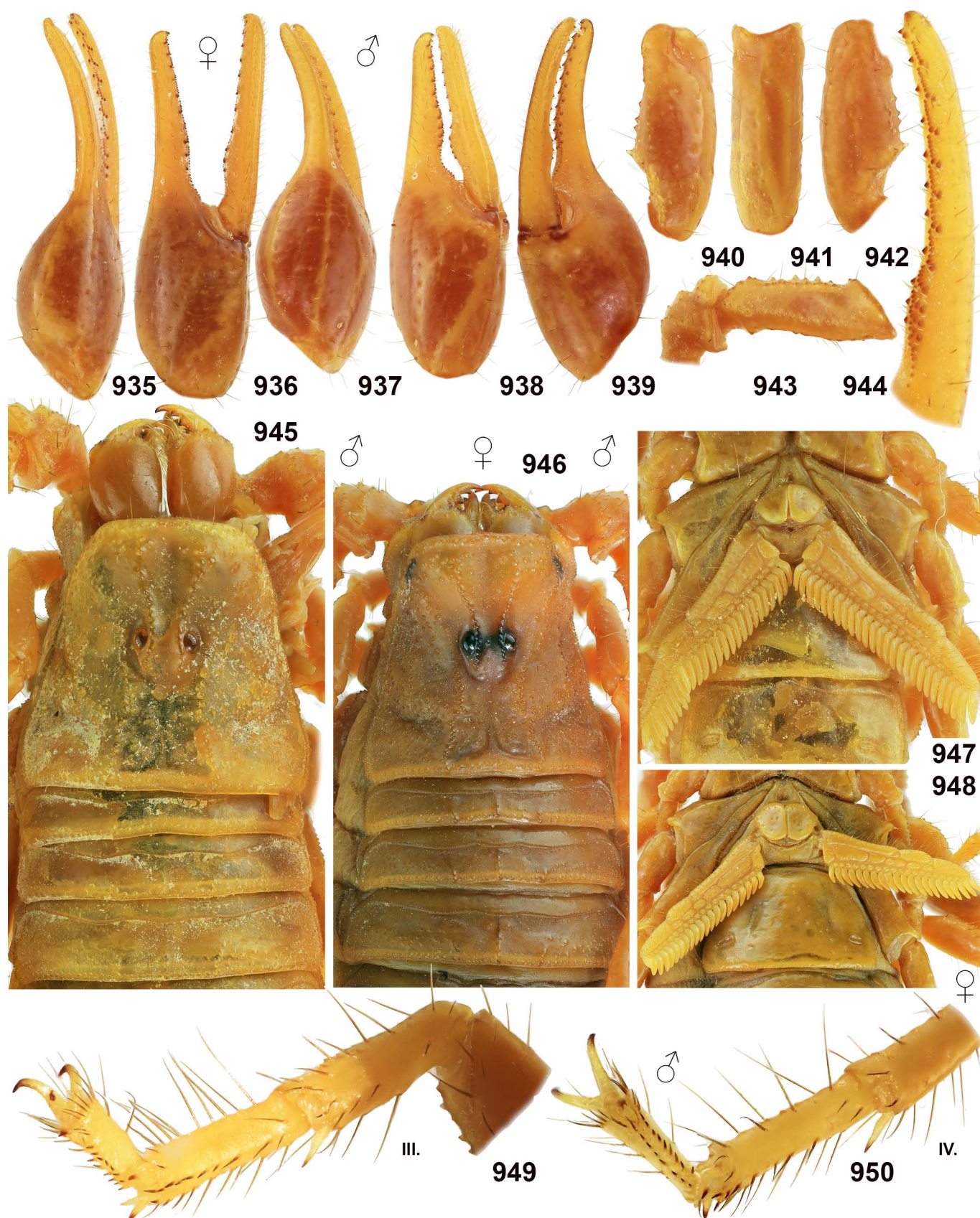
Figures 917–924: *Mesobuthus thersites* from Kazakhstan, Kyzylorda Province, S of Kyzylorda. **Figures 917, 919, 921–924.** Male neotype, chelicerae, carapace and tergites I–IV (917), sternopectinal region and sternites (919), and left legs I–IV, retrolateral aspect (921–924). **Figures 918, 920.** Female, chelicerae, carapace and tergites I–III (918), sternopectinal region and sternites (920).



Figures 925–928: *Mesobuthus thersites*, lectotype (male) and paralectotype (female) of *Buthus eupeus mongolicus*. **Figures 925–926.** Male, dorsal (925) and ventral (926) views. **Figures 927–928.** Female, dorsal (927) and ventral (928) views. The label (ZISP 359) says, in Russian and Latin: top, “*Buthus eupeus mongolicus* Bir[ula]. Det.: A. Birula. Coll.: № 22, Mongolia, Alashan, near Dyn-yuan-in, VII.1904, P. Kozlov. Mong[olian]. Sytch[uan]. Exp[edition].”. Scale bar: 10 mm.



Figures 929–934: *Mesobuthus thersites*, lectotype (male) and paralectotype (female) of *Buthus eupeus mongolicus*. **Figures 929–931.** Male, metasoma and telson, lateral (929), dorsal (930), and ventral (931) views. **Figures 932–934.** Female, metasoma and telson, lateral (932), dorsal (933), and ventral (934) views. Scale bars: 10 mm (929–931, 932–934).



Figures 935–950: *Mesobuthus thersites*, lectotype (male) and paralectotype (female) of *Buthus eupeus mongolicus*. **Figures 935–936, 946, 948.** Female, pedipalp chela, dorsal (935) and external (936). Chelicerae, carapace and tergites I–III (946) and sternopectinal region and sternite III (948). **Figures 937–945, 947, 949–950.** Male, chela, dorsal (937), external (938), and ventral (939) views. Patella, dorsal (940), external (941) and ventral (942) views. Femur and trochanter, dorsal (943). Movable finger (944). Chelicerae, carapace and tergites I–III (945) and sternopectinal region and sternite III (947). Left legs III–IV, retrolateral aspect (949–950).

TYPE MATERIAL EXAMINED. **Kazakhstan, Kyzylorda Province**, S of Kyzyl-Orda, 44°39'25"N 66°01'36"E (44.66°N 66.02°E), 127–135 m a. s. l., 26 May 2002, 1♂ (neotype of *Androctonus thersites*, designated here, Figs. 883–884, 887, 889–891, 895–905, 917, 919, 921–924), leg. V. Fet & A. Gromov, NMPC; **China, Inner Mongolia Autonomous Region**, Alxa League (Alashan Prefecture), Ting-yuan-ying (Bayanhot) (38.83°N 105.66°E), July 1908, leg. P. Kozlov, 1♂ (lectotype of *Buthus eupeus mongolicus*, designated here) 1♀ (paralectotype of *B. e. mongolicus*), ZISP 359 (Figs. 925–950).

OTHER MATERIAL EXAMINED. **China**, 3♂3♀, 1991–1992, FKCP. **Kazakhstan, Almaty Province**, ca 20 km SEE of Koktepek, 46°01'N 79°42'E (46.02°N 79.70°E), 11–12 June 2001, 1♀juv., leg. A. Gromov, NMPC; ca 6 km NNEE of Kapchagay, 43°56'N 77°05'E (43.93°N 77.08°E), 11 May 2001, 1♀2juvs., leg. A. Gromov, NMPC; 15 km NNW from Karabastau Village, Tyrnakty Natural Reserve, 43°53'N 75°30'E (43.88°N 75.50°E), mountain stony steppe with rocks, 850–950 m a. s. l., 20–22 April 2016, 2♀, leg. A. A. Fomichev, NMPC; **Jizzak Province**, Farish District, near Shardara, 41°12'52"N 68°30'34"E (41.20°N 68.50°E), 285 m a. s. l., 23 May 2002, 2juvs., leg. V. Fet (NG-051), NMPC; **Kostanay Province**, Amangeldy District, "Altyn Dala" State Nature Reservat (49.50°N 64.83°E), Site Altybai, 12 May 2013, 1♀juv., leg. T. M. Bragina, AZMM; Site Rakhmet, 4 July 2013, 2♂2juvs., AZMM, near the Ulyzhilanshik River, 4♂3♀2juvs., leg. T. M. Bragina, AZMM; **Kyzylorda Province**, S of Kyzyl-Orda, 44°39'25"N 66°01'36"E (44.65°N 66.02°E), 127–135 m a. s. l., 26 May 2002, 2♂5♀7juvs., leg. V. Fet & A. Gromov; Shiili (Chiili) District, ca. 2.5 km NW of Baigakum, 44°20'37"N 66°27'07"E (44.33°N 66.45°E), 137 m a. s. l., 25 May 2002, 1♂6♀3juvs., leg. V. Fet & A. Gromov (NG-015), NMPC; **Turkistan Province**, Turkistan, 43°19'02"N 68°13'35"E (43.32°N 68.22°E), 212 m a. s. l., 27 May 2002, 1♂juv., leg. A. Gromov (NG-069), NMPC; Karatau Mts., Turlan Pass, 43°34'58"N 68°57'13"E (43.57°N 68.95°E), 963 m a. s. l., 27 May 2002, 1♂juv., leg. A. Gromov (NG-040), NMPC; Karatau Mts., Turlan Pass, 43°35'40"N 68°58'55"E (43.59°N 68.98°E), 832 m a. s. l., 27 May 2002, 1♂juv., leg. A. Gromov (NG-041), NMPC; Kyzylkum Sands, Kayraktau Mts., 42°17'53.8"N 67°46'21"E (42.28°N 67.77°E), 314 m a. s. l., 28 April 2017, 5♀2juvs., leg. Yu. V. Dyachkov, NMPC; Karatau Mt. Range, Syrdarya-Turkestan National Park, near Terekty Village, Boraldy River, 42°51'48.2"N 69°51'55"E (42.85°N 69.85°E), 529 m a. s. l., 14–15 May 2017, 2♀4juvs., leg. A. A. Fomichev, NMPC; Beltau Mts., 41°50'09.9"N 68°32'15.4"E (41.83°N 68.53°E), 392 m a. s. l., 8–9 June 2017, 2♂5♀1juv., leg. A. A. Fomichev, NMPC; 50 km NW Achisay Village, Kyzylkol Lake shore, 43°46'34"N 69°30'36.4"E (43.77°N 69.50°E), 328 m a. s. l., 9 May 2017, 1♀juv., leg. Yu. V. Dyachkov, NMPC; Western Tian Shan, Ugamskiy Mt. Range, Sayram-Ugamskiy National Park, 10 km N Tyulkubas Village, Iirsu Gorge, 42°24'58"N 70°21'30.08"E (42.40°N 70.35°E), 1296 m a. s. l., 16–18 May 2017, 3♂1juv., leg. Yu. V. Dyachkov, NMPC; 10 km SW Abay Village, Karatau

Mt. Range, Kelinshektau Mts., Karatau Nature Reserve, 43°47'04.2"N 68°46'42"E (43.78°N 68.77°E), 1029 m a. s. l., 6–7 May 2017, 2♂2♀2juvs., leg. A. A. Fomichev, NMPC; **Zhambyl Province**, Moyinkum Sands, SW of Lake Balkhash, 44.17°N 71.12°E, 350 m a. s. l., 28 May 2002, 1♀juv., leg. V. Fet & A. Gromov (NG-043), NMPC; Moyinkum Sands, SW of Lake Balkhash, 44°51'03"N 74°07'05"E (44.85°N 74.12°E), 362 m a. s. l., 28 May 2002, 2juvs., leg. V. Fet & A. Gromov (NG-054), NMPC; same locality, 1♂1♀19juvs., leg. V. Fet (NG-111), NMPC; Moyinkum Sands, SW of Lake Balkhash, 44°10'49"N 73°48'54"E (44.17°N 73.80°E), 28 May 2002, 1juv., leg. V. Fet & A. Gromov (NG-056), NMPC. **Kyrgyzstan: Talas Province**, Kara-Buura District, 15 km S of Kyzyl-Adyr, 42°29'12.7"N 71°31'32.5"E (42.48°N 71.52°E), 1392 m a. s. l., 14 July 2021, 4♂1♀ (Nos. 1950, 1951), leg. W. Grosser. **Mongolia, Khovd Province**, Bodonchiyn-Gol River Valley, 38 km SW from Altai Village, 45°45'N 92°11'E (45.75°N 92.18°E), stony desert, 1300 m a. s. l., 7–8 May 2012, 1♀1♀juv., leg. A. A. Fomichev, NMPC; Uenchiyn-Gol River Valley, 23 km SW from Uench Village, 45°54'05"N 91°50'20"E (45.90°N 91.83°E), sandy desert, 1200 m a. s. l., 13–14 May 2012, 1♂, leg. A. A. Fomichev, NMPC; Arshantyn-Nuruu Mountain Range, 46°16'48"N 91°16'53"E (46.16°N 91.16°E), mountain stony steppe, 1560 m a. s. l., 14 May 2012, 1♀, leg. A. A. Fomichev, NMPC; Baitag-Bogd-Uul Mountain Range, Baruun-Khargaityn-Gol River Valley, 45°17'N 90°57'E (45.28°N 90.95°E), stony desert with rocks, 1900–2000 m a. s. l., 21 May 2015, 1♂, leg. A. A. Fomichev, NMPC; Baitag-Bogd-Uul Mountain Range, Baruun-Khargaityn-Gol River Valley, 45°17'N 90°58'E (45.28°N 90.97°E), 1900–2000 m a. s. l., 19–22 May 2015, 1♀2♂, leg. A. A. Kechaikin, NMPC; Bodonchiyn-Gol River Basin, Khondiyn-Gol River Valley, 46°08'N 92°30'E (46.13°N 92.30°E), stony semi-desert with rocks, 1750–1900 m a. s. l., 26–28 June 2015, 1♀, leg. A. A. Fomichev, NMPC; Dood-Nariyn-Gol River Valley, 46°29'N 91°24'E (46.48°N 91.40°E), mountain stony steppe with rocks, in the nighttime, 1500 m a. s. l., 7–8 July 2015, 1♂1♀juv., leg. A. A. Fomichev, NMPC; **South Gobi Province**, 90 km NW Dalanzadgad 43.57°N 104.39°E, 22 July 1986, 1♀, NMPC; SW. Gobi, Tsagan Bogd env., 42.83°N 98.98°E, IX.1999, 1♀2juvs., FKCP; Galbyn-Gobi, 42°35'9.4"N 105°45'44.8"E (42.58°N 105.45°E), 1 July 2009, 3♂3♀, leg. M. Heddergott, NMPC; Dumdajn-gol, 42°36'6.6"N 105°55'39.7"E (42.60°N 105.92°E), 3 July 2009, 1♂1♀, leg. M. Heddergott, NMPC; Somon Maulai/Bajan-gol, 43°35'29.5"N 107°35'40.1"E (43.58°N 107.58°E), 1 August 2009, 2♂1♀, leg. M. Heddergott, NMPC; Somon Maulai, 43°54'21.4"N 107°43'35.81"E (43.90°N 107.72°E), 2–4 August 2009, 4♂, leg. M. Heddergott, NMPC.

DNADATA. *Mesobuthus thersites* was represented in our survey by 12 DNA sequences from 10 localities in Kazakhstan, two sequences from Kyrgyzstan, and one sequence from China. We also included one representative sequence from Mongolia published by Shi et al. (2013) (Table 16).

DIAGNOSIS. Total length of adults 32 mm (male) to 60 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.2–3.3 in male and 3.0–3.2 in female. Pectinal teeth number 22–28 in male, 17–23 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites yellowish to reddish brown, black pigmented, metasoma, telson, pedipalps and legs reddish brown but can be almost black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, only dorsal carinae can be granulated. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII medially smooth with 4 well marked smooth or granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Intercarinal surfaces on metasomal segments ventral and lateral smooth. Length to depth ratio of metasoma III 1.0–1.4, metasoma IV 1.35–1.6 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 8–12 retroinferior macrosetae on basitarsus III. Telson elongated in male and rather bulbous in female. Anal lobe divided into two parts.

HISTORY OF STUDY. The holotype of *Androctonus thersites*, described by Carl L. Koch in 1839, came from the Nuremberg collection of Jacob Sturm (1771–1848), a famed engraver and insect collector. This specimen is now lost, and its provenance is unknown. By tradition, this name is used for the oldest *Mesobuthus* taxon described from the former Russian Central Asia. Birula (1917a: 41) wrote:

“The name *Androctonus thersites* was given by C. L. Koch to a specimen wanting any indication as to the place of origin, found in Sturm’s collection. In my opinion, the description and picture indicate that the scorpion belongs to the *B[uthus]. eupeus* differing from it only by its paler coloration. According to some characters which can be seen in Koch’s illustration, such as the strongly thickened chela with large raptorial denticles on fingers although the specimen is a female (combs with 20 teeth), and also the weak pigmentation on the back, I have assigned the specific name given by Koch to the Turkestan race of *B. eupeus*. It is possible that the abovementioned specimen reached Sturm’s collection from the collections made by Eversmann and Pander (1820–1821) or by Eversmann (1824). However, the subspecific name *thersites* may designate the Turkestan race of *B. eupeus* (C. L. Koch) only until investigation of the holotype (if accessible).”

Eduard Eversmann and Christian Pander were the first Russian naturalists who traveled in Central Asia in a diplomatic mission to Bukhara (now Uzbekistan) in 1820–1821. The expedition, led by Alexander Negri, traveled from Orenburg

in the Urals via the Kyzylkum Desert. Mlíkovský & Frahnert (2009) provided detailed information about this expedition and reconstructed the expedition route. Numerous specimens (mainly of vertebrates) were collected, and some were sent to Berlin (ZMHB). Indeed, C. L. Koch himself described two spiders from Eversmann collection (“Bukhara”): *Salticus tricinctus* (Koch, 1846) and *Alopecosa obsoleta* (Koch, 1846).

No scorpions originating from Eversmann’s collections were ever reported by Koch, Birula, or other specialists. However, we discovered that, in his brief description of the natural history results of this expedition, the famous zoologist Hinrich Liechtenstein (1823: 149) (Eversmann’s teacher and then the Director of ZMHB) mentioned “Eine Abänderung des [a variety of] *Scorpio occitanus*”, found from Bukhara to Syr Darya. This is the very first published scientific record of scorpions from Central Asia, clearly referring to a *Mesobuthus* or/and *Olivierus* sp. This indicates that scorpions indeed were collected by Eversmann and Pander as early as 1820.

On our request, Jason Dunlop (pers. comm.) searched ZMHB collection, and discovered several unpublished Eversmann’s specimens from “Russia” (“Russland”), without any original label, later identified by someone as “*Buthus gibbosus*”. These specimens (5♂2♀), which have no type status, were loaned and studied by us. We confirm that they indeed belong to *M. thersites*, and therefore were likely collected during the Bukhara expedition and sent to Berlin (ZMHB) by Eversmann. These are possibly the oldest scorpion specimens in ZMHB. Coloration in these specimens has entirely disappeared.

To designate the neotype, we chose a well-studied population in the Kyzylkum Desert near Syrdarya River (Kazakhstan, Kyzylorda Province), close to Baigakum (formerly Djulek). There, the very first biological observations were made on Central Asian buthid scorpions by Evgenii N. Pavlovsky a century ago (Pavlovsky, 1916a, 1916b). The locality was last visited by V. F. and A. Gromov in May 2002; based on their field material, Baigakum was also recently designated as a type locality for as many as three other scorpion species: *Anomalobuthus pavlovskiy* Teruel et al., 2018, *Olivierus mikhailovi* Fet et al., 2021, and *Orthochirus melanurus* (Kessler, 1874) (Fet et al., 2021; Kovařík et al., 2020; Teruel et al., 2018). Koch’s description (20 pectinal teeth) suggests that the holotype was a female. We selected a female with 20 pectinal teeth as a neotype of *Mesobuthus thersites* (C. L. Koch, 1839). Eversmann and Pander in 1820 and 1821 crossed the Syrdarya River somewhat further downstream, at the point when later (1853) the Russian fort of Kazaly will be constructed, now Kazalinsk (Kyzyl-Orda Province; 45.7667°N 62.1167°E). The world-famous Baikonur spaceport (established in 1955) is located nearby.

Birula (1911a) described a subspecies *Buthus eupeus mongolicus*, collected by the famous Russian explorer Petr Kozlov (1863–1935) in his 1907–1909 expeditions to the Gobi Desert. His syntypes included seven lots (labels) (our translation from German with preserved toponym spelling),

Dimensions (mm)		<i>M. turcicus</i> sp. n. ♂ holotype	<i>M. turcicus</i> sp. n. ♀ paratype	<i>M. vesiculatus</i> ♂ from Rayy	<i>M. vesiculatus</i> ♀ from Rayy
Carapace	L / W	5.09 / 2.56	5.47 / 6.09	5.15 / 4.96	7.02 / 6.81
Mesosoma	L	12.45	10.72	12.42	20.43
Tergite VII	L / W	3.07 / 5.27	2.96 / 6.06	3.53 / 4.85	5.07 / 7.41
Metasoma + telson	L	26.05	26.99	26.27	34.66
Segment I	L / W / D	3.17 / 3.44 / 3.19	3.40 / 3.44 / 3.20	3.40 / 2.93 / 2.74	4.54 / 3.78 / 3.27
Segment II	L / W / D	4.05 / 3.30 / 3.01	4.00 / 3.37 / 3.12	3.98 / 2.74 / 2.59	5.03 / 3.49 / 3.11
Segment III	L / W / D	4.05 / 3.12 / 3.03	4.02 / 3.29 / 2.92	4.07 / 2.68 / 2.64	5.25 / 3.41 / 3.08
Segment IV	L / W / D	4.59 / 2.95 / 3.07	4.61 / 3.12 / 2.69	4.52 / 2.58 / 2.47	5.78 / 3.30 / 2.95
Segment V	L / W / D	5.50 / 2.74 / 2.41	5.61 / 2.85 / 2.20	5.49 / 2.53 / 2.07	7.22 / 3.10 / 2.73
Telson	L / W / D	4.69 / 2.01 / 1.84	5.35 / 2.29 / 2.06	4.81 / 2.08 / 2.01	6.84 / 2.91 / 3.04
Pedipalp	L	17.04	18.13	17.68	23.06
Femur	L / W	4.08 / 1.41	4.44 / 1.59	3.99 / 1.38	5.32 / 1.75
Patella	L / W	4.90 / 2.11	5.14 / 2.20	5.20 / 2.12	6.71 / 2.64
Chela	L	8.06	8.55	8.49	11.03
Manus	W / D	2.60 / 2.64	2.27 / 2.41	2.32 / 2.34	2.76 / 2.91
Movable finger	L	4.98	5.26	5.48	7.32
Total	L	43.59	43.18	43.84	62.11

Table 12. Comparative measurements of *Mesobuthus turcicus* sp. n. and *M. vesiculatus* specimens. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

of which in ZISP were found the following ones: “2♀, Jhegun-chara-teg, road from the mouth of the Ezsin-gol River to Gobi Altai, central Mongolia; 1♂, “road from Lan-tsichou-fu (Gansu Province) to the Dyn-juan-in Oasis (Alashan Province)”, China; 17♂1♀1juv., Dyn-juan-in Oasis, Alashan Province, China; 2 subadult ♀, Jinbeichu, Alashan Province, China. We designated a lectotype ♂ of *B. e. mongolicus* from Ting-yuan-ying (Bayanhot) (spelled “Dyn-juan-in” in Birula’s German text).

Our DNA phylogeny implies that the same species inhabits Kazakhstan, Kyrgyzstan, Mongolia, and China. A *COI* sequence from the Gobi Desert in China (Gantenbein et al., 2003) and a representative sequence from Mongolia (from Shi et al., 2013) group well inside the *M. thersites* clade, joining northern Kazakhstan population (Bakanas, at the Ili River) and Kyrgyzstan population from Talas. Shi et al. (2007) reported 36 localities in China (Gansu, Ningxia, Xinjiang, and Inner Mongolia); the southernmost locality was Jingyuan (36.50°N 104.60°E). For detailed information about distribution and ecology of this species in China, see Shi et al. (2007, 2013, 2015, 2021), and in Mongolia (as *M. e. mongolicus*), see Heddergott et al. (2016).

COMMENTS. We have no confident confirmation of presence of this species in Russia or Uzbekistan, but there are populations, formerly identified as *M. eupeus* or *M. e. thersites*, in the areas of these countries bordering Kazakhstan. Their taxonomic status requires clarification.

DISTRIBUTION. China, Kazakhstan, Kyrgyzstan, Mongolia (Figs. 1155, 1158).

Mesobuthus turcicus sp. n.

(Figures 4, 951–990, 1155–1156, 1166, Tables 12, 15)

<http://zoobank.org/urn:lsid:zoobank.org:act:82742C1C-C052-445A-9C19-6672CC79DBD9>

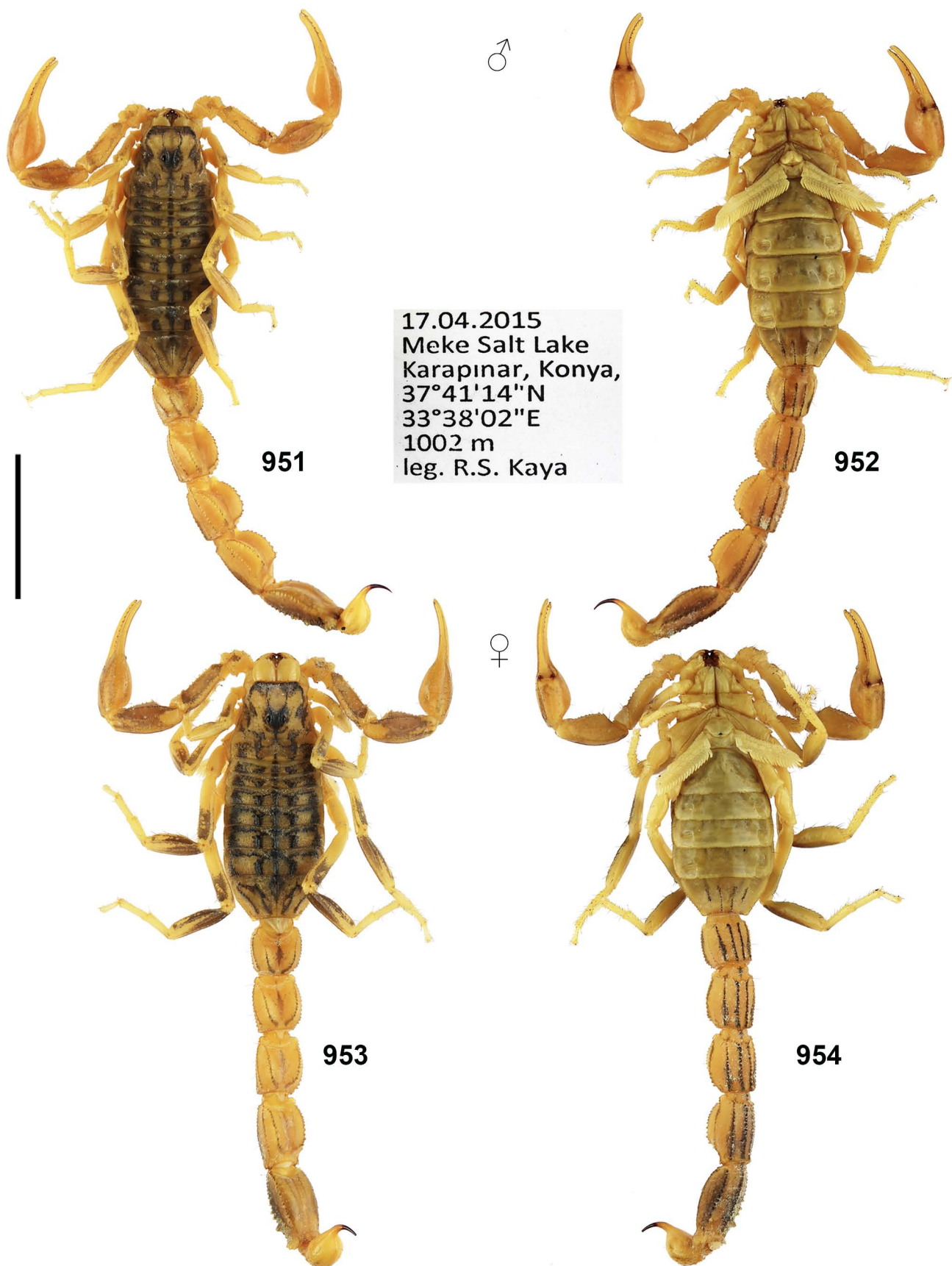
TYPE LOCALITY AND TYPE REPOSITORY. Turkey, *Konya Province*, Karapınar, Meke Salt Lake, 37°41'14"N 33°38'02"E (37.68°N 33.63°E), 1002 m a. s. l.; AZMM.

REFERENCES:

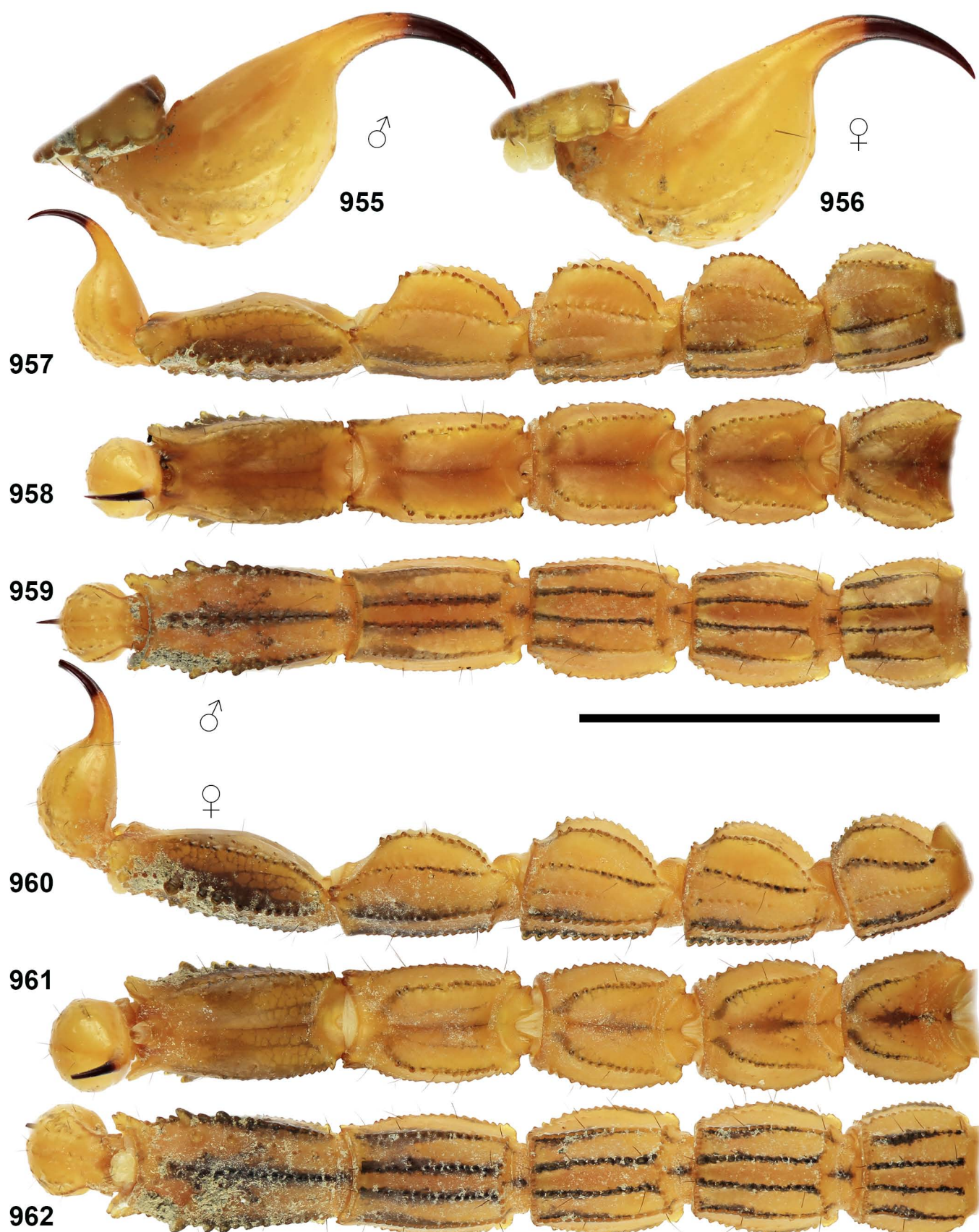
- Mesobuthus eupeus*: Teruel, 2002: 75–76, figs. 1–3 (in part); Karataş & Karataş, 2003: 1–4, figs. 1–2 (in part).
Mesobuthus eupeus eupeus: Gantenbein et al., 2003: 413; Kovařík et al., 2011: 1–13, figs. 17, 21 (in part).

TYPE MATERIAL. Turkey, Konya Province, Karapınar, Meke Salt Lake, 37°41'14"N 33°38'02"E (37.68°N 33.63°E), 1002 m a. s. l., 29 March 2013, 1♀(paratype), leg. E. A. Yağmur, AZMM; same label, 17 April 2015, 1♂3♀4juvs. (holotype and paratypes), leg. R. S. Kaya, AZMM, 8.IV.2019, 1♀2juvs.♂♀ (paratypes), leg. E. A. Yağmur & S. Örgel, AZMM; same label, 30 May 2019, 3juvs., leg. E. A. Yağmur & S. Örgel, AZMM; Karapınar, Meke Salt Lake, 37°41'39"N 33°38'33"E (37.68°N 33.63°E), 1033 m a. s. l., 9 July 2021, 2♂2♀ (paratypes, No. 1956), leg. E. A. Yağmur & Ö. Sipanhioğlu, AZMM; Karapınar, 2 km North of Konya, Acıgöl Lake, 37°42'29"N 33°41'26"E (37.70°N 33.68°E), 1090 m a. s. l., 23 June 2012, 3juvs. (paratypes), leg. E. A. Yağmur & M. Kesdek, AZMM.

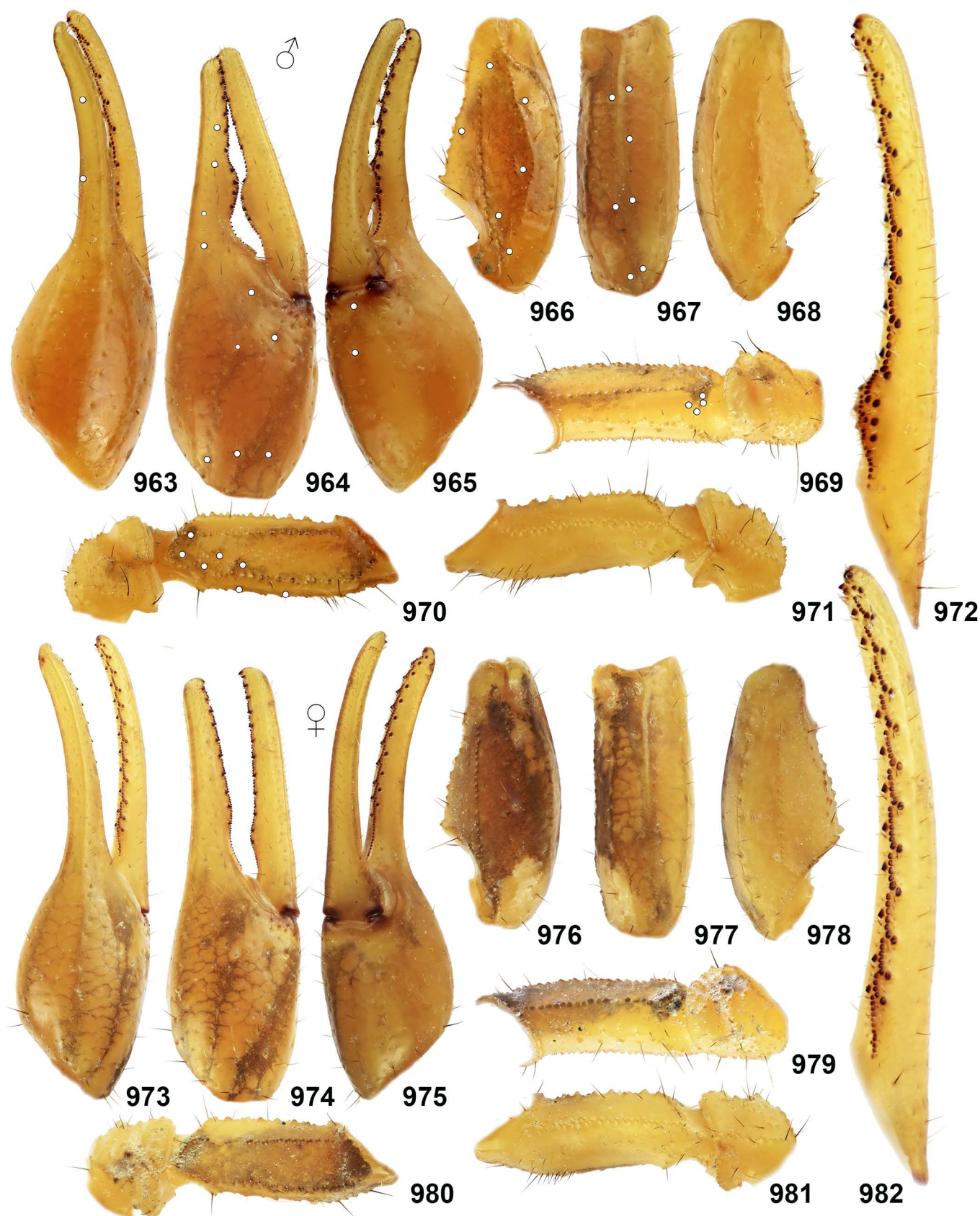
ETYMOLOGY. The new species is named after its country of occurrence, Turkey.



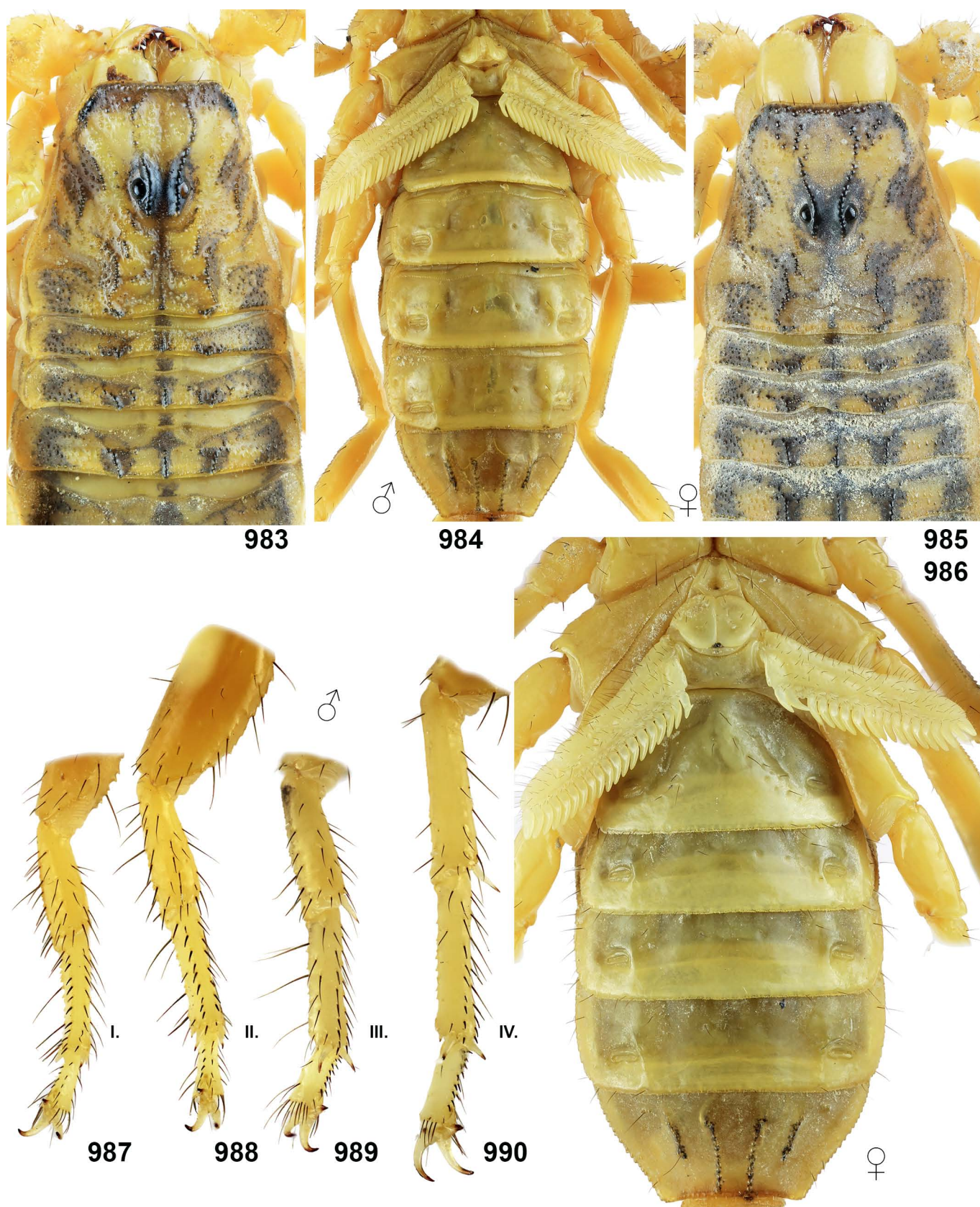
Figures 951–954: *Mesobuthus turcicus* sp. n. Figures 951–952. Male holotype, dorsal (951) and ventral (952) views. Figures 953–954. Female paratopotype, dorsal (953) and ventral (954) views. Scale bar: 10 mm.



Figures 955–962: *Mesobuthus turcicus* sp. n. **Figures 955, 957–959.** Male holotype, telson lateral (955), metasoma and telson, lateral (957), dorsal (958), and ventral (959) views. **Figures 956, 960–962.** Female paratopotype, telson lateral (956), metasoma and telson, lateral (960), dorsal (961), and ventral (962) views. Scale bar: 10 mm.



Figures 963–982: *Mesobuthus turcicus* sp. n., pedipalp. **Figures 963–971.** Male holotype, chela, dorsal (963), external (964), and ventral (965) views. Patella, dorsal (966), external (967) and ventral (968) views. Femur and trochanter, internal (969), dorsal (970), and ventral (971) views. **Figure 972.** Male paratopotype, movable finger. **Figures 973–982.** Female paratopotype, chela, dorsal (973), external (974), and ventral (975) views. Patella, dorsal (976), external (977) and ventral (978) views. Femur and trochanter, internal (979), dorsal (980), and ventral (981) views. Movable finger (982). The trichobothrial pattern is indicated in Figures 963–967, 969–970.



Figures 983–990: *Mesobuthus turcicus* sp. n. **Figures 983–984, 987–990.** Male holotype, chelicerae, carapace and tergites I–IV (983), sternopectinal region and sternites (984), and left legs I–IV, retrolateral aspect (987–990). **Figures 985–986.** Female paratopotype, chelicerae, carapace and tergites I–IV (985), sternopectinal region and sternites (986).

DNA DATA. *Mesobuthus turcicus* sp. n. was represented in our survey by one DNA sequence from Turkey (Konya Province) (Table 16).

DIAGNOSIS. Total length of adults 38 mm (male) to 50 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than in female. Pedipalp chela length/width ratio 3.1 (male) to 3.8 (female). Pectinal teeth number 23–27 in male, 18–22 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites reddish brown, black pigmented; metasoma, telson, pedipalps and legs reddish brown with dark spots. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae, both dorsal can be granulated. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with several solitary granules on margins and with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth. Length to depth ratio of metasoma III 1.1–1.4, metasoma IV 1.48–1.8 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–9 retroinferior macrosetae on basitarsus III. Telson rather bulbous in female. Telson length to depth ratio is 2.55–2.6 in female. Anal lobe divided into three parts.

DESCRIPTION. Total length of adult males 38–45 mm, 42–55 females. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male has the fingers proximally more twisted than in female. For measurements, see Table 12.

Coloration (Figs. 951–954). Carapace and tergites are reddish brown with dark pigmentation. Telson, metasoma, pedipalps and legs are reddish brown with dark spots, part of metasomal segment black. Chelicerae yellow, without reticulation, the tips of denticles on cheliceraral fingers are black.

Mesosoma and carapace (Figs. 983–986). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacarinat. Pectinal tooth count is 23–27 in males, 18–22 in females. Pectinal marginal tips extend to end of sternite IV in males and about half of sternite IV in females. Pectines have three marginal lamellae and seven to eight middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. The Sternite VII smooth, with several solitary granules on margins and with four well marked granulated carinae. Other sternites are smooth with two furrows.

Pedipalps (Figs. 963–982). Pedipalps sparsely hirsute and usually smooth, only femur is sparsely finely granulated. Femur has four to five granulated carinae, the middle carina on internal surface consists of irregular granules. Patella with eight carinae, of which internal and dorsal can be granulated. Chela without carinae. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 987–990). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 7–9 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate on legs III and IV and absent on the other legs.

Metasoma and telson (Figs. 955–962). All metasomal segments are sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma smooth. Ventrolateral carinae of metasoma V posteriorly with several lobate denticles. Telson is usually hairless, rather bulbous mainly in females and smooth. Anal lobe divided into three parts.

DISTRIBUTION. Turkey (Konya Province) (Figs. 1155–1156).

Mesobuthus vesiculatus (Pocock, 1899)

(Figures 991–1033, 1155, 1157, Table 12)

<http://zoobank.org/urn:lsid:zoobank.org:act:431A6ED3-41ED-44AD-A0A0-DC694B0699DD>

Buthus vesiculatus Pocock, 1899: 405–406, pl. XXVI, fig. 4.

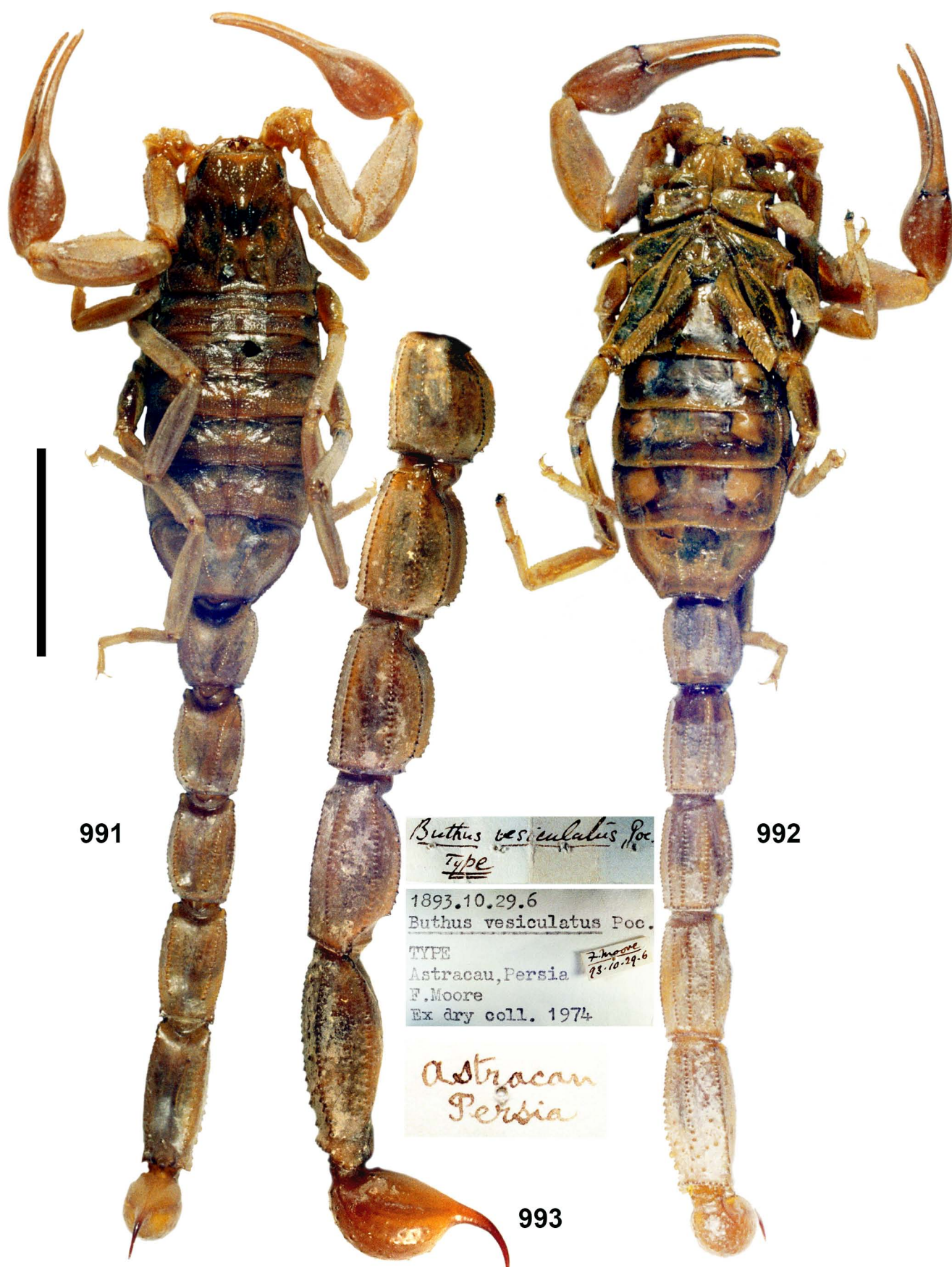
TYPE LOCALITY AND TYPE REPOSITORY. Iran, *East Azerbaijan Province*, Astarqān (38.53°N 46.21°E); BMNH.

REFERENCES (selected):

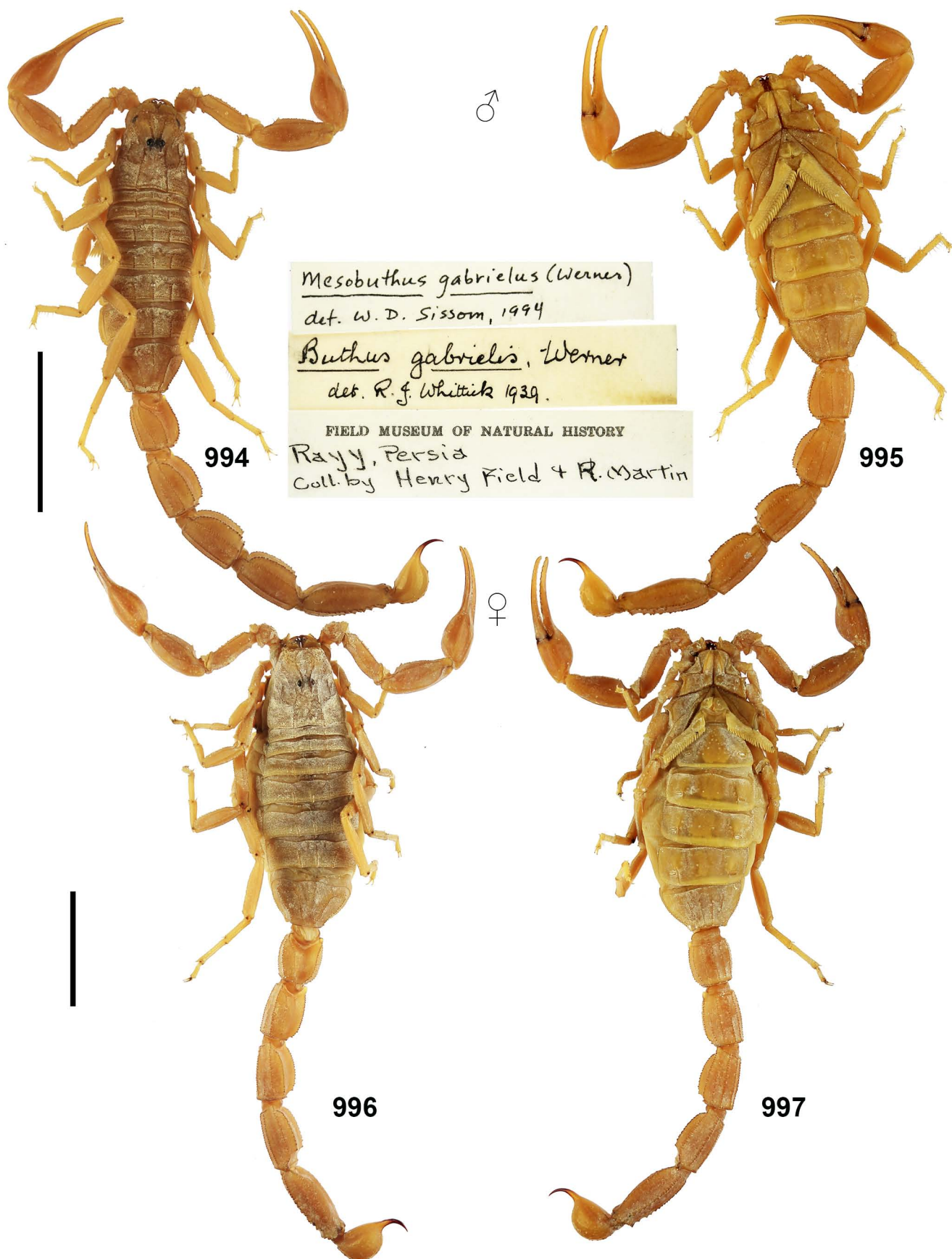
- Buthus vesiculatus*: Birula, 1905a: 120; Birula, 1917a: 71, 214.
Mesobuthus vesiculatus: Fet & Lowe, 2000: 180 (in part; complete references list until 1998); Vignoli et al., 2003: 3–4; Vignoli & Crucitti, 2005: 6 (in part); Mirshamsi et al., 2011b: 20; Karataş et al., 2012: 116; Karataş & Gharkheloo, 2012: 577–583, figs. 1–6; Kovařík, 2019: 17; Barahoei et al., 2020: 399 (in part).
Mesobuthus eupeus: Mirshamsi et al., 2011b: 20 (in part)

TYPE MATERIAL EXAMINED. Iran (Persia), “Astracan” (=Astarqān), 1♀ (paralectotype, designated by Fet & Lowe, 2000: 180) (Figs. 991–993), leg. F. Moore, BMNH No. 1893.10.29.6.

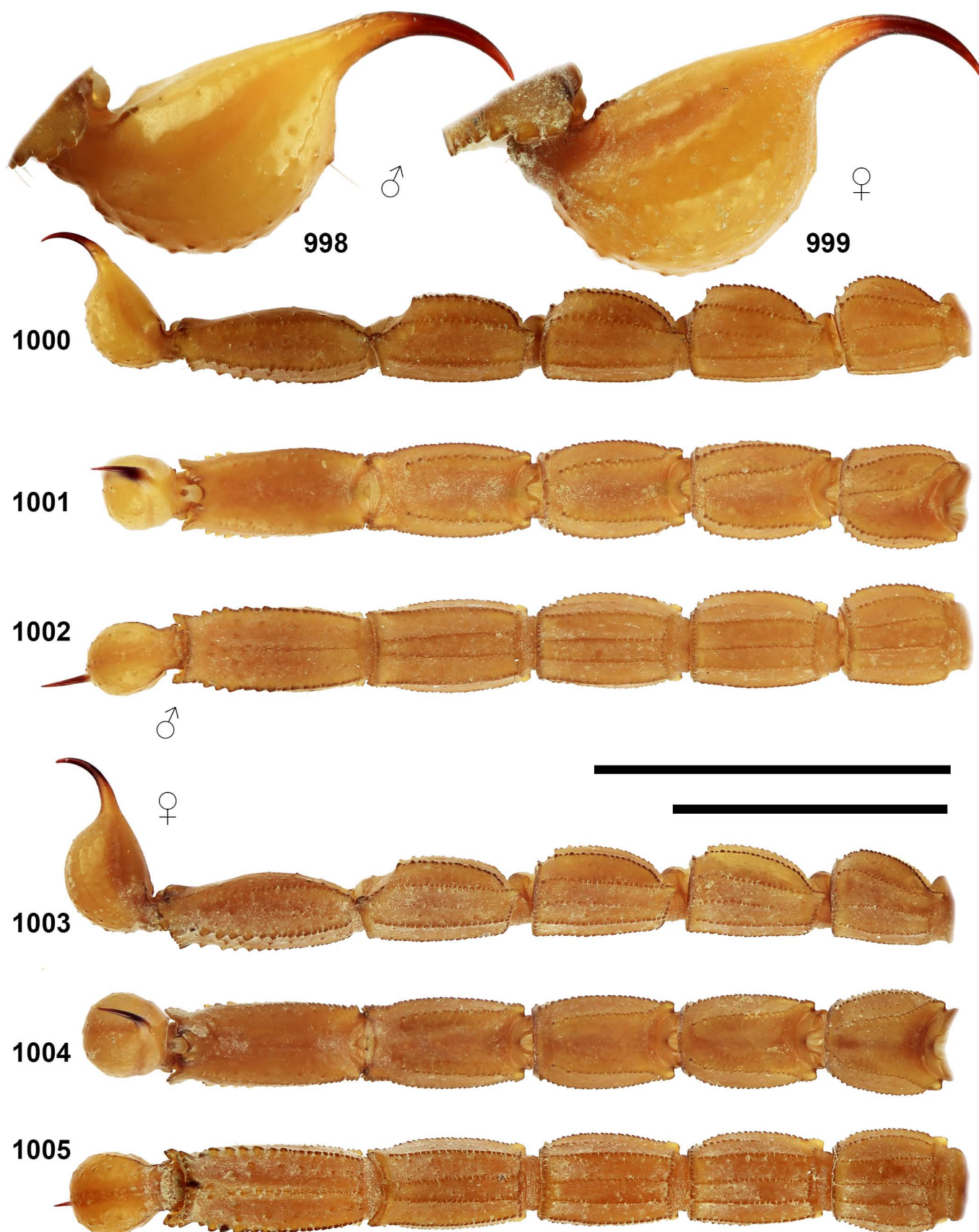
OTHER MATERIAL EXAMINED. Iran, *Esfahan Province*, Kashan City (33.98°N 51.34°E), 11 August 2000, 1♂1♀, leg. V. Vignoli, FKCP; *Tehran Province*, Persia, Teheran (35.70°N



Figures 991–993: *Mesobuthus vesiculatus*, female paralectotype. Figures 991–992. Dorsal (991) and ventral (992) views. Figure 993. Metasoma and telson lateral view. Scale bar: 10 mm (991–992).



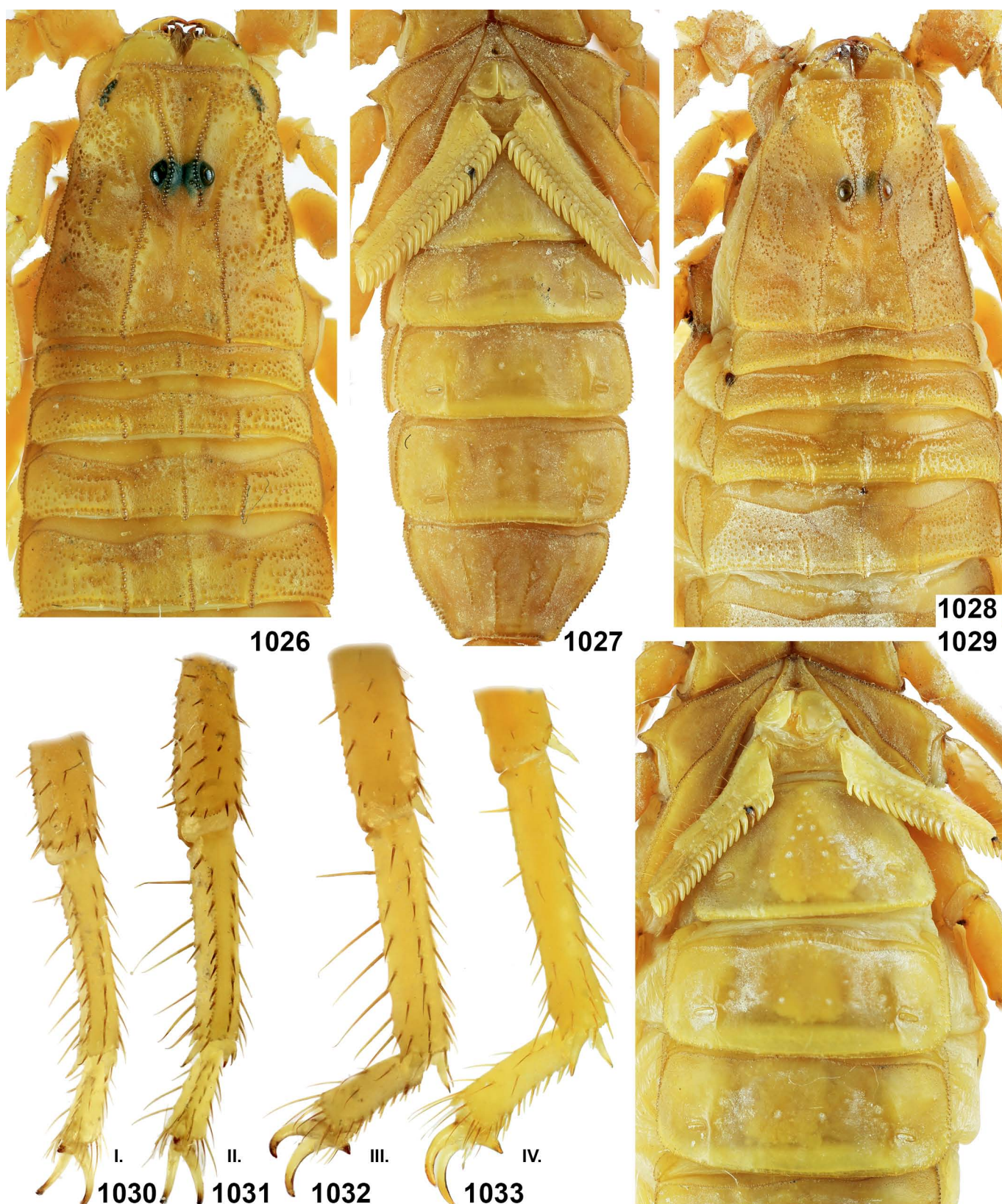
Figures 994–997: *Mesobuthus vesiculatus* from Iran, Tehran Province, Rayy. Figures 994–995. Male, dorsal (994) and ventral (995) views. Figures 996–997. Female, dorsal (996) and ventral (997) views. Scale bars: 10 mm (994–995, 996–997).



Figures 998–1005: *Mesobuthus vesiculatus* from Iran, Tehran Province, Rayy, NMPC. **Figures 998, 1000–1002.** Male, telson lateral (998), metasoma and telson, lateral (1000), dorsal (1001), and ventral (1002) views. **Figures 999, 1003–1005.** Female, telson lateral (999), metasoma and telson, lateral (1003), dorsal (1004), and ventral (1005) views. Scale bars: 10 mm (1000–1002, 1003–1005).



Figures 1006–1025: *Mesobuthus vesiculatus* from Iran, Tehran Province, Rayy, NMPC, pedipalp. **Figures 1006–1015.** Male, chela, dorsal (1006), external (1007), and ventral (1008) views. Patella, dorsal (1009), external (1010) and ventral (1011) views. Femur and trochanter, internal (1012), dorsal (1013), and ventral (1014) views. Movable finger (1015). **Figures 1016–1025.** Female, chela, dorsal (1016), external (1017), and ventral (1018) views. Patella, dorsal (1019), external (1020) and ventral (1021) views. Femur and trochanter, internal (1022), dorsal (1023), and ventral (1024) views. Movable finger (1025). The trichobothrial pattern is indicated in Figures 1006–1010, 1012–1013.



Figures 1026–1033: *Mesobuthus vesiculatus* from Iran, Tehran Province, Rayy, NMPC. **Figures 1026–1027, 1030–1033.** Male, chelicerae, carapace and tergites I–IV (1026), sternopectinal region and sternites (1027), and left legs I–IV, retrolateral aspect (1030–1033). **Figures 1028–1029.** Female, chelicerae, carapace and tergites I–IV (1028), sternopectinal region and sternites (1029).

51.07°E), 1♂1♀, January 1935, leg. E. Bonati, NMPC; Persia, Rayy (Ray) (35.57°N 51.42°E), 1♂1♀ (Figs. 994–1033, Table 12), leg. Henry Field and R. Martin, 18–20 May 1934, det. by Whittick, 1939 as *Buthus gabrielis* Werner (Field Museum).

DNA DATA. *Mesobuthus vesiculatus*, in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their survey of Iranian *Mesobuthus* (a single DNA sequence from the Esfahan Province, Kashan, Niasar Road, 33.98°N 51.34°E).

DIAGNOSIS. Total length of adults 40–65 mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally slightly more twisted than in female. Pedipalp chela length/width ratio 3.6–4 in both sexes. Pectinal teeth number 20–25 in male, 18–20 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites yellowish to reddish brown with black pigmentation reduced; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V can be black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually granulated carinae. Chela lacks carinae. Movable fingers of pedipalps with 12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth to finely granulated, with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth or coarsely sparsely granulated. Length to depth ratio of metasoma III 1.5–1.8, metasoma IV 1.8–2 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 5–8 retroinferior macrosetae on basitarsus III. Telson bulbous, mainly in females; telson length to depth ratio is 2.20–2.42 (female) to 2.39–2.52 (male). Anal lobe divided into two or three parts.

COMMENTS. This species was described in a paper which dealt with the material collected in the neighborhood of the Lake Oromiyeh (Urmi) but in a separate note. Its type locality (“Astracan”) remained unclear (Fet & Lowe, 2000: 180) until Karataş et al. (2012) clarified it as Astarqān in the East Azerbaijan Province.

An enigmatic *Buthus gabrielis* Werner, 1929 (type lost; type locality: Rudbar, 28.01°N 58.00°E, Kerman Province), was considered a synonym of *M. vesiculatus* by Fet & Lowe (2000: 180). Later, Kovařík et al. (2011: 18) placed *B. gabrielis* in a tentative synonymy with *Sassanidotus gracilis* (Birula, 1900).

DISTRIBUTION. Iran (East Azerbaijan, Esfahan, and Tehran Provinces) (Figs. 1155, 1157).

Mesobuthus vignolii sp. n.

(Figures 1034–1077, 1155, 1157, Table 13)

<http://zoobank.org/urn:lsid:zoobank.org:act:2CBE605F-A7E2-4274-B390-26FDD500BFF1>

TYPE LOCALITY AND TYPE REPOSITORY. Iran, Yazd Province, 32°09'299"N 53°49'542"E (32.15°N 53.82°E), 1450 m a. s. l.; NMPC.

REFERENCES:

- Mesobuthus vesiculatus* (in part): Vignoli & Crucitti, 2005: 6, fig. 2c; Barahoei et al., 2020: 399.
Mesobuthus eupeus kirmanensis ((in part): Mirshamsi et al., 2010: 2867 (in part); Mirshamsi et al., 2011a: 9.
Mesobuthus eupeus: Mirshamsi et al., 2011b: 20 (in part).

TYPE MATERIAL EXAMINED (NMPC). Iran, Yazd Province, W of Baghdadabad, Taft, 31°35'210"N 54°24'585"E (31.58°N 54.40°E), 1502 m a. s. l., 9 April 2004, 1♀ (paratype), leg. V. Vignoli & P. Crucitti; 23 km W of Ardakan, Yazd, 32°09'299"N 53°49'542"E (32.15°N 53.82°E), 1450 m a. s. l., 12 April 2004, 1♀ (holotype, Figs. 1036–1037, 1039, 1043–1045, 1057–1067, 1071–1076), leg. V. Vignoli & P. Crucitti; 31°44'41"N 55°43'13"E (31.73°N 55.72°E), 1837 m a. s. l., 2015, (Ya-02), 2♂1♀ (paratypes, Fig. 1068), leg. S. Navidpour et al.; 31°19'56"N 54°17'12"E (31.33°N 54.28°E), 2023 m a. s. l., 2015, (Ya-07), 1♂2♀ (paratypes), leg. S. Navidpour et al.; 31°34'26"N 54°28'30.9"E (31.56°N 54.47°E), 2023 m a. s. l., 2015, (Ya-26, Figs. 1034–1035, 1038, 1040–1042, 1046–1056, 1069–1070, 1077, Table 13), 2♂1♂juv.1♀ (paratypes), leg. S. Navidpour et al.

ETYMOLOGY. The new species is named in honor of our colleague Valerio Vignoli (Italy) for his contributions to scorpiology.

DNA DATA. *Mesobuthus vignolii* sp. n., in our opinion, was represented among the populations studied by Mirshamsi et al. (2010) in their survey of Iranian *Mesobuthus* (a single DNA sequence from the Yazd Province, Mehriz-Marvast road, 31.11°N 54.21°E) (Table 16).

DIAGNOSIS. Total length of adults 40 (male) – 51.64 (female) mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally little bit more twisted than female. Pedipalp chela length/width ratio 3.8–4 in both sexes. Pectinal teeth number 19–26 in males and 18–20 in females. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites yellowish to reddish brown with black pigmentation reduced; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V can be black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually granulated carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central

Dimensions (mm)		<i>M. vignolii</i> sp. n. ♂ paratype	<i>M. vignolii</i> sp. n. ♀ holotype	<i>M. zonsteini</i> sp. n. ♂ holotype	<i>M. zonsteini</i> sp. n. ♀ paratype
Carapace	L / W	5.54 / 5.86	6.62 / 6.99	4.84 / 5.56	6.53 / 7.11
Mesosoma	L	13.04	14.59	10.60	13.9
Tergite VII	L / W	3.61 / 5.58	3.79 / 7.02	3.04 / 5.47	3.78 / 7.27
Metasoma + telson	L	30.40	33.94	25.62	-
Segment I	L / W / D	3.95 / 3.46 / 3.13	4.17 / 3.68 / 3.21	3.25 / 3.31 / 2.78	4.59 / 4.10 / 3.15
Segment II	L / W / D	4.45 / 3.21 / 2.83	4.90 / 3.41 / 3.08	3.60 / 3.23 / 2.76	5.07 / 4.18 / 3.65
Segment III	L / W / D	4.63 / 3.10 / 2.77	5.09 / 3.35 / 3.08	3.67 / 3.20 / 2.82	-
Segment IV	L / W / D	5.42 / 2.90 / 2.55	5.77 / 3.26 / 2.77	4.61 / 3.18 / 2.58	5.86 / 4.11 / 3.29
Segment V	L / W / D	6.20 / 2.88 / 2.22	7.60 / 3.04 / 2.59	5.48 / 2.92 / 2.14	7.45 / 3.97 / 2.70
Telson	L / W / D	5.75 / 2.23 / 2.10	6.41 / 2.97 / 2.65	5.01 / 2.10 / 1.86	6.23 / 3.10 / 2.59
Pedipalp	L	19.85	21.78	16.62	20.56
Femur	L / W	4.71 / 1.49	5.03 / 1.60	3.74 / 1.30	4.97 / 1.65
Patella	L / W	5.81 / 2.06	6.37 / 2.64	4.61 / 1.80	5.78 / 2.32
Chela	L	9.33	10.38	8.27	9.81
Manus	W / D	2.40 / 2.63	2.68 / 2.77	1.93 / 2.27	3.29 / 3.56
Movable finger	L	5.40	6.72	5.08	5.86
Total	L	48.98	55.15	41.06	-

Table 13. Comparative measurements of *Mesobuthus vignolii* sp. n. and *M. zonsteini* sp. n. types. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

lateral and posterior lateral carinae of carapace joined to form a continuous linear series of granules to posterior margin. Sternite VII usually finely granulated, with 4 well marked smooth or granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth to sparsely granulated. Length to depth ratio of metasoma III 1.60–1.75, metasoma IV 2.10–2.15 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 8–12 retroinferior macrosetae on basitarsus III. Telson bulbous in females and with elongate aculeus in males; telson length to depth ratio is 2.40–2.45 in females and 2.65–2.75 in males. Anal lobe divided into three parts.

DESCRIPTION. Total length of adults 40 (male) – 51.64 (female) mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Female has the fingers proximally slightly twisted. For measurements, see Table 13.

Coloration (Figs. 1034–1037). Carapace and tergites are yellowish to reddish brown with pigmentation reduced. Telson, metasoma, pedipalps and legs are yellowish brown without dark spots, only part of metasomal segment V black. Chelicerae yellow, without reticulation, the tips of denticles on cheliceraral fingers are black.

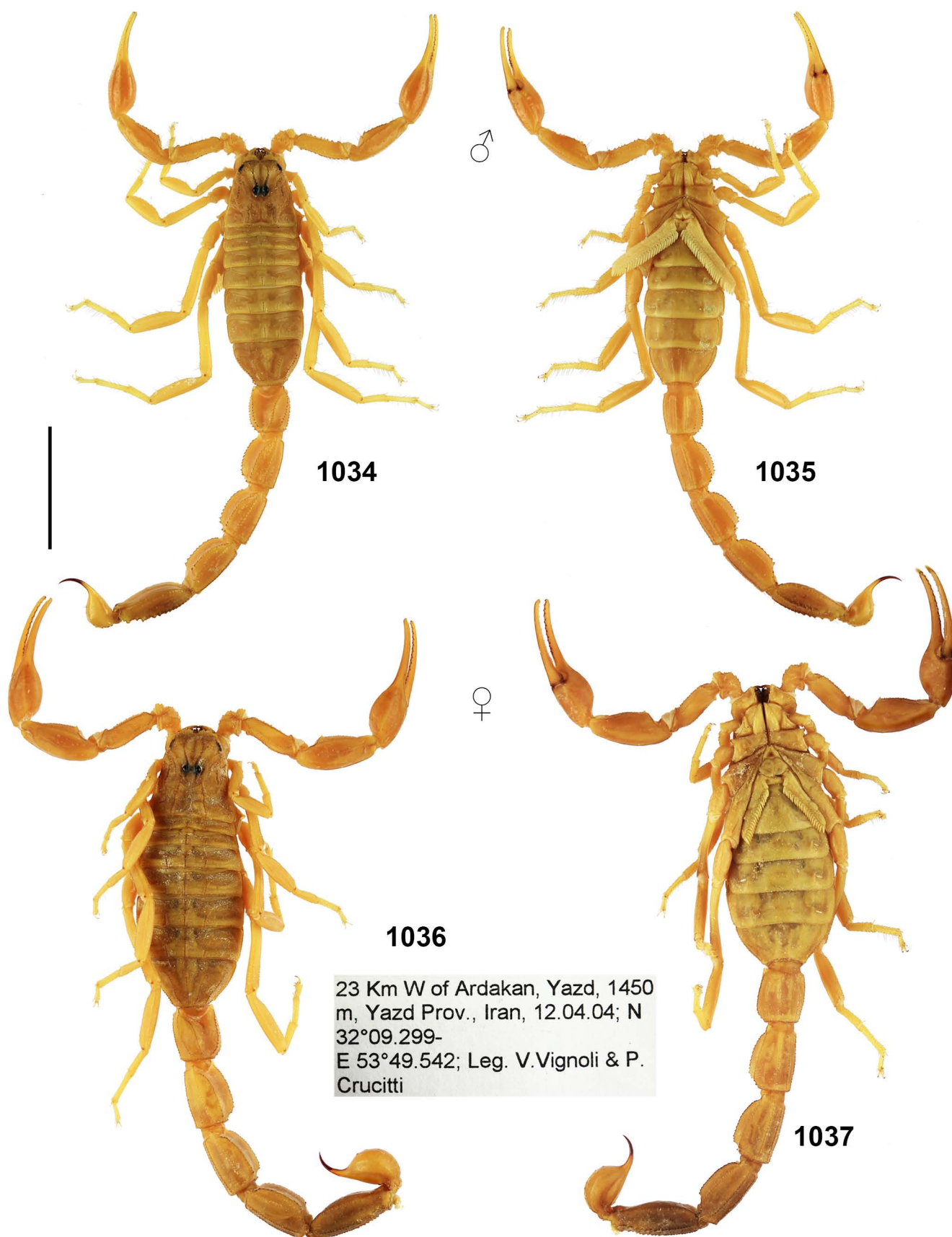
Mesosoma and carapace (Figs. 1068–1072). Carapace carinate, unevenly covered by granules of varying size; much

of the granulation is fine but some granules are larger and distinctly rounded. Central lateral and posterior lateral carinae of carapace joined to form a continuous linear series of granules to posterior margin. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacarinat. Pectinal tooth count is 19–26 in males, 18–20 in females. Pectinal marginal tips extend to about one-fourth of sternite IV in females. Pectines have three marginal lamellae and eight to nine middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. Sternite VII usually finely granulated, with four well marked smooth or granulated carinae. Other sternites are smooth with two furrows.

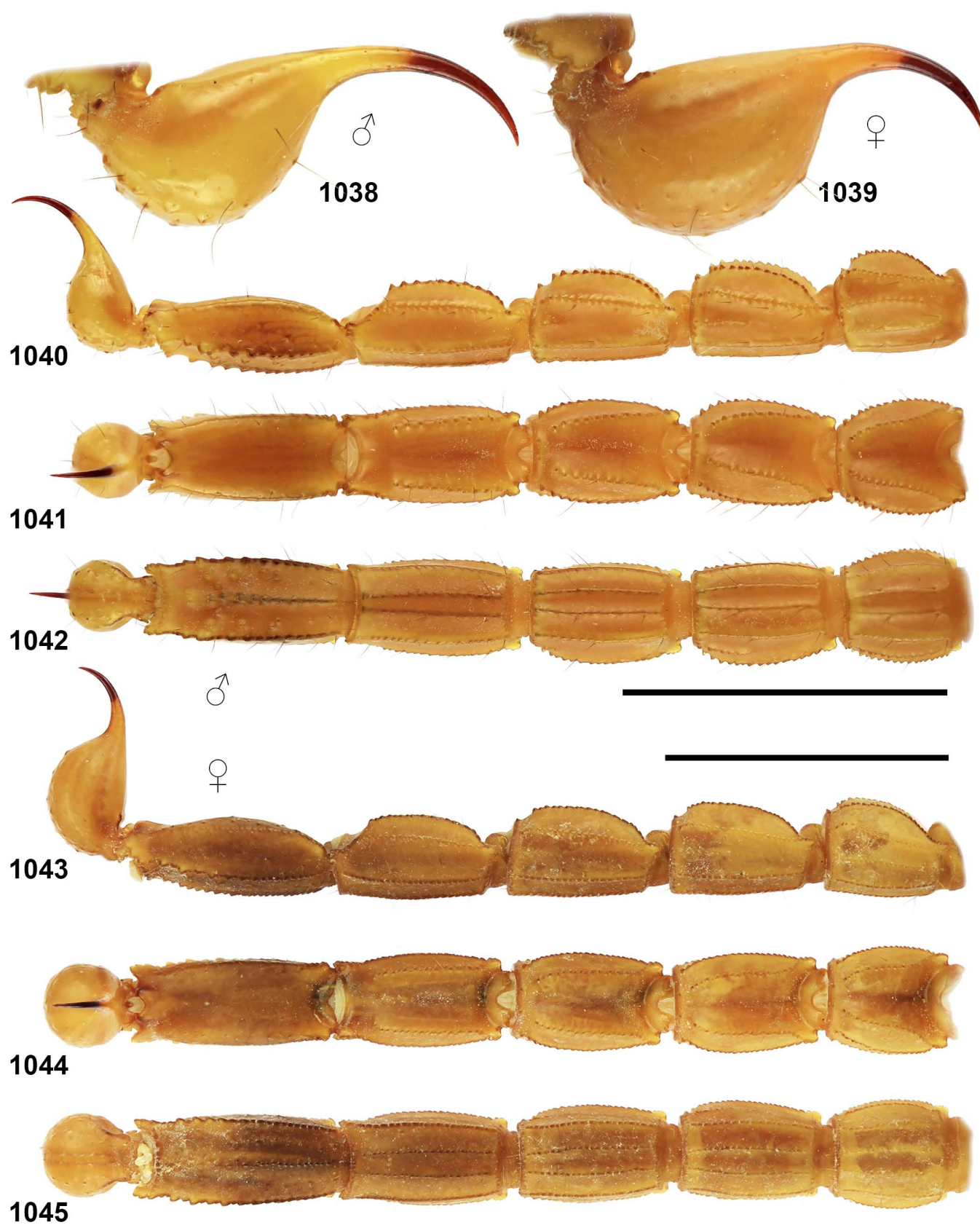
Pedipalps (Figs. 1046–1067). Pedipalps very sparsely hirsute, more in males and generally smooth, only femur is sparsely finely granulated. Femur has four to five granulated carinae, the middle carina on internal surface consists of strong irregular granules. Patella with eight carinae, of which internal and dorsal can be granulated. Chela without carinae. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.

Legs (Figs. 1073–1077). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 8–12 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate on legs III and IV and absent on the other legs.

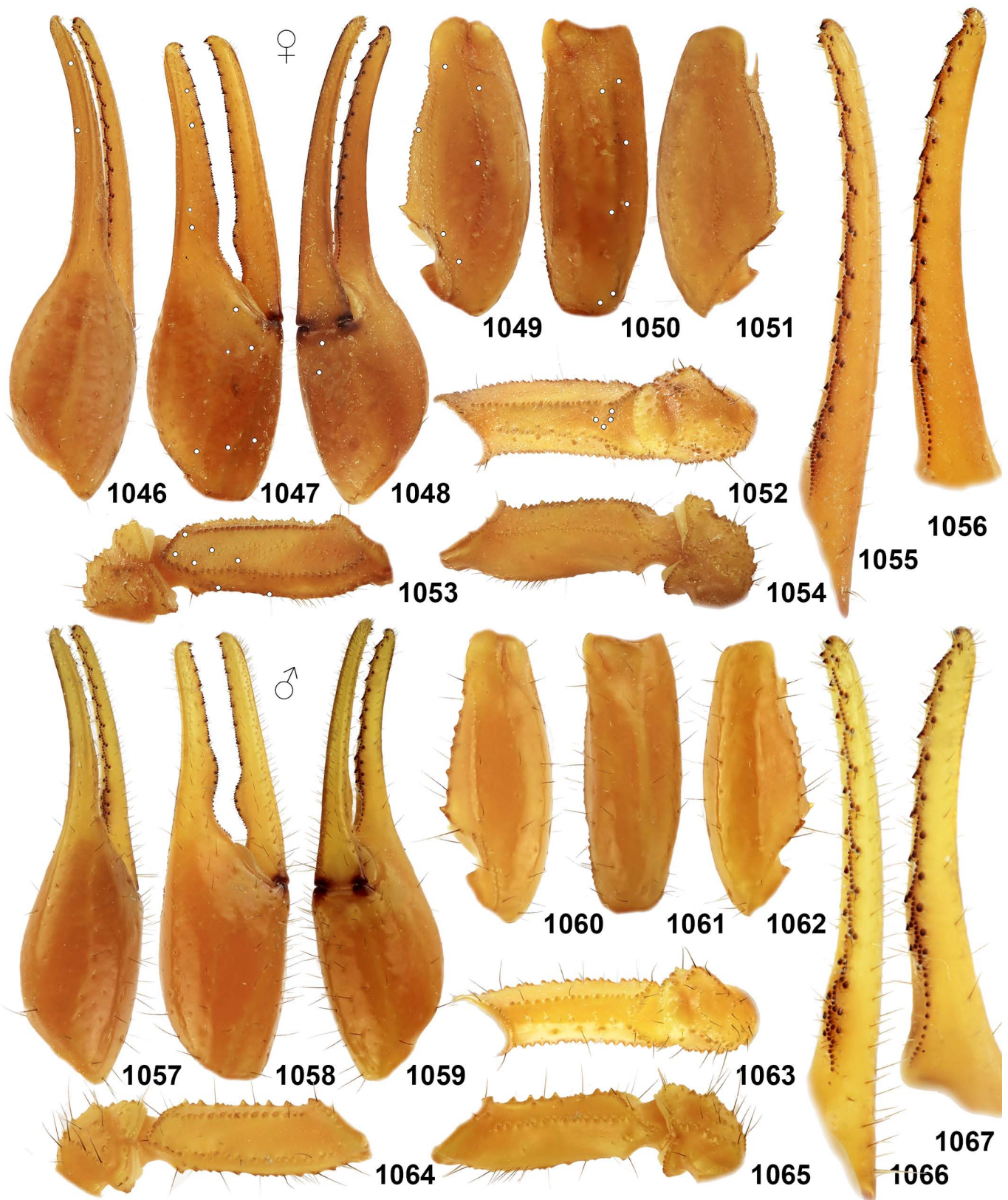
Metasoma and telson (Figs. 1038–1045). All metasomal segments are very sparsely hirsute, almost hairless. Metasomal



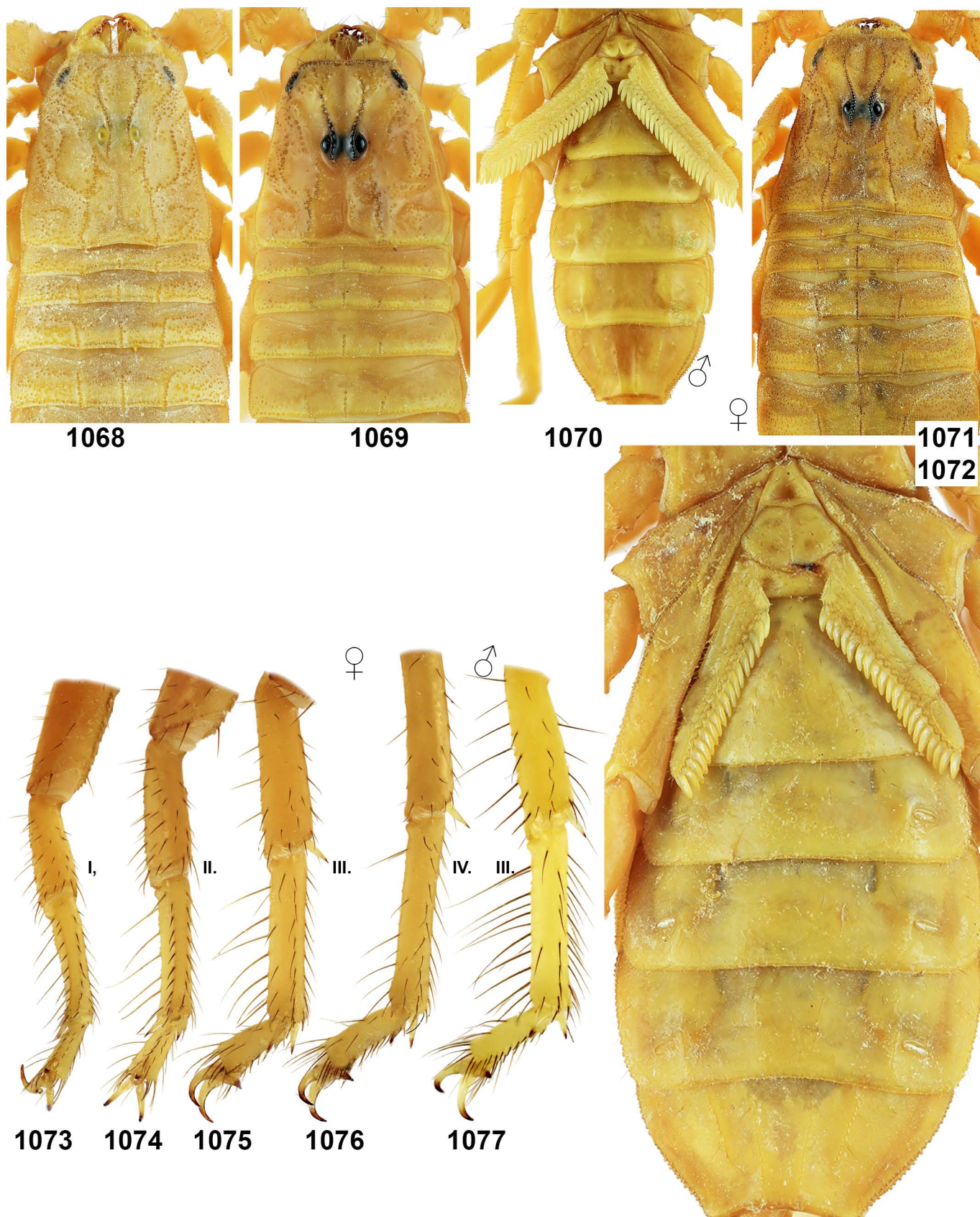
Figures 1034–1037: *Mesobuthus vignolii* sp. n. **Figures 1034–1035.** Male paratype (Ya-26), dorsal (1034) and ventral (1035) views. **Figures 1036–1037.** Female holotype, dorsal (1036) and ventral (1037) views. Scale bar: 10 mm.



Figures 1038–1045: *Mesobuthus vignolii* sp. n. Figures 1038, 1040–1042. Male paratype (Ya-26), telson lateral (1038), metasoma and telson, lateral (1040), dorsal (1041), and ventral (1042) views. **Figures 1039, 1043–1045.** Female holotype, telson lateral (1039), metasoma and telson, lateral (1043), dorsal (1044), and ventral (1045) views. Scale bars: 10 mm (1040–1042, 1043–1045).



Figures 1046–1067: *Mesobuthus vignolii* sp. n., pedipalp. **Figures 1046–1056.** Male paratype (Ya-26), chela, dorsal (1046), external (1047), and ventral (1048) views. Patella, dorsal (1049), external (1050) and ventral (1051) views. Femur and trochanter, internal (1052), dorsal (1053), and ventral (1054) views. Movable (1055) and fixed (1056) fingers. **Figures 1057–1067.** Female holotype, chela, dorsal (1057), external (1058), and ventral (1059) views. Patella, dorsal (1060), external (1061) and ventral (1062) views. Femur and trochanter, internal (1063), dorsal (1064), and ventral (1065) views. Movable (1066) and fixed (1067) fingers. The trichobothrial pattern is indicated in Figures 1046–1050, 1052–1053.



Figures 1068–1077: *Mesobuthus vignolii* sp. n. **Figure 1068.** Male paratype (Ya-02), chelicerae, carapace and tergites I–IV. **Figures 1069–1070, 1077.** Male paratype (Ya-26), chelicerae, carapace and tergites I–IV (1069), sternopectinal region and sternites (1070), and left leg III, retrolateral aspect (1077). **Figures 1071–1076.** Female holotype, chelicerae, carapace and tergites I–V (1071), sternopectinal region and sternites (1072), left legs I–IV, retrolateral aspect (1073–1076).

Dimensions (mm)		<i>M. yagmuri</i> sp. n. ♂ holotype	<i>M. yagmuri</i> sp. n. ♂ paratype, 1896	<i>M. yagmuri</i> sp. n. ♀ paratopotype	<i>M. kaftani</i> sp. n. ♀ holotype
Carapace	L / W	5.01 / 5.90	4.59 / 5.29	5.50 / 6.35	6.45 / 7.04
Mesosoma	L	14.59	13.24	15.91	17.86
Tergite VII	L / W	3.65 / 5.73	3.10 / 5.09	3.88 / 6.27	4.39 / 7.04
Metasoma + telson	L	27.06	25.11	25.75	32.88
Segment I	L / W / D	3.37 / 3.61 / 3.57	3.01 / 3.34 / 2.81	3.22 / 3.41 / 3.29	4.33 / 4.10 / 3.41
Segment II	L / W / D	3.86 / 3.49 / 3.53	3.64 / 3.10 / 2.90	3.64 / 3.43 / 3.39	4.62 / 3.82 / 3.52
Segment III	L / W / D	4.17 / 3.43 / 3.35	3.77 / 3.05 / 2.91	3.90 / 3.16 / 3.24	4.86 / 3.68 / 3.50
Segment IV	L / W / D	4.83 / 3.34 / 3.14	4.38 / 2.90 / 2.73	4.64 / 3.03 / 2.98	5.80 / 3.47 / 3.07
Segment V	L / W / D	5.66 / 2.73 / 2.62	5.31 / 2.57 / 2.23	5.67 / 2.69 / 2.52	7.07 / 3.19 / 2.58
Telson	L / W / D	5.17 / 1.98 / 1.93	5.00 / 1.87 / 1.74	4.68 / 2.06 / 1.92	6.20 / 2.71 / 2.23
Pedipalp	L	18.48	17.48	18.54	20.48
Femur	L / W	4.34 / 1.41	4.00 / 1.25	4.61 / 1.53	4.85 / 1.57
Patella	L / W	5.36 / 2.03	4.80 / 1.94	5.44 / 2.10	6.00 / 2.29
Chela	L	8.78	7.84	8.49	9.63
Manus	W / D	2.78 / 2.54	2.31 / 2.42	2.29 / 2.08	2.19 / 2.25
Movable finger	L	5.36	4.50	5.41	5.77
Total	L	46.66	42.94	47.16	57.19

Table 14. Comparative measurements of *Mesobuthus yagmuri* sp. n. and *M. kaftani* sp. n. types. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma laterally smooth to sparsely granulated. Ventrolateral carinae of metasoma V posteriorly with several slightly lobate denticles. Telson is only very sparsely hirsute, smooth and bulbous in females and with elongate aculeus in males. Anal lobe divided into three parts.

DISTRIBUTION. Iran (Yazd Province) (Figs. 1155, 1157).

***Mesobuthus yagmuri* Kovařík & Fet, sp. n.**

(Figures 1078–1119, 1155–1156, Table 14)

<http://zoobank.org/urn:lsid:zoobank.org:act:1B02D85C-F08F-4A07-9550-70505A41A6CA>

TYPE LOCALITY AND TYPE REPOSITORY. **Turkey, Hakkari Province**, Hakkari (37.38°N 43.50°E); NMPC.

REFERENCES:

Mesobuthus eupeus eupeus (in part): Kovařík et al., 2011: 1–5.

TYPE MATERIAL. **Turkey, Hakkari Province**, Hakkari (37.38°N 43.50°E), 14 July 2012, 5♂5♀ (holotype ♂ and paratypes), leg. Mehmet Colak, NMPC; Berçelan Plateau, Konak Village, 4 km W, 37°38'23"N 43°45'09"E (37.63°N 43.75°E), 2660 m a. s. l., 31 July 2021, 1♂2♀1♂juv. (paratypes, No. 1953), leg. Melek Erdek, AZMM; Berçelan Plateau, 37°38'11"N 43°45'20"E, 2701 m a. s. l., 3 June 2013, 3♂1juv. (paratypes),

leg. Bekir Keskin, AZMM; Gecidi, 37°20'51"N 43°33'29"E (37.33°N 43.55°E), 1854 m a. s. l., 7 July 2014, 1♀2juvs. (paratypes), leg. Ersen Yağmur, AZMM.

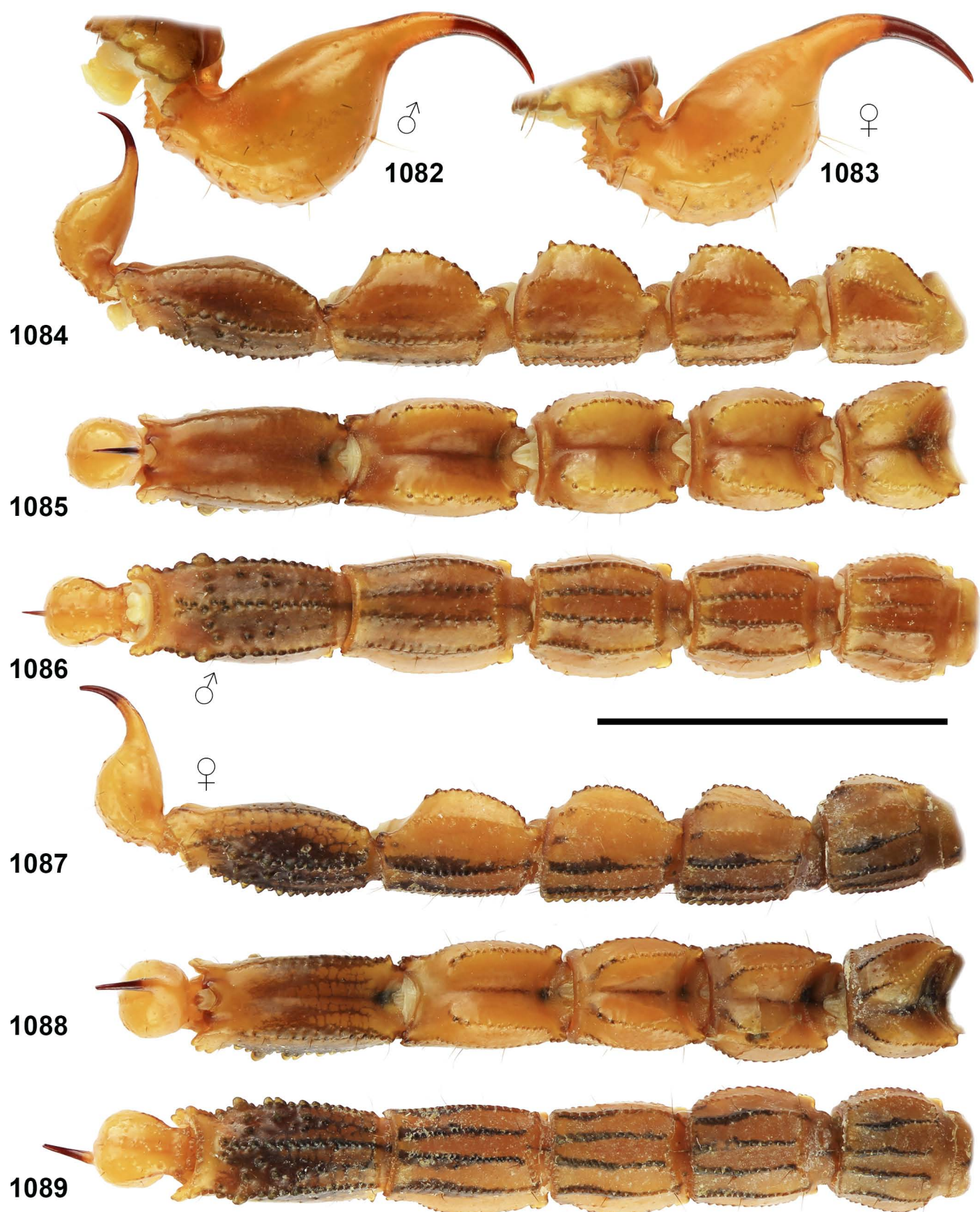
DNA DATA. *Mesobuthus yagmuri* sp. n. was represented in our survey by one DNA sequence from Turkey (Hakkari Province) (Table 16).

ETYMOLOGY. The new species is named in honor of our colleague and friend Ersen Aydin Yağmur (Manisa, Turkey) who made great contributions to Turkish arachnology. Since Ersen is one of the coauthors of this revision, we restrict authorship of this single species only to Kovařík & Fet.

DIAGNOSIS. Total length of adults 38 mm (male) to 50 mm (both sexes). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than female. Pedipalp chela length/width ratio 3.15–3.4 in male and 3.65–3.8 in female. Pectinal teeth number 21–24 in male, 16–19 in female. Chelicerae yellow, without or with poor reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites reddish brown, strongly black pigmented; metasoma, telson, pedipalps and legs yellowish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Seventh sternite bumpy and



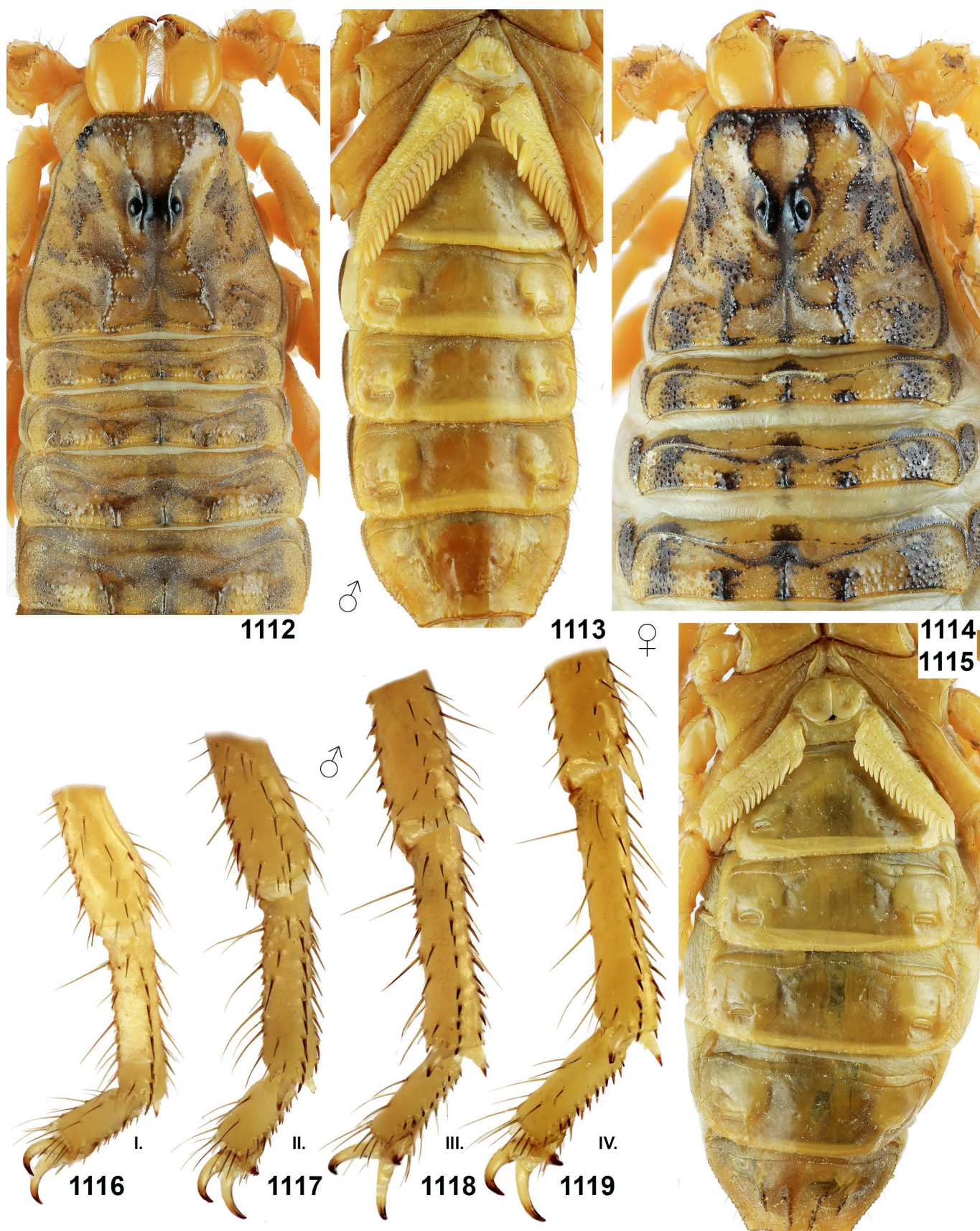
Figures 1078–1081: *Mesobuthus yagmuri* sp. n. Figures 1078–1079. Male holotype, dorsal (1078) and ventral (1079) views. Figures 1080–1081. Female paratype, dorsal (1080) and ventral (1081) views. Scale bar: 10 mm.



Figures 1082–1089: *Mesobuthus yagmuri* sp. n. **Figures 1082, 1084–1086.** Male holotype, telson lateral (1082), metasoma and telson, lateral (1084), dorsal (1085), and ventral (1086) views. **Figures 1083, 1087–1089.** Female paratype, telson lateral (1083), metasoma and telson, lateral (1087), dorsal (1088), and ventral (1089) views. Scale bar: 10 mm (1084–1089).



Figures 1090–1111: *Mesobuthus yagmuri* sp. n., pedipalp. **Figures 1090–1100.** Male holotype, chela, dorsal (1090), external (1091), and ventral (1092) views. Patella, dorsal (1093), external (1094) and ventral (1095) views. Femur and trochanter, internal (1096), dorsal (1097), and ventral (1098) views. Movable (1099) and fixed (1100) fingers. **Figures 1101–1111.** Female paratype, chela, dorsal (1101), external (1102), and ventral (1103) views. Patella, dorsal (1104), external (1105) and ventral (1106) views. Femur and trochanter, internal (1107), dorsal (1108), and ventral (1109) views. Movable (1110) and fixed (1111) fingers. The trichobothrial pattern is indicated in Figures 1090–1094, 1096–1097.



Figures 1112–1119: *Mesobuthus yagmuri* sp. n. **Figures 1112–1113, 1116–1119.** Male holotype, chelicerae, carapace and tergites I–IV (1112), sternopectinal region and sternites (1113), and left legs I–IV, retrolateral aspect (1116–1119). **Figures 1114–1115.** Female paratype, chelicerae, carapace and tergites I–III (1114), and sternopectinal region and sternites (1115).

usually roughly granulated with 4 well marked rather smooth carinae. Metasomal segment V with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of granules on metasomal segments II and III; segment V with 5 carinae. Metasoma IV with lateromedian carinae smooth, all other carinae granulated. Intercarinae surface on metasoma I laterally bumpy and usually smooth. Length to depth ratio of metasoma III 1.2–1.4 in both sexes; metasoma IV 1.5–1.7 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, adults with 7–9 retroinferior macrosetae on basitarsus III. Telson elongated. Anal lobe divided into three parts.

DESCRIPTION. Total length of adult males 38–50 mm, females 42–50 mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male has the fingers proximally more twisted than female. Female has longer and slightly narrower chela of pedipalps. For measurements, see Table 14.

Coloration (Figs. 1078–1081). Carapace and tergites redish brown, strongly black pigmented. Chelicerae yellow, without or with poor reticulation, the tips of teeth on cheliceral fingers are black. Metasoma, telson, pedipalps and legs yellowish brown, faintly black pigmented. Metasoma ventral, mainly segment V, black pigmented.

Mesosoma and carapace (Figs. 1112–1115). Carapace carinate, unevenly covered with granules of varying size; much of the granulation is fine, but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are granulated, with some intercarinal granules small and others larger and rounded. Tergite VII is pentacarinata. Pectinal tooth count is 21–24 in males, 16–19 in females. Pectinal marginal tips extend to about half of the fourth sternite in males and about end of the third sternite in females. Pectines have three marginal lamellae and seven to eight middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. All sternites are smooth and sparsely hirsute. Sternite VII bumpy and usually rudely granulated with four well marked rather smooth carinae. Other sternites have two furrows.

Pedipalps (Figs. 1090–1111). Pedipalps sparsely hirsute and smooth, only femur is sparsely granulated. Femur has four to five granulated carinae, the middle carina on internal surface consist from strong irregular granules. Patella with eight carinae from which internal are always and dorsal are rarely granulated. Chela without carinae. Movable fingers of pedipalps have 11–12 cutting rows of denticles, every row with external and internal denticles present, and five terminal denticles.

Legs (Figs. 1116–1119). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, adults with 7–9 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and moderate to strong on third and fourth legs and absent on the other legs.

Metasoma and telson (Figs. 1082–1089). Metasomal segments are only very sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two latero median carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma IV with lateromedian carinae smooth, all other carinae granulated. All other carinae with consistent granules. Intercarinae surface on metasoma I laterally bumpy and usually smooth. Ventrolateral carinae of metasoma V posteriorly with several large lobate denticles. Telson sparsely hirsute, elongate, bumpy and smooth. Anal lobe divided into three parts.

DISTRIBUTION. Turkey (Hakkari Province, Figs. 1155–1156).

Mesobuthus zarudnyi Novruzov et al., 2022

(Figures 1155–1157)

<http://zoobank.org/urn:lsid:zoobank.org:act:BC4425DF-ABAC-4D70-9A22-3F9464FE6774>

TYPE LOCALITY AND TYPE REPOSITORY. **Azerbaijan**, Absheron Peninsula, Shuvalan (40.45°N 49.71°E); NMPC.

REFERENCES (selected):

Mesobuthus eupeus: Birula, 1917a: 34 (in part); Yusubov, 1978: 49 (in part); Yusubov, 1985: 43 (in part); Fet, 1989: 88–89 (in part); Fet & Lowe, 2000: 170–171 (in part; complete references list until 1998); Novruzov, 2017: 67; Novruzov, 2019: 28 (in part).

Mesobuthus eupeus eupeus (in part): Fet, 1989: 88–89; Fet & Lowe, 2000: 171–172 (complete references list until 1998).

Mesobuthus zarudnyi: Novruzov et al., 2022: 1–9, figs. 1–41, tab. 1.

TYPE MATERIAL EXAMINED. **Azerbaijan**, Absheron Peninsula, Shuvalan (40.45°N 49.71°E), 18 June 2021, 1♂ (DNA No. 2060, holotype), 1♀, leg. N. Novruzov, NMPC; Qobustan Village (40.49°N 49.48°E), 23 August 2021, 2♀ (paratypes), leg. N. Novruzov, NMPC; Absheron Peninsula, Umbali Mts., 19 April 2001, 1♀2juvs. (paratypes), leg. Yu. M. Marusik, NMPC; near Baku (40.39°N 49.71°E), 27 April 2013, 3♀ (paratypes), leg. D. Kasatkin, AZMM; Baku, near Qobustan Village (40.08°N 49.34°E), 3 May 2013, 1♀1♂juv. (paratypes), leg. D. Kasatkin, AZMM; near Khyzy, 40°55'05"N 49°03'54"E (40.92°N 49.05°E), 614 m a. s. l., 14 June 2013, 1juv. (paratype), leg. D. Kasatkin & I. Shokhin, AZMM.

DIAGNOSIS. Total length of adults 40 mm (male) to 58 mm (female). Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Male with fingers proximally more twisted than female. Pedipalp chela length/width ratio 3.2–3.4 in male and 3.7–3.8 in female. Pectinal teeth number 25 in male, 17–22 in female. Chelicerae yellow, without or with poor reticulation. Pedipalps and metasoma sparsely hirsute. Carapace and tergites reddish brown, strongly black

pigmented; metasoma, telson, pedipalps and legs yellowish to reddish brown, only part of metasomal segment V black. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 usually smooth carinae. Chela lacks carinae. Movable fingers of pedipalps with 11–12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Seventh sternite bumpy and usually finely granulated with 4 well marked rather smooth carinae. First metasomal segment with 10 carinae; second to fourth with 8 carinae, other two carinae are indicated by incomplete row of granules on metasomal segments II and III; fifth with 5 carinae. Metasoma III–IV with lateromedian carinae smooth in male but granulated in female, all other carinae usually granulated. Intercarinae surface on metasoma I laterally bumpy and smooth. Length to depth ratio of metasoma III 1.1–1.2 in both sexes; metasoma IV 1.4–1.5 in both sexes. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, adults with 7–9 retroinferior macrosetae on basitarsus III. Telson rather elongated. Anal lobe divided in two parts.

DISTRIBUTION. Azerbaijan (Figs. 1155–1156).

***Mesobuthus zonsteini* sp. n.**

(Figures 1120–1154, 1155, 1158, Table 13)

<http://zoobank.org/urn:lsid:zoobank.org:act:9569037F-982E-4438-9F0C-FE98B284EF50>

TYPE LOCALITY AND TYPE REPOSITORY. **Uzbekistan, Navoi Province**, Tamdy District, 1 km NW of Zarafshan, 22 April 1998, 41°36'N 64°11'E (41.60°N 64.18°E); NMPC.

REFERENCES:

Mesobuthus eupeus thersites: Fet, 1989: 98 (in part); Gantenbein et al., 2003: 413 (in part; Uzbekistan: Zarafshan).

TYPE MATERIAL. **Uzbekistan, Navoi Province**, Tamdy District, 1 km NW of Zarafshan, 22 April 1998, 41°36'N 64°11'E (41.60°N 64.18°E), 1♂ (holotype), leg. A. Gromov, NMPC; Tamdy District, 1–2 km from Zarafshan, 18 April 1998, 41°34'N 64°13'E (41.57°N 64.22°E), 1♀ (incomplete; paratype), leg. A. Gromov (DNA-165, 7359), NMPC.

ETYMOLOGY. The new species is named in honor of our colleague and friend Sergei Zonstein (Tel Aviv, Israel) originally from Kyrgyzstan) who made great contributions to arachnology over the decades. Among many other things, Sergei was instrumental in re-examining one of the most interesting scorpions known (and possibly extinct), a troglobitic *Akrav israchanani* Levy, 2007 (Akravidae) (see Fet et al., 2011, 2017).

DNA DATA. *Mesobuthus zonsteini* sp. n. was represented in our survey by a single DNA sequence from Uzbekistan (Navoi Province) (Table 16).

DIAGNOSIS. Total length of adult male 41 mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, very near to *est*. Both sexes with fingers proximally slightly twisted. Pedipalp chela length/width ratio 2.98 in female and 4.28 in male. Pectinal teeth number 28–29 in male, 24–25 in female. Chelicerae yellow, without reticulation. Pedipalps and metasoma very sparsely hirsute. Carapace and tergites yellowish brown, black pigmented; metasoma, telson, pedipalps and legs yellowish brown with spots sparsely and black part of metasoma V. Femur of pedipalp with 4–5 granulated carinae. Patella with 8 carinae. Chela lacks carinae. Movable fingers of pedipalps with 12 cutting rows of denticles and 5 terminal denticles. Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin. Sternite VII smooth, with 4 well marked granulated carinae. Metasomal segment I with 10 carinae; segments II to IV with 8 carinae, other two carinae are indicated by incomplete row of denticles on metasomal segments II and III; segment V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma I laterally smooth. Length to depth ratio of metasoma III 1.3, metasoma IV 1.8 in male. Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 10–15 retroinferior macrosetae on basitarsus III. Telson elongated. Anal lobe divided into two parts.

DESCRIPTION. Total length of adult male 41 mm. Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *est* and *esb*, near to *est*. Both sexes have fingers proximally slightly twisted. For measurements, see Table 13.

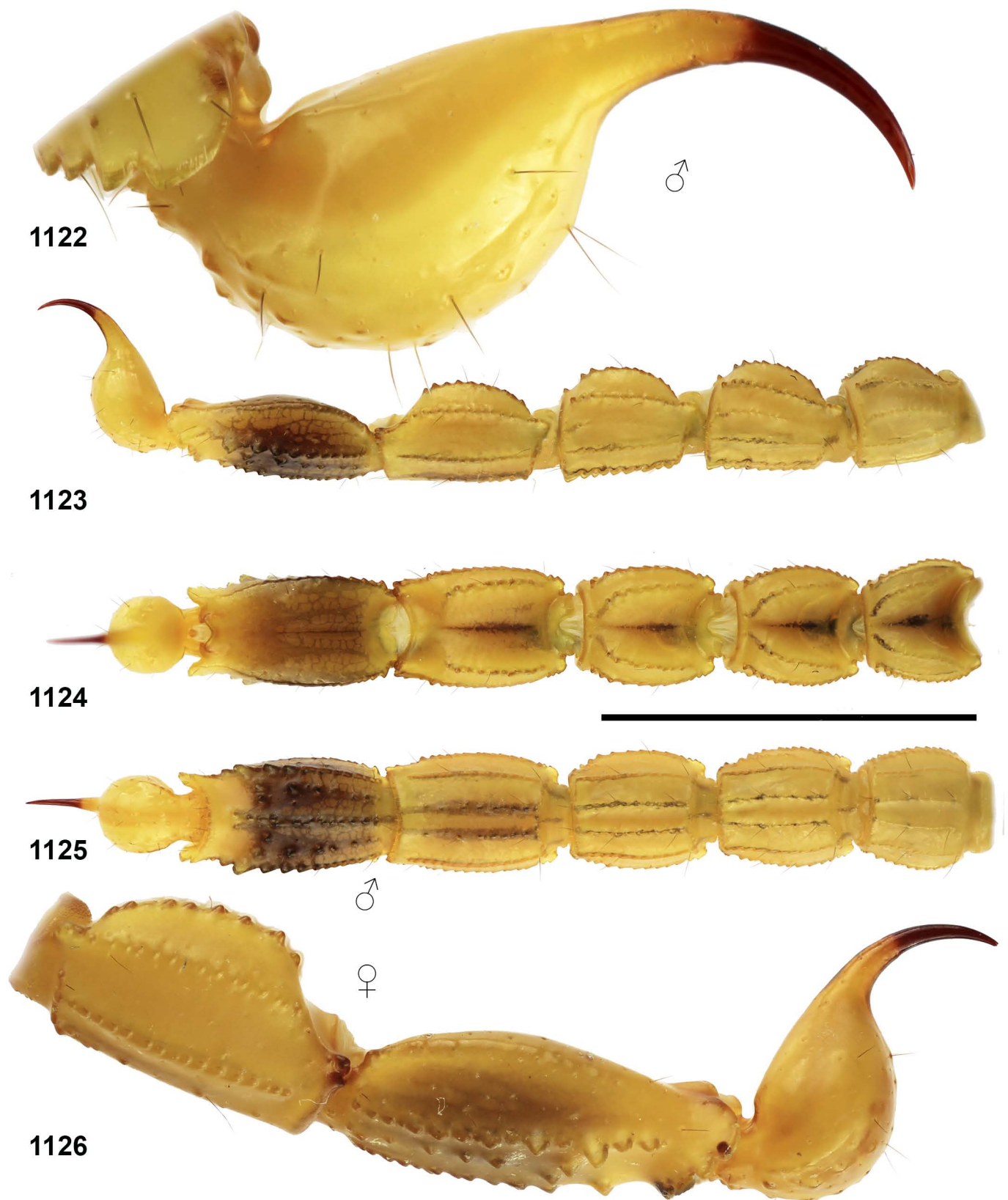
Coloration (Figs. 1120–1121). Carapace and tergites are yellowish brown with dark pigmentation. Telson is yellow. Metasoma, pedipalps and legs are yellowish brown with several dark spots, part of metasomal segment V black. Chelicerae yellow, without reticulation, the tips of denticles on chelical fingers are black.

Mesosoma and carapace (Figs. 1147–1150). Carapace carinate, unevenly covered by granules of varying size; much of the granulation is fine but some granules are larger and distinctly rounded. Tergites I–VI with three carinae and are sparsely granulated. Tergite VII is pentacarinata. Pectinal tooth count 28–29 in male, 24–25 in female. Pectinal marginal tips extend to the end of the sternite IV in male and female. Pectines have three marginal lamellae and eight to nine middle lamellae. Lamellae with numerous long setae, each fulcrum with three to five dark setae. All sternites are smooth and sparsely hirsute. Sternite VII with four well marked granulated carinae. Other sternites have two furrows.

Pedipalps (Figs. 1127–1146). Pedipalps hirsute and smooth. Femur has four to five granulated carinae, the middle carina on internal surface consists of strong irregular granules. Patella with eight carinae, of which internal and dorsal are granulated. The chela is smooth. Movable fingers of pedipalps have 11–12 cutting rows of denticles, each with external and internal denticles present, and five terminal denticles.



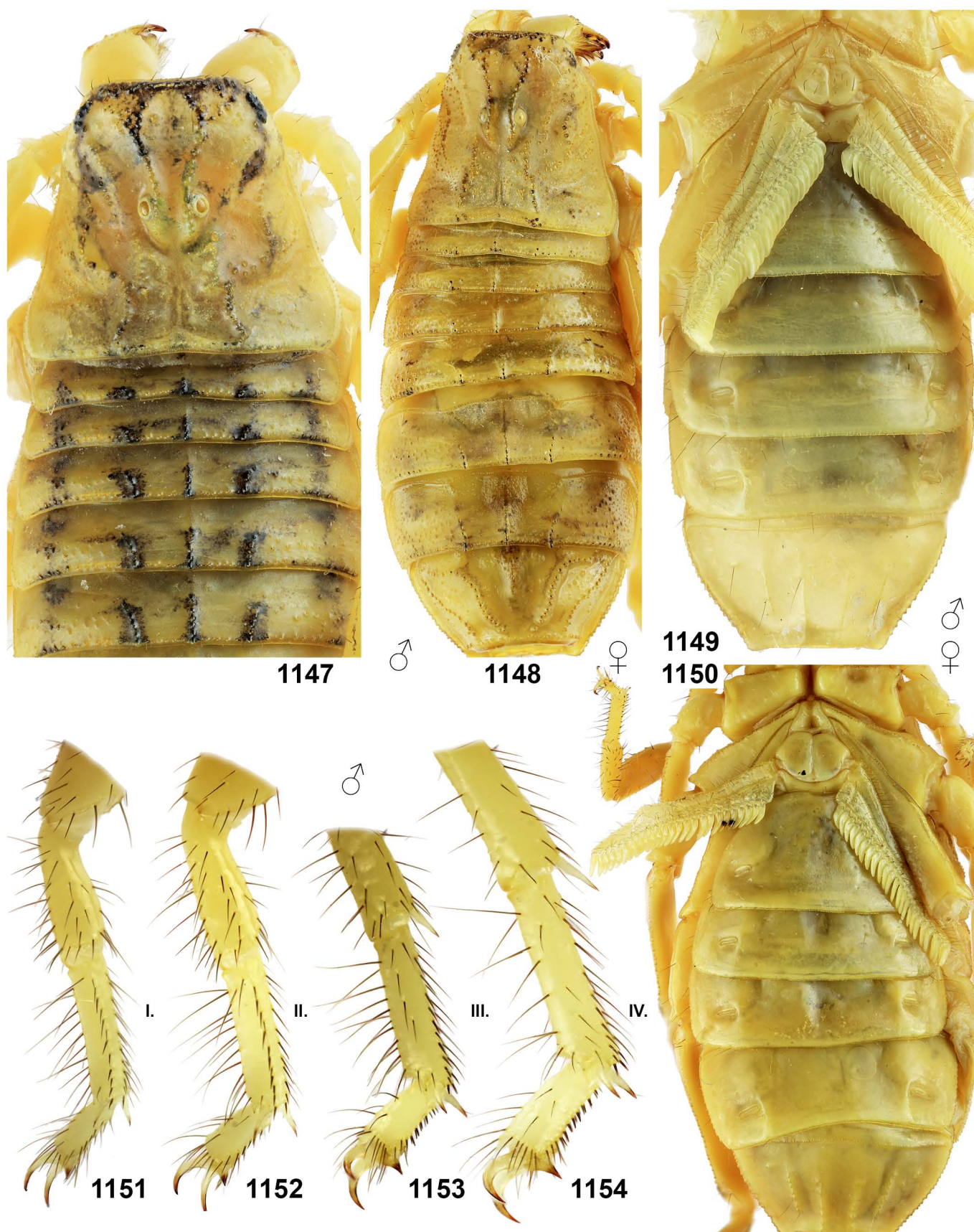
Figures 1120–1121: *Mesobuthus zolsteini* sp. n., male holotype, dorsal (1120) and ventral (1121) views. Scale bar: 10 mm.



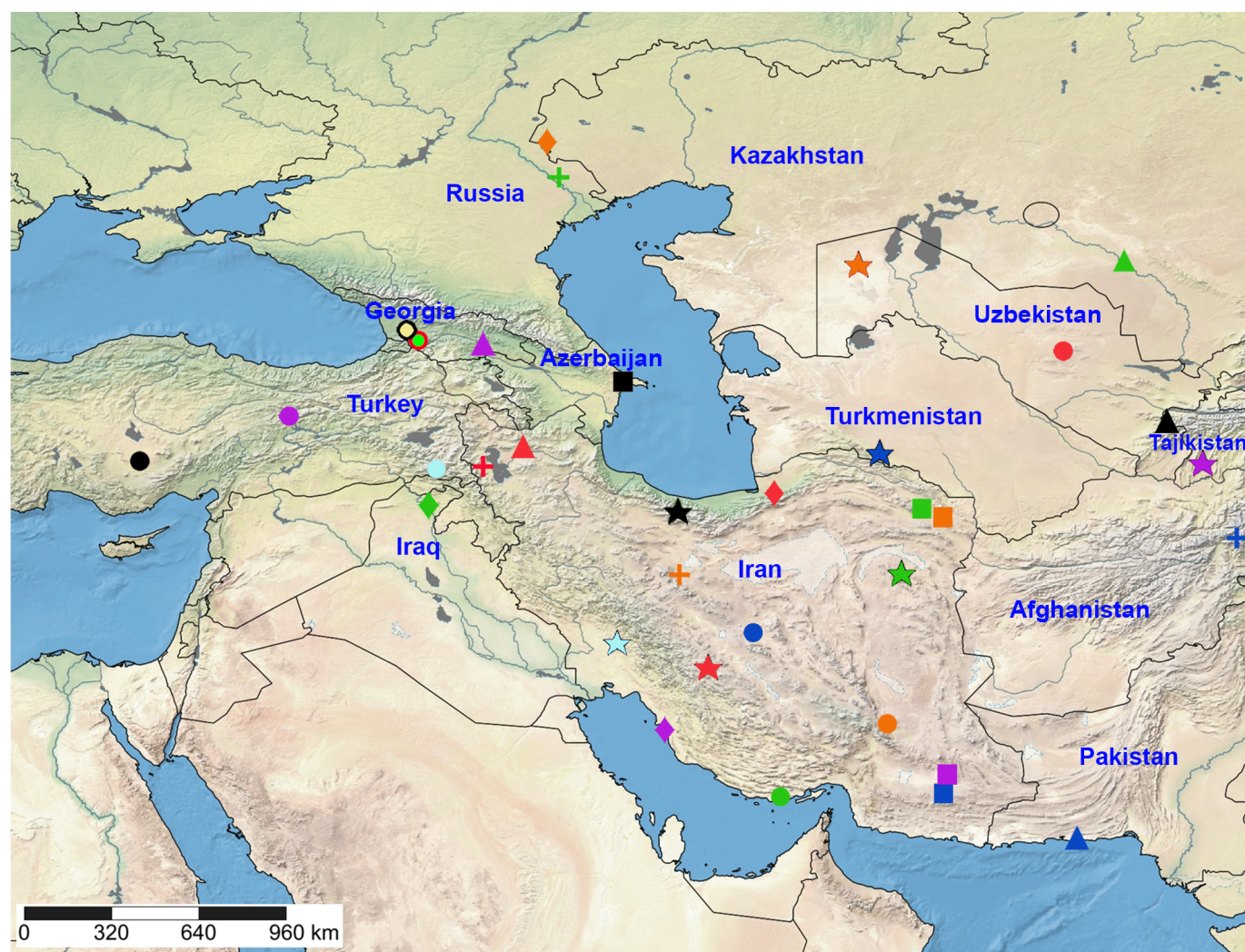
Figures 1122–1126: *Mesobuthus zonsteini* sp. n. **Figures 1122–1125.** Male holotype, telson lateral (1122), metasoma and telson, lateral (1123), dorsal (1124), and ventral (1125) views. **Figure 1126.** Female paratype, metasoma IV–V and telson lateral. Scale bar: 10 mm (1123–1125).



Figures 1127–1146: *Mesobuthus zonsteini* sp. n., pedipalp. **Figures 1127–1136.** Male holotype, chela, dorsal (1127), external (1128), and ventral (1129) views. Patella, dorsal (1130), external (1131) and ventral (1132) views. Femur and trochanter, internal (1133), dorsal (1134), and ventral (1135) views. Movable finger (1136). **Figures 1137–1146.** Female paratype, chela, dorsal (1137), external (1138), and ventral (1139) views. Patella, dorsal (1140), external (1141) and ventral (1142) views. Femur and trochanter, internal (1143), dorsal (1144), and ventral (1145) views. Movable finger (1146). The trichobothrial pattern is indicated in Figures 1127–1131, 1133–1134.



Figures 1147–1154: *Mesobuthus zonsteini* sp. n. **Figures 1147, 1149, 1151–1154.** Male holotype, chelicerae, carapace and tergites I–V (1147), sternopectinal region and sternites (1149), and left legs I–IV, retrolateral aspect (1151–1154). **Figures 1148, 1150.** Female paratype, chelicerae, carapace and tergites (1148), and sternopectinal region and sternites (1150).



- | | |
|---|--|
| ■ <i>Mesobuthus afghanus</i> (Pocock, 1889) | ★ <i>Mesobuthus birulai</i> sp. n. |
| ■ = ? <i>Buthus agnetis</i> Werner, 1936 syn. n. | ★ <i>Mesobuthus crucittii</i> sp. n. |
| ▲ <i>Mesobuthus barszczewskii</i> (Birula, 1904) | ★ <i>Mesobuthus farleyi</i> sp. n. |
| ◆ <i>Mesobuthus bogdoensis</i> (Birula, 1896) | ★ <i>Mesobuthus fomichevi</i> sp. n. |
| + = <i>Buthus eupeus volgensis</i> Birula, 1925 syn. n. | ★ <i>Mesobuthus galinae</i> sp. n. |
| ▲ <i>Mesobuthus eupeus</i> (C. L. Koch, 1839) | ★ <i>Mesobuthus kaftani</i> sp. n. |
| ● = <i>Androctonus ornatus</i> Nordmann, 1840 | ★ <i>Mesobuthus marusiki</i> sp. n. |
| ● = <i>Buthus cognatus</i> L. Koch, 1878 | ● <i>Mesobuthus mirshamsii</i> sp. n. |
| + <i>Mesobuthus haarlovi</i> Vachon, 1958 | ● <i>Mesobuthus navidpouri</i> sp. n. |
| + <i>Mesobuthus iranensis</i> (Birula, 1917) | ● <i>Mesobuthus rahsenae</i> sp. n. |
| ■ <i>Mesobuthus kirmanensis</i> (Birula, 1900) | ● <i>Mesobuthus turcicus</i> sp. n. |
| ■ = <i>Buthus pachysoma</i> Birula, 1900 syn. n. | ● <i>Mesobuthus vignolii</i> sp. n. |
| ▲ <i>Mesobuthus macmahoni</i> (Pocock, 1900) | ● <i>Mesobuthus yagmuri</i> sp. n. |
| ◆ <i>Mesobuthus mesopotamicus</i> (Penther, 1912) | ● <i>Mesobuthus zonsteini</i> sp. n. |
| + <i>Mesobuthus persicus</i> (Pocock, 1899) | ■ <i>Mesobuthus zarudnyi</i> Novruzov et al., 2022 |
| ◆ <i>Mesobuthus philippovitschi</i> (Birula, 1905) | |
| ◆ <i>Mesobuthus phillipsii</i> (Pocock, 1889) | |
| ▲ <i>Mesobuthus thersites</i> (C. L. Koch, 1839) | |
| = <i>Buthus eupeus mongolicus</i> Birula, 1911 syn. n. | |
| ▲ <i>Mesobuthus vesiculatus</i> (Pocock, 1899) | |

Figure 1155. Type localities of *Mesobuthus* taxa (except *Buthus eupeus mongolicus* which is in Figure 1158).

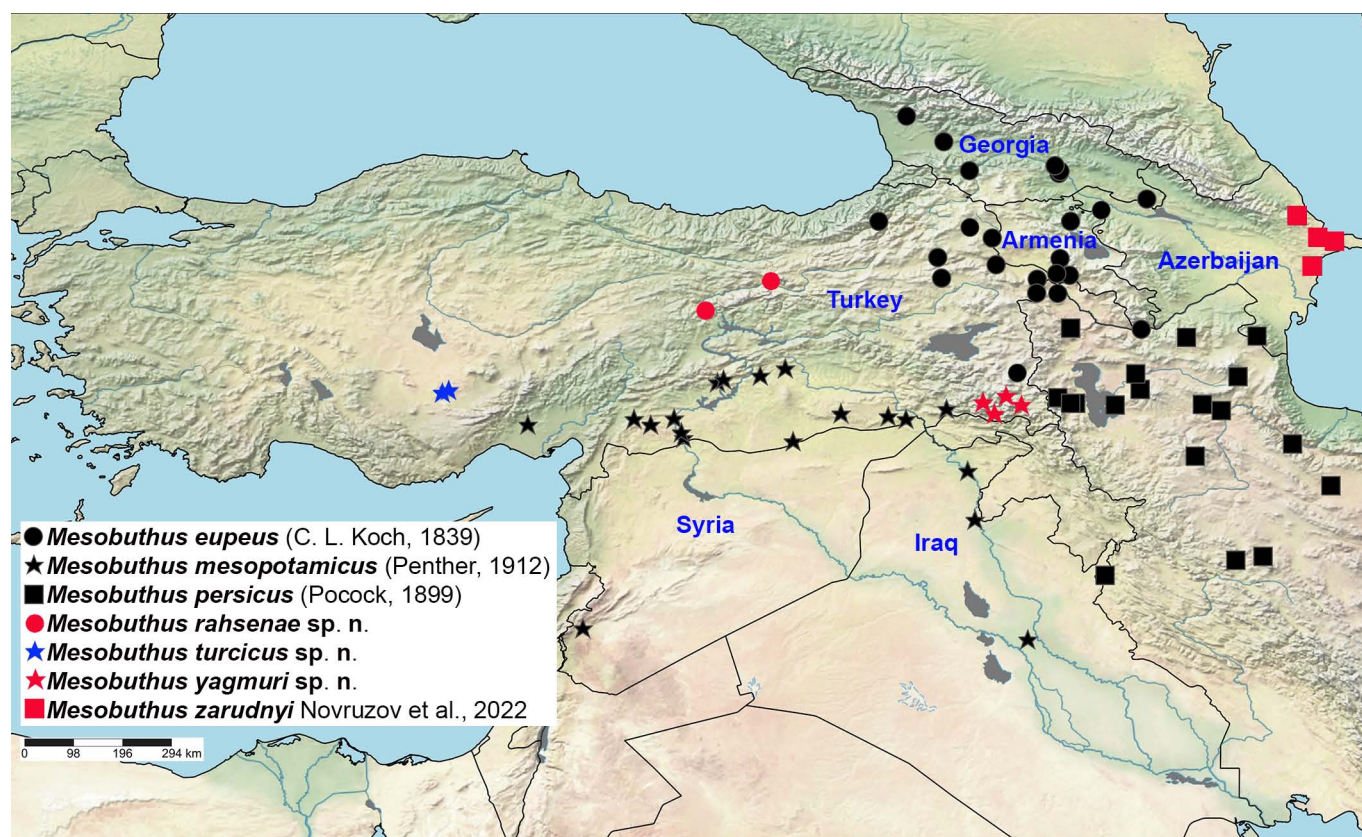


Figure 1156. Distribution of *Mesobuthus* spp. in Armenia, Azerbaijan, Georgia, Iraq, Syria, and Turkey. Based on studied material only.

Legs (Figs. 1151–1154). Telotarsus III ventral setation represented by short and strong spiniform setae. Tarsi hirsute, in adults with 10–15 retroinferior macrosetae on basitarsus III. Femur with only several macrosetae. Femur and patella with carinae well developed. Tibial spurs present and media to strong on legs III and IV and absent on the other legs.

Metasoma and telson (Figs. 1122–1126). All metasomal segments only sparsely hirsute. Metasomal segment I with 10 carinae, II–III with 8 carinae but other two lateromedian carinae are indicated by incomplete row of granules, IV with 8 carinae, and V with 5 carinae. Metasoma with all carinae granulated. Intercarinal surfaces on metasoma smooth. Ventrolateral carinae of metasoma V posteriorly and metasoma II–III laterally with several large lobate denticles. Telson is very sparsely hirsute, elongate and smooth. Anal lobe divided into two parts.

DISTRIBUTION. Uzbekistan (Figs. 1155, 1158).

Discussion

With almost 30 valid species, our revision is the most comprehensive analysis of the genus *Mesobuthus* s. str. published up to date. At the same time, fresh specimens, especially for DNA analysis, from many countries were not readily available (e. g. Iraq) or were sparse (e. g. Uzbekistan, Tajikistan) and the genus proves to be much more diverse in some regions where populations have been densely collected (e. g. Iran, Turkey, Turkmenistan). However, available new

collections allowed us to present a much more detailed understanding of *Mesobuthus* than was ever possible.

The emerging pilot phylogeny of the genus, based on *COI* mtDNA markers representing 25 out of 29 valid species (Fig. 1172), reveals surprising depth and diversity. This was, however, somewhat suspected as the number of subspecies recognized historically (Vachon, 1958; Fet & Lowe, 2000) clearly indicated a hidden diversity of these very common, widespread, ecologically successful scorpions.

Table 17 shows crown and stem age estimates for each *Mesobuthus* species. Most species-level diversification (estimated from stem ages) has occurred from the late Miocene to early Pleistocene (average 5.65 ± 2.24 Mya).

The origins of the genus appear to be from what is now the territory of Iran, where its last common ancestor (LCA) is estimated to have existed in the end of early Miocene (17.16 Mya at the shores of the receding Tethys Ocean. Speciation and separation of *Mesobuthus* into several major clades (five “complexes”) also all can be dated by mid to late Miocene events, corresponding to various stages of reduction and isolation of the Paratethys “megalake” (Palcu et al., 2021).

Two of the most ancient clades correspond to the Iranian “*phillipsii* complex” and the rest of the genus (LCA 15.37 Mya, middle Miocene). The “*phillipsii* complex” includes 5 species, all from Iran, in the order of branching: *M. navidpourii* sp. n., at 10.07 Mya; (*M. vesiculatus* + *M. vignolii* sp. n.) at 7.48 Mya; *M. crucittii* sp. n. at 4.49 Mya (early Pliocene), and *M. phillipsii* (2.36 Mya). The youngest clades are of late Pliocene to early Pleistocene age.

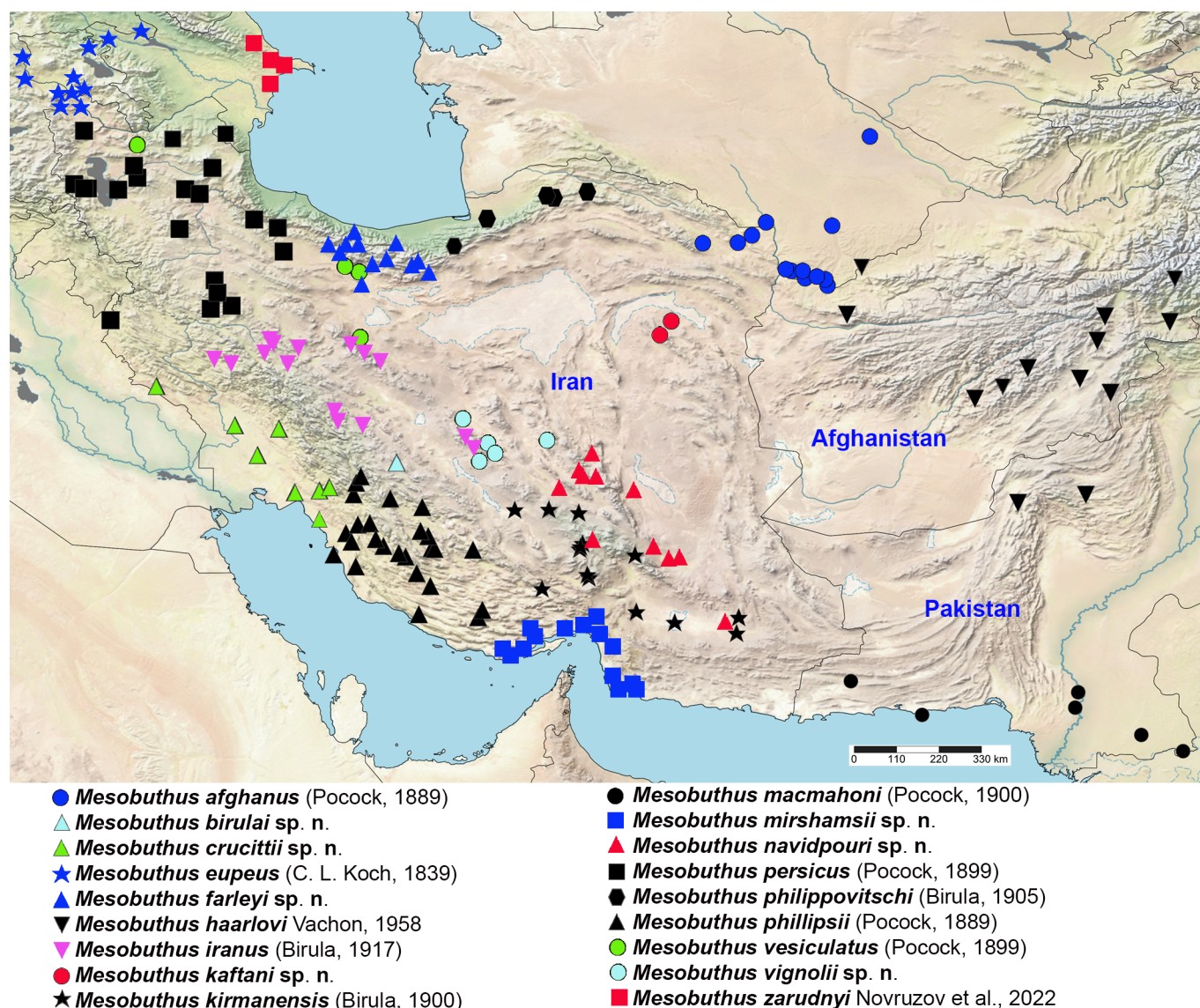


Figure 1157. Distribution of *Mesobuthus* spp. in Afghanistan, Iran, and Pakistan. Based on studied material only.

The rest of the genus *Mesobuthus* clearly diverges into two clades, with their separation dated at 13.73 Mya (late Miocene). The most basal is the “*kirmanensis* complex”, which includes 4 species. Western *M. mesopotamicus* (Iraq, Syria, and SE Turkey) was estimated to diverge from the remaining 3 species at 11.29 Mya. Then, at 8.43 Mya, a clade of (*M. haarlovi* (Afghanistan) + *M. macmahoni* (Pakistan)) diverged from *M. kirmanensis* (SE Iran) at around 8.13 Mya, with the former then speciating around 4.62 Mya. Again, important speciation events in this complex are dated in Miocene, between 14 and 8 Mya.

Next in branching order are two major ancient clades, western and eastern, with their divergence, also in the Miocene, estimated at 12.02 Mya. The western clade (“*Eupeus* complex”), which includes 8 species, was estimated to diverge into two clades at 10.4 Mya. One of these clades is currently represented by a northeastern Iranian species *M. philippovitschi*, found across the Alborz Mts. of the south Caspian shore;

further east it is replaced by its sister species, *M. galinae* sp. n. (Kopetdagh Mts) of southwestern Turkmenistan. The second clade is limited to Anatolia and the Caucasus (with earliest divergence estimated at 8.17 Mya) and is represented by 6 closely related species: *M. yagmuri* sp. n., *M. rahsenae* sp. n., *M. turcicus* sp. n., *M. zarudnyi*, *M. persicus*, and *M. eupeus*. Divergence estimates among those species varies from 4 to 6 Mya, the Pliocene age. The biogeographic pattern revealed in the “*Eupeus* complex” (connection between the Caucasus, Alborz and Kopetdagh Mts.) has been long observed in other animal groups (Kryzhanovsky, 1965; Fet, 1994).

The eastern clade was estimated to diverge into two clades at 10.69 Mya: northeastern “*thersites* complex” and “*afghanus* complex”. The “*thersites* complex”, currently ranging from Russia to China, includes 5 species: a very widely ranging *M. thersites*; Central Asian endemics *M. barszchevskii* (Uzbekistan), *M. fomichevi* sp. n. (Tajikistan, Uzbekistan), and *M. zonsteini* sp. n. (Uzbekistan), as well as *M. bodgoensis* (Russia, Kazakhstan).

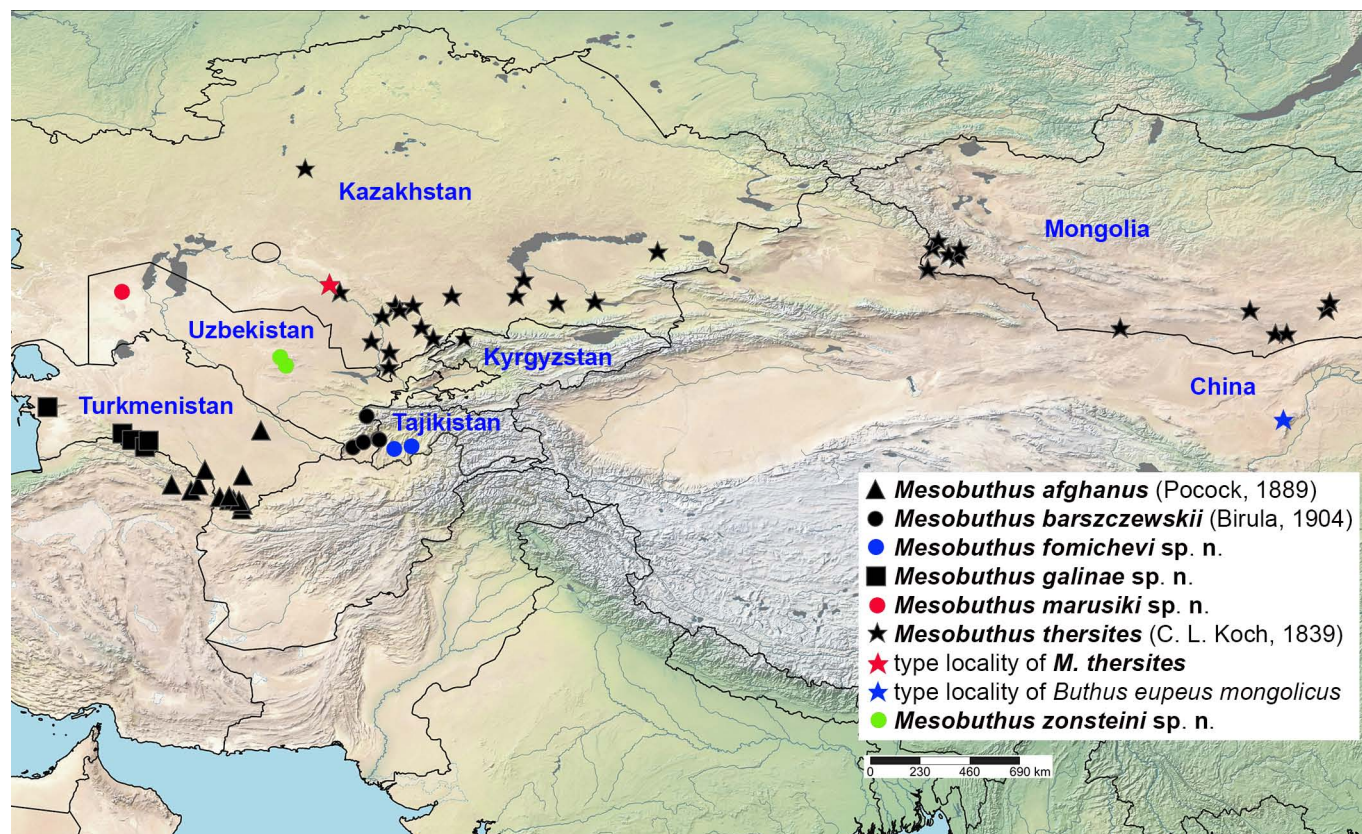


Figure 1158. Distribution of *Mesobuthus* spp. in China, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, and Uzbekistan. Based on studied material only.

At 8.31 Mya we see divergence of the oldest clade in “*thersites* complex” (*M. barszczewskii* + *M. bodgoensis*), with divergence between these two species dated to 6.37 Mya. Both represent interesting, disjunct relicts whose ancestors could have been isolated on landmasses in the late Miocene while the Paratethys was receding: *M. barszczewskii* in the mountains of southern Central Asia, and northwestern *M. bodgoensis*, at the “paleo-Caspian” shores.

Further divergent clades, at 6.25, 4.55 and 2.80 Mya, all correspond to Central Asian species (*M. fomichevi* sp. n., *M. zonsteini* sp. n. *M. thersites*), of which the youngest is the very widespread *M. thersites*. Its speciation clearly reflects formation of great Central Asian lowland deserts during the Pliocene with ranges expansions to now cover vast arid landscapes from Kazakhstan to China.

The last clade, which we address as “*afghanus* complex”, includes 3 species (all of Iranian origin) with the LCA dated to 10.69 Mya. At 8.61 Mya it branches into two clades: one represented by Iranian endemics *M. farleyi* sp. n. and *M. kaftani* sp. n. (the two diverging at 6.25 Mya); and a more recent, widespread *M. afghanus* (3.98 Mya), which ranges from the northeastern Iran and northern Afghanistan across the great deserts of Turkmenistan to the Amudarya River.

Mesobuthus is the most widespread scorpion genus in Eurasia, both longitudinally (from Turkey to China) and latitudinally (from the Indian Ocean coast in Pakistan to the Orenburg Province, Russia; the latter is the northernmost scorpion record in the Eastern Hemisphere). Ecologically,

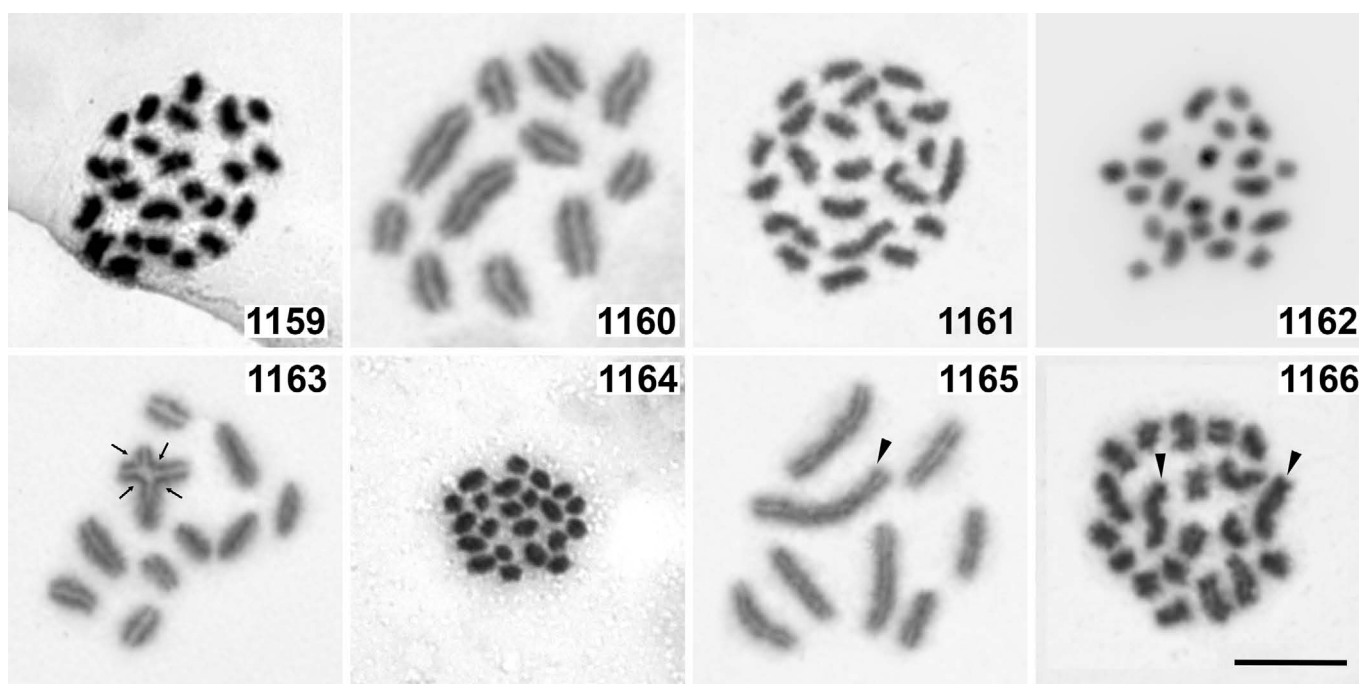
species of *Mesobuthus* are extremely diverse and found in habitat ranging from the driest deserts and semideserts of Central Asia (*M. thersites*, *M. marusiki* sp. n., *M. zonsteini* sp. n.) to the high mountains of the Caucasus (*M. eupeus*), Alborz (*M. farleyi* sp. n.), Pamiro-Alai (*M. barszczewskii*), and Hindukush (*M. haarlovi*, up to 3500 m). They are quite abundant in all studied landscapes.

The current distribution of *Mesobuthus* species is uneven. They appear to be most diverse within presumed ancestral regions of Iran (we confirm 15 species for Iran, or 50% of species of the genus) and Central Asia, and less so in the Caucasus and Anatolia in the west, and China in the east. However, judging from our revision, we predict that many more new (not necessarily even ‘cryptic’) species will be discovered, especially in understudied regions like Afghanistan, Tajikistan, Kyrgyzstan, and Pakistan, especially in the mountains.

Above, we attempted to trace some possible scenarios of the evolution of *Mesobuthus*. Biogeographically, one interesting result is that the Amudarya River is now spectacularly confirmed as a boundary for *Mesobuthus*, a fact known for other buthid scorpions but not this genus (Graham et al., 2012). The great river clearly divides the southern “*afghanus*” clade from the northeastern “*thersites*” clade and appears to have been an important driver of vicariance among arid-adapted scorpions. The extent to which the river has impacted additional co-distributed animals would be ideal for testing in a comparative phylogeographic framework.

Species	Sample ID	2n	Postpachytene configuration	% TCL ($\pm$ SD)	Sex	Country
<i>M. eupeus</i>	16	22	n/a	7.87 ($\pm$ 0.55) – 2.66 ($\pm$ 0.32)	1♂	Georgia
	460	22	n/a	7.27 ($\pm$ 0.26) – 2.97 ($\pm$ 0.15)	1♀	Armenia
	1476	22	11II	2x 6.51 ($\pm$ 0.33) – 2x 3.18 ($\pm$ 0.14)	1♂	Armenia
	1477–1479	22	11II	2x 6.68 ($\pm$ 0.26) – 2x 3.24 ($\pm$ 0.15)	3♂	Armenia
	363	22	n/a	7.03 ($\pm$ 0.36) – 2.97 ($\pm$ 0.45)	1♀	Turkey
<i>M. haarlovi</i>	20–23, 52–54	22	n/a	6.93($\pm$ 0.51) – 2.84($\pm$ 0.34)	6♂	Afghanistan
<i>M. macmahoni</i>	1947	22	9II+IV	7.74 ($\pm$ 0.86), 6.56 ($\pm$ 0.44), 2x 5.62 ($\pm$ 0.32) – 2x 3.39 ($\pm$ 0.18), 2.97 ($\pm$ 0.38)	1♂	Pakistan
<i>M. mesopotamicus</i>	211, 217, 223	22	n/a	6.45 ($\pm$ 0.60) – 2.91 ($\pm$ 0.24)	3♂	Turkey
<i>M. rahsenae</i> sp. n.	364, 365	20	11II	2x 8.96 ($\pm$ 0.40), 2x 6.45 ($\pm$ 0.39) – 2x 3.50 ($\pm$ 0.18)	1♂1♀	Turkey

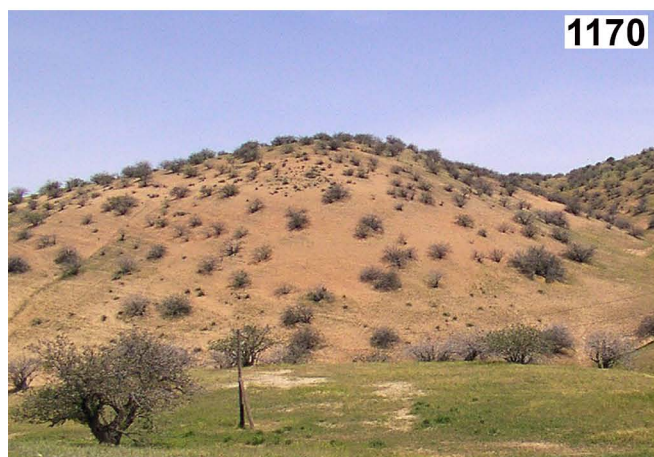
Table 15. The diploid number, the postpachytene configuration, the percentage of the total chromosome length of the diploid set (% TCL) including the standard deviation ($\pm$ SD) and the origin of *Mesobuthus* species cytogenetically investigated. Asterisk marks the sample analyzed as *Mesobuthus eupeus* in Štáhlavský et al., 2020.



Figures 1159–1166: Mitotic metaphases (1159, 1161, 1162, 1164, 1166), pachytene (1165) and postpachytene (1160, 1163) of *Mesobuthus* species. **Figure 1159.** Female of *M. eupeus* from Georgia (2n=22). **Figure 1160.** Male of *M. eupeus* from Armenia (2n=22). **Figure 1161.** Female of *M. eupeus* from Turkey (2n=22). **Figure 1162.** Male of *M. haarlovi* (2n=22). **Figure 1163.** Male of *M. macmahoni* (2n=22). Arrows show chromosomes in multivalent association during postpachytene. **Figure 1164.** Male of *M. mesopotamicus* (2n=22). **Figures 1165, 1166.** Male of *M. rahsenae* sp. n. (2n=20). The pair of the extra-large chromosomes are marked with arrowheads. Scale bar: 10 μ m.

The situation in the northwest of Central Asia—which was assumed to house uniform “*M. eupeus thersites*” (Fet, 1989) is now also unclear and intriguing. Our discovery of *M. marusiki* sp. n. in Ustyurt and *M. zonsteini* sp. n. in the Kizylkum Desert indicates that much more diversity is present in the vast deserts of Central Asia than suspected. Mountains, which are supposed to house even more diversity due to isolation and fragmentation, are barely

studied, as indicated by the presence of *M. barczsevskii* and *M. fomichevi* sp. n. in southern Uzbekistan and Tajikistan. Furthermore, the unexpected discovery of a separate clade representing the north Caspian relict *M. bogdoensis*, a sister group to *M. barczsevskii*, indicates ancient speciation and range expansions in the area dating back to Miocene (10 to 6 Mya) desiccations and recoveries of the Paratethys Sea (Palcu et al., 2021).



Figures 1167–1171: Localities of *Mesobuthus*. **Figure 1167.** Armenia, Gorovan sands, 39°53'N 44°44'E, 970 m a.s.l. Recorded occurrence of *Mesobuthus eupeus*. **Figure 1168.** Kazakhstan, Kyzylorda Province. Recorded occurrence of *M. thersites*. **Figure 1169.** Turkmenistan, Akhal Province, foothills of Kopetdagh Mts. Recorded occurrence of *M. galinae* sp. n. **Figure 1170.** Turkmenistan, Serhetabat District, Badkhyz Nature Reserve, Kepele. Recorded occurrence of *Mesobuthus afghanus*. **Figure 1171.** Uzbekistan, Surxondaryo Province, Babatag Mts. Recorded occurrence of *M. barszcevskii*.

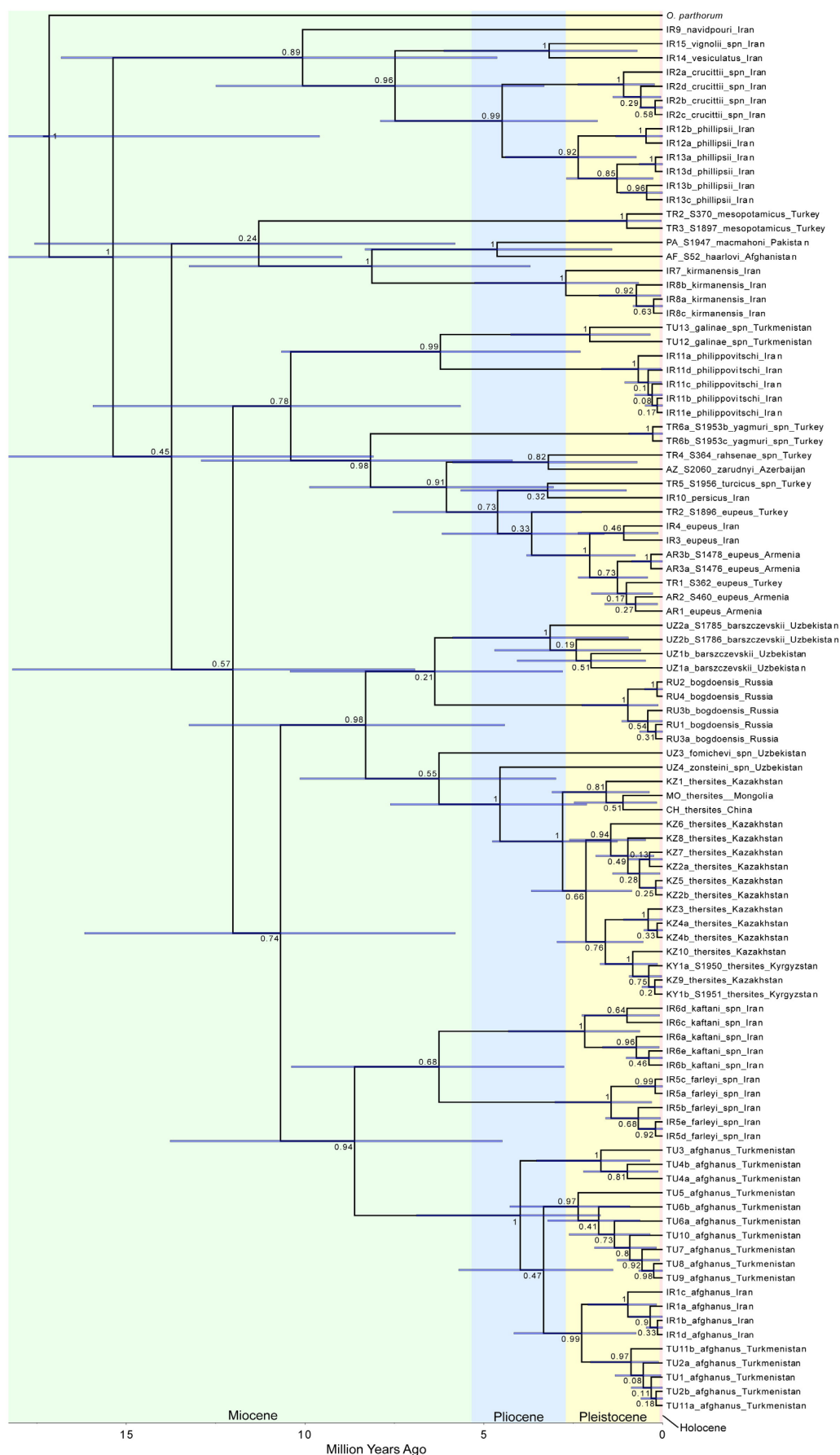


Figure 1172. Bayesian chronogram depicting relationships and timing of diversification among *Mesobuthus* spp., generated using *COI* data with BEAST. Values at nodes represent posterior probabilities; bars show 95% HPD (highest posterior density)

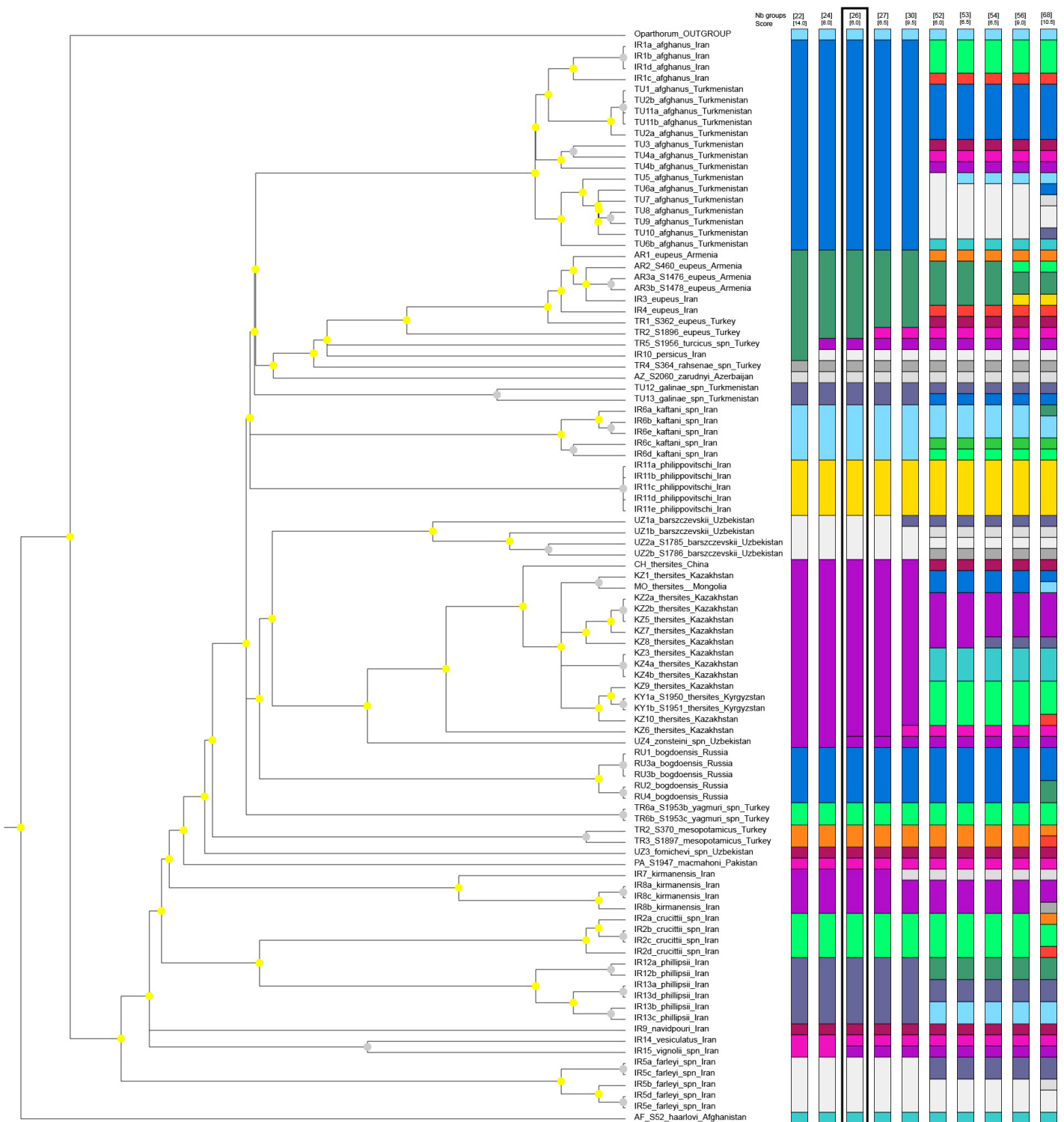


Figure 1173. Species delimitation results from Assemble Species by Automatic Partitioning (ASAP). Colored bars represent different partitions, with the best ranked partitioning scheme outlined in black. Yellow circles at nodes indicate groups that are unlikely to represent a panmictic species ($p\text{-val} > 0.1$). Gray circles at nodes indicate groups for which the probability of panmixia was not calculated. See Puillandre et al. (2021) for details on ASAP.

No.	Ingroup Species	Label	Tree label	GenBank #	Reference
1	<i>Mesobuthus afghanus</i> (Pocock, 1899)	Iran, Razavi Khorasan Province, Mashhad, Sarakhs Road, Robat-e Sharaf (31.32°N 60.58°E)	IR1a	HM567375	Mirshamsi et al., 2010
			IR1b	HM567374	Mirshamsi et al., 2010
			IR1c	HM567377	Mirshamsi et al., 2010
			IR1d	HM567376	Mirshamsi et al., 2010
2	<i>M. afghanus</i>	Turkmenistan, Akhal Province, Tejen District, Gurudandan Sands, 5 km W of Kazarma (37.30°N 60.25°E), 02 April 2002, leg. V. Fet & A. V. Gromov	TU1	AJ783590	Gantenbein et al., 2005
3	<i>M. afghanus</i>	Turkmenistan, Akhal Province, Tejen District, near Tejen Reservoir, ca. 12 km SSE of Gangaly (36.92°N 60.83°E), 03 April 2002, leg. V. Fet & A. V. Gromov	TU2a	AJ783583	Gantenbein et al., 2005
			TU2b	AJ783584	Gantenbein et al., 2005
4	<i>M. afghanus</i>	Turkmenistan, Mary Province, Serhetabat District, Serhetabat (38.28°N 62.40°E), 05 April 2002, leg. V. Fet & A. V. Gromov	TU3	AJ783582	Gantenbein et al., 2005
5	<i>M. afghanus</i>	Turkmenistan, Mary Province, Serhetabat District, Kushka River valley, right bank, ca. 1.5 km NNE of Chemenibit (35.47°N 62.40°E), 05 April 2002, leg. V. Fet & A. Gromov	TU4a	AJ783592	Gantenbein et al., 2005
			TU4b	AJ783593	Gantenbein et al., 2005
6	<i>M. afghanus</i>	Turkmenistan, Mary Province, Serhetabat District, Badkhyz Plateau, ca. 22.5 km NW of Chemenibit (35.6225°N 62.2547°E), 06 April 2002, leg. V. Fet & A. V. Gromov	TU5	AJ783587	Gantenbein et al., 2005
7	<i>M. afghanus</i>	Turkmenistan, Mary Province, Serhetabat District, Badkhyz Plateau, ca. 42 km NW of Chemenibit, Chainury Sands (35.47°N 61.83°E), 06 April 2002, leg. V. Fet & A. V. Gromov	TU6a	AJ783588	Gantenbein et al., 2005
			TU6b	AJ783589	Gantenbein et al., 2005
8	<i>M. afghanus</i>	Turkmenistan, Mary Province, Serhetabat District, Badkhyz Plateau, ca. 1 km ESE of Eroilanduz Depression (35.6758°N 61.8197°E), 07 April 2002, leg. V. Fet & A. V. Gromov	TU7	AJ783596	Gantenbein et al., 2005
9	<i>M. afghanus</i>	Turkmenistan, Mary Province, Serhetabat District, Badkhyz Nature Reserve, Kepele (35.8°N 61.53°E), 10 April 2002, leg. V. Fet & A. V. Gromov	TU8	AJ783586	Gantenbein et al., 2005
10	<i>M. afghanus</i>	Turkmenistan, Mary Province, Serhetabat District, Badkhyz Nature Reserve, SW of Akarcheshme, (35.7856°N 61.46°E), 10 April 2002, leg. V. Fet & A. V. Gromov	TU9	AJ783595	Gantenbein et al., 2005
11	<i>M. afghanus</i>	Turkmenistan, Akhal Province, Saragt District, Badkhyz Plateau, ca. 20 km WNW of Kala-i-Mor, Kaazly Sands (35.7108°N 62.3414°E), 11 April 2002, leg. V. Fet & A. V. Gromov,	TU10	AJ783581	Gantenbein et al., 2005
12	<i>M. afghanus</i>	Turkmenistan, Lebap Province, Charzhev District, East Karakum Desert, Repetek Nature Reserve (38.55°N 63.17°E), 15–18 April 2002, leg. V. Fet & A. V. Gromov	TU11a	AJ550707	Gantenbein et al., 2003, 2005
			TU11b	AJ783580	Gantenbein et al., 2005
13	<i>M. barszcevskii</i> (Birula, 1904)	Uzbekistan, Surxondaryo Province, Uzun District, W foothills of Babatag Mts, ca. 13 km ESE of Denau [=Denov], Argamchi Canyon (38.55°N 63.17°E), 30 April 2002, leg. V. Fet & A. V. Gromov	UZ1a	AJ550709	Gantenbein et al., 2003, 2005
			UZ1b	AJ783600	Gantenbein et al., 2005
14	<i>M. barszcevskii</i>	Uzbekistan, Surxondaryo Province, Babatag Mts. (38.17°N 68.10°E), 950 m a.s.l., 21 April 2019, leg. S. Zonstein	UZ2a-S1785	OM905075	unpublished
			UZ2b-S1786	OM905075	unpublished
15	<i>M. bogdoensis</i> (Birula, 1896)	Russia, Astrakhan Province, Akhtubinsky District, Bogdo	RU1	OM905077	unpublished

Table 16. Label data for ingroup specimen vouchers, labels used on phylogenetic tree, and GenBank accession numbers for samples used in the phylogenetic analysis.

No.	Ingroup Species	Label	Tree label	GenBank #	Reference
16	<i>M. bogdoensis</i>	Russia, <i>Saratov Province</i> , Krasnoarmeisky District, Nizhne-Bannovsky Natural Monument, Reserve (50°40'N, 45.38°E), 5 September 2015, leg. N. M. Poverennyi	RU2	OM905078	unpublished
17	<i>M. bogdoensis</i>	Russia, <i>Saratov Province</i> , Krasnoarmeisky District, Danilovsky Ravine (50.32°N, 45.43°E), 18 August 2017, leg. N. M. Poverennyi	RU3a	OM905079	unpublished
			RU3b	OM905080	unpublished
18	<i>M. bogdoensis</i>	Russia, <i>Volgograd Province</i> , Kamyshinsky District, Shcherbakovsky Natural Park (50.29°N, 45.41°E), 4 June 2017, leg. N. M. Poverennyi	RU4	OM905081	unpublished
19	<i>M. crucittii</i> sp. n.	Iran, <i>Khuzestan Province</i> , Ahwaz, Baghmalek (31.50°N, 49.90°E)	IR2a	HM567385	Mirshamsi et al., 2010
			IR2b	HM567386	Mirshamsi et al., 2010
			IR2c	HM567387	Mirshamsi et al., 2010
			IR2d	HM567388	Mirshamsi et al., 2010
20	<i>M. eupeus</i> (C.L. Koch, 1839)	Armenia, Erevan, Nubarashen District (40.0833°N, 44.55°E), leg. I. Martynenko	AR1	OM905083	unpublished
21	<i>M. eupeus</i>	Armenia, <i>Ararat Province</i> , Vedi, near Goravan (39.90°N, 77.73°E), 17–20 June 2013, leg. J. Rolčík	AR2-S460	OM905084	unpublished
22	<i>M. eupeus</i>	Armenia, <i>Syunik Province</i> , Meghri (38.88°N 46.25°E), 648 m a. s. l., 9–10 July 2018, leg. D. Hoferek	AR3a-S1476	OM905085	unpublished
			AR3b-S1478	OM905086	unpublished
23	<i>M. eupeus</i>	Iran, <i>West Azerbaijan Province</i> , Bazargan–Gerik Road (39.30°N 44.41°E)	IR3	HM567335	Mirshamsi et al., 2010
24	<i>M. eupeus</i>	Iran, <i>West Azerbaijan Province</i> , Bazargan, Oskanlu–Kalibar Road (38.95°N 47.17°E)	IR4	HM567336	Mirshamsi et al., 2010
25	<i>M. eupeus</i>	Turkey, <i>Kars Province</i> , Kars, Kars Castle, 1817 m a. s. l. (40.62°N, 43.09°E), leg. Ç. Altın	TR1-S362	OM905087	unpublished
26	<i>M. eupeus</i>	Turkey, <i>Van Province</i> , Başkale, Çamlık Village (37.95°N 44.08°E), 1889 m a. s. l., 22 July 2007, leg. H. Koç & A.V. Gromov	TR2-S1896	OM905088	unpublished
27	<i>M. farleyi</i> sp. n.	Iran, <i>Mazendaran Province</i> , 40 km S of Chalus, Kordichal (36.52°N 51.21°E)	IR5a	HM567352	Mirshamsi et al., 2010
			IR5b	HM567353	Mirshamsi et al., 2010
			IR5c	HM567354	Mirshamsi et al., 2010
			IR5d	HM567355	Mirshamsi et al., 2010
			IR5e	HM567356	Mirshamsi et al., 2010
28	<i>M. fomichevi</i> sp. n.	Uzbekistan, <i>Surxondaryo Province</i> , Uzun District, E slope of Babatag Mts., 7 km W of Okmachit (38.0275°N 68.245°E), 05 May 2002, leg. V. Fet & A. Gromov	UZ3	AJ783597	Gantenbein et al., 2005
29	<i>M. galinae</i> sp. n.	Turkmenistan, <i>Akhal Province</i> , Gyavers District, ca 1 km SSE of Berzengi, N foothills of Central Kopetdag Mts. (37.87°N 58.39°E), 30 March 2002, leg. A. V. Gromov	TU12	AJ783591	Gantenbein et al., 2005
30	<i>M. galinae</i> sp. n.	Turkmenistan, <i>Akhal Province</i> , E of Chagaly (38.13°N 58.48°E), 31 March 2002, leg. V. Fet & A. V. Gromov	TU13	AJ783585	Gantenbein et al., 2005
31	<i>M. haarlovi</i> (Vachon, 1958)	Afghanistan, <i>Uruzgan Province</i> , Tarin Kowt (32.63°N, 65.87°E), 1300 m a.s.l.	AF-S52	OM905089	unpublished
32	<i>M. kaftani</i> sp. n.	Iran, <i>Razavi Khorasan Province</i> , Gonabad County, 10 km NE of Kakhk (34.19°N 58.75°E)	IR6a	HM567371	Mirshamsi et al., 2010
			IR6b	HM567390	Mirshamsi et al., 2010
			IR6c	HM567391	Mirshamsi et al., 2010
			IR6d	HM567392	Mirshamsi et al., 2010
			IR6e	HM567393	Mirshamsi et al., 2010
33	<i>M. kirmanensis</i> (Birula, 1900)	Iran, <i>Kerman Province</i> , vicinity of Jiroft (28.60°N 57°71'E)	IR7	HM567383	Mirshamsi et al., 2010

Table 16. Label data for ingroup specimen vouchers, labels used on phylogenetic tree, and GenBank accession numbers for samples used in the phylogenetic analysis.

No.	Ingroup Species	Label	Tree label	GenBank #	Reference
34	<i>M. kirmanensis</i>	Iran, <i>Sistan & Baluchistan Province</i> , Bampur, Bampur River (27.17°N 60.46°E)	IR8a	HM567381	Mirshamsi et al., 2010
			IR8b	HM567368	Mirshamsi et al., 2010
			IR8c	HM567382	Mirshamsi et al., 2010
35	<i>M. macmahoni</i> (Pocock, 1900)	Pakistan (no exact locality)	PA-S1947	OM905090	unpublished
36	<i>M. mesopotamicus</i> (Penther, 1912)	Turkey, <i>Kahramanmaraş Province</i> , Türkoğlu, Evri Village (37.27°N 37.13°E), 720 m a. s. l., 23 June 2007, leg. E. A. Yağmur	TR2-S1897	OM905091	unpublished
37	<i>M. mesopotamicus</i>	Turkey, <i>Mardin Province</i> , Yesilli (37.33°N, 40.81°E), 12 May 2013, leg. H. Koç	TR3-S370	n/a	In press
38	<i>M. navidpouri</i> sp. n.	Iran, <i>Sistan & Baluchistan Province</i> , Khash–Zahedan road, 90 km S of Zahedan (28.74°N 60.77°E)	IR9	HM567369	Mirshamsi et al., 2010
39	<i>M. persicus</i> (Pocock, 1899)	Iran, <i>West Azerbaijan Province</i> , Buralan–Poldasht Road (39.30°N 44.92°E)	IR10	HM567337	Mirshamsi et al., 2010
40	<i>M. philippovitschi</i> (Birula, 1905)	Iran, <i>Mazendaran Province</i> , Kiasar, Savasareh Village (36.23°N 53.54°E)	IR11a	HM567348	Mirshamsi et al., 2010
			IR11b	HM567349	Mirshamsi et al., 2010
			IR11c	HM567350	Mirshamsi et al., 2010
			IR11d	HM567347	Mirshamsi et al., 2010
			IR11e	HM567346	Mirshamsi et al., 2010
41	<i>M. phillipsii</i> (Pocock, 1900)	Iran, <i>Fars Province</i> , Kenar Tapeh, Kazeroon Road, (29.58°N 51.51°E)	IR12a	HM567338	Mirshamsi et al., 2010
			IR12b	HM567339	Mirshamsi et al., 2010
42	<i>M. phillipsii</i>	Iran, <i>Fars Province</i> , Ghir-o-Karzin (Qiro Karzin) (28.32°N 52.92°E)	IR13a	HM567340	Mirshamsi et al., 2010
			IR13b	HM567341	Mirshamsi et al., 2010
			IR13c	HM567343	Mirshamsi et al., 2010
			IR13d	HM567342	Mirshamsi et al., 2010
43	<i>M. rahsenae</i> sp. n.	Turkey, <i>Erzincan Province</i> , Erzincan Merkez District, 1 km from Günebank Village, August 2014 (39.74°N, 39.62°E), leg. Ç. Altın	TR4-S364	OM905092	unpublished
44	<i>M. thersites</i> (C.L. Koch, 1839)	China, Gobi Desert (no exact locality), 30 July 1998, leg. A. Davidson	CH	AJ550700	Gantenbein et al., 2003, 2005
45	<i>M. thersites</i>	Kazakhstan, <i>Almaty Province</i> , Balkhash District, Bakanas (44.82°N 76.27°E), 02–05 June 2000, leg. A.V. Gromov	KZ1	AJ550704	Gantenbein et al., 2003, 2005
46	<i>M. thersites</i>	Kazakhstan, <i>Kyzylorda Province</i> , Shiili (Chiili) District, ca. 2.5 km NW of Baigakum (44.34°N 66.45°E), 25 May 2002, leg. V. Fet & A. V. Gromov	KZ2a	AJ550705	Gantenbein et al., 2003, 2005
			KZ2b	AJ783574	Gantenbein et al., 2005
47	<i>M. thersites</i>	Kazakhstan, <i>Kyzylorda Province</i> , Kairaktau Mts., 43.94°N 67.68°E, leg. D. Shovkun	KZ3	OM905093	unpublished
48	<i>M. thersites</i>	Kazakhstan, <i>Kyzylorda Province</i> , Kyzylkol Lake, 43°78'N 69.51°E, leg. D. Shovkun	KZ4a	OM905094	unpublished
			KZ4b	OM905095	unpublished
49	<i>M. thersites</i>	Kazakhstan, <i>Kyzylorda Province</i> , Syrdarya River Valley, 44.41°N 66.27°E, leg. D. Shovkun	KZ5	OM905096	unpublished
50	<i>M. thersites</i>	Kazakhstan, <i>Turkistan Province</i> , Turkistan District, SW slope of Karatau Mts., ca. 9 km SW of Achisai (43.48°N 68.84°E), 27 May 2002, leg. V. Fet & A. V. Gromov,	KZ6	AJ550706	Gantenbein et al., 2003, 2005
51	<i>M. thersites</i>	Kazakhstan, <i>Turkistan Province</i> , Turkistan District, Turkistan (43.32°N 68.23°E), 27 May 2002, leg. V. Fet & A. V. Gromov	KZ7	AJ783578	Gantenbein et al., 2005
52	<i>M. thersites</i>	Kazakhstan, <i>Turkistan Province</i> , Turkistan District, Karatau Mts., Turlan Pass (43.58°N 68.95°E), 27 May 2002, leg. V. Fet & A. V. Gromov	KZ8	AJ783576	Gantenbein et al., 2005

Table 16. Label data for ingroup specimen vouchers, labels used on phylogenetic tree, and GenBank accession numbers for samples used in the phylogenetic analysis.

No.	Ingroup Species	Label	Tree label	GenBank #	Reference
53	<i>M. thersites</i>	Kazakhstan, <i>Zhambyl Province</i> , Moyinkum Sands, SW of Lake Balkhash (44.17°N 71.12°E), 28 May 2002, leg. S. V. Morozov & A. Gromov	KZ9	AJ783577	Gantenbein et al., 2005
54	<i>M. thersites</i>	Kazakhstan, <i>Zhambyl Province</i> , Taraz, 43°02'02.1"N 71°03'34.8"E (43.03°N 71.06°E), 12 May 2021, leg. R. Garaev	KZ10	OM905097	unpublished
55	<i>M. thersites</i>	Kyrgyzstan, <i>Talas Province</i> , Kara-Buura District, 15 km S of Kyzyl-Adyr, 42°29'12.7"N 71°31'32.5"E (42.48°N 71.52°E), 1392 m a. s. l., 14 July 2021, leg. W. Grosser.	KY1a-S1950	OM905098	unpublished
			KY1b-S1951	OM905099	unpublished
56	<i>M. thersites</i>	Mongolia (no exact locality)	MO	KC142041	Shi et al., 2013
57	<i>M. turcicus</i> sp. n.	Turkey, <i>Konya Province</i> , Karapınar, Meke Salt Lake (37.68°N 33.63°E), 1033 m a. s. l., 9 July 2021, leg. E. A. Yağmur & Ö. Sipanhioğlu	TR5-S1956	OM905100	unpublished
58	<i>M. vesiculatus</i> (Pocock, 1899)	Iran: <i>Esfahan Province</i> : Kashan, Niasar Road (33.98°N 51.34°E)	IR14	HM567380	Mirshamsi et al., 2010
59	<i>M. vignolii</i> sp. n.	Iran, <i>Yazd Province</i> , Mehriz–Marvast Road (31.11°N 54.21°E)	IR15	HM567370	Mirshamsi et al., 2010
60	<i>M. yagmuri</i> sp. n.	Turkey, <i>Hakkari Province</i> , Berçelan Plateau, 4 km W of Konak Village (37.63°N 43.75°E), 2660 m a. s. l., 31 July 2021, leg. M. Erdek	TR6a-S1953b	OM905101	unpublished
			TR6b-S1953c	OM905102	unpublished
61	<i>M. zarudnyi</i> Novruzov et al., 2022	Azerbaijan, Absheron Peninsula, Shuvalan (40.45°N 49.71°E), 18 June 2021, leg. N. Novruzov	AZ- S2060	OM905103	unpublished
62	<i>M. zonsteini</i> sp. n.	Uzbekistan, <i>Navoi Province</i> , Kizylkum Desert, 18 April 1998, leg. A. V. Gromov	UZ4	AJ550708	Gantenbein et al., 2003, 2005

Table 16. Label data for ingroup specimen vouchers, labels used on phylogenetic tree, and GenBank accession numbers for samples used in the phylogenetic analysis.

Key for *Mesobuthus* species

1. Metasoma III length to depth ratio 1.02–1.45 2
 - Metasoma III length to depth ratio 1.50–1.90. 3
2. Anal lobe divided into two parts (Fig. 8). 6
 - Anal lobe divided into three or four parts (Fig. 369). . 13
3. Central lateral and posterior lateral carinae of carapace joined to form a continuous linear series of granules to posterior margin (Fig. 1026).. 4
 - Central lateral and posterior lateral carinae of carapace not joined to form a continuous linear series of granules to posterior margin (Fig. 559). *M. macmahoni*
4. Telson bulbous at least in females; Telson length to depth ratio is 2.20–2.45 (female) to 2.39–2.75 (male). Male chela length to width ratio 3.6–4. 5
 - Telson elongate, telson length to depth ratio is 2.85–3.05 (female) to 3.00–3.15 (male). Male chela length to width ratio 4.5–4.8. *M. navidpouri* sp. n.
5. Telson bulbous in male; telson length to depth ratio is 2.39–2.52 in male. Aculeus shorter than vesicle (Fig. 998). *M. vesiculatus*
 - Telson with elongate aculeus in males; telson length to depth ratio is 2.65–2.75 in males. Aculeus longer or long as vesicle (Fig. 1038). *M. vignolii* sp. n.
6. Metasoma IV with lateromedian carina absent, incomplete or smooth, at least in male. 7
 - Metasoma IV in male with lateromedian carina present, consisting of large granules. 9
7. Pedipalp chela length/width ratio higher than 3.1 in male. 10
 - Pedipalp chela length/width ratio lower than 3.0 in male. 8
8. Telson bulbous. Telson length to depth ratio is 2.2–2.31 in both sexes. Carapace and tergites yellowish brown, black pigmented. *M. fomichevi* sp. n.
 - Telson rather elongate. Telson length to depth ratio is 2.44–2.60 in both sexes. Entire body usually light yellow. *M. afghanus*
9. Pedipalp chela length to width ratio in female 2.98. Dentate margin of pedipalp-chela movable finger with distinct denticles divided usually into 12 linear rows. Pectinal teeth number 28–29 in male, 24–25 in female. *M. zonsteini* sp. n.
 - Pedipalp chela length to width ratio in female 3.2–3.8. Dentate margin of pedipalp-chela movable finger with distinct denticles divided usually into 11 linear rows. Pectinal teeth number 20–22 in male, 19–21 in female. *M. galinae* sp. n.

10. Intercarinal surfaces on metasoma I laterally smooth. *M. thersites*
 – Intercarinal surfaces on metasoma I laterally granulate or bumpy at least in male. 12
11. Telson elongated in both sexes. Telson length to depth ratio more than 2.65 in both sexes. *M. barszczewskii*
 – Telson elongated in male and bulbous in female. Telson length to depth ratio in female less than 2.50..... *M. bogdoensis*
12. Pedipalps femur smooth. *M. bogdoensis*
 – Pedipalps femur is finely granulated. *M. zarudnyi*
13. Metasoma IV length to depth ratio 1.45–1.90. 15
 – Metasoma IV length to depth ratio 1.30–1.42. 14
14. Intercarinal surfaces on metasomal segments ventrally and laterally granulated, more in female. Occurs in Iran. *M. philippovitschi*
 – Intercarinal surfaces on metasoma smooth. Occurs in Afghanistan and Pakistan. *M. haarlovi*
15. Metasoma hirsute, with long setae, often densely (Figs. 808–813). 16
 – Metasoma rather hairless, only with several setae (Figs. 490–495). 18
16. Telson elongate. Telson length to depth ratio 2.55 (male) to 2.65 (female). *M. phillipsii*
 – Telson rather bulbous. Telson length to depth ratio 2.20–2.50 in both sexes. 17
17. Metasoma hirsute, with dense long setae. Sternite VII medially smooth, with 4 smooth carinae. Intercarinal surfaces on metasomal segments smooth. *M. crucittii* sp. n.
 – Metasoma hirsute, with long setae but not densely. Sternite VII finely granulated on margins, with 4 well marked granulated carinae. Intercarinal surfaces on metasoma I laterally finely granulated. *M. mirshamsii* sp. n.
18. Intercarinal surfaces on all metasomal segments finely granulated in female and at least sparsely on metasoma I in male; anal lobe mostly divided into four parts. *M. kirmanensis*
 – Intercarinal surfaces on metasoma usually smooth. 19
19. Basitarsus of leg III with 12–16 retroinferior macrosetae (Fig. 438). *M. kaftani* sp. n.
 – Basitarsus of leg III with 5–10 retroinferior macrosetae (Fig. 1118). 20
20. Sternite VII usually bumpy and rudely granulated. Occurs in the northwestern Turkey (see Fig. 1156). *M. yagmuri* Kovařík & Fet, sp. n.
 – Sternite VII smooth. Does not occur in the northwestern Turkey (see Fig. 1156). 21
21. Telson rather elongate. Telson length to depth ratio 2.60–2.80 in female. 22
 – Telson rather bulbous, mainly in female. Telson length to depth ratio 2.0–2.55 in female. 27
22. Carapace and tergites reddish brown, with black pigmentation. 23
 – Carapace and tergites yellow, without black pigmentation. *M. marusiki* sp. n.
23. Metasomal ventral carinae usually dark colored. 24
 – Metasomal ventral carinae usually without pigmentation. *M. iranensis*
24. Metasoma IV length to width ratio in male above 1.70. Total length of adult males 28–35 mm. *M. birulai* sp. n.
 – Metasoma IV length to width ratio in male less than 1.70. Total length of adult males 35–50 mm. 25
25. Genital operculum in female large and wide. Found in Iran (Alborz, Mazandaran, Semnan, and Tehran Provinces, see Fig. 1157). *M. farleyi* sp. n.
 – Genital operculum in female usually not as large and wide. Found in other areas (see Fig. 1157). 26
26. Tibial spur on leg III moderate, on leg IV usually strong. Tergites III–IV with straight median carina and two oblique marginal carinae *M. persicus*
 – Tibial spur on both legs III and IV moderate. Tergites III–IV with three straight, parallel carinae. *M. eupeus*
27. Telson length to depth ratio in female 2.55–2.60. *M. turcicus* sp. n.
 – Telson length to depth ratio in female 2.10–2.50 28
28. Pedipalp chela length/width ratio 3.2–3.45 in both sexes. Telson bulbous in female. Telson length to depth ratio 2.10–2.40 in female. *M. mesopotamicus*
 – Pedipalp chela length/width ratio 3.5–3.7 in both sexes. Telson rather bulbous in female. Telson length to depth ratio 2.40–2.50 in female. *M. rahsenae* sp. n.

NOTE: this key is intended only for general orientation purposes along with geographic references to the known range of a species (see Figs. 1155–1158). The listed morphological characters could vary within species, and presence of cryptic species in *Mesobuthus* makes it difficult at this moment to present a full set of mutually exclusive characters.

Complex	Species	Median Crown Age, Mya	Median Stem Age, Mya
		[95% HPD]	[95% HPD]
“phillipsii complex”	<i>M. navidpouri</i> sp. n.	NA	10.07 [4.63–16.82]
(Median crown age: 10.07 Mya)	<i>M. vesiculatus</i>	NA	3.17 [0.71–6.12]
(Median stem age: 15.37 Mya)	<i>M. vignolii</i> sp. n.	NA	3.17 [0.71–6.12]
	<i>M. crucittii</i> sp. n.	1.09 [0.22–2.38]	4.49 [1.82–7.90]
	<i>M. phillipsii</i>	2.36 [0.74–4.40]	4.49 [1.82–7.90]
“kirmanensis complex”	<i>M. mesopotamicus</i>	1.00 [0.04–2.63]	11.29 [5.18–17.57]
(Median crown age: 11.29 Mya)	<i>M. haarlovi</i>	NA	4.63 [1.42–8.32]
(Median stem age: 13.73 Mya)	<i>M. macmahoni</i>	NA	4.63 [1.42–8.32]
	<i>M. kirmanensis</i>	2.71 [0.67–5.26]	8.13 [3.7–13.24]
“eupeus complex”	<i>M. philippovitschi</i>	0.68 [0.04–1.71]	6.22 [2.30–10.66]
(Median crown age: 10.4 Mya)	<i>M. galinae</i> sp. n.	2.04 [0.34–4.25]	6.22 [2.30–10.66]
(Median stem age: 12.02 Mya)	<i>M. yagmuri</i> sp. n.	0.28 [0.00–0.95]	8.17 [4.20–12.90]
	<i>M. rahsenae</i> sp. n.	NA	3.19 [0.71–5.88]
	<i>M. zarudnyi</i>	NA	3.19 [0.71–5.88]
	<i>M. turcicus</i> sp. n.	NA	3.21 [1.01–5.64]
	<i>M. periscus</i>	NA	3.21 [1.01–5.64]
	<i>M. eupeus</i>	3.66 [1.63–6.17]	4.62 [2.26–7.54]
“thersites complex”	<i>M. barszczewskii</i>	3.15 [0.96–5.87]	6.37 [2.8–10.42]
(Median crown age: 8.31 Mya)	<i>M. bodgoensis</i>	0.97 [0.13–2.26]	6.37 [2.8–10.42]
(Median stem age: 10.69 Mya)	<i>M. fomichevi</i> sp. n.	NA	6.25 [2.98–10.14]
	<i>M. zonsteini</i> sp. n.	4.55 [2.12–7.61]	4.55 [2.12–7.61]
	<i>M. thersites</i>	2.80 [1.26–4.76]	4.55 [2.12–7.61]
“afghanus complex”	<i>M. kaftani</i> sp. n.	2.18 [0.63–4.32]	6.25 [2.76–10.38]
(6.25 to 3.98 Mya)	<i>M. farleyi</i> sp. n.	1.44 [0.30–3.01]	6.25 [2.76–10.38]
	<i>M. afghanus</i>	3.98 [1.74–6.89]	8.61 [4.48–13.77]

Table 17. Crown and stem age estimates for *Mesobuthus* species.

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References

- ADILARDI, R. S., A. A. OJANGUREN-AFFILASTRO, D. A. MARTÍ & L. M. MOLA. 2020. Chromosome puzzle in the southernmost populations of the medically important scorpion *Tityus bahiensis* (Perty 1833) (Buthidae), a polymorphic species with striking structural rearrangements. *Zoologischer Anzeiger*, 288: 139–150.
- AITCHISON, J. E. T. 1888. The botany of the Afghan Delimitation Commission. *Transactions of Linnean Society of London, Botany*, 3(1): 1–139.
- ANIKIN, V. V. 1997. [Rare species of Insecta and Arachnida in marginal structures of the steppe zone of the Saratov Province]. Pp. 28–29 in: *Problemy izucheniia kraevykh struktur biotsenozov* [Problems of study of marginal structures]. Saratov (in Russian).
- ANIKIN, V. V. 2006. [Rare and endangered species of terrestrial invertebrates in the Saratov Province]. *Povolzhskii ekologicheskii zhurnal* [Povolzhye Ecological Journal], *Vyp. Spets.* [Special Issue]: 47–56 (in Russian).
- ANIKIN, V. V. & E. A. KIREEV. 1998. [Ecological-floristic description of the habitats of some rare species of insects and arachnids of the Lower Volga region]. Pp. 106–107 in: *Materials of the International Research-Practical Conference "Problemy sokhraneniia bioraznobraziia aridnykh regionov Rossii"* [Problems of Conservation of Biodiversity of the Arid Regions of Russia]. Volgograd, 11–17 September 1998 (in Russian).
- ANIKIN, V. V. & N. M. POVERENNYI. 2017. [Establishing the taxonomic status of scorpions of the genus *Mesobuthus* (Arachnida: Scorpiones) from the Lower Povolzhye based on coxI DNA sequence analysis]. *Entomologicheskii i parazitologicheskii issledovaniia v Povolzhye* [Entomological and Parasitological Research in Povolzhye], 14: 20–24 (in Russian).
- ANIKIN, V. V. & A. S. SAZHNEV. 2016. [Terrestrial invertebrate species recommended for the new edition of the Red Data Book of the Saratov Province]. *Izvestiia Saratovskogo universiteta. Nov. ser. Khimiia. Biologiia. Ekologiia* [Proceedings of the Saratov University. New Ser. Chemistry, Biology, Ecology], 16(3): 313–317 (in Russian).
- ATAMURADOV, K. I. 1994. Paleogeography of Turkmenistan. Pp. 49–64 in: Fet, V. & K. I. Atamuradov (eds), *Biogeography and Ecology of Turkmenistan*. Kluwer Academic Publishers, Dordrecht.
- BARAHOEI, H., S. NAVIDPOUR, M. ALIABADIAN, R. SIAHSARVIE & O. MIRSHAMSI. 2020. Scorpions of Iran (Arachnida: Scorpiones): Annotated checklist, delta database and identification key. *Journal of Insect Biodiversity and Systematics*, 6(4): 375–474.
- BIRULA, A. A. 1896. Miscellanea scorpologica. I. Zur Synonymie der russischen Skorpione. *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Petersbourg*, 1: 229–245.
- BIRULA, A. A. 1900a. Beiträge zur Kenntniss der Scorpionenfauna Ost-Persiens. (1. Beitrag). *Bulletin de l'Académie Impériale des Sciences de St.-Petersbourg*, (5), 12(4): 355–375.
- BIRULA, A. A. 1900b. Scorpiones mediterranei Musei Zoologici mosquensis. *Izvestiya Imperatorskago Obshchestva Lyubitelei Prirody, Istorii, Antropologii i Etnografii* (Societas Caesarea Amicorum Rerum Naturalium, Anthropologiae Ethnographiae Universitatis Moscoviensis), 98, 3(1): 8–20 (in Russian).
- BIRULA, A. A. 1903. Beiträge zur Kenntniss der Scorpionenfauna Ost-Persiens. (Zweiter Beitrag). *Bulletin de l'Académie Impériale des Sciences de St.-Petersbourg*, (5), 19(2): 67–80.
- BIRULA, A. A. 1904a. Miscellanea scorpologica. VI. Ueber die *Buthus*-Arten des Centralasiens nebst ihrer geographischen Verbreitung. *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Petersbourg*, 9: 20–27.

- BIRULA, A. A. 1904b. Miscellanea scorpiologica. VII. Synopsis der russischen Skorpione. *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Petersbourg*, 9: 28–38.
- BIRULA, A. A. 1905a. Beiträge zur Kenntniss der Skorpionenfauna Persiens (Dritter Beitrag). *Bulletin de l'Académie Impériale des Sciences de St.-Petersbourg*, 23: 119–148.
- BIRULA, A. A. 1905b. Miscellanea Scorpiologica. VIII. Bemerkung ueber die Skorpione-Sammlung des Kaukasischer Museum zu Tiflis. *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Petersbourg*, 10: 119–131.
- BIRULA, A. A. 1911a. Arachnologische Beiträge. I. Zur Skorpionen- und Solifugen-Fauna des Chinesischen Reichs. *Revue Russe d'Entomologie*, 11: 195–201.
- BIRULA, A. A. 1911b. Miscellanea scorpiologica. IX. Ein Beitrag zur Kenntniss der Skorpionenfauna des Russischen Reiches und der angrenzender Länder. *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St. Pétersbourg*, 16: 161–179.
- BIRULA, A. A. 1912. Ein Beitrag zur Kenntniss der Skorpionenfauna des Kaukasusländer. *Izvestiya Kavkazskago muzeya (Mitteilungen des Kaukasischen Museums)*, 7(1): 117–127.
- [BIRULA, A. A.] BYALYNITSKII-BIRULYA, A. A. 1917a. Arachnoidea Arthrogastra Caucasia. Pars I. Scorpiones. *Zapiski Kavkazskago Muzeya (Mémoires du Musée du Caucase)*, Tiflis: Imprimerie de la Chancellerie du Comité pour la Transcaucasie, A(5), 253 pp. (in Russian; published August 1917) (in Russian). English translation: Byalynitskii-Birulya, A. A. 1964. *Arthrogastric Arachnids of Caucasia. 1. Scorpions*. Jerusalem: Israel Program for Scientific Translations, 170 pp.
- [BIRULA, A. A.] BYALYNITSKII-BIRULYA, A. A. 1917b. *Faune de la Russie et des pays limitrophes fondée principalement sur les collections du Musée Zoologique de l'Académie des Sciences de Russie. Arachnides (Arachnoidea)*. Petrograd, 1(1): xx, 227 (in Russian). English translation: Byalynitskii-Birulya, A. A. 1965. *Fauna of Russia and Adjacent Countries. Arachnoidea. Vol. I. Scorpions*. Jerusalem: Israel Program for Scientific Translations, xix, 154 pp.
- BIRULA, A. A. 1918. Miscellanea scorpiologica. XI. (Matériaux pour servir à la scorpiofaune de la Mésopotamie inférieure, du Kurdistan et de la Perse septentrionale). *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de Russie*, 27: 1–44 (in Russian).
- BIRULA, A. A. 1925. Skorpiologische Beiträge. 10. Zur geographischen Verbreitung zweier weitverbreiteter Skorpionen-Arten Palaearcticums. *Zoologischer Anzeiger*, 63: 62–67.
- BIRULA, A. A. 1927. Zoologische Ergebnisse der von P. K. Kozlov in den Jahren 1925–1926 ausgeführten Expedition nach der Mongolei. I. Skorpione und Solifugen. *Annuaire du Musée Zoologique de l'Académie des Sciences d'URSS*, 28: 201–218.
- BIRULA, A. A. 1928. K voprosu o nizhnem techenii Volgi kak zoogeograficheskoi granitse [On the Lower Volga as a zoogeographic border]. *Doklady Akademii Nauk SSSR* 1928: 338–340 (in Russian).
- BRAGINA, T. M. & E. A. YAĞMUR. 2014. New data on the distribution of *Mesobuthus eupeus thersites* (C.L. Koch, 1839) (Scorpiones: Buthidae) in Central Kazakhstan. *Serket*, 14(1): 1–5.
- BRYSON, R. W., L. PRENDINI, W. E. SAVARY & P. B. PEARMAN. 2014. Caves as microrefugia: Pleistocene phylogeography of the troglomorphic North American scorpion *Pseudouroctonus reddelli*. *BMC Evolutionary Biology*, 14(1): 1–17.
- CRUCITTI, P. & D. CICUZZA. 2000. Gli Scorpioni del Parco Nazionale del Monte Nemrut (Turchia sud-orientale) (Scorpiones). *Memorie della Società entomologica italiana*, 78(2): 275–294.
- CRUCITTI, P. & D. CICUZZA. 2001a. Ricerche bio-ecologiche su *Mesobuthus eupeus* del Monte Ararat (Turchia orientale) (Scorpiones: Buthidae). *Boll. Soc. Entomol. Ital.* 133(1): 3–11.
- CRUCITTI, P. & D. CICUZZA. 2001b. Scorpions of Anatolia: Ecological patterns. Pp. 225–234 in Fet, V. & P. A. Selden (eds.). *Scorpions 2001. In Memoriam Gary A. Polis*. Burnham Beeches, Bucks: British Arachnological Society.
- CRUCITTI, P. & V. VIGNOLI. 2002. Gli Scorpioni (Scorpiones) dell'Anatolia sud-orientale (Turchia). *Bolletino del Museo Regionale di Scienze Naturali, Torino*, 19(2): 433–480.
- DERMITZAKIS, D. M. & D. J. PAPANIKOLAOU. 1981. Paleogeography and geodynamics of the Aegean region during the Neogene. *Annales Géologique des Pays Hellénique*, 30: 245–289.
- DRUMMOND, A. J., M. A. SUCHARD, D. XIE & A. RAMBAUT. 2012. Bayesian phylogenetics with BEAUti and the BEAST 1.7. *Molecular Biology and Evolution*, 29: 1969–1973.

- EDGAR, R. C. 2004. MUSCLE: multiple sequence alignment with high accuracy and high throughput. *Nucleic Acids Research*, 32: 1792–1797.
- FET, V. 1989. A catalogue of scorpions (Chelicerata: Scorpiones) of the USSR. *Rivista del Museo Civico di Scienze Naturali "Enrico Caffi"*, 13(1988): 73–171.
- FET, V. 1994. Fauna and zoogeography of scorpions (Arachnida: Scorpiones) in Turkmenistan. Pp. 525–534 in Fet, V. & K. I. Atamuradov (eds.). *Biogeography and Ecology of Turkmenistan. Monographiae Biologicae* 72. Dordrecht: Kluwer Academic Publishers.
- FET, V. 2010. Scorpions of Europe. *Acta Zoologica Bulgarica*, 62: 3–12.
- FET, V., B. GANTENBEIN, A. V. GROMOV, G. LOWE & W. R. LOURENÇO. 2003. The first molecular phylogeny of Buthidae (Scorpiones). *Euscorpius*, 4: 1–10.
- FET, V., F. KOVAŘÍK, B. GANTENBEIN & M. R. GRAHAM. 2021. Three new cryptic species of *Olivierus* (Scorpiones: Buthidae) from Kazakhstan and Uzbekistan. *Zootaxa*, 5006(1): 54–72.
- FET, V., F. KOVAŘÍK, B. GANTENBEIN, R. C. KAISER, A. K. STEWART & M. R. GRAHAM. 2018. Revision of the *Mesobuthus caucasicus* complex from Central Asia, with descriptions of six new species (Scorpiones: Buthidae). *Euscorpius*, 255: 1–77.
- FET, V. & G. LOWE. 2000. Family Buthidae. Pp. 54–286 in Fet, V., W. D. Sissom, G. Lowe & M. E. Braunwalder (eds.). *Catalog of the Scorpions of the World (1758–1998)*. New York: New York Entomological Society, 690 pp.
- FET, V., M. E. SOLEGLAD & S. L. ZONSTEIN. 2011. The genus *Akrav* Levy, 2007 (Scorpiones: Akravidae) revisited. *Euscorpius*, 134: 1–49.
- FET, V., M. E. SOLEGLAD, S. L. ZONSTEIN, I. NAAMAN, S. LUBATON, B. LANGFORD & A. FRUMKIN. 2017. The second record of a relict *Akrav israchanani* Levy, 2007 (Scorpiones: Akravidae) from Levana Cave, Israel. *Euscorpius*, 247: 1–12.
- FOMICHEV, A. A. 2011. A new locality of *Mesobuthus eupeus thersites* (C. L. Koch, 1839) (Scorpiones: Buthidae) in East Kazakhstan. *Euscorpius*, 136: 1–3.
- GANTENBEIN, B., V. FET, I. A. GANTENBEIN-RITTER & F. BALLOUX. 2005. Evidence for recombination in scorpion mitochondrial DNA (Scorpiones: Buthidae). *Proceedings of the Royal Society: Biological Sciences*, 272(1564): 697–704.
- GANTENBEIN, B., V. FET & A. V. GROMOV. 2003. The first DNA phylogeny of four species of *Mesobuthus* Vachon, 1950 (Scorpiones: Buthidae) from Eurasia. *Journal of Arachnology*, 31: 412–420.
- GHARAKHLOO, M. M., S. A. HEYDARABAD & E. A. YAĞMUR. 2018. The scorpion fauna of West Azerbaijan Province in Iran (Arachnida: Scorpiones). *Biharean Biologist*, 12(2): 84–87.
- GRAHAM, M. R., E. A. MYERS, R. KAISER & V. FET. 2019. Cryptic species and co-diversification in sand scorpions from the Karakum and Kyzylkum deserts of Central Asia. *Zoologica Scripta*, 48(6): 801–812.
- GRAHAM, M. R., V. OLÁH-HEMMINGS & V. FET. 2012. Phylogeography of co-distributed dune scorpions identifies the Amu Darya River as a long-standing component of Central Asian biogeography (Scorpiones: Buthidae). *Zoology in the Middle East*, 55: 95–110.
- GRAHAM, M. R., D. A. WOOD, J. A. HENAULT, Z. J. VALOIS & P. E. CUSHING. 2017. Ancient lakes, Pleistocene climates and river avulsions structure the phylogeography of a large but little-known rock scorpion from the Mojave and Sonoran deserts. *Biological Journal of the Linnean Society*, 122(1): 133–146.
- GROMOV, A. V. 2001. The northern boundary of scorpions in Central Asia. Pp. 301–306 in Fet, V. & P. A. Selden (eds.). *Scorpions 2001. In Memoriam Gary A. Polis*. Burnham Beeches, Bucks: British Arachnological Society.
- GROMOV, A. V. & Ye. Ye. KOPDYKBAEV. 1994. [The fauna of the scorpions and solpugids (Arachnida: Scorpiones, Solifugae) in Kazakhstan]. *Selevinia*, 2(2): 19–23 (in Russian).
- HEDDERGOTT, M., M. STUBBE, W. STUBBE, P. STEINBACH & A. STUBBE. 2016. Geographical distribution of the genus *Mesobuthus* (Scorpiones: Buthidae) in Mongolia. *Erforschung biologischer Ressourcen der Mongolei / Exploration into the Biological Resources of Mongolia*, 13: 147–164.
- HUSSEN, F. S. & S. T. AHMED. 2020. New data of scorpion fauna, include two new records with identification key of scorpion species (Arachnida: Scorpiones) in Iraq. *Plant Archives*, 20 (2): 6711–6725.
- KACHEL, H. S., A. M. AL-KHAZALI, F. S. HUSSEN & E. A. YAĞMUR. 2020. Checklist and review of the scorpion fauna of Iraq (Arachnida: Scorpiones). *Arachnologische Mitteilungen*, 61(1): 1–10.

- KALTSAS, D., I. STATHI & V. FET. 2008. Scorpions of the Eastern Mediterranean. Pp. 209–246 in Makarov, S.E. & R.N. Dimitrijević (eds.). *Advances in Arachnology and Developmental Biology. Papers dedicated to Prof. Dr. Božidar Čurčić*. Vienna–Belgrade–Sofia, 517 pp.
- KARATAŞ, AY. & M. ÇOLAK. 2005. Scorpions of Gaziantep Province, Turkey (Arachnida: Scorpiones). *Euscorpius*, 30: 1–7.
- KARATAŞ, A., V. FET & M. M. GHARKHELOO. 2012. On the type locality of *Mesobuthus vesiculatus* (Pocock, 1899) (Scorpiones: Buthidae). *Euscorpius*, 147: 1–3.
- KARATAŞ, A. & M. M. GHARKHELOO. 2012. Redescription of *Mesobuthus vesiculatus* (Pocock, 1899) (Scorpiones: Buthidae) based on specimens from Iran. *Turkish Journal of Zoology*, 36(5): 576–584.
- KARATAŞ, A., M. M. GHARKHELOO & M. UÇAK. 2012. Contribution to the distribution of the scorpions of Iran. *Zoology in the Middle East*, 55: 111–120.
- KARATAŞ, A. & A. KARATAŞ. 2001. First record of *Mesobuthus eupeus* (C. L. Koch, 1839) from central Anatolia (Scorpiones: Buthidae). Pp. 297–299 in Fet, V. & P. A. Selden (eds.) *Scorpions 2001. In Memoriam Gary A. Polis*. British Arachnological Society, Burnham Beeches, Bucks, UK.
- KARATAŞ, A. & A. KARATAŞ. 2003. *Mesobuthus eupeus* (C.L. Koch, 1839) (Scorpiones: Buthidae) in Anatolia. *Euscorpius*, 7: 1–7.
- KARATAŞ, A., M. UÇAK, A. KARATAŞ & O. EROĞLU. 2019. Records of chromosomal data of some scorpions (Arachnida: Scorpiones) from Turkey. *Hacettepe Journal of Biology and Chemistry*, 47: 1–6.
- KESSLER, K. F. 1874. O russkikh skorpionakh [On Russian scorpions]. *Trudy Russkago Entomologicheskago Obshchestva v S.-Peterburge* [Transactions of the Russian Entomological Society in St. Petersburg], (1): 3–27 (in Russian) [date on the volume cover, 1876; separatum first available in 1874].
- KOCH, C. L. 1839a. *Die Arachniden*. Nurnberg: C. H. Zeh'sche Buchhandlung, 5(6): 125–158, figs. 418–419.
- KOCH, C. L. 1839b. *Die Arachniden*. Nurnberg: C. H. Zeh'sche Buchhandlung, 6(3): 51–53, figs. 466–467.
- KOCH, L. 1878. Kaukasische Arachnoideen. Pp. 36–71 in Schneider, O. (ed.) *Naturwissenschaftliche Beiträge zur Kenntnis der Kaukasusländer, auf Grund seiner Sammelbeute herausgegeben*. Dresden: Gesellschaft "Isis", 3.
- KOVAŘÍK, F. 2002. A checklist of scorpions (Arachnida) in the collection of the Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany. *Serket*, 8(1): 1–23.
- KOVAŘÍK, F. 2009. *Illustrated catalog of scorpions. Part I. Introductory remarks; keys to families and genera; subfamily Scorpioninae with keys to Heterometrus and Pandinus species*. Prague: Clairon Production, 170 pp.
- KOVAŘÍK, F. 2019. Taxonomic reassessment of the genera *Lychas*, *Mesobuthus*, and *Olivierus*, with descriptions of four new genera (Scorpiones: Buthidae). *Euscorpius*, 288: 1–27.
- KOVAŘÍK, F. & P. BERON. 2015. A checklist of the scorpions (Arachnida, Scorpiones) in the collections of the National Museum of Natural History (Sofia). *Historia naturalis bulgarica*, 22: 37–44.
- KOVAŘÍK, F. & A. A. OJANGUREN AFFILASTRO. 2013. *Illustrated catalog of scorpions. Part II. Bothriuridae; Chaerilidae; Buthidae I. Genera Compsobuthus, Hottentotta, Isometrus, Lychas, and Sassanidotus*. Prague: Clairon Production, 400 pp.
- KOVAŘÍK, F., F. ŠTÁHLAVSKÝ, T. KOŘÍNKOVÁ, J. KRÁL & T. VAN DER ENDE. 2009. *Tityus ythieri* Lourenço, 2007 is a synonym of *Tityus magnimanus* Pocock, 1897 (Scorpiones: Buthidae): a combined approach using morphology, hybridization experiments, chromosomes, and mitochondrial DNA. *Euscorpius*, 77: 1–12.
- KOVAŘÍK, F. & S. WHITMAN. 2005. Cataloghi del Museo di Storia Naturale dell'Università di Firenze – sezione di zoologia «La Specola» XXII. Arachnida Scorpiones. Tipi. Addenda (1998–2004) e checklist della collezione (Euscorpiinae esclusi). *Atti della Società Toscana di Scienze Naturali, Memorie*, serie B, 111 (2004): 103–119.
- KOVAŘÍK, F., E. A. YAĞMUR, V. FET & S. NAVIDPOUR. 2011. On two subspecies of *Mesobuthus eupeus* (C. L. Koch, 1839) in Turkey (Scorpiones: Buthidae). *Euscorpius*, 109: 1–15.
- KRYZHANOVSKY, O. L. 1965. *Sostav i proiskhozhdenie nazemnoi fauny Srednei Azii* [The Composition and Origin of the Terrestrial Fauna of Middle Asia]. Moscow & Leningrad: Nauka, 419 pp. (in Russian; English translation: New Delhi, 1980).
- KUMAR, S., G. STECHER, M. LI, C. KNYAZ & K. TAMURA. 2018. MEGA X: molecular evolutionary genetics analysis across computing platforms. *Molecular Biology and Evolution*, 35(6): 1547.

- LARSSON, A. 2014. AliView: a fast and lightweight alignment viewer and editor for large datasets. *Bioinformatics*, 30(22): 3276–3278 (Nov 15). doi: [10.1093/bioinformatics/btu531](https://doi.org/10.1093/bioinformatics/btu531).
- LIECHTENSTEIN, H. 1823. Naturhistorische Anhang. Pp. 113–150 in: Eversmann, E. *Reise von Orenburg nach Buchara*. Berlin: E. H. G. Christiani.
- LIPSKY, V. I. 1902. *Gornaya Bukhara: rezul'taty tryokhletnikh puteshestvii v Srednyuyu Aziyu v 1896, 1897 i 1899 godu. Chast' I. Gornaya Bukhara: Gissarskaya ekspeditsiya, 1896 g.* [The Mountainous Buchara: the results of three years of travels to Central Asia in 1896, 1897 and 1899. Part I. The Mountainous Buchara: the Gissar Expedition, 1896]. St. Petersburg (in Russian).
- MAKINO, S. 1956. *A review of the chromosome numbers in animals*. Tokyo: Hokuryukan.
- MAYR, E. 1969. *Principles of Systematic Zoology*. New York: McGraw-Hill Book Co., xi + 428 pp.
- MAYR, E. 1971. *Prinstipy zoologicheskoi sistematiki* [Principles of Systematic Zoology]. Moscow: Mir, 454 pp. (in Russian).
- MIRSHAMSI, O. 2012. Ecological niche modeling of two scorpion species *Mesobuthus eupeus* (C. L. Koch, 1839) and *M. phillipsii* (Pocock, 1889) from the Iranian Plateau and Zagros region (Arachnida: Scorpiones). *Euscorpius*, 154: 1–10.
- MIRSHAMSI, O., A. SARI, E. ELAHI & S. HOSSEINIE. 2010. Phylogenetic relationships of *Mesobuthus eupeus* (C. L. Koch, 1839) inferred from COI sequences (Scorpiones: Buthidae). *Journal of Natural History*, 44(47): 2851–2872.
- MIRSHAMSI, O., A. SARI, E. ELAHI & S. HOSSEINIE. 2011a. *Mesobuthus eupeus* (Scorpiones: Buthidae) from Iran: A polytypic species complex. *Zootaxa*, 2929: 1–21.
- MIRSHAMSI, O., A. SARI & S. HOSSEINIE. 2011b. History of study and checklist of the scorpion fauna (Arachnida: Scorpiones) of Iran. *Progress in Biological Sciences*, 1(2): 16–28.
- MLÍKOVSKÝ, J. & S. FRAHNERT. 2009. Type specimens and type localities of birds (Aves) collected by Eduard Eversmann and Christian Pander during the Negri Expedition to Bukhara in 1820–1821. *Zootaxa*, 2297: 15–26.
- MORADI, M., E. A. YAĞMUR, P. M. GHARAKHLOO & F. AHMADI. 2015. Scorpion fauna of Zanjan Province, Iran (Arachnida: Scorpiones). *Journal of Applied Biological Sciences*, 9(1): 11–14.
- MORITZ, M. & S.-CH. FISCHER. 1980. Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. III. Scorpiones. *Mitteilungen aus dem Zoologischen Museum in Berlin*, 2(36): 309–326.
- NAVIDPOUR, S., M. EZATKHAH, F. KOVAŘÍK, M. E. SOLEGLAD & V. FET. 2011. Scorpions of Iran (Arachnida, Scorpiones). Part VII. Kerman Province. *Euscorpius*, 131: 1–32.
- NAVIDPOUR, S., V. FET, F. KOVAŘÍK & M. E. SOLEGLAD. 2008a. Scorpions of Iran (Arachnida, Scorpiones). Part III. Ilam Province. *Euscorpius*, 69: 1–29.
- NAVIDPOUR, S., V. FET, F. KOVAŘÍK & M. E. SOLEGLAD. 2012. Scorpions of Iran (Arachnida, Scorpiones). Part VIII. Fars Province. *Euscorpius*, 139: 1–32.
- NAVIDPOUR, S., F. KOVAŘÍK, M. E. SOLEGLAD & V. FET. 2008b. Scorpions of Iran (Arachnida, Scorpiones). Part I. Khoozestan Province. *Euscorpius*, 65: 1–41.
- NAVIDPOUR, S., F. KOVAŘÍK, M. E. SOLEGLAD & V. FET. 2008c. Scorpions of Iran (Arachnida, Scorpiones). Part IV. Kohgilouyeh & Boyer Ahmad Province. *Euscorpius*, 74: 1–24.
- NAVIDPOUR, S., F. KOVAŘÍK, M. E. SOLEGLAD & V. FET. 2019. Scorpions of Iran (Arachnida, Scorpiones). Part X. Alborz, Markazi and Tehran Provinces with descriptions of *Orthochirus carinatus* sp. n. (Buthidae). *Euscorpius*, 276: 1–20.
- NAVIDPOUR, S., H. H. NAYEBZADEH, M. E. SOLEGLAD, V. FET, F. KOVAŘÍK & M. H. KAYEDI. 2010. Scorpions of Iran (Arachnida, Scorpiones). Part VI. Lorestan Province. *Euscorpius*, 99: 1–23.
- NAVIDPOUR, S., M. E. SOLEGLAD, V. FET & F. KOVAŘÍK. 2013. Scorpions of Iran (Arachnida, Scorpiones). Part IX. Hormozgan Province, with description of *Odontobuthus tavighiae* sp. n. (Buthidae). *Euscorpius*, 170: 1–29.
- NAVIDPOUR, S., M. E. SOLEGLAD, F. KOVAŘÍK & V. FET. 2008d. Scorpions of Iran (Arachnida, Scorpiones). Part II. Bushehr Province. *Euscorpius*, 67: 1–33.
- NORDMANN, A. 1840. Notice sur les Scorpions de la faune pontique. In: *Voyage dans la Russie méridionale et la Crimée, par la Hongrie, la Valachie et la Moldavie, exécuté en 1837, sous la direction de M. Anatole de Demidoff, par Mm. de-Sainson, Le-Play, Huot, Léveville, Raflet, Rousseau, de Nordmann et du Ponceau; dédié à S. M. Nicolas 1-er, Empereur de toutes les Russies*. Paris, 3: 751–752.

- NOVRUZOV, N. E., F. KOVAŘÍK & V. FET. 2022. *Mesobuthus zarudnyi* sp. n. from Azerbaijan (Scorpiones: Buthidae). *Euscorpius*, 347: 1–9.
- OVCHINNIKOVA, O. G., M. G. VOLKOVICH & V. FET. 2021. Remembering Victor Anatolyevich Krivokhatsky (January 20, 1954 – August 18, 2021). *Caucasian Entomological Bulletin*, 17(2): 499–509.
- PALCU, D. V., I. S. PATINA, I. ŞANDRIC, S. LAZAREV, I. VASILIEV, M. STOICA & W. KRIJGSMAN. 2021. Late Miocene megalake regressions in Eurasia. *Scientific Reports*, 11: 11471. <https://doi.org/10.1038/s41598-021-91001-z>
- PALLAS, P. S. 1776. *Reise durch verschiedene Provinzen des Russischen Reichs. Dritter Theil vom Jahr 1772. und 1773. Reise aus Sibirien zurück an die Wolga im 1773sten Jahr. Des Dritten Theil. Zweytes Buch.* St. Petersburg: Kayserliche Academie der Wissenschaften, S. 455–760 + [1–26].
- PAVLOVSKY, E. N. 1916a. [Dzhulek, of Perovsky District, Syr-Darya Province, and some biological observations in its environs]. *Trudy Imperatorskago Petrogradskago Obshchestva Yestestvoispytatelei* [Travaux de la Société impériale des Naturalistes de Petrograd], 47(1): 27–68 (in Russian).
- PAVLOVSKY, E. N. 1916b. Quelques observations biologiques sur les scorpions de la famille des Buthidae. *Comptes rendus de la Société biologique* [Petrograd], 81: 243–246.
- PAVLOVSKY, E. N. 1934. [Some data on the poisonous animals of Turkmenia]. Pp. 191–204 in: *Trudy Kara-Kalinskoi i Kzyl-Atrekskoi parazitologicheskoi ekspeditsii 1931 goda i materialy po faune Turkmenii* [Transactions of the 1931 Kara-Kala and Kzyl-Atrek Parasitological Expedition, with contributions to the fauna of Turkmenia]. Leningrad: Ed. Acad. Sci. USSR and Narkomzdrav of Turkmenia (in Russian).
- PENTHER, A. 1912. Wissenschaftliche Ergebnisse der Expedition nach Mesopotamien, 1910. Scorpiones. *Annalen des Kaiserlich-Königlichen Naturhistorischen Hofmuseums in Wien*, 26(1/2): 109–115.
- PÉREZ MINNOCCI, S. 1974. Un inventario preliminar de los escorpiones de la región Paleártica y claves para la identificación de los géneros de la región Paleártica Occidental. *Madrid: Universidad Complutense de Madrid, Facultad de Ciencias, Departamento de Zoología, Cátedra de Artrópodos*, 7: 1–45.
- PIRALI-KHEIRABADI, K., S. NAVIDPOUR, V. FET, F. KOVAŘÍK & M. E. SOLEGLAD. 2009. Scorpions of Iran (Arachnida, Scorpiones). Part V. Chahar Mahal & Bakhtiyari Province. *Euscorpius*, 78: 1–23.
- POCOCK, R. I. 1889a. Arachnida, Chilopoda and Crustacea. On the zoology of the Afghan Commission on Delimitation. *Transactions of Linnean Society of London, Zoology*, ser. 2, 5(3): 110–122.
- POCOCK, R. I. 1889b. Notes on some Buthidae, new and old. *Annals and Magazine of Natural History*, 3: 334–351.
- POCOCK, R. I. 1899. Chilopoda and Arachnida. In: R. T. Günther. Contributions to the natural history of Lake Urmi, N. W. Persia, and its neighbourhood. *Journal of the Linnean Society of London, Zoology*, 27: 399–406.
- POCOCK, R. I. 1900. *Arachnida. The Fauna of British India, including Ceylon and Burma. Published under the authority of the Secretary of State for India in Council.* London: W. T. Blandford, xii, 279 pp.
- POVERENNYI, N. M. 2015. [The scorpion *Mesobuthus eupeus* (Scorpiones) in various habitats of the Bogdo-Baskunchak Reserve]. *Entomologicheskii i parazitologicheskii issledovaniia v Povolzh'e* [Entomological and Parasitological Research in Povolzh'e], 12: 153–155 (in Russian).
- POVERENNYI, N. M. 2018. [The scorpion *Mesobuthus eupeus* (C. L. Koch, 1839) (Scorpiones) in the Ryn Sands of the Western Kazakhstan]. *Entomologicheskii i parazitologicheskii issledovaniia v Povolzh'e* [Entomological and Parasitological Research in Povolzh'e], 15: 109–111 (in Russian).
- POVERENNYI, N. M. & V. V. ANIKIN. 2017. [Study of phylogenetic relationships of the representatives of the genus *Mesobuthus* (Arachnida: Scorpiones) based on the molecular DNA analysis]. *Izvestiia Saratovskogo universiteta. Nov. ser. Khimiia. Biologiia. Ekologiia* [Proceedings of the Saratov University. New Ser. Chemistry, Biology, Ecology], 17(3): 333–334 (in Russian).
- POVERENNYI, N. M. & V. V. ANIKIN. 2019. [Phylogenetic relationships of the scorpion *Mesobuthus eupeus* (C. L. Koch, 1839) (Scorpiones) from the Lower Povolzh'e and Southern Kazakhstan. Part 1. Molecular genetic similarity of the CO1 gene sequences]. *Entomologicheskii i parazitologicheskii issledovaniia v Povolzh'e* [Entomological and Parasitological Research in Povolzh'e], 16: 9–14 (in Russian).

- POVERENNYI, N. M. & V. V. ANIKIN. 2020a. [Studies of phylogenetic relationships of the scorpion *Mesobuthus eupeus volgensis* (Birula, 1925) from the Lower Povolzhye with the closely related species from Central Asia based on coxI DNA analysis]. Pp. 98–101 in: *Issledovaniia molodykh uchënykh v biologii i ekologii* [Studies by Young Researchers in Biology and Ecology]. Saratov: Amirit (in Russian).
- POVERENNYI, N. M. & V. V. ANIKIN. 2020b. [Phylogenetic relationships of the scorpion *Mesobuthus eupeus volgensis* (Birula, 1925) from the Lower Povolzhye with the closely related species from Central Asia based on coxI DNA analysis]. *Entomologicheskie i parazitologicheskie issledovaniia v Povolzh'ye* [Entomological and Parasitological Research in Povolzh'ye], 17: 12–17 (in Russian).
- PUILLANDRE, N., S. BROUILLET & G. ACHAZ. 2021. ASAP: assemble species by automatic partitioning. *Molecular Ecology Resources*, 21: 609–620.
- RAMBAUT, A., A.J. DRUMMOND, D. XIE, G. BAELE & M. A. SUCHARD. 2018. Posterior summarisation in Bayesian phylogenetics using Tracer 1.7. *Systematic Biology*. [syy032](https://doi.org/10.1093/sysbio/syy032). doi:10.1093/sysbio/syy032
- ROSELAAR, C. S. & M. ALIABADIAN. 2007. A century of breeding bird assessment by western travellers in Iran, 1876–1977. Appendix 1. *Podoces*, 2(2): 77–96.
- SADÍLEK, D., P. NGUYEN, H. KOÇ, F. KOVAŘÍK, E. A. YAĞMUR & F. ŠTÁHLAVSKÝ. 2015. Molecular cytogenetics of *Androctonus* scorpions: an oasis of calm in the turbulent karyotype evolution of the diverse family Buthidae. *Biological Journal of the Linnean Society*, 115: 69–76.
- SCHNEIDER, M. C., V. F. MATTOS & D. M. CELLA. 2021. The scorpion cytogenetic database. Available at: <http://www.arthropodacytogenetics.bio.br/scorpiondatabase/index.html>. Accessed 1 September 2021.
- SHARMA, G. P., R. PARSHAD & M. G. JONEJA. 1959. Chromosome mechanism in the males of three species of scorpions (Scorpiones – Buthidae). *Research Bulletin of the Panjab University*, 10: 197–207.
- SHEDD, M. L. 1922. *The Measure of a Man: The Life of William Ambrose Shedd, Missionary to Persia*. New York: George H. Doran.
- SHI, C. M., Z. S. HUANG, L. WANG, L. J. HE, Y. P. HUA, L. LENG, & D. X. ZHANG. 2007. Geographical distribution of two species of *Mesobuthus* (Scorpiones, Buthidae) in China: insights from systematic field surveys and predictive models. *Journal of Arachnology*, 35: 215–226.
- SHI, C. M., Y. J. JI, L. LIU, L. WANG & D. X. ZHANG. 2013. Impact of climate changes from Middle Miocene onwards on evolutionary diversification in Eurasia: Insights from the mesobuthid scorpions. *Molecular Ecology*, 22: 1700–1716.
- SHI, C.-M., H.-B. LIANG, D. ALTANCHIMEG, NONNAIZAB, C. CHULUUNJAV & D.-X. ZHANG. 2015. Climatic niche defines geographical distribution of *Mesobuthus eupeus mongolicus* (Scorpiones: Buthidae) in Gobi desert. *Zoological Systematics*, 40(3): 339–348.
- SHI, C.-M., X.-S. ZHANG, L. LIU, Y.-J. JI & D.-X. ZHANG. 2021. Phylogeography of the desert scorpion *Mesobuthus mongolicus* illuminates a route out of Central Asia and Junggar Basin as a corridor for faunal exchange between Central and East Asia. *bioRxiv preprint*, doi: <https://doi.org/10.1101/2021.10.31.466646> (posted November 2, 2021): 1–25.
- SOLEGLAD, M. E. & V. FET. 2003. The scorpion sternum: structure and phylogeny (Scorpiones: Orthosterni). *Euscorpius*, 5: 1–34.
- STAHNKE, H. L. 1971. Scorpion nomenclature and mensuration. *Entomological News*, 81: 297–316.
- ŠTÁHLAVSKÝ, F., P. NGUYEN, D. SADÍLEK, J. ŠTUNDLOVÁ, P. JUST, C. R. HADDAD, H. KOÇ, K. B. RANAWANA, M. STOCKMANN, E. A. YAGMUR & F. KOVAŘÍK. 2020. Evolutionary dynamics of rDNA clusters on chromosomes of buthid scorpions (Chelicerata: Arachnida). *Biological Journal of the Linnean Society*, 131: 547–565.
- SUN, D. & Z.-N. SUN. 2011. Notes on the genus *Mesobuthus* (Scorpiones: Buthidae) in China, with description of a new species. *The Journal of Arachnology*, 39: 59–75.
- TCHERNAVIN, V. V. 1935. *I Speak for the Silent. Prisoners of the Soviets*. Translated from the Russian by Nicholas M. Oushakoff. Boston-New York: Hale, Cushman & Flint.
- TERUEL, R. 2002. First record of *Mesobuthus eupeus* (Koch, 1839) from western Turkey (Scorpiones: Buthidae). *Revista Ibérica de Aracnología*, 5: 75–76.
- TERUEL, R., F. KOVAŘÍK & V. FET. 2018. Revision of the Central Asian scorpion genus *Anomalobuthus* Kraepelin, 1900, with descriptions of three new species and a generic synonymy (Scorpiones: Buthidae). *Euscorpius*, 270: 1–45.
- VACHON, M. 1950. Études sur les Scorpions. III (suite). Description des Scorpions du Nord de l'Afrique. *Archives de l'Institut Pasteur d'Algérie*, 28(2): 152–216.

- VACHON, M. 1952. Études sur les scorpions. *Institut Pasteur d'Algérie, Alger*, 1–482 (published 1948–1951 in *Archives de l'Institut Pasteur d'Algérie*, 1948, 26: 25–90, 162–208, 288–316, 441–481. 1949, 27: 66–100, 134–169, 281–288, 334–396. 1950, 28: 152–216, 383–413. 1951, 29: 46–104).
- VACHON, M. 1958. Scorpionidea (Chelicerata) de l'Afghanistan. (The 3d Danish Expedition to Central Asia. Zoological Results 23). *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i København*, 120: 121–187.
- VACHON, M. 1963. De l'utilité, en systématique d'une nomenclature des dents des chélicères chez les scorpions. *Bulletin du Muséum National d'Histoire Naturelle Paris*, 35(2): 161–166.
- VACHON, M. 1966. Liste des scorpions connus en Égypte, Arabie, Israël, Liban, Syrie, Jordanie, Turquie, Irak, Iran. *Toxicon*, 4: 209–218.
- VACHON, M. 1974. Études des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum national d'Histoire naturelle*, Paris, 3e sér. n°140, Zool. 140: 857–958.
- VACHON, M. 1975. Sur l'utilisation de la trichobothriotaxie du bras des pédipalpes des scorpions (Arachnides) dans le classement des genres de la famille des Buthidae Simon. *Comptes Rendus de l'Académie des Sciences, Paris, D*, 281: 1597–1599.
- VIGNOLI, V. & P. CRUCITTI 2005. Notes on the scorpion diversity (Arachnida, Scorpiones) of the Yazd province, central Iran. *Acta Musei Moraviae. Scientiae Biologicae*, 1–2: 1–12.
- VIGNOLI, V., F. KOVAŘÍK & P. CRUCITTI. 2003. Scorpiofauna of Kashan (Esfahan Province, Iran) (Arachnida: Scorpiones). *Euscorpius*, 9: 1–7.
- WERNER, F. 1936. Reptilien und Gliedertiere aus Persien. In: *Festschrift zum 60. Geburtstage von Professor Dr. Embrik Strand*. Riga: Izdevniecība "Latvija", 2: 193–204.
- YAĞMUR, E. A., H. KOÇ, S. KESMEZOĞLU & M. YALÇIN. 2007. Scorpions of Kilis Province, Turkey (Arachnida: Scorpiones). *Serket*, 10(3): 91–105.
- YAĞMUR, E.A., H. KOÇ, G. TROPEA & F. YEŞİLYURT. 2012. Scorpion fauna of Hatila Valley National Park (Artvin, Turkey). *Anadolu Doga Bilimeri Dergisi*, 3(1):15–22.
- YUSUBOV, E. B. 1985. *Skorpiony (Arachnidae, Scorpiones) Azerbajdžana [Scorpions of Azerbaijan]*. Avtoreferat [PhD digest]. Leningrad: Leningrad State University, 20 pp. (in Russian).
- ZARUDNY, N. A. 1900. Ekskursia po severo-vostochnoi Persii i ptitsy étoi strany [An excursion in the Northeast Persia and the birds of this country]. *Zapiski Imperatorskoi Akademii Nauk [Mémoires de l'Académie Impériale des Sciences de St.-Petersbourg]*, sér. 8, 10(1): 1–262 (in Russian).
- ZARUDNY, N. A. 1901. Ekskursia po vostochnoi Persii [An excursion in the East Persia]. *Zapiski Imperatorskago Russkago Geograficheskago Obshchestva po Obshchei Geografii [Mémoires de l'Société Impériale Russe de Géographie. Géographie Générale]*, 36(1): 1–362 (in Russian).
- ZARUDNY, N. A. 1916. Tretya ekskursiya po Vostochnoi Persii. Khorasan, Seistan i Persidskii Beludzhistan. 1900–1901 g. [The third excursion to East Persia. Khorassan, Seistan and Persian Baluchistan. 1900–1901]. *Zapiski Imperatorskago Russkago Geograficheskago Obshchestva po Obshchei Geografii [Mémoires de l'Société Impériale Russe de Géographie. Géographie Générale]*, 50:1–448 pp. (in Russian).
- ZHANG, X., L. GAOMING, Y. FENG, D. ZHANG & C.-M. SHU. 2020. Genetic analysis and ecological niche modeling delimit species boundary of the Przewalski's scorpion (Scorpiones: Buthidae) in arid Asian inland. *Zoological Systematics*, 45(2): 81–96.