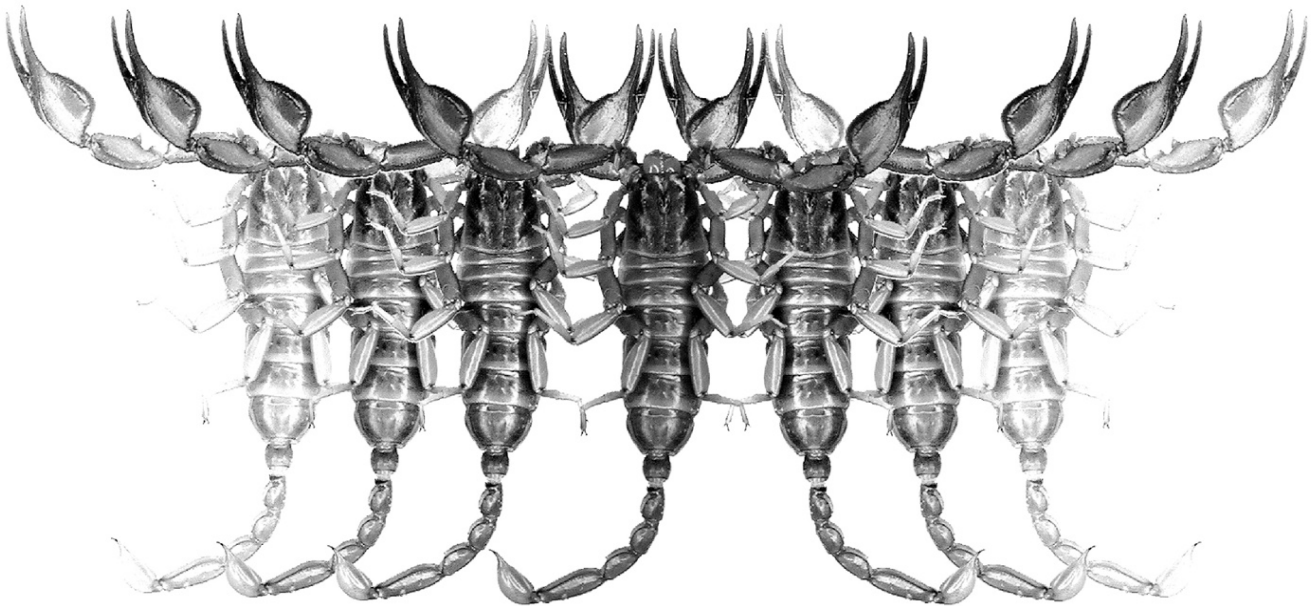


# *Euscorpius*

Occasional Publications in Scorpiology



Further review of *Orthochirus* Karsch, 1892  
(Scorpiones: Buthidae) from Asia: taxonomic position of  
*O. melanurus*, *O. persa*, *O. scrobiculosus*, and  
description of six new species

František Kovařík, Victor Fet & Ersen Aydın Yağmur

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# *Euscorpius*

## *Occasional Publications in Scorpiology*

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Further review of *Orthochirus* Karsch, 1892  
(Scorpiones: Buthidae) from Asia: taxonomic position of  
*O. melanurus*, *O. persa*, *O. scrobiculosus*, and  
description of six new species

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## Summary

We describe six new species of *Orthochirus*: *O. birulai* sp. n. (Pakistan), *O. formozovi* sp. n. (Afghanistan, Iran, Tajikistan, Turkmenistan), *O. grosseri* sp. n. (Uzbekistan), *O. kryzhanovskiyi* sp. n. (Pakistan), *O. nordmanni* sp. n. (Afghanistan), and *O. sejnai* sp. n. (Iran). Descriptions are complemented with color photographs of preserved specimens. The identities of *Orthochirus melanurus* (Kessler, 1874) (Kazakhstan, Uzbekistan), *O. persa* (Birula, 1900) stat. n. (Afghanistan, Iran), and *O. scrobiculosus* (Grube, 1873) (Turkmenistan) are reexamined, based on detailed study of the type specimens; lectotypes of all three species are designated. We demonstrate for the first time that the name *O. scrobiculosus*, previously used as an ‘umbrella’ for various *Orthochirus* from Central Asia and the Middle East, is currently applicable only to a few confirmed populations from the southwestern Turkmenistan, near the Caspian Sea. New synonymies are proposed at the species level: *Paraorthochirus blandini* Lourenço & Vachon, 1997 = *Orthochirus fuscipes* (Pocock, 1900), syn. n. and *Afghanorthochirus erardi* Lourenço & Vachon, 1997 = *Orthochirus persa* (Birula, 1900), stat. n., syn. n. We provide a distribution map and a key to all *Orthochirus* found in ten Asian countries: Afghanistan, India, Iran, Iraq, Kazakhstan, Pakistan, Tajikistan, Turkey, Turkmenistan, and Uzbekistan (41 species).

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## Introduction

This contribution continues our research group’s broader study of the genus *Orthochirus* Karsch, 1892 (Buthidae), which traditionally included several apparently morphologically uniform species found in the large area from North Africa through the Middle East and Central Asia to India. Fet & Lowe (2000) listed only nine valid species and compiled all references until 1998. Kovařík (2004) revised *Orthochirus*, described 11 new species from Asia, and defined eight major diagnostic characters for this genus. Among other publications focused on Asian *Orthochirus*, with descriptions of new species, see primarily: Kovařík & Fet (2006), Kovařík et al. (2019), and Kovařík & Navidpour (2020). In this paper, we describe six new species from six countries (Afghanistan, Iran, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan). We also discuss new data on *Orthochirus fuscipes* (Pocock, 1900) (Pakistan). Examination of old type material and vague or conflicting label data allowed us to clarify the taxonomic status, type localities, and geographic range of the old taxa *Orthochirus melanurus* (Kessler, 1874) (limited here to Kazakhstan and Uzbekistan), *O. persa* (Birula, 1900), stat.

n. (Afghanistan, Iran), and *O. scrobiculosus* (Grube, 1873) (limited here to Turkmenistan).

## Methods, Material & Abbreviations

Nomenclature and measurements follow Stahnke (1971), Soleglad & Sissom (2001), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974).

*Specimen Depositories*: BMNH (The Natural History Museum, London, United Kingdom); CASC (California Academy of Sciences, San Francisco, California, USA); FKCP (František Kovařík, private collection, Prague, Czech Republic; will in future be merged with the collections of the National Museum of Natural History, Prague, Czech Republic); GNMT (Georgian National Museum, Tbilisi, Georgia); MNHN (Muséum National d’Histoire Naturelle, Paris, France); MNHW (Museum of Natural History Wrocław, Wrocław, Poland); 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).



Figures 1–2: *Orthochirus* spp. in vivo habitus. Figure 1: *O. melanurus*, male from Uzbekistan. Figure 2: *O. nordmanni* sp. n., male (right) and female paratypes.

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

*Movable finger dentition*: ID, inner denticles; MD, median denticles; OD, outer denticles.

Specimen locality coordinates cited without square brackets were provided by the collectors (or were cited in the original descriptions), while coordinates in square brackets were estimated or inferred from online resources (e.g. Google Earth™).

*ZooBank links*: Starting from this issue on, all systematic papers published in *Euscorpius* will include active links to the ZooBank database not only for new species (as required by the ICZN for electronic publications) but for all discussed species. As of July 2020, all available scorpion names in their original form, all information about type specimens, and all primary literature where these names were published have been entered into ZooBank (a volunteer project completed by V.F. by agreement with the ZooBank administration). Note that the ZooBank does not yet support all taxonomic acts such as synonymies and transfers, therefore it is not a substitute for the complete, catalog-style taxonomic data (such as in Fet & Lowe, 2000). However, having an online, editable information on all scorpion names and type material should greatly facilitate further revisions, especially when old types become available for study, and/or type localities can be clarified (as in this paper, see below).

## Systematics

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

#### *Orthochirus* Karsch, 1892

(Figures 1–352, Tables 1–4)

<http://zoobank.org/urn:lsid:zoobank.org:act:79D5A7E7-F14F-4D64-90ED-89BF47023562>

*Orthochirus* Karsch, 1892: 306.

Type species. *Orthodactylus olivaceus* Karsch, 1881 = *Orthochirus* sp. (syn. by Kraepelin, 1895: 84 to *O. scrobiculosus* (Grube, 1873); doubtful synonymy, see below).

#### SYNONYMS:

= *Orthodactylus* Karsch, 1881: 90, a junior homonym of *Orthodactylus* Hitchcock, 1858 (Reptilia), type species: *Orthodactylus olivaceus* Karsch, 1881 = *Orthochirus* sp. (syn. by Kraepelin, 1895: 84 to *O. scrobiculosus* (Grube, 1873); doubtful synonymy, see below).

<http://zoobank.org/urn:lsid:zoobank.org:act:A6989D2C-3146-4AB2-BD32-0DF0EB8B1410>

= *Simonoides* Vachon & Farzanpay in Farzanpay, 1987: 162, type species: *Simonoides farzanpayi* Vachon & Farzanpay in Farzanpay, 1987 = *Orthochirus farzanpayi* (Vachon & Farzanpay in Farzanpay, 1987) (syn. by Kovařík & Fet, 2006: 2).

<http://zoobank.org/urn:lsid:zoobank.org:act:E7C915F8-1EE7-4A20-856A-AD3183BE5A04>

= *Paraorthochirus* Lourenço & Vachon, 1995: 299, type species: *Paraorthochirus stockwelli* Lourenço & Vachon, 1995 = *Orthochirus stockwelli* (Lourenço & Vachon,

1995) (syn. by Navidpour et al., 2008: 17).

<http://zoobank.org/urn:lsid:zoobank.org:act:3E0EC04C-0897-4126-B2CD-7373B4475A40>

= *Afghanorthochirus* Lourenço & Vachon, 1997: 330, type species: *Afghanorthochirus erardi* Lourenço & Vachon, 1997 = *Orthochirus persa* (Birula, 1900), **stat. n.**, **syn. n.**, see below (syn. by Kovařík, 2004: 5).

<http://zoobank.org/urn:lsid:zoobank.org:act:2BF83952-436B-404B-A482-6694659380F5>

#### REFERENCES:

*Orthochirus*: Fet & Lowe, 2000: 193–200 (complete reference list until 1998); Kovařík, 2004: 4–23, figs. 1–8, Table 1; Fet et al., 2003: 69–72, figs. 1–5; Kovařík & Fet, 2006: 1–10, figs. 1–9; Navidpour et al., 2008: 14–22, figs. 19, 23–30, 93–102; Kovařík, 2009: 31; Kovařík et al., 2019: 1–31, figs. 1–176, tabs. 1–2; Kovařík & Navidpour, 2020: 1–41, figs. 1–234, tabs. 1–3.

*Simonoides*: Farzanpay, 1988: 40; Fet & Lowe, 2000: 223.

*Pseudorthochirus* [nomen nudum; lapsus calami]: Lourenço & Vachon, 1995: 304.

*Paraorthochirus*: Lourenço & Vachon, 1997: 329, Fet & Lowe, 2000: 211.

*Afghanorthochirus*: Kovařík, 1998: 120; Fet & Lowe, 2000: 57.

**DIAGNOSIS.** Total length of adults 22–55 mm. Tergites I–VI with weak median or lateral carinae, or carinae indistinct. Patellar trichobothrium  $d_3$  located between dorsomedian and dorsointernal carinae. Dorsal trichobothria of femur arranged in beta-configuration. Trichobothrium  $d_2$  of pedipalp femur absent or present on dorsal surface. Chelicerae with typical buthid dentition (Vachon, 1963), ventral aspect of fixed finger with two denticles. Tibial spurs present on legs III and IV; in all legs, mid-ventral aspect of tarsomere II sparsely setose with 1 or 2 rows of short spiniform setae. Pectines with fulcra, densely hirsute. Proximal dentate margins of pedipalp fingers not strongly undulate; movable fingers of pedipalps with 7–10 rows of denticles and 2–5 subterminal denticles. Carapace strongly trapezoidal, lacking distinct carinae; in lateral view distinctly inclined downward from median eyes to anterior margin; 5 pairs of lateral eyes. First and second metasomal segments with carinae. Metasoma posteriorly widened; metasomal segments IV and V ventrally punctate. Telson elongate with subaculear tubercle absent, aculeus robust, as long as or longer than vesicle; hemispermatophore capsule with 3 laminate lobes + 1 hook-like basal lobe; spiracles slit-like.

**NOTES.** The identity of *Orthodactylus olivaceus* Karsch, 1881 is unclear, and its original locality (“Sicily”) is clearly incorrect. Herein, we limit *O. scrobiculosus* (Grube, 1873) to western Turkmenistan (see below). Karsch’s single specimen (ZMB-3628), obtained from Gustav Schneider (1834–1900), a famous taxidermist and merchant in Basel, Switzerland, possibly originated from Egypt since there are other Egyptian buthids obtained from Schneider in ZMHB collection (J. Dunlop, pers comm.).

Dimensions (mm)		<i>O. birulai</i> sp. n.	<i>O. kryzhanovskiyi</i> sp. n.	<i>O. formozovi</i> sp. n.	<i>O. formozovi</i> sp. n.
		♀ holotype	♂ holotype	♂ holotype	♀ paratype
Carapace	L / W	4.73 / 5.41	2.90 / 3.23	3.27 / 3.82	3.69 / 4.51
Mesosoma	L	11.30	5.39	7.23	11.23
Tergite VII	L / W	2.82 / 5.80	1.50 / 3.26	2.02 / 3.96	2.43 / 5.10
Metasoma + telson	L	24.44	14.15	17.87	19.24
Segment I	L / W / D	2.84 / 3.79 / 2.77	1.70 / 2.24 / 1.78	1.98 / 2.74 / 1.93	2.15 / 3.02 / 2.56
Segment II	L / W / D	3.19 / 3.76 / 3.04	1.98 / 2.18 / 1.81	2.23 / 2.79 / 2.04	2.57 / 3.23 / 2.49
Segment III	L / W / D	3.51 / 4.27 / 3.17	2.10 / 2.27 / 1.87	2.62 / 3.16 / 2.34	2.76 / 3.57 / 2.64
Segment IV	L / W / D	4.77 / 4.77 / 3.36	2.71 / 2.35 / 1.86	3.54 / 3.32 / 2.55	3.82 / 3.84 / 3.01
Segment V	L / W / D	5.33 / 4.55 / 3.20	3.07 / 2.41 / 1.64	3.81 / 3.31 / 2.41	4.12 / 3.71 / 2.82
Telson	L / W / D	4.80 / 1.37 / 1.30	2.59 / 1.02 / 0.69	3.69 / 1.33 / 1.06	3.82 / 1.54 / 1.31
Pedipalp	L	13.71	8.60	11.04	11.16
Femur	L / W	3.45 / 1.16	2.20 / 0.71	2.79 / 0.73	2.83 / 0.92
Patella	L / W	4.19 / 1.45	2.64 / 0.96	3.44 / 1.04	3.52 / 1.22
Chela	L	6.07	3.76	4.81	4.81
Manus	W / D	1.04 / 1.17	0.76 / 0.73	0.83 / 0.84	1.02 / 0.89
Movable finger	L	4.24	2.59	3.43	3.40
<b>Total</b>	<b>L</b>	<b>40.47</b>	<b>22.44</b>	<b>28.37</b>	<b>34.16</b>

**Table 1.** Comparative measurements of *Orthochirus birulai* sp. n., *O. kryzhanovskiyi* sp. n., and *O. formozovi* sp. n. types from type locality. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

### *Orthochirus birulai* sp. n.

(Figures 3–28, 343, Table 1)

<http://zoobank.org/urn:lsid:zoobank.org:act:69F9834E-471E-413A-B8B6-92D49DDA5648>

TYPE LOCALITY AND TYPE DEPOSITORY. **Pakistan**, *Khyber Pakhtunkhwa (former North-West Frontier) Province*, Upper Dir District, [35.31°N 71.39°E]; FKCP.

TYPE MATERIAL EXAMINED. **Pakistan**, *Khyber Pakhtunkhwa (former North-West Frontier) Province*, Upper Dir District, [35.31°N 71.39°E], 16 September 2009, 1♀ (holotype), leg. Z. Ahmed, FKCP.

ETYMOLOGY. The specific epithet is a patronym honoring Alexei Andreevich Bialynitskii-Birulya (or A. A. Birula) (1864–1937), a renowned Russian zoologist and arachnologist who specialized in scorpions and solpugids.

DIAGNOSIS (♀). Total length 40.5 mm of female holotype. Trichobothrium  $d_2$  on dorsal surface of pedipalp femur present. Pectinal teeth number 22 in female. Movable finger of pedipalps with 9 rows of denticles, 10 ID and 9–10 OD. Dorsal carinae on pedipalp patella developed and smooth. Pedipalp femur dorsal granulated. Metasoma V dorsal surface mesially with several fine granules only. Metasoma I–II with 10 carinae, metasoma III with 8 carinae, metasoma IV–V with 2 dorsolateral carinae; incomplete ventrolateral carinae present on metasoma V. Ventral carinae of metasoma I–III consist of small granules irregularly in wide row. Metasoma IV–V ventrally and laterally with fine punctation developed,

spaces among punctae smooth ventral and granulated lateral; metasoma I–III ventrally and laterally granulated and bumpy with punctation reduced. Tergites roughly to finely granulated. Sternite VII densely granulated, with four granulated carinae present. Pedipalp, metasoma and telson glabrous. Moderate to strong tibial spurs present on legs III and IV. Tarsomere I of legs I–III with 8–10 long setae in female. Ratio length/width of metasoma V 1.17 in female holotype. Pedipalp femur length/width ratio 2.97 in female holotype.

DESCRIPTION. Total length of adult female 40.5 mm. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 1. For habitus, see Figs. 3–4.

**Coloration** (Figs. 3–4). Carapace, tergites, and metasoma black. Femur and patella of pedipalps reddish black to black, chela of pedipalps yellowish to reddish brown. Femur and patella of legs reddish black, other segments of legs yellowish brown. Sternite VII black, other sternites reddish black with yellow median area in posterior margin of sternites III–V, mainly on sternite V. Telson reddish brown.

**Mesosoma and carapace** (Figs. 15–16, 21–22). Tergites with a median carina and is roughly to finely granulated. Seventh sternite densely granulated and with four granulated carinae, the other sternites partly granulated but smooth in middle and posteriorly. Pectinal teeth number 22 in female holotype.

**Metasoma and telson** (Figs. 23–28). Metasoma I–II with 10 granulated carinae. Metasoma III–IV lacks lateral and ventromedian carinae. Ventrolateral carinae are developed on metasoma I–III and indicated on metasoma IV–V, dorsolateral carinae are present on all metasomal segments. Ventral carinae

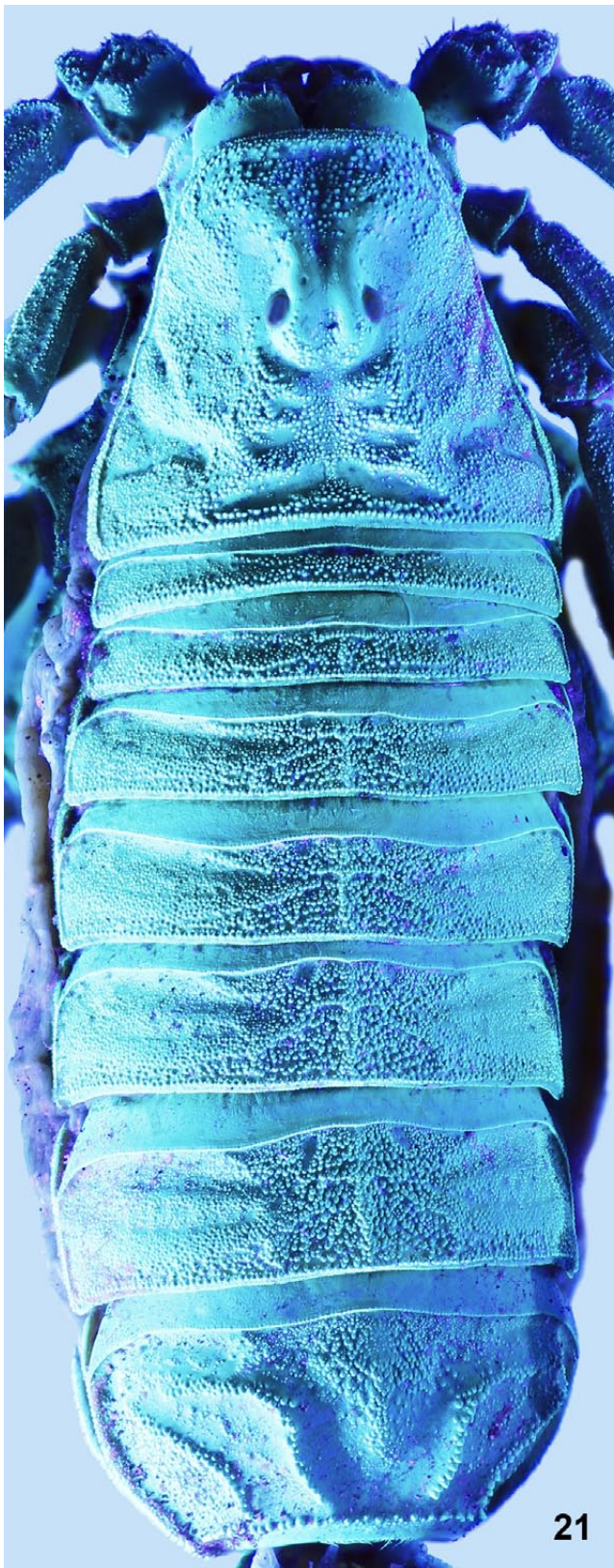


Figures 3–4. *Orthochirus birulai* sp. n., holotype female, dorsal (3) and ventral (4) views. Scale bar: 10 mm.

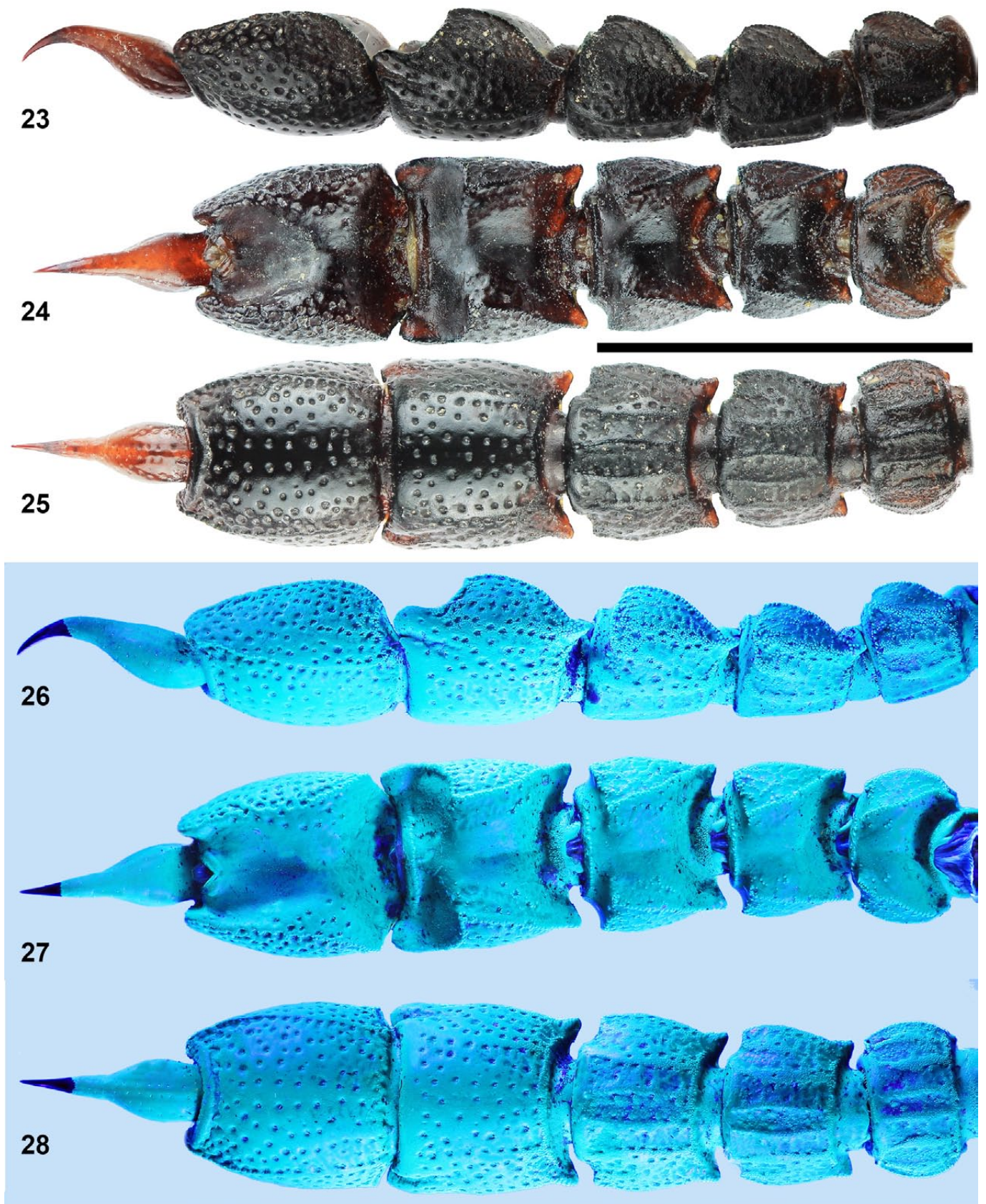


**Figures 5–20:** *Orthochirus birulai* sp. n., holotype female. **Figures 5–14.** Segments of pedipalps. Pedipalp chela, dorsal (5), external (6), and ventral (7) views. Pedipalp patella, dorsal (8), external (9), and ventral (10) views. Pedipalp femur and trochanter, dorsal (11), internal (12), and ventral (13) views. Pedipalp chela, movable finger (14) dentate margins. The trichobothrial pattern is indicated in Figures 6–9, 11–12 (white circles). **Figures 15–16.** Carapace and tergites I–IV (15), and sternoplectinal region and sternites (16). **Figures 17–20.** Right legs I–IV, retrolateral aspect.





Figures 21–22. *Orthochirus birulai* sp. n., holotype female, carapace and tergites (21), and sternopectinal region and sternites (22) under UV light.



Figures 23–28. *Orthochirus birulai* sp. n., holotype female, metasoma and telson, lateral (23, 26), dorsal (24, 27) and ventral (25, 28), under white light (23–25) and UV light (26–28). Scale bar: 10 mm.

of metasoma I–III consist of small granules irregularly in wide row. Metasoma I–IV and partly metasoma V are granulated laterally, metasoma III–V laterally punctate; granulation absent on dorsal surfaces of all metasomal segments mesially except several fine granules on metasoma; several large granules are present on metasoma I–IV rather laterally, metasoma I with ca. 10 of these granules. Fine punctation on metasoma IV–V ventrally developed, spaces among punctae smooth. Entire metasoma and telson glabrous. Telson without punctation and granulation.

**Pedipalps** (Figs. 5–14). Trichobothrium  $d_2$  on dorsal surface of pedipalp femur present; trichobothrium  $e_1$  is situated at level with  $d_4$ . Femur of pedipalps with five granulated carinae and is dorsally granulated. Patella has seven smooth carinae, and the chela has smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalps are glabrous, with several setae only. Movable fingers with 9 rows of denticles, 10 ID and 9–10 OD.

**Legs** (Figs. 17–20). Moderate to strong tibial spurs present on legs III and IV. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few setae. Tibia with setae on the outer side of legs I–II. Tarsomere I of legs I–III with 8–10 long setae, legs IV with 0–2 setae. Tarsomeres I–II of all legs internal with two rather irregular rows of setae.

**Measurements.** See Table 1.

**AFFINITIES.** The combination of six characters (metasoma V dorsal mesially with several fine granules only; entire metasoma glabrous; punctation on the ventral surfaces of metasoma IV–V developed; lateral surfaces of metasoma I–V granulated; sternite VII densely granulated; and pedipalp movable finger with 9–10 ID and OD) is unique in the entire genus *Orthochirus*.

**DISTRIBUTION.** Pakistan (Fig. 343).

### *Orthochirus formozovi* sp. n.

(Figures 29–78, 343, Table 1)

<http://zoobank.org/urn:lsid:zoobank.org:act:95FAC49D-4CD1-4CDE-8CAF-A883B353CA35>

#### REFERENCES:

- Buheolus melanurus*: Birula, 1900a: 13; Birula, 1903: 74.  
*Orthochirus scrobiculosus* (in part; Turkmenistan, in part; Tajikistan, in part): Fet, 1989: 114–115; Fet & Lowe, 2000: 196–197 (complete reference list until 1998); Kovařík, 2004: 20.  
*Orthochirus scrobiculosus melanurus* (in part; Turkmenistan): Fet, 1989: 117–118; Fet, 1994: 531; Fet & Lowe, 2000: 198.

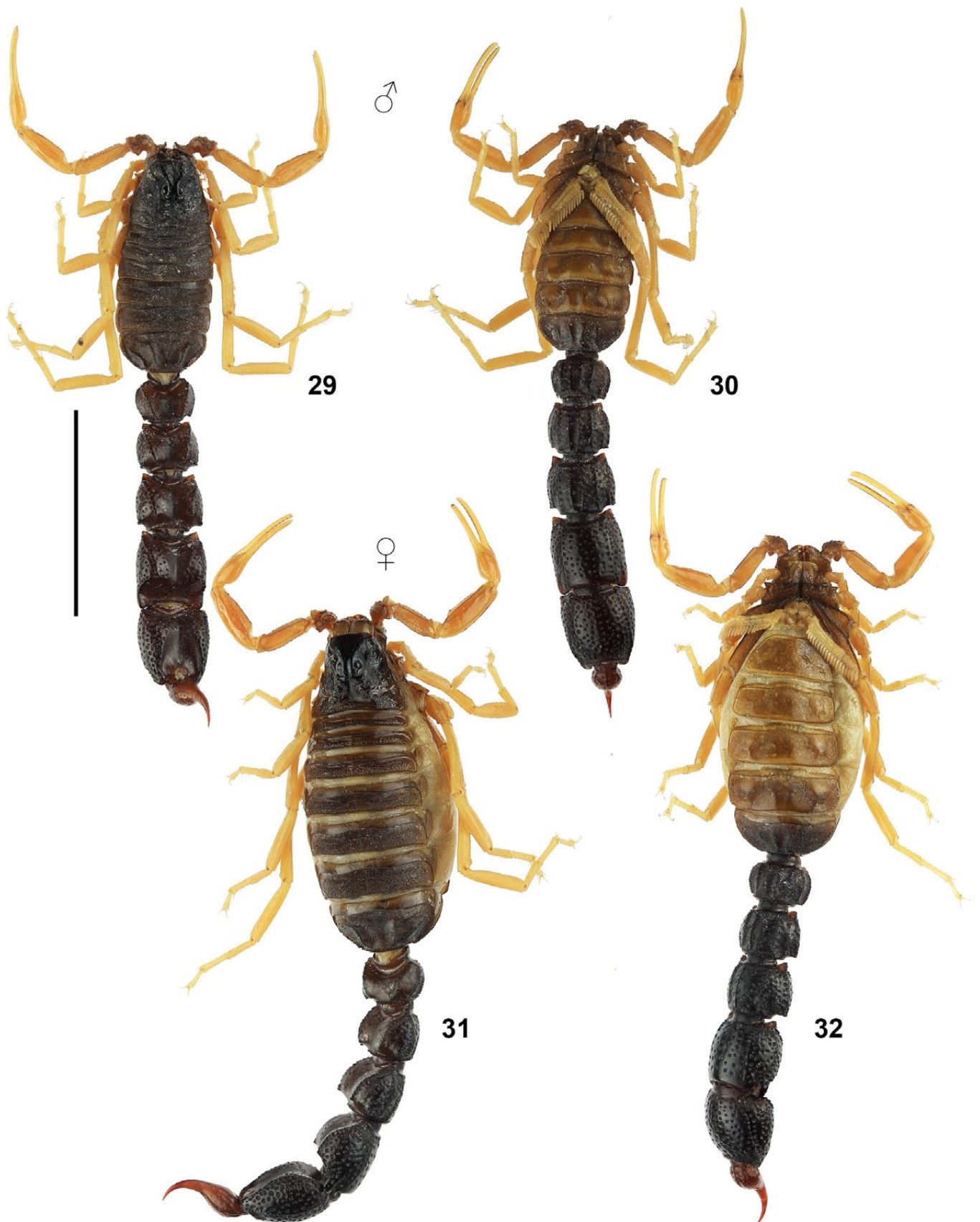
**TYPE LOCALITY AND TYPE DEPOSITORY.** **Turkmenistan**, *Mary Province*, Badkhyz Nature Reserve, ca 14–16 km SSW of Kyzyltdzhar cordon (field station), near Eroilanduz Salt Lake, 35°40'33"N 61°49'18"E to 35°42'04"N 61°48'53"E, 340–350 m a. s. l.; FKCP.

**TYPE MATERIAL EXAMINED (FKCP).** **Afghanistan**, *Balkh Province*, Mazar-e Sharif City [36.70°N 67.08°E], 2012, 1♂ (paratype), leg. M. Misch; Kholm District, Kholm town area, 36°40'25"N 67°41'59"E, 550 m a. s. l., 2013, 2♂1♀ (paratypes, Table 5) leg. M. Misch. **Iran**, *Razavi Khorasan Province*, 10 km W of Baqbaqu, 36°05'N 60°25'E, 10 May 1997, 680 m a. s. l., 2♀ (paratypes), leg. M. Kaftan; Robat-e Sharaf, 36°15'51.54"N 60°39'25.1"E, 630 m a.s.l., 6 April 2016, 2♀ (paratypes). **Tajikistan**, *Khatlon Province*, Kyzyl-Kaly District, 40 km NW from Kurgan-Tyube, Ganjina, 37°34'59"N 68°33'32"E, 2 June 2002, 1♀ (paratype, destroyed), leg. A. Feodorov; Aruktau Mt. Range, 6 km ENE from Garavuti Village, 37°35.130'N 68°31.659'E, 380 m a. s. l., 7 April 2019, 1♂5♀ (paratypes), leg. A. A. Fomichev. **Turkmenistan**, *Akhal Province*, Ashkhabad (now Ashgabat) [37.96°N 58.11°E], 27 April 1987, 1♂ (paratype), leg. P. Slabý; Ashkhabad, 1988, 1♀ (paratype), leg. Šeda; May 1988, 1♀E, leg. M. Král; S of Ashkhabad, May 1990, 2♀ (paratypes), leg. Podhajský; Ashgabat, Bagir, 800 m a.s.l., 16 May 1996, 1♂ (paratype), leg. Liehtfang. *Mary Province*, Badkhyz Nature Reserve, ca 14–16 km SSW of Kyzyltdzhar cordon (field station), near Eroilanduz Salt Lake, 35°40'33"N 61°49'18"E to 35°42'04"N 61°48'53"E, 340–350 m a. s. l., 7 April 2002, 1♂ (holotype) 3♂2♀1♂juv.1juv. (paratypes), leg. V. Fet & A. V. Gromov.

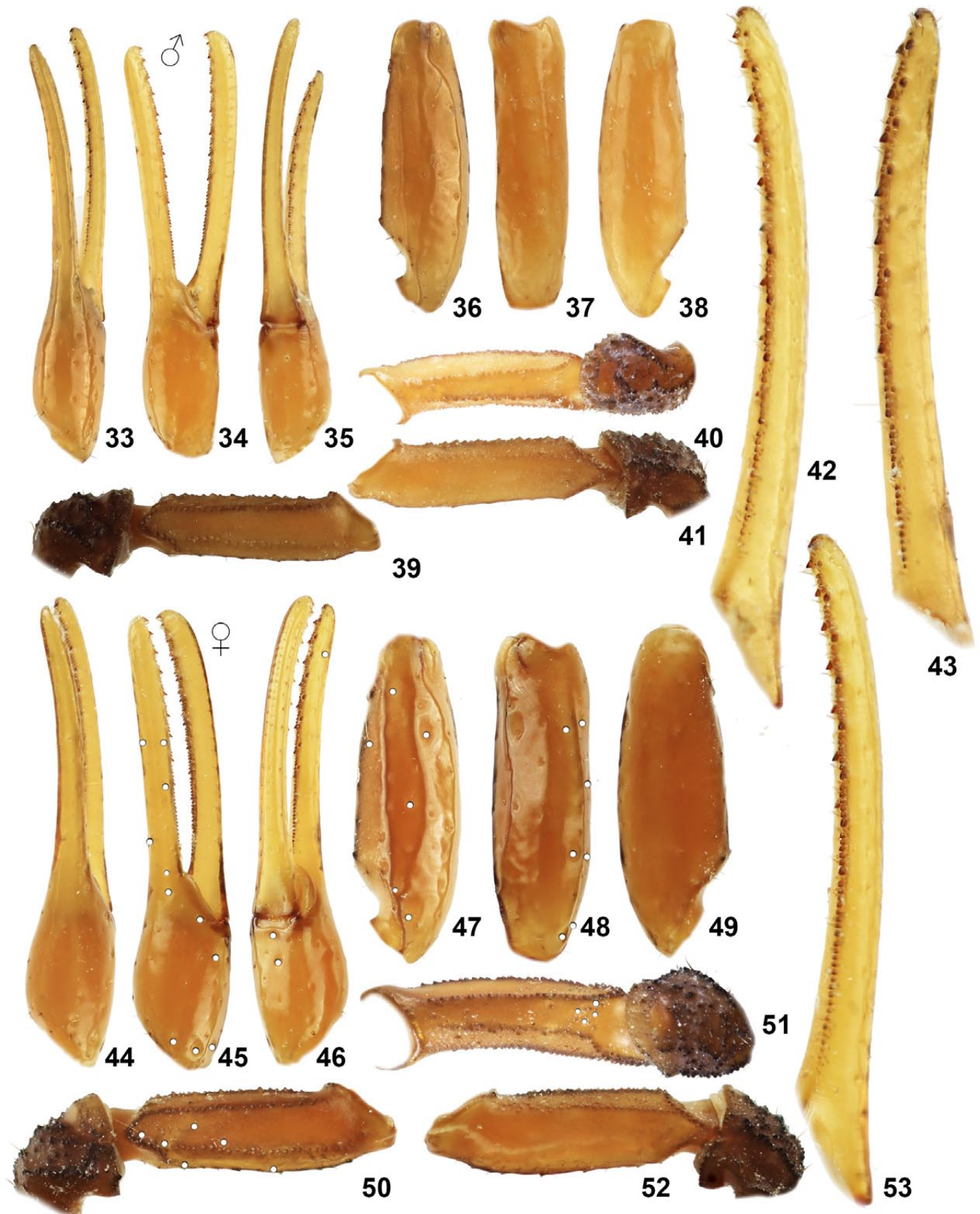
**ETYMOLOGY.** The species epithet is a patronym honoring a Russian zoologist Nikolay A. Formozov (b. 1955), a friend and colleague of V.F. and his family, in memory of our common field work in Turkmenistan back in the 1980s.

**DIAGNOSIS** (♂♀). Total length of adults 26–36 mm. Trichobothrium  $d_2$  on dorsal surface of pedipalp femur absent or reduced. Pectinal teeth number 18–21 in males and 15–19 in females. Movable finger of pedipalps with 9 rows of denticles, 7–9 ID and no OD. Dorsal carinae on pedipalp patella developed and smooth. Pedipalp femur dorsal smooth. Metasoma I–II with 10 carinae, metasoma III with 6–8 carinae, metasoma IV–V with 2 dorsolateral carinae and incomplete ventrolateral carinae. Ventral carinae of metasoma I–III consist of large granules in one or two rows. Metasoma III–V ventrally and laterally smooth with fine punctation developed, spaces among punctae smooth; metasoma I–II ventrally and laterally smooth sparsely granulated with punctation reduced. Metasoma V dorsal surface mesially smooth or with several fine granules only; metasoma I dorsally with 3–8 large granules. Tergites roughly to finely granulated. Sternite VII granulated, with four granulated carinae present. Pedipalp, metasoma and telson glabrous. Moderate to strong tibial spurs present on legs III and IV. Tarsomere I of legs I–III with 6–9 long setae in both sexes. Ratio length/width of metasoma V 1.11–1.15 in both sexes.

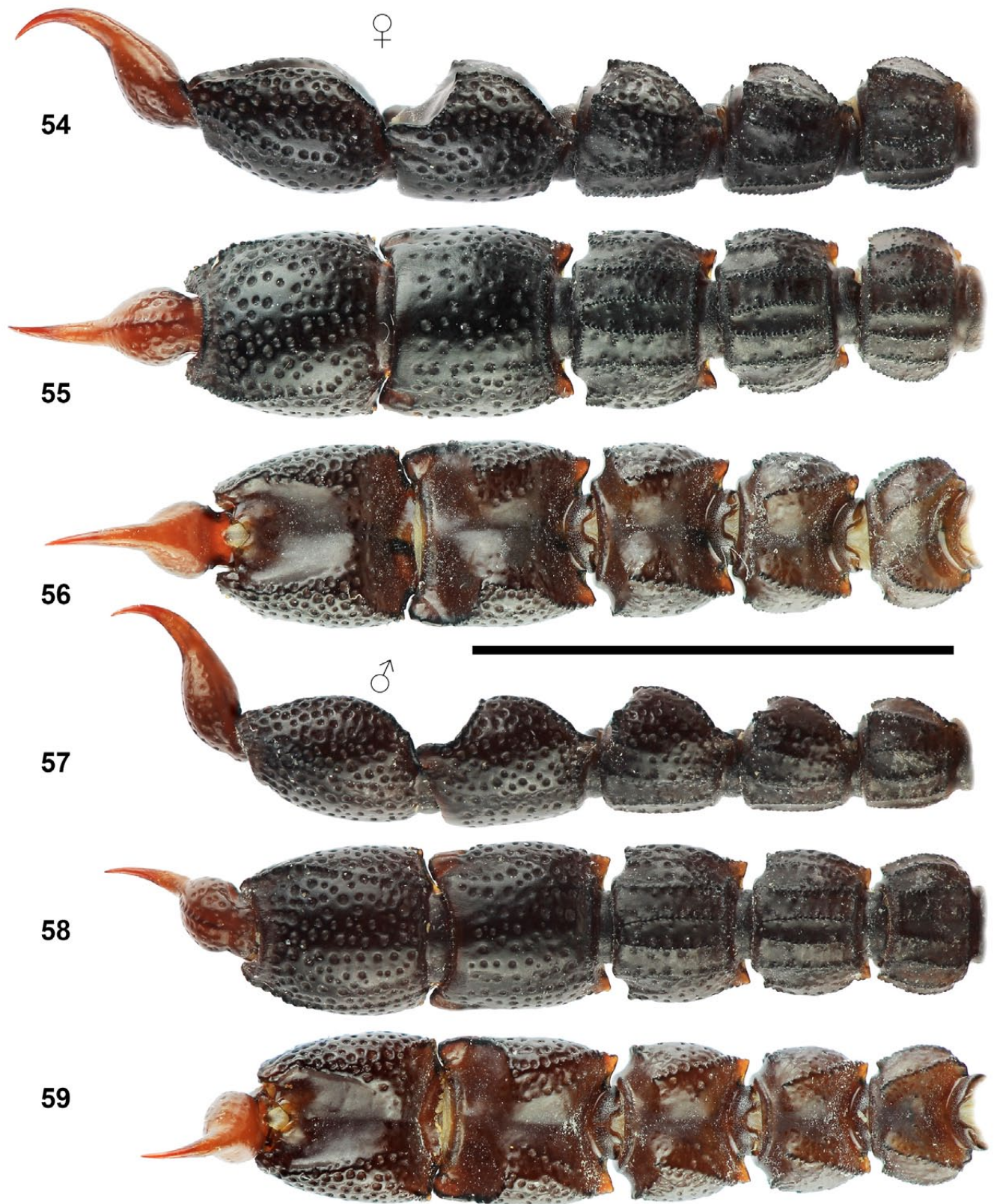
**DESCRIPTION.** Total length of adults 26–36 mm in both sexes. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 1. For habitus, see Figs. 29–32.



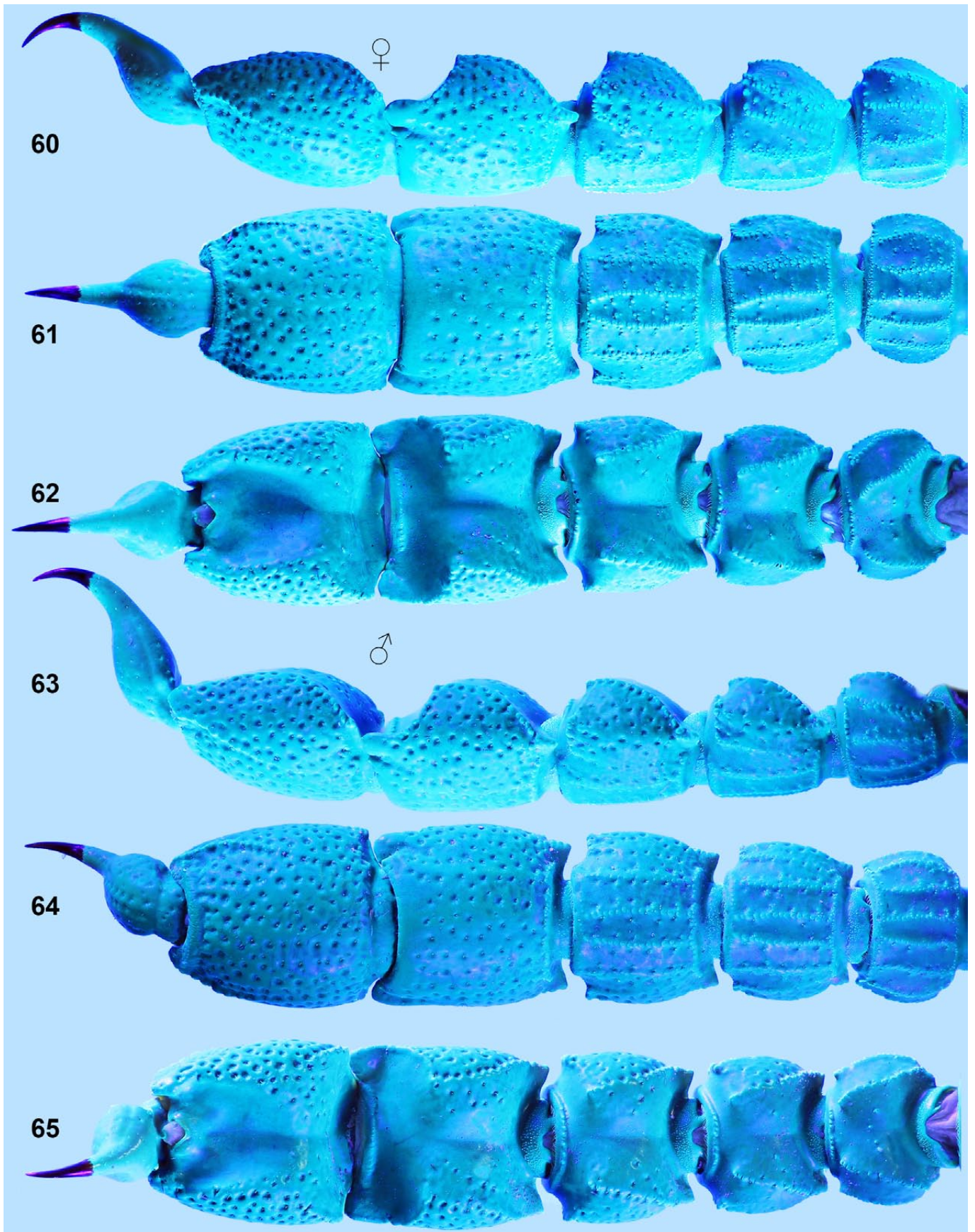
**Figures 29–32:** *Orthochirus formozovi* sp. n. **Figures 29–30.** Holotype male, dorsal (29) and ventral (30) views. **Figures 31–32.** Paratype female from type locality, dorsal (31) and ventral (32) views. Scale bar: 10 mm.



**Figures 33–53:** *Orthochirus formozovi* sp. n., segments of pedipalps. **Figures 33–43.** Holotype male. Pedipalp chela, dorsal (33), external (34), and ventral (35) views. Pedipalp patella, dorsal (36), external (37), and ventral (38) views. Pedipalp femur and trochanter, dorsal (39), internal (40) and ventral (41) views. Pedipalp chela, movable (42) and fixed (43) fingers dentate margin. **Figures 44–53.** Paratype female from type locality. Pedipalp chela, dorsal (44), external (45), and ventral (46) views. Pedipalp patella, dorsal (47), external (48), and ventral (49) views. Pedipalp femur and trochanter, dorsal (50), internal (51), and ventral (52) views. Pedipalp chela, movable finger (53) dentate margin. The trichobothrial pattern is indicated in Figures 45–48, 50–51 (white circles).



**Figures 54–59:** *Orthochirus formozovi* sp. n., metasoma and telson under white light. **Figures 54–56.** Paratype female from type locality, lateral (54), ventral (55), and dorsal (56) views. **Figures 57–59.** Holotype male, lateral (57), ventral (58), and dorsal (59) views. Scale bar: 10 mm.



Figures 60–65: *Orthochirus formozovi* sp. n., metasoma and telson under UV light. Figures 60–62. lateral (60), ventral (61), and dorsal (62) views. Figures 63–65. Holotype male, lateral (63), ventral (64), and dorsal (65) views.



Figures 66–67. *Orthochirus formozovi* sp. n., holotype male, carapace and tergites (66) and sternopectinal region and sternites (67) under UV light.

**Coloration** (Figs. 29–32). Carapace, tergites, and metasoma black. Pedipalps and legs usually yellow to yellowish brown only trochanter and femur of patella darker. Sternites yellowish brown. Telson reddish brown.

**Mesosoma and carapace** (Figs. 66–73). Tergites with a median carina and is roughly to finely granulated. Seventh sternite sparsely to densely granulated with four granulated carinae, the other sternites partly granulated but smooth in middle and posteriorly. Pectine teeth number 18–21 (2 x

18, 6 x 19, 4 x 20, 2 x 21) in males and 15–19 (1 x 15, 1 x 16, 11 x 17, 4 x 18, 3 x 19) in females.

**Metasoma and telson** (Figs. 54–65). Metasoma I–II with 10 granulated carinae. Metasoma III–V lacks lateral, and metasoma IV–V, ventromedian carinae. Ventrolateral carinae are developed on metasoma I–III and indicated on metasoma IV–V, more on metasoma V, dorsolateral carinae are present on all metasomal segments. Ventral carinae of metasoma I–III consist of large granules in one or two rows. Metasoma

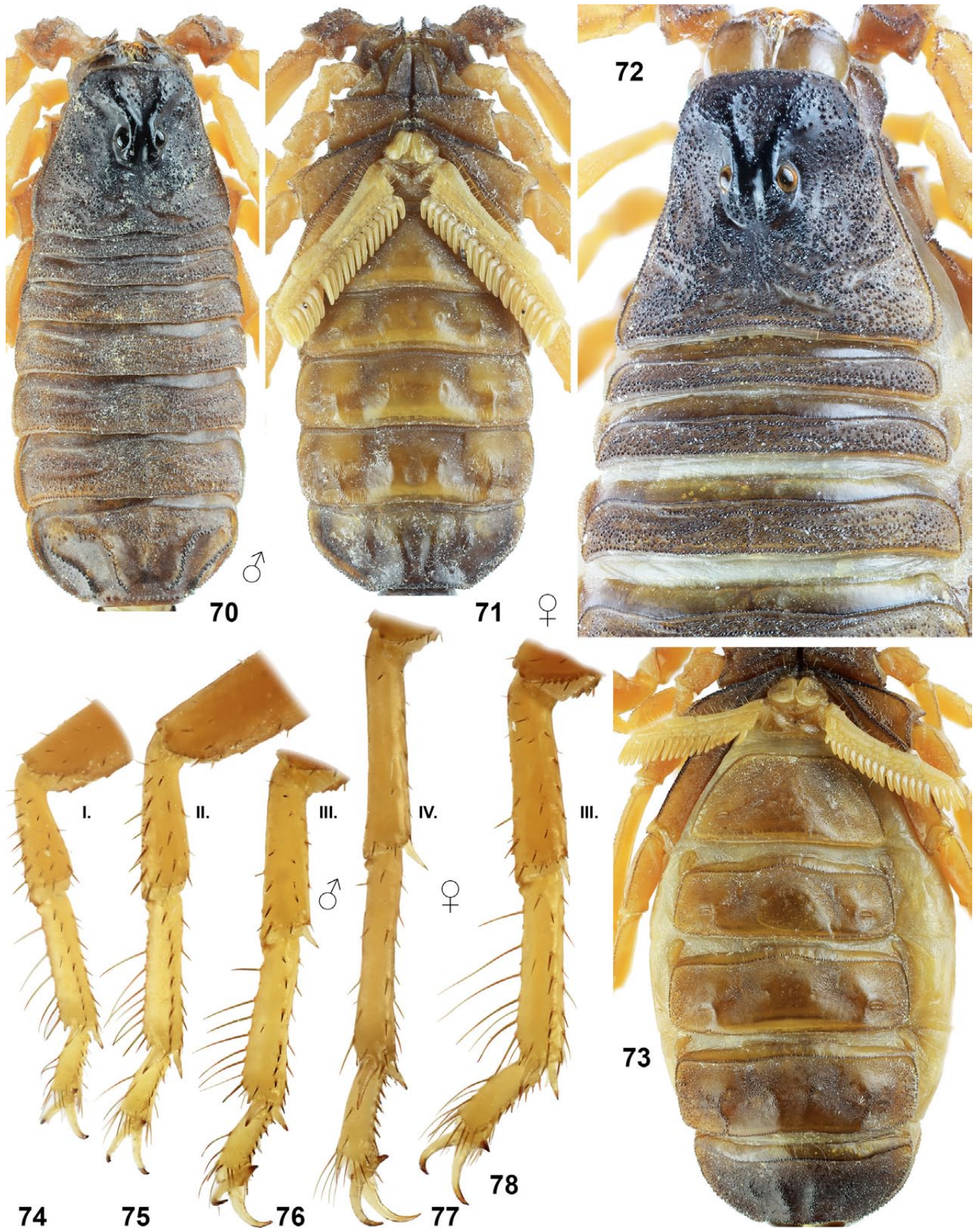




Figures 68–69. *Orthochirus formozovi* sp. n., paratype female from type locality, carapace and tergites (68) and sternopectinal region and sternites (69) under UV light.

I–III are very sparsely granulated laterally, metasoma III–V laterally punctate; granulation absent on dorsal surfaces of metasoma II–V but on metasoma V there could be several fine granules mesially. Dorsal surface of metasoma I with 3–8 large granules. Fine punctation on ventral surfaces of metasoma IV–V developed, spaces between punctae smooth. Entire metasoma and telson glabrous. Telson with punctation present but reduced.

**Pedipalps** (Figs. 33–53). Trichobothrium  $d_2$  on dorsal surface of pedipalp femur absent or reduced; trichobothrium  $e_1$  is situated between trichobothria  $d_2$  and  $d_4$ . Femur of pedipalps with five granulated carinae and is dorsally smooth. Patella has seven smooth carinae, and the chela has smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalps are glabrous with only several setae. Movable fingers with 9 rows of denticles, 7–9 ID and no OD.



**Figures 70–78:** *Orthochirus formozovi* sp. n. **Figures 70–71, 74–77.** Holotype male, carapace and tergites (70), sternite and sternites (71), and distal segments of right legs I–IV, retrolateral aspect (74–77 respectively). **Figures 72–73, 78.** Paratype female from type locality, carapace and tergites I–III (72), sternite and sternites (73), and distal segment of right leg III, retrolateral aspect (78).

**Legs** (Figs. 74–78). Moderate to strong tibial spurs present on legs III and IV. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few setae. Tibia with setae on the outer side of legs I–II. Tarsomere I of legs I–III with 6–9 long setae in both sexes, legs IV with 2–4 setae. Tarsomeres I–II internal of all legs with two rather irregular rows of setae.

**Measurements.** See Table 1.

**AFFINITIES.** Species *O. melanurus*, *O. formozovi* **sp. n.**, and *O. grosseri* **sp. n.** could be considered as members of an “*O. melanurus* group”, which is characterized by the absence of OD on the pedipalp movable finger (Fig. 42) and glabrous metasoma. This combination is present also in *O. scrobiculosus* (Fig. 291), which is differentiated from all these species by strongly granulated metasoma, especially the ventral surface of metasoma IV (Fig. 281 versus Fig. 137).

*O. grosseri* **sp. n.** and *O. melanurus* are characterized by presence of 11–22 large granules on the dorsal surface of metasoma I (*O. formozovi* **sp. n.** has only 3–8 of these large granules); they also differ by color and other characters cited in the key below.

**DISTRIBUTION.** Afghanistan, Iran, Tajikistan, Turkmenistan (Fig. 343).

### *Orthochirus fuscipes* (Pocock, 1900)

(Figure 343)

*Butheolus melanurus fuscipes* Pocock, 1900: 29.

<http://zoobank.org/urn:lsid:zoobank.org:act:C55CA44B-443A-4BE0-8C0C-E94432A9F00F>

**SYNONYMS:**

= *Paraorthochirus blandini* Lourenço & Vachon, 1997: 329 (type locality and type repository: Pakistan, environs of Karachi); Fet & Lowe, 2000: 212. **Syn. n.**

<http://zoobank.org/urn:lsid:zoobank.org:act:D304CCB0-DA0D-465E-9653-69ADF7E80965>

**REFERENCES:**

*Orthochirus fuscipes*: Vachon, 1949: 139 (1952: 225); Fet & Lowe, 2000: 195 (complete reference list until 1998); Kovařík, 2004: 11 (in part); Kovařík & Fet, 2006: 8. *Afghanorthochirus erardi*: Lourenço & Vachon, 1997: 332 (in part; paratypes from Pakistan).

**TYPE LOCALITY AND TYPE REPOSITORY.** Northern Baluchistan, now Pakistan; ?BMNH (could not be found; see Kovařík, 2004: 11).

**MATERIAL EXAMINED.** **Pakistan**, *Balochistan Province*, Lasbela District, 7 mi NW Uthal, [25°48'N 66°37'E], 2 January 1960, 1♂5♀, leg. S. Minton, CASC; Lasbela District, 7 mi from Diwana, [26°24'N 67°10'12"E], 21 February 1960, 1♀A, leg. S. Minton, CASC; Khurkhra, 38 km S Uthal, 2♂2♀, 24 April 1993, leg. S. Bečvář, FKCP. *Sindh Province*, Hyderabad, [25°22'45"N 68°22'06"E], 2012, 1♂, FKCP; 7 mi NW Karachi,

20 December 1958, 2♂3♀, leg. S. Minton, CASC; 1.75 mi NW Karachi, Airport, [24°51'36"N 67°00'12"E], 4 January 1959, leg. 1♂1juv.A, leg. S. Minton, CASC; Karachi environs, January 2007, 5♂5♀, leg. Z. Ahmed, 2008, 8♂6♀, FKCP; Thatta District, 1 mi NW Kalri (Keenjhar) Lake [24°57'N 68°03'E], 17 January 1959, 3♂3♀1juv., leg. S. Minton, CASC.

**DIAGNOSIS** (♂♀). Total length of adults 24–40 mm. Trichobothrium  $d_2$  on dorsal surface of pedipalp femur absent or reduced. Pectinal teeth number 19–22 in males and 16–20 in females. Movable finger of pedipalps with 8–9 rows of denticles, 7–9 ID and 8–9 OD. Dorsal carinae on pedipalp patella developed and smooth. Metasoma I–II with 10 carinae, metasoma III with 6–8 carinae, metasoma IV–V with 2 dorsolateral carinae and 2 partly incomplete ventrolateral carinae. Metasoma III with laterodorsal carinae without punctae. Ventral carinae of metasoma I–III consist of large granules in one or two rows. Metasoma IV–V ventrally and laterally smooth with fine punctation developed at least in female, spaces among punctae usually smooth; metasoma I ventrally and laterally granulated or bumpy with punctation reduced. Metasoma V dorsal surface mesially usually granulated; metasoma I dorsal with 0–10 large granules in adults. Tergites roughly to finely granulated. Sternite VII granulated, with four granulated carinae present. Pedipalp, metasoma and telson glabrous. Moderate tibial spurs present on legs III and IV. Tarsomere I of legs I–III with 4–8 long setae in both sexes.

**COMMENTS.** We studied specimens from Pakistan, environs of Karachi (locality of holotype of *Paraorthochirus blandini* and paratypes of *Afghanorthochirus erardi*) with strong intraspecific variability, which belong to *Orthochirus fuscipes*. Species *P. blandini* and *A. erardi* were described in different genera, which are now in synonymy with *Orthochirus*. In our opinion, all specimens from this area belong to *Orthochirus fuscipes*.

**DISTRIBUTION.** Pakistan (Fig. 343).

### *Orthochirus grosseri* **sp. n.**

(Figures 79–105, 343, Table 2)

<http://zoobank.org/urn:lsid:zoobank.org:act:15713756-558A-497B-8832-6E3BC4EFAD77>

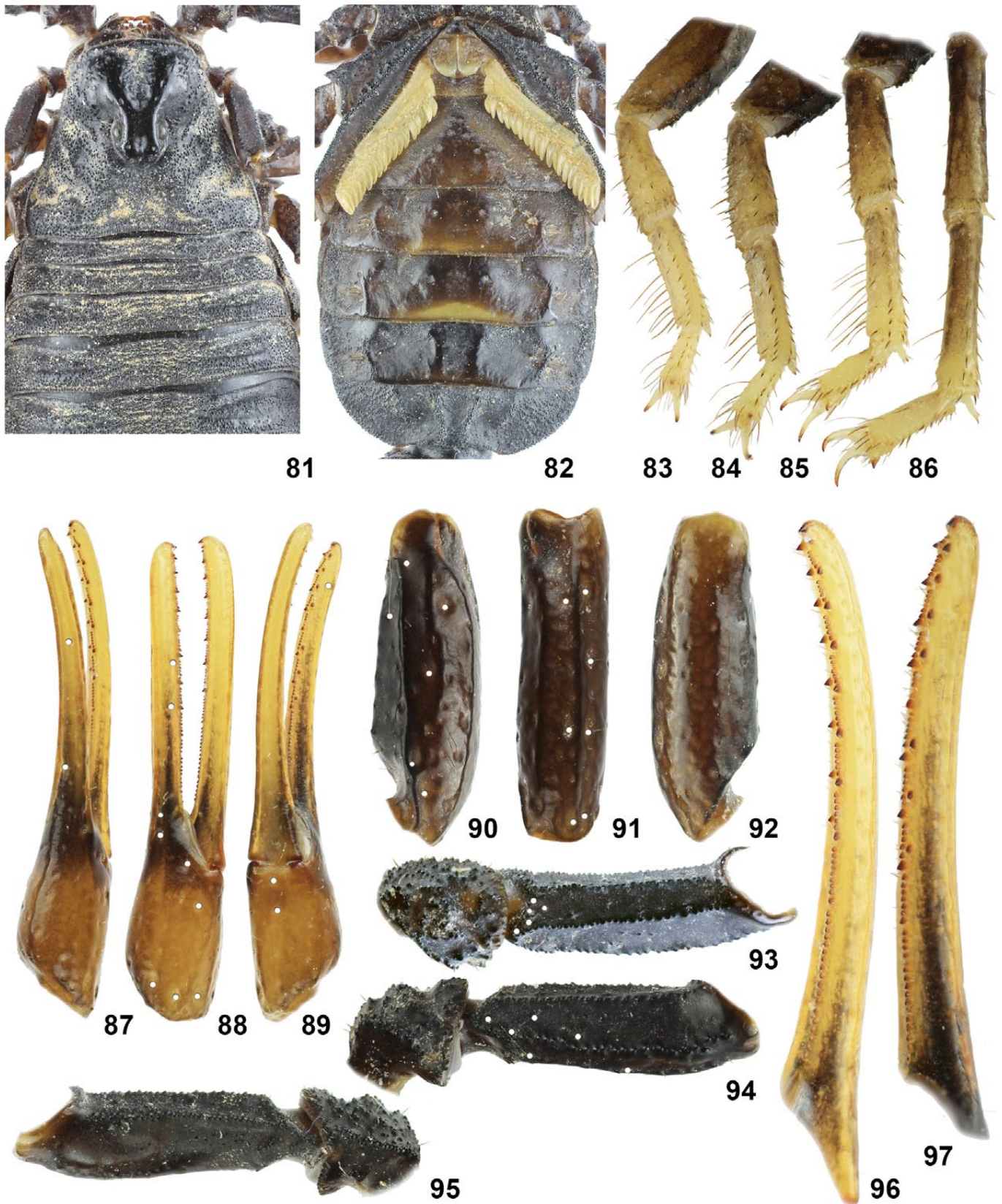
**TYPE LOCALITY AND TYPE DEPOSITORY.** **Uzbekistan**, *Surxondaryo Province*, 20 km N of Sherobod (Shirabad), 37°51.339'N 067°00.394'E, 668 m a. s. l.; FKCP.

**TYPE MATERIAL EXAMINED.** **Uzbekistan**, *Surxondaryo Province*, 20 km N of Sherobod (Shirabad), 37°51.339'N 067°00.394'E, 668 m a. s. l., 17 May 2019, 1♀ (holotype) 1♀1♂juv. (paratypes), leg. W. Grosser, FKCP.

**ETYMOLOGY.** The species epithet is a patronym honoring a Czech entomologist Walter Grosser, the collector of types of the new species.



Figures 79–80. *Orthochirus grosseri* sp. n., holotype female, dorsal (79) and ventral (80) views. Scale bar: 10 mm.



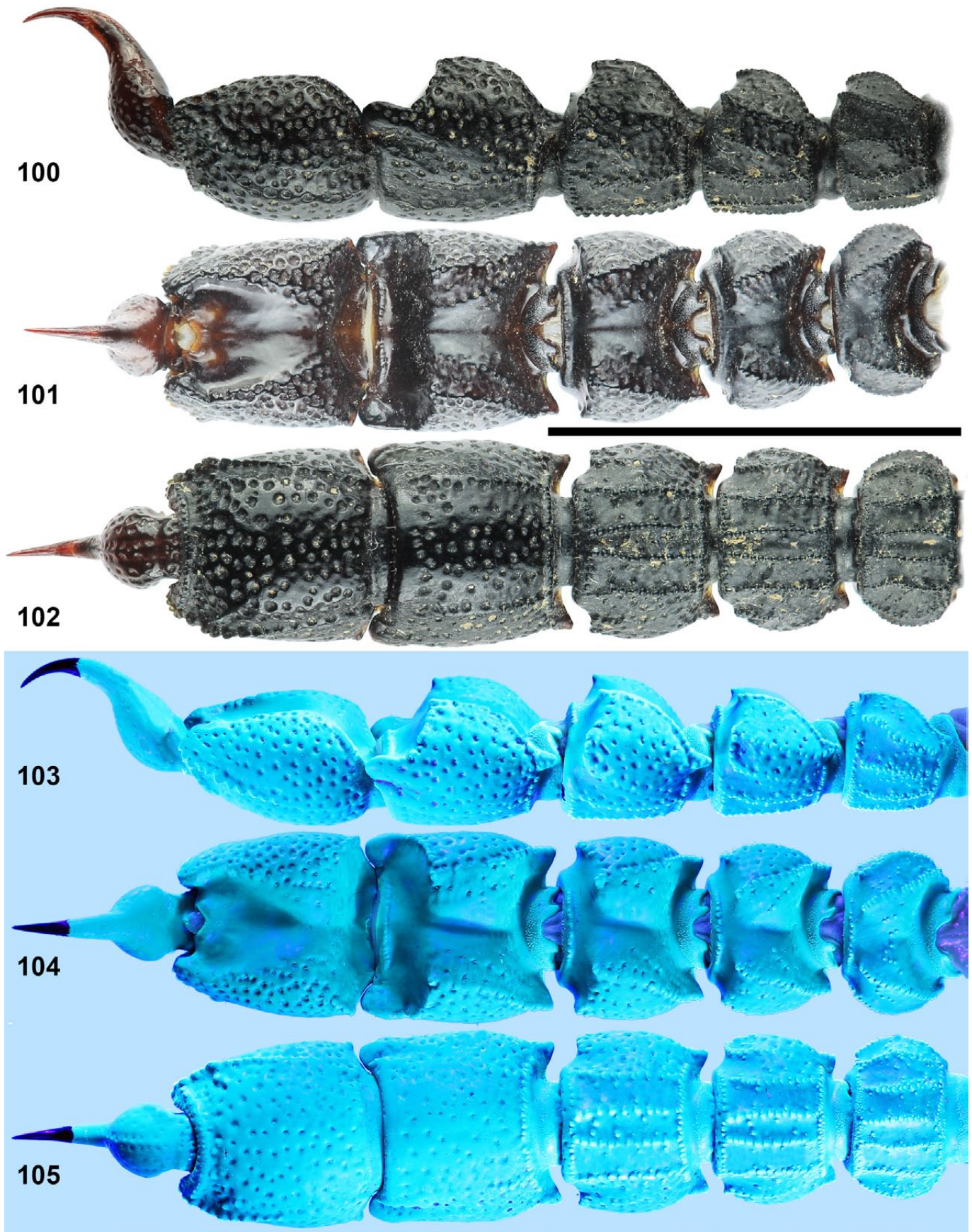
**Figures 81–97:** *Orthochirus grosseri* sp. n., holotype female. **Figures 81–82.** Carapace and tergites I–IV (81), and sternoplectinal region and sternites (82). **Figures 83–86.** Right legs I–IV, retrolateral aspect. **Figures 87–97.** Segments of pedipalps. Pedipalp chela, dorsal (87), external (88), and ventral (89) views. Pedipalp patella, dorsal (90), external (91), and ventral (92) views. Pedipalp femur and trochanter, internal (93), dorsal (94), and ventral (95) views. Pedipalp chela, movable (96) and fixed (97) fingers dentate margins. The trichobothrial pattern is indicated in Figures 87–91, 93–94 (white circles).



Figures 98–99. *Orthochirus grosseri* sp. n., holotype female, carapace and tergites (98), and sternopectinal region and sternites (99) under UV light.

DIAGNOSIS (♀). Total length of adult females 40–43 mm. Trichobothrium  $d_2$  on pedipalp femur is present but located on internal surface. Pectinal teeth number 18–20 in females. Movable finger of pedipalps with 9 rows of denticles, 8 ID and no OD. Dorsal carinae on pedipalp patella present and smooth. Metasoma I–II with 10 carinae, metasoma III with 6–8 carinae, metasoma IV–V with 2 incomplete dorsolateral carinae; ventrolateral carinae indicated on metasoma IV and present on metasoma V. Metasoma IV–V ventrally and

laterally with fine punctation developed, spaces among punctae smooth; metasoma II–III ventrally and laterally bumpy with punctation reduced. Metasoma V dorsal surface mesially smooth; metasoma I dorsally with 11–14 large granules. Tergites roughly granulated. Sternite VII densely granulated. Pedipalp, metasoma and telson glabrous. Moderate tibial spurs present on legs III and IV. Tarsomere I of legs I–III with bristlecombs composed of 9–13 setae. Ratio length/width of metasoma V 1.03 in females.



Figures 100–105. *Orthochirus grosseri* sp. n., holotype female, metasoma and telson, lateral (100, 103), dorsal (101, 104) and ventral (102, 105), under white light (100–102) and UV light (103–105). Scale bar: 10 mm.

**DESCRIPTION.** Total length 40–43 mm of adult females. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 2. For habitus, see Figs. 79–80.

**Coloration** (Figs. 79–80). Carapace, tergites, metasoma, and femur and patella of pedipalps and legs black. Chela of pedipalps reddish brown with black spots, fingers lighter. Tarsomeres of legs yellowish brown. Sternites reddish black with yellow median area indicated in posterior margin of sternite IV and developed on sternite V. Telson reddish black to black.

**Mesosoma and carapace** (Figs. 81–82, 98–99). Tergites with a median carina and is roughly granulated. Seventh sternite densely granulated with four granulated carinae, the other sternites partly granulated but smooth in middle and posteriorly. Pectine teeth number 20 in juvenile male and 18–20 (1 x 18, 2 x 19, 1x20) in females.

**Metasoma and telson** (Figs. 100–105). Metasoma I–II with 10 granulated carinae. Metasoma III–V lacks lateral and metasoma IV–V ventromedian carinae. Ventrolateral carinae are developed on metasoma I–III and indicated on metasoma IV–V, more on metasoma V, dorsolateral carinae are present on metasoma I–IV. Ventral carinae of metasoma I–III consist of large granules in one (metasoma II–III) or two (usually on metasoma I) rows. Metasoma I granulated laterally, metasoma III–V laterally punctate and smooth; granulation absent on dorsal surfaces of metasoma II–V. Metasoma I dorsally with 11–14 large granules. Fine punctation on metasoma IV–V ventrally developed, spaces among punctae smooth. Entire metasoma and telson glabrous. Telson smooth with punctation present ventrally.

**Pedipalps** (Figs. 87–97). Trichobothrium  $d_2$  on pedipalp femur is present but located on internal surface; trichobothrium  $e_1$  is situated between trichobothria  $d_2$  and  $d_4$ . Femur of pedipalps with five granulated carinae and is dorsally rather smooth. Patella has seven smooth carinae, and the chela has smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalps are glabrous with several setae only. Movable fingers with 9 rows of denticles, 8 ID and no OD.

**Legs** (Figs. 83–86). Moderate tibial spurs present on legs III and IV. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few setae. Tibia with setae on the outer side of legs I–III. Tarsomere I of legs I–III with 9–13 long setae in females, legs IV with 2–4 setae. Tarsomeres I–II of all legs internally with two rather irregular rows of setae.

**Measurements.** See Table 2.

**AFFINITIES.** See affinities under description of *O. formozovi* sp. n.

**DISTRIBUTION.** Uzbekistan (Fig. 343). Known only from the type locality.

### *Orthochirus kryzhanovskiy* sp. n.

(Figures 106–132, 343, Table 1)

<http://zoobank.org/urn:lsid:zoobank.org:act:CEF6E0E2-1290-48DD-8489-F6B24050A63E>

**TYPE LOCALITY AND TYPE DEPOSITORY.** Pakistan, Sindh Province, Nagarparkar, [24.3558°N, 70.7544°E]; FKCP.

**TYPE MATERIAL EXAMINED.** Pakistan, Sindh Province, Nagarparkar, [24.3558°N, 70.7544°E], 15 September 2010, 1♂ (holotype), leg. Z. Ahmed, FKCP.

**ETYMOLOGY.** The species epithet is a patronym honoring Oleg Leonidovich Kryzhanovskiy (1918–1997), a great Russian entomologist, coleopterologist, and biogeographer who worked extensively on the Central Asian fauna (Kryzhanovskiy, 1965). His monumental work influenced numerous zoologists across the former USSR, including V.F.

**DIAGNOSIS** (♂). Total length of male holotype 22.44 mm. Color yellow, with mesosoma yellow to yellowish brown. Trichobothrium  $d_2$  on dorsal surface of pedipalp femur absent. Pectinal teeth number 21–23 in male. Movable finger of pedipalps with 8–9 rows of denticles, 8 ID and 8–9 OD. Dorsal carinae on pedipalp patella present and partly granulated. Pedipalp femur dorsal finely granulated. Metasoma I–V dorsal densely granulated. Metasoma I–III with 6–8 carinae, metasoma IV–V with 2 dorsolateral carinae; ventrolateral carinae indicated on metasoma IV and present on metasoma V. Ventral carinae of metasoma I–III smooth or consist of a row of large granules. Fine punctation ventrally developed on metasoma V and reduced on metasoma IV. Tergites roughly granulated. Sternite VII densely granulated laterally but smooth in middle, without carinae. Pedipalp, metasoma and telson glabrous. Moderate tibial spurs present on legs III and IV. Tarsomere I of legs I–III with 5–7 long setae in male. Ratio length/width of metasoma V 1.27 in male holotype. Pedipalp femur length/width ratio 3.1 in male holotype.

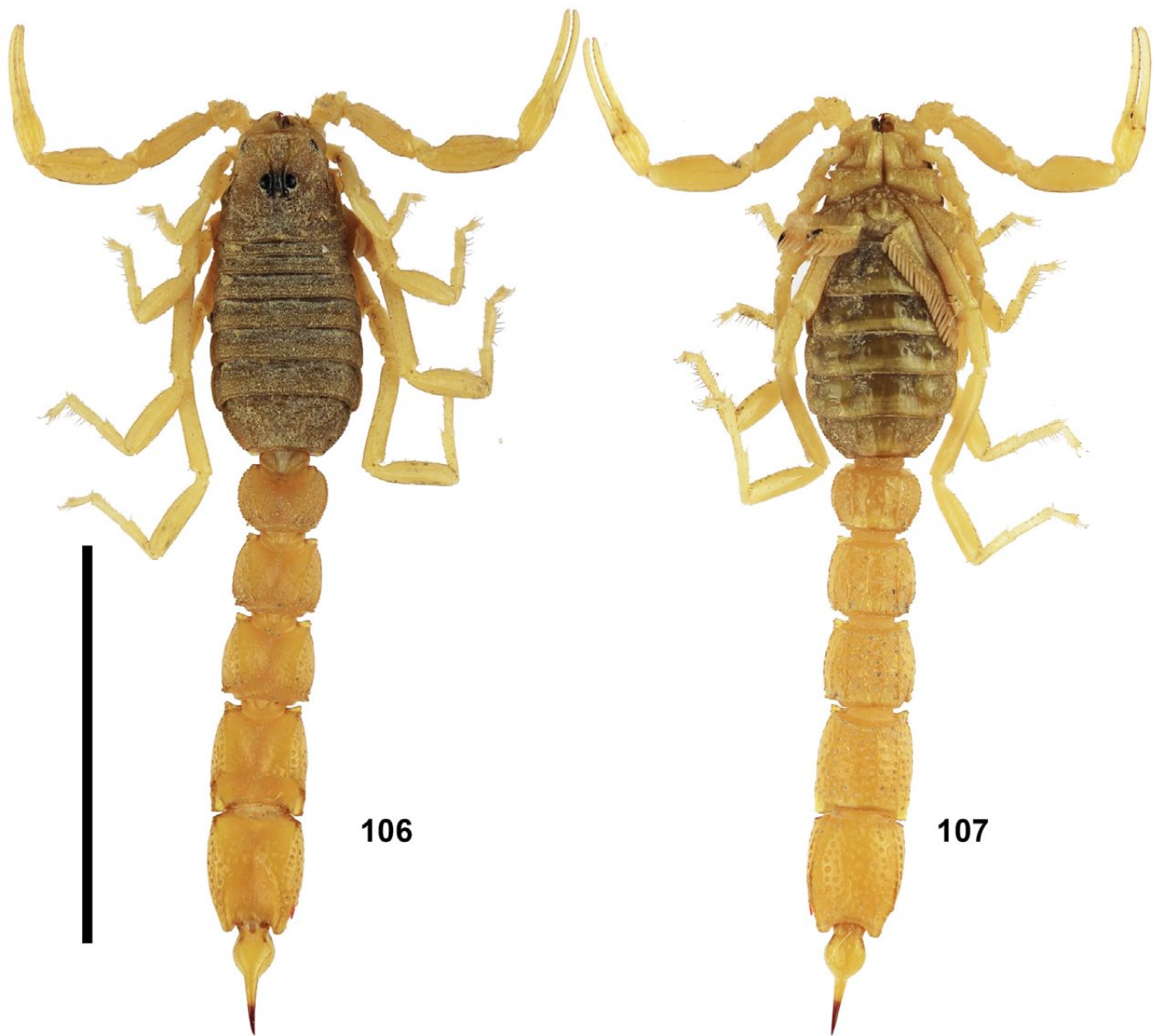
**DESCRIPTION.** Total length of adult male 22.44 mm. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 1. For habitus, see Figs. 106–107.

**Coloration** (Figs. 106–107). Color yellow, with mesosoma yellow to yellowish brown.

**Mesosoma and carapace** (Figs. 108–111). Tergites with a median carina and is roughly granulated. Seventh sternite densely granulated laterally but smooth in middle, without carinae, the other sternites almost smooth with small symmetrical granulated areas and several granules anteriorly and laterally. Pectinal teeth number 21–23 in male holotype.

**Metasoma and telson** (Figs. 116–122). Metasoma I–III with 6–8 partly granulated carinae. Metasoma I, IV–V lack ventromedian carinae; metasoma II–V lack lateral carinae,





Figures 106–107. *Orthochirus kryzhanovskiy* sp. n., holotype male, dorsal (79) and ventral (80) views. Scale bar: 10 mm.

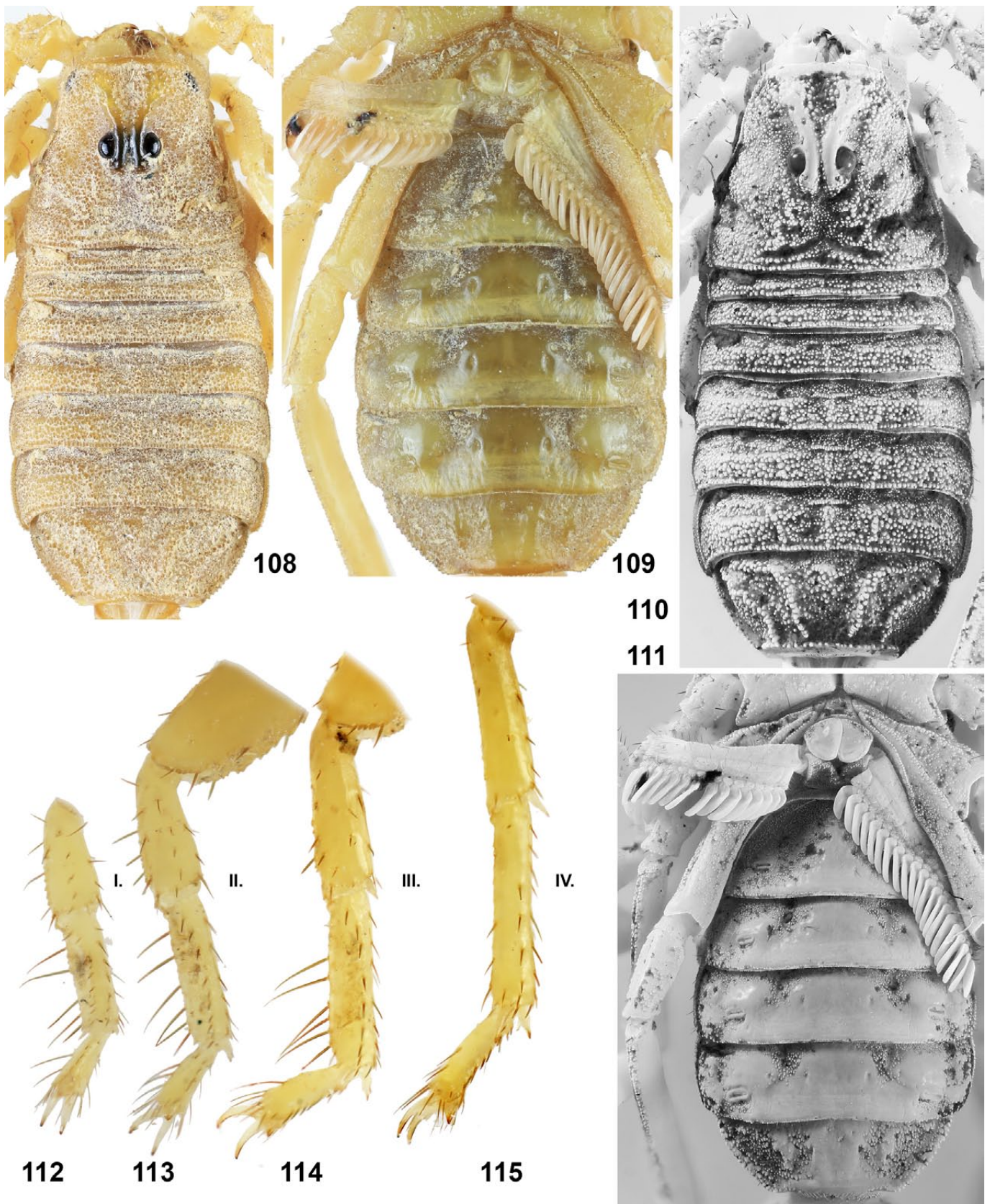
which are indicated on metasoma II. Ventrolateral carinae are developed on metasoma I–III, V and indicated on metasoma IV, dorsolateral carinae are present on metasoma I–III, and indicated to absent on metasoma IV–V. Ventral carinae of metasoma I–III smooth or consist of a row of large granules. Metasoma I and partly metasoma II–III are granulated laterally, metasoma III–V laterally punctate; granulation present on dorsal surfaces of all metasomal segments and irregularly also on ventral surfaces. Fine punctation ventrally developed on metasoma V and reduced on metasoma IV. Entire metasoma and telson glabrous. Telson smooth, without punctation.

**Pedipalps** (Figs. 123–132). Trichobothrium  $d_2$  on dorsal surface of pedipalp femur absent; trichobothrium  $e_1$  is situated at level with  $d_4$ . Femur of pedipalps with five granulated

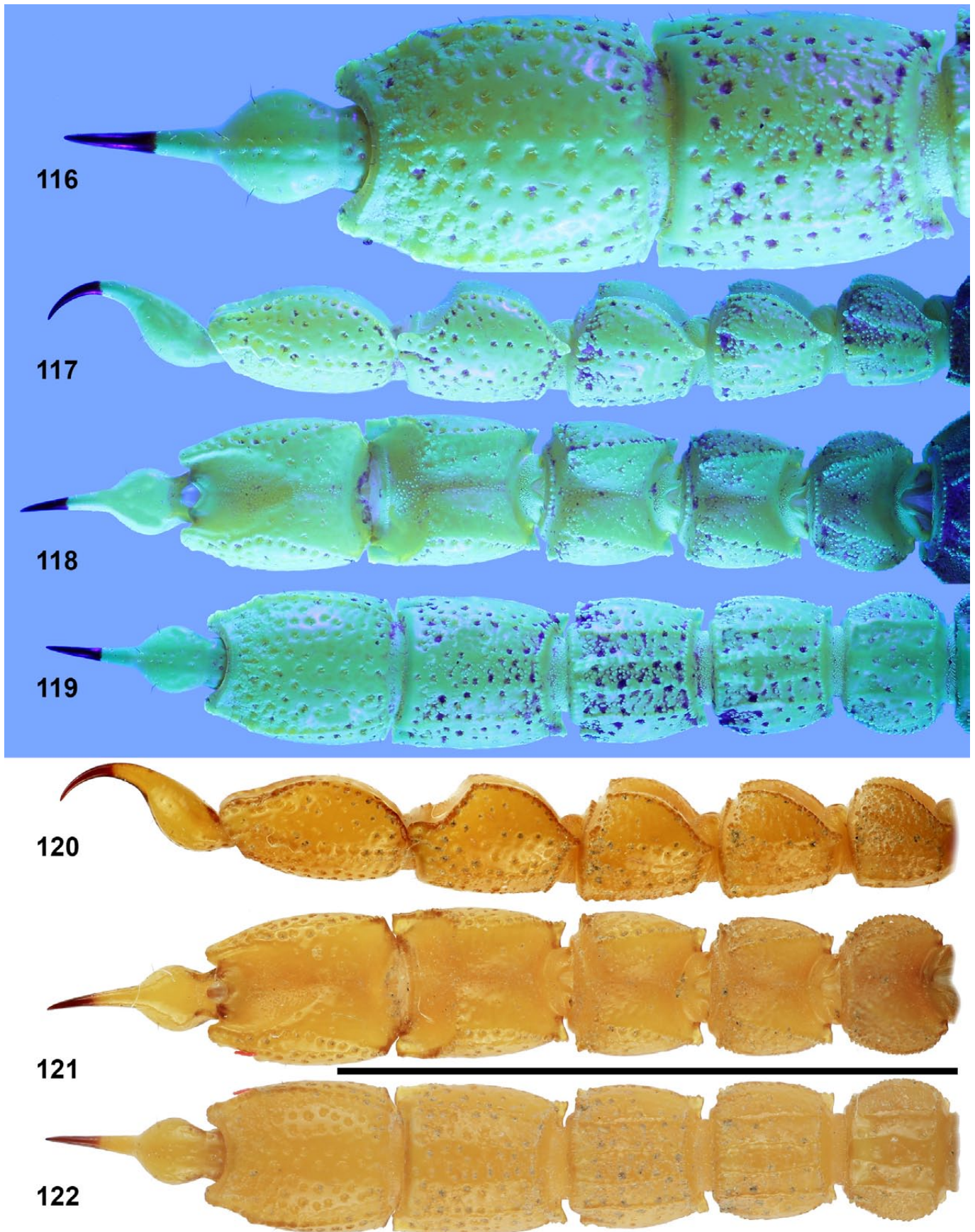
carinae and is dorsally granulated. Patella has seven partly granulated carinae, and the chela has smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalps are glabrous with several setae only. Movable fingers with 8–9 rows of denticles, 8 ID and 8–9 OD.

**Legs** (Figs. 112–115). Moderate tibial spurs present on legs III and IV. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few setae. Tibia with setae on the outer side of legs I–III. Tarsomere I of legs I–III with 5–7 long setae in male, legs IV with 3–4 setae. Tarsomeres I–II internal of all legs with two rather irregular rows of setae.

**Measurements.** See Table 1.



**Figures 108–115:** *Orthochirus kryzhanovskiy* sp. n., holotype male. **Figures 108–111.** Carapace and tergites (108, 110), and sternopleural region and sternites (109, 111), under white light (108–109) and UV light (110–111). **Figures 112–115.** Right legs I–IV, retrolateral aspect.



Figures 116–122. *Orthochirus kryzhanovskyi* sp. n., holotype male, metasoma IV–V and telson ventral (116), metasoma and telson, lateral (117, 120), dorsal (118, 121), and ventral (119, 122), under UV light (116–119) and white light (120–122). Scale bar: 10 mm. (117–122).



**Figures 123–132.** *Orthochirus kryzhanovskiy* sp. n., holotype male, segments of pedipalps. Pedipalp chela, dorsal (123), external (124), and ventral (125) views. Pedipalp patella, dorsal (126), external (127), and ventral (128) views. Pedipalp femur and trochanter, internal (129), dorsal (130), and ventral (131) views. Pedipalp chela, movable finger (132) dentate margins. The trichobothrial pattern is indicated in Figures 123–127, 129–130 (white circles).

**AFFINITIES.** Yellow color, with mesosoma yellow to yellowish brown (Figs. 106–107) distinguish *O. kryzhanovskiy* sp. n. from all other species of the genus except *O. pallidus*, which, according to Pocock (1897: 107–108), is “entirely pale yellow throughout, the eyes alone black”. The first author studied and designated lectotype of *O. pallidus* in 2004 (see Figs. 344–349); this specimen most likely has changed color due to long storage in alcohol so its original color cannot be verified. Tikader & Bastawade (1983) cited its color as “... yellowish in color but darker on metasomal segments.”

Another unusual character is presence of granulation on dorsal surfaces of all metasomal segments. *O. pallidus* also has granulated metasomal segments but mainly ventrally (Figs. 346 and 348). Dorsal surfaces of metasoma I–III are in *O. pallidus* rather smooth and bumpy (Fig. 347), and in *O. kryzhanovskiy* sp. n. they are granulated (Fig. 118).

**DISTRIBUTION.** Pakistan (Fig. 343). Known only from the type locality.

### *Orthochirus melanurus* (Kessler, 1874)

(Figures 1, 133–188, 343, 350–351, Table 2)

*Androctonus melanurus* Kessler, 1874: 16–18, pl. I, fig. 1–3 (see our Fig. 350).

<http://zoobank.org/urn:lsid:zoobank.org:act:DE1849D4-AD47-4513-A8F2-0357143EEEEED>

#### SYNONYMS:

= ? *Orthochirus melanurus* forma  $\gamma$  (*concolor*) Birula, 1898: 282–283 (type locality and type repository: Uzbekistan, Karshi [now Qarshi, 38.86°N 65.79°E]; ZISP No. 645, type lost). **Syn. n.**

<http://zoobank.org/urn:lsid:zoobank.org:act:35B50AC1-46A8-4355-8A3E-4DED66B1B97F>

#### REFERENCES:

“A small scorpion, yellowish green, with black tail”: Bogdanov, 1882: 47, one figure on p. 48 (see our Fig. 351).

Dimensions (mm)		<i>O. scrobiculosus</i>	<i>O. melanurus</i>	<i>O. melanurus</i>	<i>O. grosseri</i> sp. n.
		♀ lectotype	♂ Baigakum	♀ Baigakum	♀ holotype
Carapace	L / W	4.48 / 5.30	3.59 / 4.12	4.07 / 4.73	4.87 / 5.70
Mesosoma	L	8.98	6.93	11.59	14.08
Tergite VII	L / W	2.61 / 5.88	1.94 / 4.40	2.27 / 5.55	3.47 / 6.70
Metasoma + telson	L	22.93	18.77	19.94	24.00
Segment I	L / W / D	2.53 / 3.37 / 2.75	2.07 / 2.87 / 2.29	2.14 / 3.07 / 2.69	2.95 / 4.10 / 3.27
Segment II	L / W / D	2.87 / 3.82 / 3.07	2.56 / 2.95 / 2.19	2.73 / 3.13 / 2.54	3.36 / 4.22 / 3.46
Segment III	L / W / D	3.70 / 4.07 / 3.30	2.85 / 3.20 / 2.42	3.11 / 3.31 / 2.64	3.82 / 4.50 / 3.83
Segment IV	L / W / D	4.81 / 4.18 / 3.02	3.71 / 3.43 / 2.51	3.88 / 3.46 / 2.52	4.85 / 4.65 / 3.91
Segment V	L / W / D	4.87 / 4.03 / 2.80	3.86 / 3.34 / 2.23	4.05 / 3.36 / 2.29	4.43 / 4.32 / 3.39
Telson	L / W / D	4.15 / 1.72 / 1.38	3.72 / 1.46 / 1.21	4.03 / 1.45 / 1.28	4.59 / 1.71 / 1.46
Pedipalp	L	13.23	11.15	12.08	14.52
Femur	L / W	3.34 / 0.94	2.91 / 0.87	3.01 / 0.84	3.62 / 1.05
Patella	L / W	4.21 / 1.32	3.40 / 1.09	3.69 / 1.13	4.47 / 1.46
Chela	L	5.68	4.84	5.38	6.43
Manus	W / D	1.07 / 1.08	0.88 / 0.88	0.95 / 0.99	1.39 / 1.15
Movable finger	L	3.90	3.33	3.76	4.45
<b>Total</b>	<b>L</b>	<b>36.39</b>	<b>29.29</b>	<b>35.60</b>	<b>42.95</b>

**Table 2.** Comparative measurements of *Orthochirus scrobiculosus*, *O. melanurus*, and *O. grosseri* sp. n. specimens. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

*Orthochirus melanurus*: Birula, 1898: 281–283 (in part); Tikader & Bastawade, 1983: 134–140, figs. 367–381 (misidentification).

*Butheolus melanurus* (in part): Kraepelin, 1899: 35–36; Pocock, 1900: 28–29; Birula, 1900a: 13; Birula, 1903: 74–75; Birula, 1905a: 125–129.

*Butheolus melanurus typicus*: Birula, 1900b: 373–374 [not an available name since it was intended to designate the nominotypic subspecies *B. m. melanurus*].

*Butheolus melanurus concolor*: Birula, 1900b: 374.

*Butheolus scrobiculosus melanurus*: Birula, 1909: 359.

*Butheolus scrobiculosus concolor*: Birula, 1909: 359; Werner, 1916: 81.

*Orthochirus scrobiculosus*: Fet, 1989: 114–115 (in part); Gromov & Kopdykbaev, 1994: 20; Fet & Lowe, 2000: 196 (complete reference list until 1998).

*Orthochirus scrobiculosus scrobiculosus* (in part): Fet, 1989: 116; Fet & Lowe, 2000: 197 (complete reference list until 1998).

*Orthochirus scrobiculosus melanurus* (in part): Birula, 1917: 241; Birula, 1918: 40; Birula, 1918: 39; Fet, 1989: 118; Fet & Lowe, 2000: 198 (complete reference list until 1998); Kovařík, 2004: 20.

*Orthochirus scrobiculosus concolor*: Birula, 1917: 241; Birula, 1918: 40; Birula, 1918: 40; Fet, 1989: 118; Fet, 1994: 530; Kovařík, 1998: 116; Fet & Lowe, 2000: 198 (complete reference list until 1998); Kovařík, 2004: 20.

TYPE LOCALITY AND TYPE DEPOSITORY. **Uzbekistan**, central Kyzylkum Desert, exact locality unclear; ZISP No. 667.

TYPE MATERIAL EXAMINED. 1♀ (lectotype, designated here, Figs. 133–139), “Syr-Darya Province, Kyzylkum Desert”, now Uzbekistan, exact locality unclear [approximately between 42°35'N 63°30'E and 41°00'N 62°00'E], ZISP No. 667, leg. M[odest N.] Bogdanov, [April–May] 1873 (see History of Study below).

OTHER TYPE MATERIAL (presumed lost). Paralectotypes: **Kazakhstan**, *Mangystau Province*, Tyubkaragan District, Novoalexandrovskoye (now in ruins), at Kaydak Bay (Sor Kaydak) [44°41'N 53°25'E], 2♀, leg. Alexander Lehmann, [1840], ZISP No. 656; **Turkmenistan**, Krasnovodsk, no date, leg. Göbel, 3♂3♀, ZISP No. 690 [belong to *O. scrobiculosus* (Grube, 1873)].

OTHER MATERIAL EXAMINED. **Kazakhstan**, *Kyzylorda Province*, Chiili District, ca 2.5 km NW Baigakum [formerly Dzhulek, or Djulek], 44°20'29" to 37"N 66°27'07" to 09"E, 127 m a. s. l., 25 May 2002, 6♂2♀juvs. (Figs. 141–184), leg. V. Fet & A. V. Gromov (FKCP); Dzhulek [now Baigakum], 4 [Old Style, 17 New Style] May 1905, 1♀, leg. Yu. Beckmann, ZISP No. 665. **Uzbekistan**, *Bokhara Province*, [12 km from Qorovulbozor [39.50°N 64.80°E], Djeiran Pitomnik (Gazelle Nursery), June 1989, 1♂1♀, leg. J. Růžička (FKCP). *Jizzakh Province*, Nuratau Range, May 1989, 1♂1♀, leg. D. Král (FKCP); Nuratinski Reserve, Khayatsai Valley [40°30'29"N 66°43'26"E], 1400 m a.s.l., 15 May 1996, 1♀ (FKCP). *Qashqadaryo Province*, Qarshi (Karshi) Steppe near Muborak (Mubarek), 39°20'38"N 65°05'16"E, 272 m a. s. l., 10 May 2002, 1♂4♀2juvs., leg. V. Fet (FKCP). *Surxondaryo Province*,



Figures 133–138: *Orthochirus melanurus*, lectotype female. Figures 133–134. Dorsal (133) and ventral (134) views. Figures 135–137. Metasoma and telson, lateral (135), dorsal (136), and ventral (137) views. Figure 138. Original labels. Scale bars: 10 mm (133–134, 135–137).

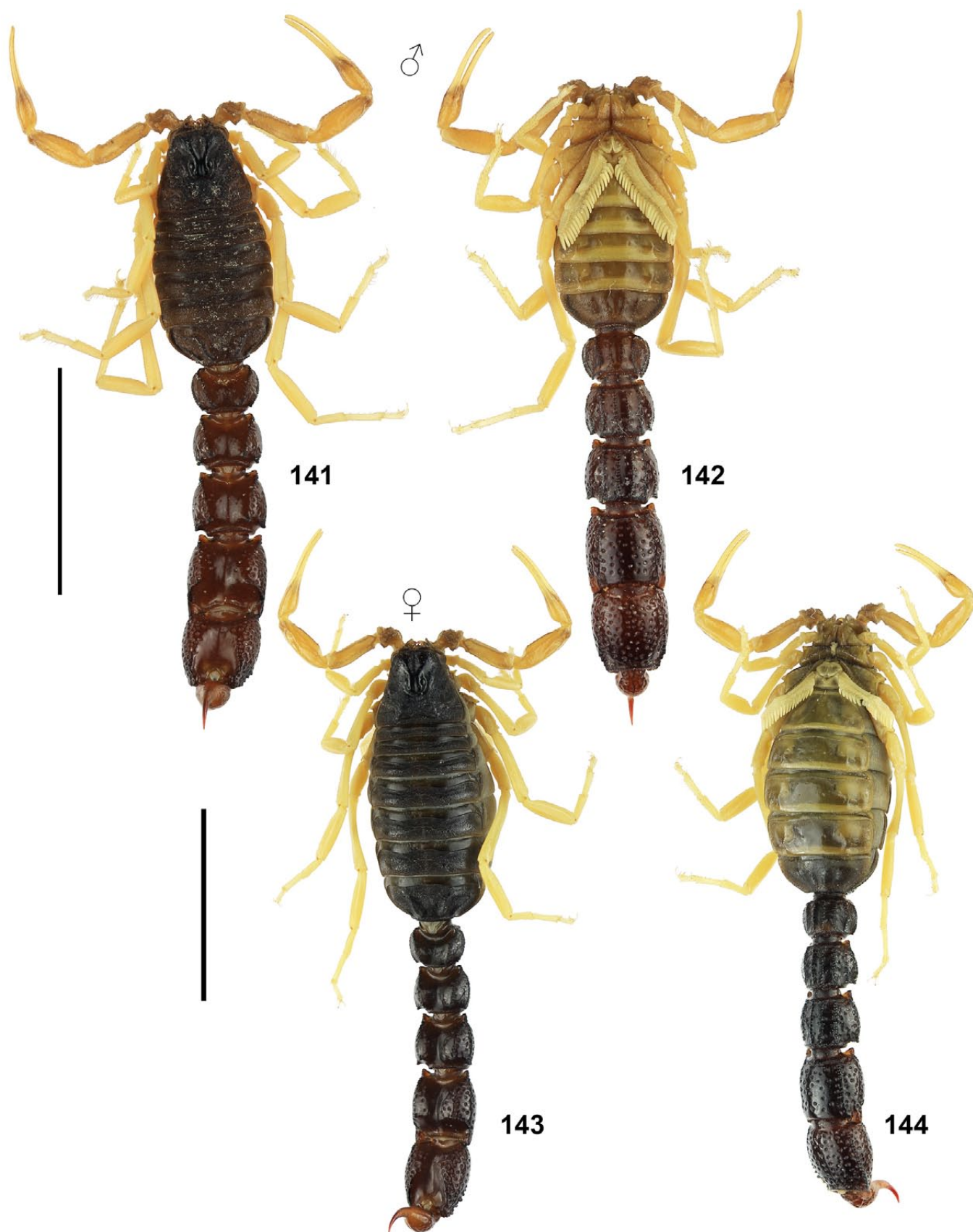
139 *Orthochirus scrobiculatus melanurus* (Kessl.) Наземн. жив.  
Рус. Центр. Муз. Листъ 3  
Серб. Дарвин. од.с.

№ входящего журн.	Число экз.			Полъ.	МѢСТО СБОРА.	Время сбора.	КОЛЛЕКТОРЪ.	Кто опредѣлялъ.	ОТМѢТКА.
	Самц.	Сухихъ.	Мертв. прел.						
665 106-1905	1			♂	Серб. Дарвин. од.с., Дубичка	21 V 1905	Ю. Дебицкая	А. Вирала	
669 107-1907	1			♀	Серб. Дарвин. од.с., Камладенъ - Рудука (пески на до в. къ 10-9.)	20 VI 1907	Н. Зарудкий		
667 1318	1			♀	i вид.; Кизилъ-Кумуль	1879	М. Богдановъ	"	{ « <i>Orthochirus melanurus</i> n. sp.» teste H. Kessler

140 *Orthochirus scrobiculatus*  
(= *Bathochirus melanurus*) реведъ Вирала Наземн. жив.  
Перевъ Листъ 1

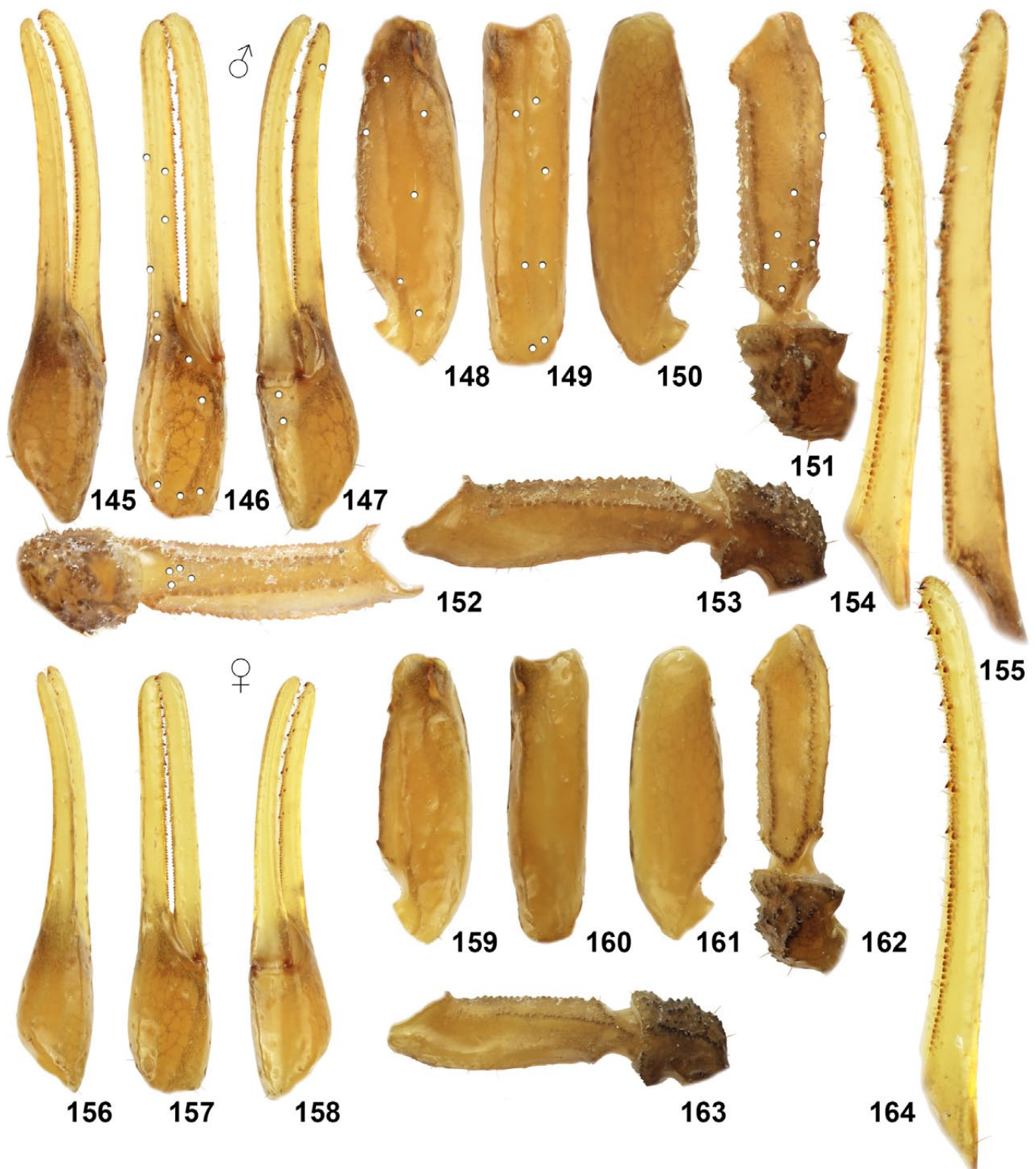
№ входящего журн.	Число экз.			Полъ.	МѢСТО СБОРА.	Время сбора.	КОЛЛЕКТОРЪ.	Кто опредѣлялъ.	ОТМѢТКА.
	Самц.	Сухихъ.	Мертв. прел.						
675	6			♂	Сейстанъ; Экск. по Нейзару	21-24 V 1896	Н. Зарудкий	Ex. Turpan.	в банке - 4 ин
676 18-1899	1			♀	Сейстанъ: Бусейтъ - Аббадъ	2 VI 1898	Н. Зарудкий	А. Вирала	
677 18-1899	2			♂	Сейстанъ: развалины Кочудара	7 VI 1898	Н. Зарудкий	"	
678 18-1899	1			♂	Кирманъ: городъ Базъ- манъ.	5 VII 1898	Н. Зарудкий	"	
	1				Кирманъ: Бирдусанъ дер.				
679 191-1901	5			♂	Сейстанъ; ко даровъ мездъ Нейзаровъ и дер. Ам-абадъ	1-10 VI 1901	Н. Зарудкий	"	
680 191	1			♀	Бирдусанъ; пр. Сарбазъ дер. Сарбазъ	20 II 1901	Н. Зарудкий	"	

Figures 139–140. Original registered cards (ZISP) of *Orthochirus melanurus* (139) and *O. persa* stat. n. (140) types.

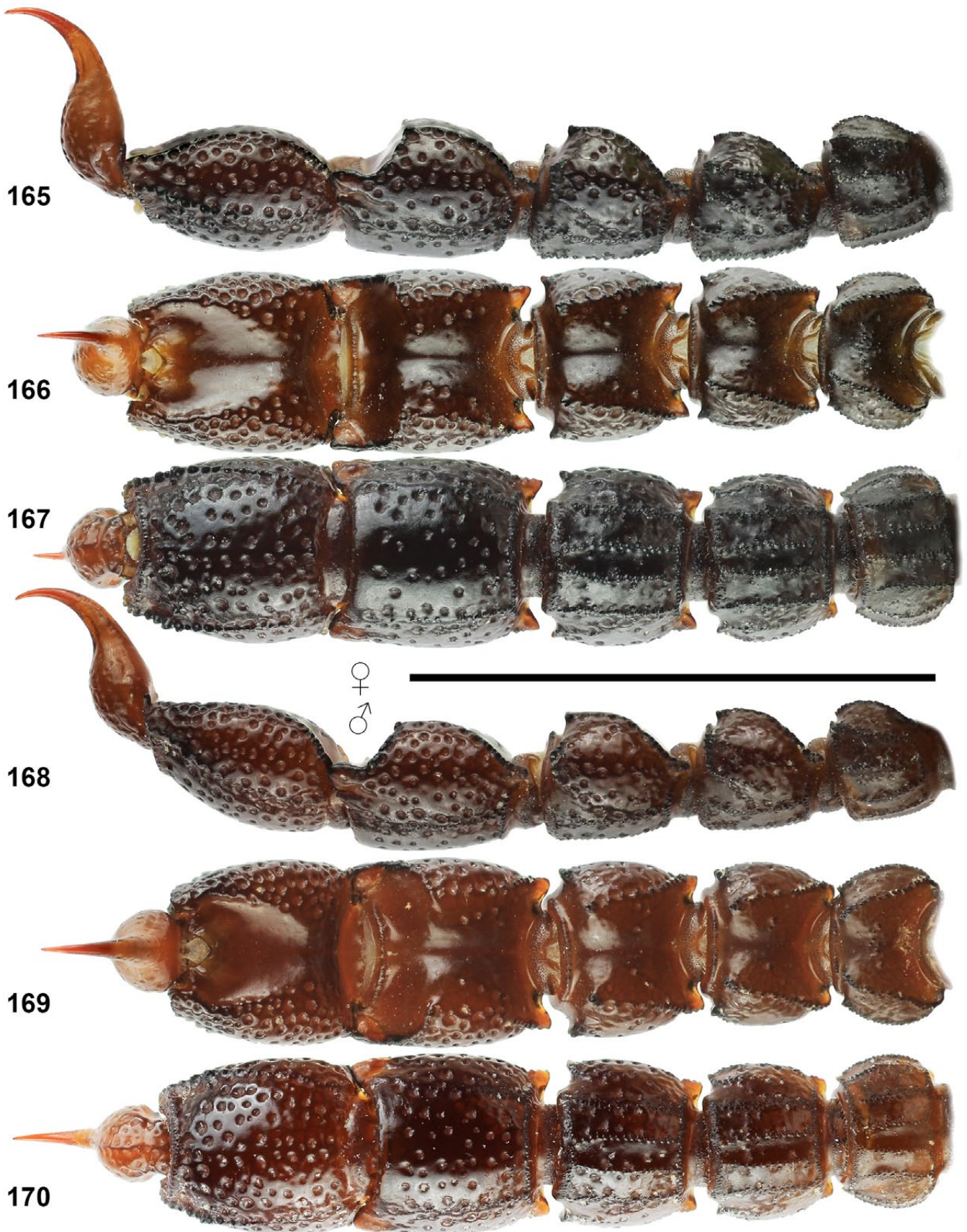


**Figures 141–144:** *Orthochirus melanurus*, Kazakhstan, Kyzylorda Province, Baigakum, 44°20'29" to 37°N 66°27'07" to 09"E, FKCP. **Figures 141–142.** Male, dorsal (141) and ventral (142) views. **Figures 143–144.** Female, dorsal (143) and ventral (144) views. Scale bars: 10 mm 141–142, 143–144).

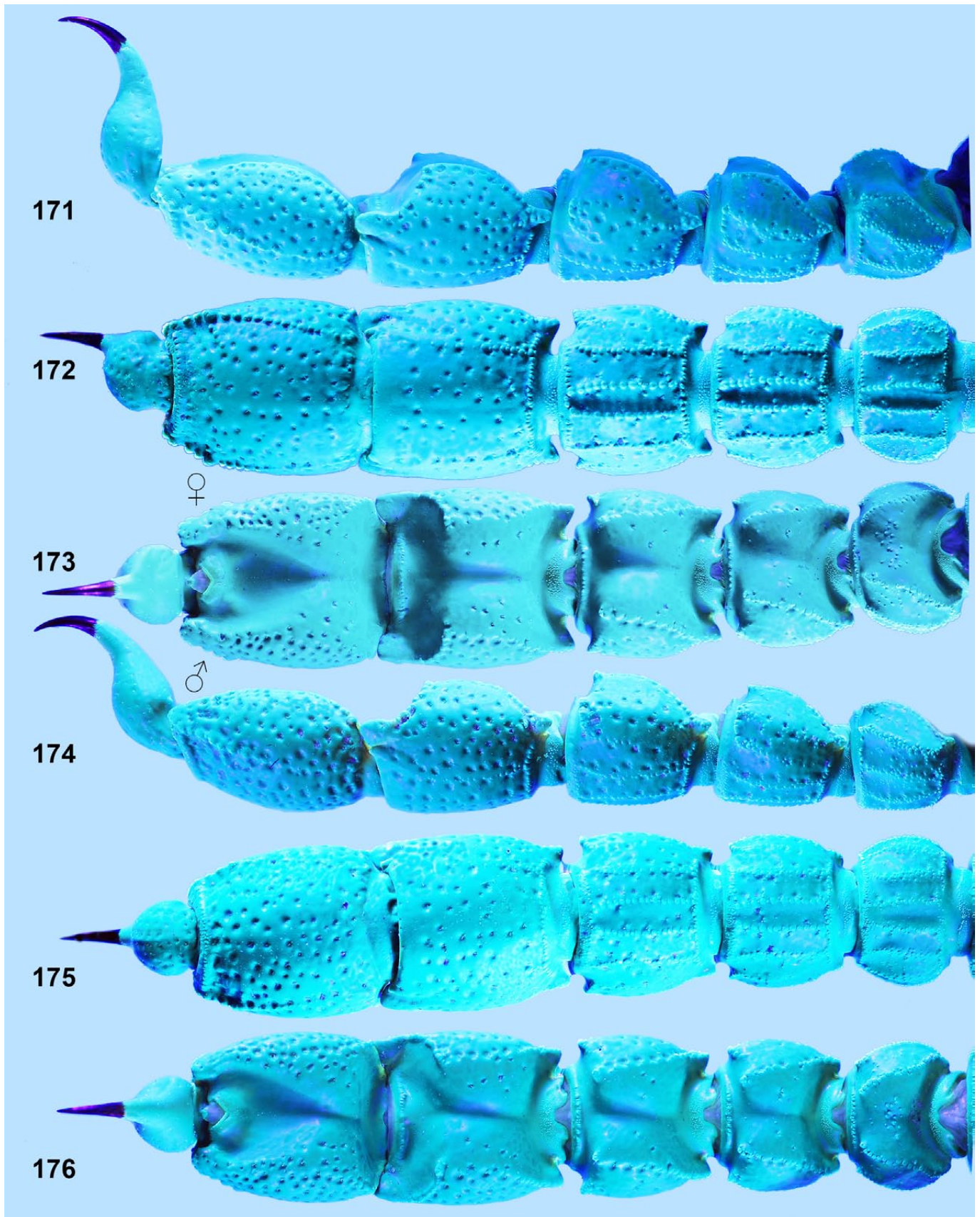




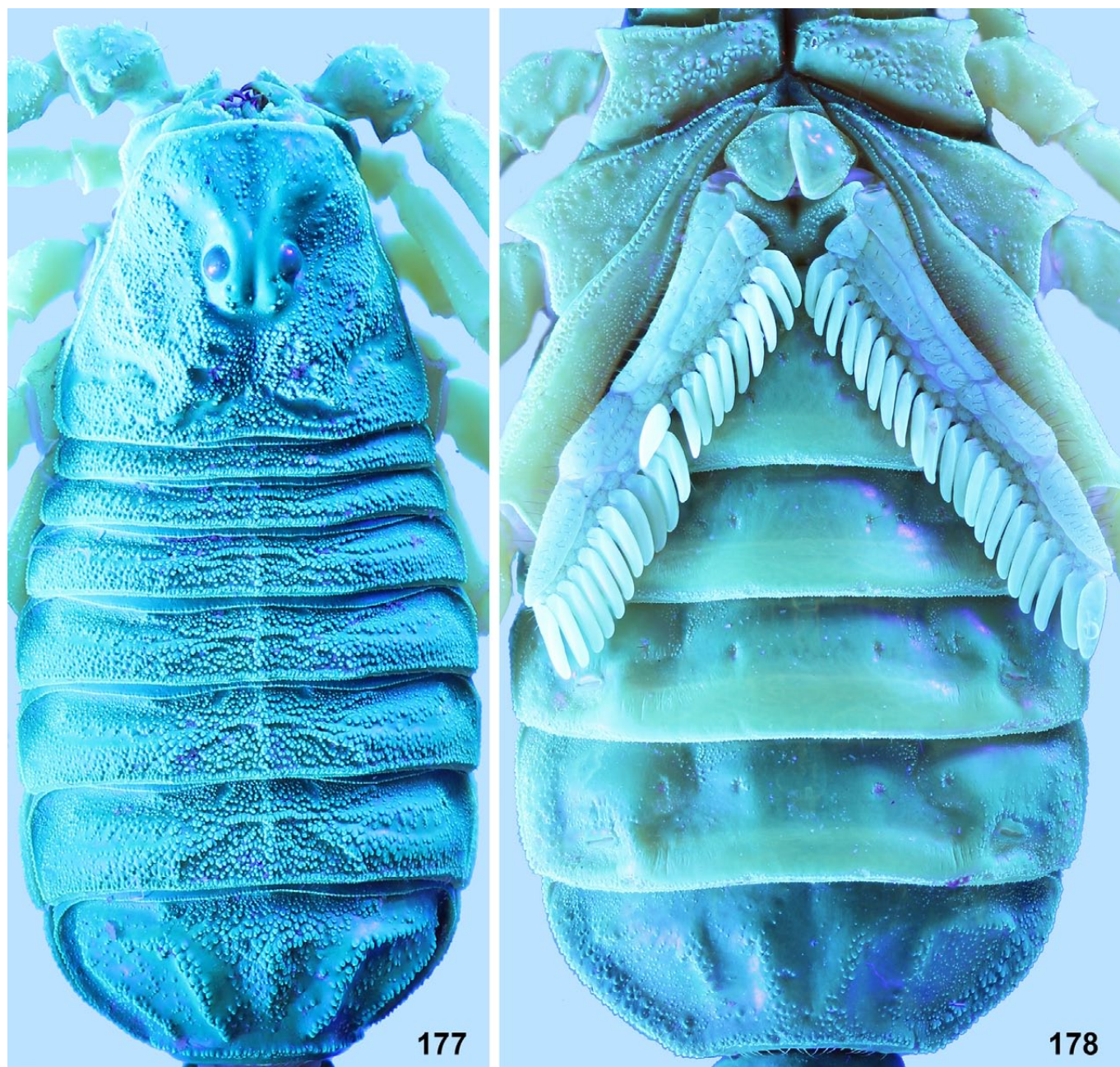
**Figures 145–164:** *Orthochirus melanurus*, Kazakhstan, Kyzylorda Province, Baigakum, 44°20'29" to 37°N 66°27'07" to 09"E, FKCP, segments of pedipalps. **Figures 145–155.** Male. Pedipalp chela, dorsal (145), external (146), and ventral (147) views. Pedipalp patella, dorsal (148), external (149), and ventral (150) views. Pedipalp femur and trochanter, dorsal (151), internal (152) and ventral (153) views. Pedipalp chela, movable (154) and fixed (155) fingers dentate margin. **Figures 156–164.** Female. Pedipalp chela, dorsal (156), external (157), and ventral (158) views. Pedipalp patella, dorsal (159), external (160), and ventral (161) views. Pedipalp femur and trochanter, dorsal (162), and ventral (163) views. Pedipalp chela, movable finger (164) dentate margin. The trichobothrial pattern is indicated in Figures 146–149, 151–152 (white circles).



**Figures 165–170:** *Orthochirus melanurus*, Kazakhstan, Kyzylorda Province, Baigakum, 44°20'29" to 37°N 66°27'07" to 09°E, FKCP, metasoma and telson under white light. **Figures 165–167.** Female, lateral (165), dorsal (166), and ventral (167) views. **Figures 168–170.** Male, lateral (168), dorsal (169), and ventral (170) views. Scale bar: 10 mm.



**Figures 171–176:** *Orthochirus melanurus*, Kazakhstan, Kyzylorda Province, Baigakum, 44°20'29" to 37°N 66°27'07" to 09"E, FKCP, metasoma and telson under UV light. **Figures 171–173.** Female, lateral (171), ventral (172), and dorsal (173) views. **Figures 174–176.** Male, lateral (174), ventral (175), and dorsal (176) views.

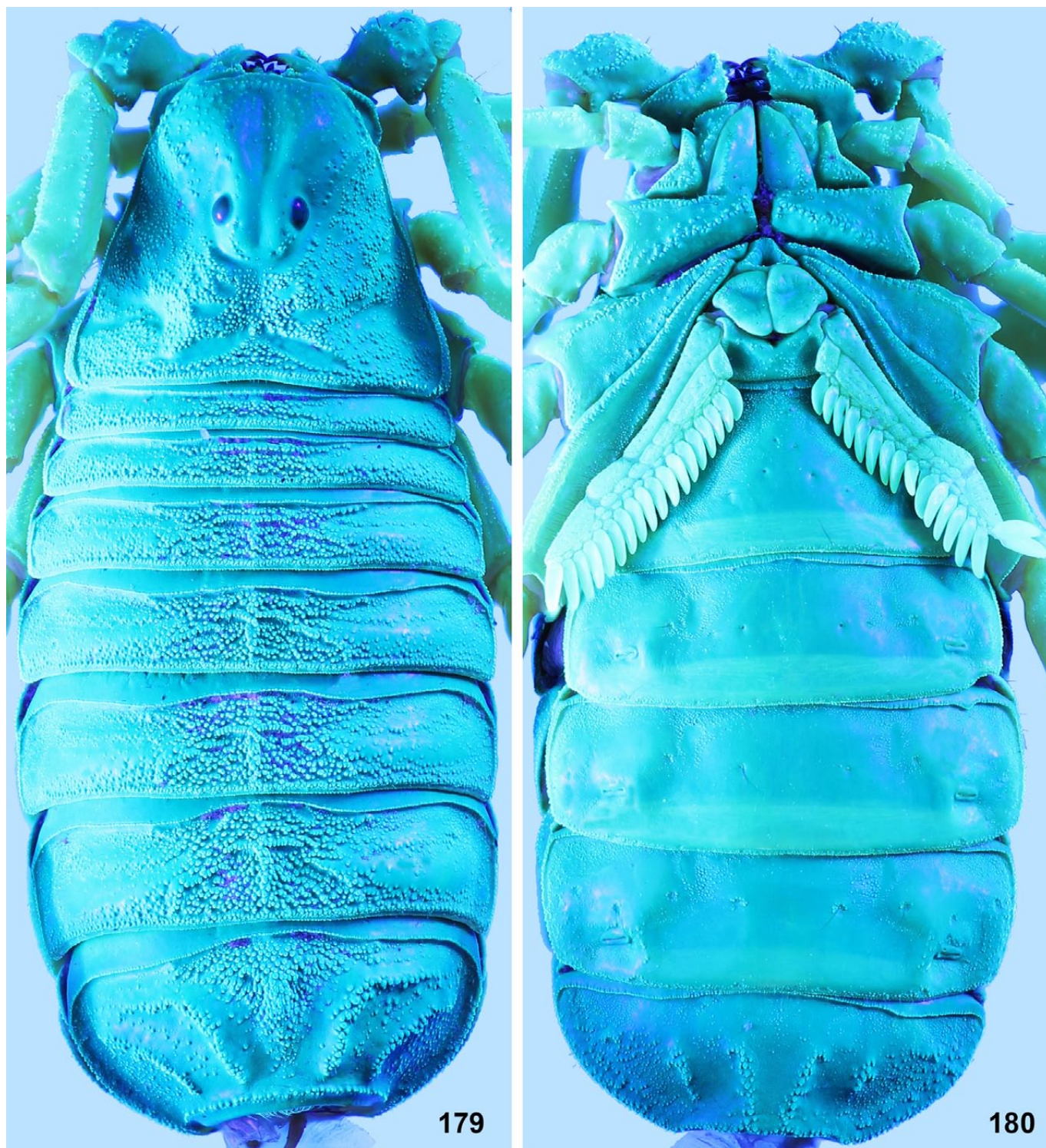


**Figures 177–178.** *Orthochirus melanurus*, Kazakhstan, Kyzylorda Province, Baigakum, 44°20'29" to 37°N 66°27'07" to 09°E, FKCP, male, carapace and tergites (177) and sternopectinal region and sternites (178) under UV light.

Baysun District, Darband [Derbent], [38.1761°N 67.0351°E], 02 May 1981, 1 juv., leg. S. Bečvář (FKCP). *Turkistan Province*, Bel'tau Mts., 41°50'28.5"N 68°32'30.3"E, 392 m a. s. l., 12–13 May 2017, 2♂2♀, leg. Yu. V. Dyachkov (donated by A. A. Fomichev) (FKCP).

**DIAGNOSIS** (♂♀). Total length of adults 24–42 mm. Coloration of carapace, tergites, sternite VII and metasoma reddish black to black; sternites III–VI yellowish green to brown; pedipalps and legs usually yellow but femur and patella of pedipalps can be yellowish brown to black. Trichobothrium  $d_2$  on dorsal surface of pedipalp femur usually present but could be absent. Pectinal teeth number 19–22 in males and

16–20 in females. Movable finger of pedipalps with 8–9 rows of denticles, 7–9 ID and 0–1 OD. Dorsal carinae on pedipalp patella developed and smooth. Pedipalp femur dorsal smooth. Metasoma I–II with 10 carinae, metasoma III with 6–8 carinae, metasoma IV–V with 2 dorsolateral carinae and incomplete ventrolateral carinae. Ventral carinae of metasoma I–III consist of large granules in one or two rows. Metasoma III–V ventrally and laterally smooth with fine punctation developed, spaces among punctae smooth; metasoma I–II ventrally and laterally smooth sparsely granulated with punctation reduced. Metasoma V dorsal surface mesially smooth or with several fine granules only; metasoma I dorsal with 11–22 large granules. Tergites



**Figures 179–180.** *Orthochirus melanurus*, Kazakhstan, Kyzylorda Province, Baigakum, 44°20'29" to 37°N 66°27'07" to 09"E, FKCP, female, carapace and tergites (179) and sternopectinal region and sternites (180) under UV light.

roughly to finely granulated. Sternite VII granulated, with four granulated carinae present. Pedipalp, metasoma and telson glabrous. Moderate to strong tibial spurs present on legs III and IV. Tarsomere I of legs I–III with 5–8 long setae in both sexes. Ratio length/width of metasoma V 1.12–1.15 in males and 1.20–1.22 in females.

**HISTORY OF STUDY.** This species, which for a long time was considered a synonym or a subspecies of *O. scrobiculosus* (see below), was described by Karl F. Kessler (1815–1881), a great Russian zoologist of German extraction, at that time the Rector (President) of the St. Petersburg University. In the very first paper devoted to the scorpions of the Russian Empire,



**Figures 181–188:** *Orthochirus melanurus*, Kazakhstan, Kyzylorda Province, Baigakum, 44°20'29" to 37°N 66°27'07" to 09"E, FKCP. **Figures 181–182, 185–188.** Male, carapace and tergites (181), sternopleural region and sternites (182), and distal segments of right legs I–IV, retrolateral aspect (185–188 respectively). **Figures 183–184.** Female, carapace and tergites (183) and sternopleural region and sternites (184).

Kessler (1874: 16) listed syntypes from: “Ustyurt, Kyzylkum Desert, Transcaspia”, i.e. a very broad range across the lowland deserts of Central Asia then within the Russian Empire, now covering three independent countries: Kazakhstan, Uzbekistan, and Turkmenistan. One of the syntypes of *O. melanurus* was depicted by Kessler (see our Fig. 350).

Kessler’s type specimens were studied by Birula (1898, 1900). Nine of these syntypes were still listed by Fet (1989) who studied the ZISP collection in the mid-1980s, and published following data: “Kazakhstan, Mangyshlak Region, Novoalexandrovskoe, year? (A. Lehman), 2♀ ZIN-666 [error; should be 656; correct in Fet, 1989: 117]; Chimkent Province [error; see below], Kyzylkum Desert, 1873 (M. Bogdanov), 1♀, ZIN-667; Turkmenia, Krasnovodsk Region, Krasnovodsk, year? (Göbel), 3♂3♀, ZIN-690; all these specimens have a label “*Androctonus melanurus* n.sp. teste Kessler” and the sample No. 666 [error; should be 656] was designated as ‘typus’ (Fet, 1989: 113).

Fet & Lowe (2000: 196) listed one of the ZISP-656 females from Novoalexandrovskoe as a ‘holotype’ and another as a ‘paratype’; they also listed ZISP-667 and 690 as ‘paratypes’. However, the label designation ‘typus’ by Kessler did not apply to the specific one of the two females in the ZIN-656 lot (Fet, 1989), therefore there was no actual specimen with the holotype status designated by Kessler. Even if one argued that the listing of a ‘holotype’ by Fet & Lowe (2000: 196) could amount to an inadvertent designation of a *lectotype*, still, Fet & Lowe (2000) also did not physically mark one of the two females as a ‘holotype’. Therefore, all three of Kessler’s original lots (ZISP-656, 667, and 690) still have syntype status.

During our recent, exhaustive study of the ZISP collection (by F.K. and E.A.Y. in 2018–2019), the lots ZISP-656 (as well as ZISP-690 from Krasnovodsk, which likely belongs to *O. scrobiculosus*, see below) could not be found, and appear to be lost. Therefore, the lectotype of *O. melanurus* designated here is the only one available of Kessler’s syntypes, an adult female from the Kyzylkum Desert (ZISP-667) (Fig. 139; the original page from Birula’s handwritten catalog).

The type locality of *O. melanurus* needs a detailed discussion as it is presently undefined. The lectotype was collected by another famous Russian zoologist, Modest N. Bogdanov (1841–1888), a student and a biographer of Kessler, who succeeded the latter as a zoology professor in the St. Petersburg University. Its label (Fig. 138–139) says, in Russian, “Syr-Daryinskaya Obl., Kizyl-Kumy, 1873 [Syr-Darya Province, Kyzylkum Desert], M. Bogdanov”. Fet (1989: 113) assigned it to Chimkent Province in southern Kazakhstan, which is incorrect. Bogdanov was the very first naturalist who traveled in the Kyzylkum Desert, accompanying the formidable (12,000 soldiers) Russian military expedition of General von Kaufmann against the Khiva Khanate, then the last remaining independent state in Central Asia. Bogdanov traveled between lower Syrdarya and lower Amudarya Rivers; his travel report has been published (Bogdanov, 1882).

*O. melanurus* was in fact mentioned (without using Kessler’s scientific name) by Bogdanov (1882: 47), and even

depicted, along with a solpugid (a figure on p. 48, reproduced in our Fig. 351). Bogdanov addressed it as “a small scorpion, yellowish green, with black tail”, and mentioned that locals call it *chayan*—a ‘Kyrgyz’ (now Kazakh) word, which means ‘scorpion’ in many Turkic languages.

The lectotype of *O. melanurus* most likely was collected in the central Kyzylkum Desert, which Bogdanov crossed in April–May 1873, prior to the military engagement with the Khiva Khanate in the end of May. Bogdanov entered the territory of modern Uzbekistan on 12 April 1873 [“Old Style” (Julian), 25 April “New Style” (Gregorian)], at the Kizilkak Well, and continued along the Bukantau Mts., Tamdy Oasis, and Uchuchak Hills. They reached Amudarya at the Uchuchak Hills, near the Lake Sardobakul, on 11 May 1873 [“Old Style” (Julian), 24 May “New Style” (Gregorian)] (Bogdanov, 1882: 50). Therefore, we can bracket the type locality range approximately between 42°35′N 63°30′E (Bukantau Mts) and 41°00′N 62°00′E (Lake Sardobakul) (the ellipse in Fig. 343).

Two other syntype females in a vial labeled by Kessler himself as a “typus” (ZISP-656, now presumed lost) originated from Novoalexandrovskoe (modern western Kazakhstan), a very distant point compared to Bogdanov’s specimen. They were collected by Alexander Lehmann (1814–1842) a Russian-Estonian naturalist of Baltic German extraction who traveled to the eastern Caspian Sea shore in spring 1840. Birula (1904: 32) referred to this locality as “Novo-Alexandrovsk”. Fet (1989: 117) listed it as “Novoalexandrovskoe, now in ruins, environs of Fort-Shevchenko”.

Novoalexandrovskoe (Novo-Alexandrovskoe, Novo-Alexandrovsk) was a military fort established in 1834 by the Russian explorer Grigory Karelin (1801–1872) in 1834 at the northeastern shore of the Caspian Sea, at the Kaydak Bay (now Sor Kaydak, 44°41′N 53°25′E). This was the original site where Lehmann collected in 1840. Due to the drop in the sea level, in 1846 the fort was moved to the Mangyshlak Peninsula (at the Tyub-Karagan Cape) and renamed Novopetrovskoe; later it was again renamed Fort Alexandrovskii. The greatest Ukrainian poet Taras Shevchenko (1814–1861) was exiled there to served as an army private in 1850–1857. The town now is called Fort-Shevchenko (Kazakhstan, Mangystau Province, 44°31′N 50°16′E).

This locality represents the northwesternmost known record for the genus *Orthochirus*. Gromov & Kopykbaev (1994: 20) quote likely the same species (as ‘*O. scrobiculosus*’) as widespread in Kazakhstan, including northern deserts of Betpak-Dala and Moyunkum (Zhambyl Province) up to 45°27′N, the northernmost record of the genus, and to 73°59′E, the northeasternmost record. On the map (Fig. 343), we included all four localities listed by Gromov & Kopykbaev (1994) to show the range limits of the genus in Central Asia.

COMMENTS. Kessler’s original description of *Androctonus melanurus* (in Russian) clearly stated: “The most characteristic trait for this species are rather large pits, which are densely present on the sides and below on fourth and fifth segments

Dimensions (mm)		<i>O. nordmanni</i> sp. n.	<i>O. nordmanni</i> sp. n.	<i>O. sejnai</i> sp. n.	<i>O. sejnai</i> sp. n.
		♂ holotype	♀ paratype	♂ holotype	♀ paratype
Carapace	L / W	3.66 / 4.28	4.63 / 5.78	4.45 / 5.20	4.33 / 5.50
Mesosoma	L	7.00	8.41	9.60	11.46
Tergite VII	L / W	1.89 / 4.69	2.31 / 6.20	2.68 / 5.23	3.00 / 5.98
Metasoma + telson	L	20.72	24.11	23.62	22.23
Segment I	L / W / D	2.25 / 3.31 / 2.64	2.68 / 3.91 / 3.12	2.65 / 3.52 / 2.87	2.49 / 3.46 / 3.06
Segment II	L / W / D	2.72 / 3.42 / 2.74	3.08 / 4.09 / 3.09	3.33 / 3.61 / 2.99	2.95 / 3.58 / 3.22
Segment III	L / W / D	3.14 / 3.67 / 2.84	3.64 / 4.38 / 3.44	3.52 / 3.99 / 3.61	3.41 / 3.78 / 3.51
Segment IV	L / W / D	4.11 / 3.84 / 2.82	4.76 / 4.62 / 3.73	4.57 / 4.33 / 3.64	4.44 / 4.07 / 3.39
Segment V	L / W / D	4.43 / 3.82 / 2.63	5.09 / 4.64 / 3.35	4.80 / 4.27 / 3.57	4.91 / 4.15 / 3.10
Telson	L / W / D	4.07 / 1.51 / 1.18	4.86 / 1.88 / 1.49	4.75 / 1.72 / 1.63	4.03 / 1.81 / 1.47
Pedipalp	L	12.38	14.23	13.92	12.81
Femur	L / W	3.23 / 0.92	3.63 / 1.12	3.56 / 1.09	3.32 / 1.09
Patella	L / W	3.84 / 1.14	4.38 / 1.50	4.23 / 1.42	3.85 / 1.30
Chela	L	5.31	6.22	6.13	5.64
Manus	W / D	0.95 / 0.87	1.23 / 1.12	1.06 / 1.08	1.06 / 1.11
Movable finger	L	3.45	4.13	4.11	3.84
<b>Total</b>	<b>L</b>	<b>31.38</b>	<b>37.15</b>	<b>37.67</b>	<b>38.02</b>

**Table 3.** Comparative measurements of *Orthochirus nordmanni* sp. n. and *O. sejnai* sp. n. types from type locality. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

of the tail. These pits begin already on the third segment, but there they are interspersed with granules, which are completely absent on fourth and fifth segments.” (Kessler, 1874: 17). This species was first revised by Birula (1898) who observed a distinct variation among then available specimens. Birula (1898: 281–282) distinguished three “forms” under *Orthochirus melanurus*: “forma  $\alpha$  (typica)”, “forma  $\beta$  (intermedia), and “forma  $\gamma$  (concolor).” Soon, Birula (1900a: 13; 1900b: 373) realized that his “forma  $\alpha$ ” (or “*Orthochirus melanurus typicus* Birula”; Turkmenistan), corresponded to *Butheolus conchini* Simon, 1899, with metasoma IV–V granulated laterally and ventrally, while it was his “forma  $\beta$ ” (or “*Orthochirus melanurus intermedius* Birula” that corresponded to Kessler’s original description (i.e. had metasoma IV–V non-granulated ventrally). Birula (1900a: 13; 1900b: 373) noticed that some of Kessler’s syntypes from Krasnovodsk had granulated metasoma IV–V and corresponded therefore to *Butheolus conchini*—which, as Birula (1909) realized later, was a junior synonym of *Androctonus scrobiculosus* Grube, 1873. Today, we see this morphological difference as the species-level distinction between *O. scrobiculosus* (Grube, 1873) (see below) and *O. melanurus* (Kessler, 1874).

Birula (1900b, 1905a) treated his three ‘forms’ as subspecies of *Butheolus melanurus* (Kessler). They were eventually considered to be subspecies of *Orthochirus scrobiculosus* by Birula (1917, 1918), and were not revised for the next 100 years (Fet, 1989, 1994; Fet & Lowe, 2000).

In the unpublished catalog of the ZISP collection compiled by Birula until late 1920s (before he was demoted from ZISP directorship and arrested in 1931 for political reasons), the

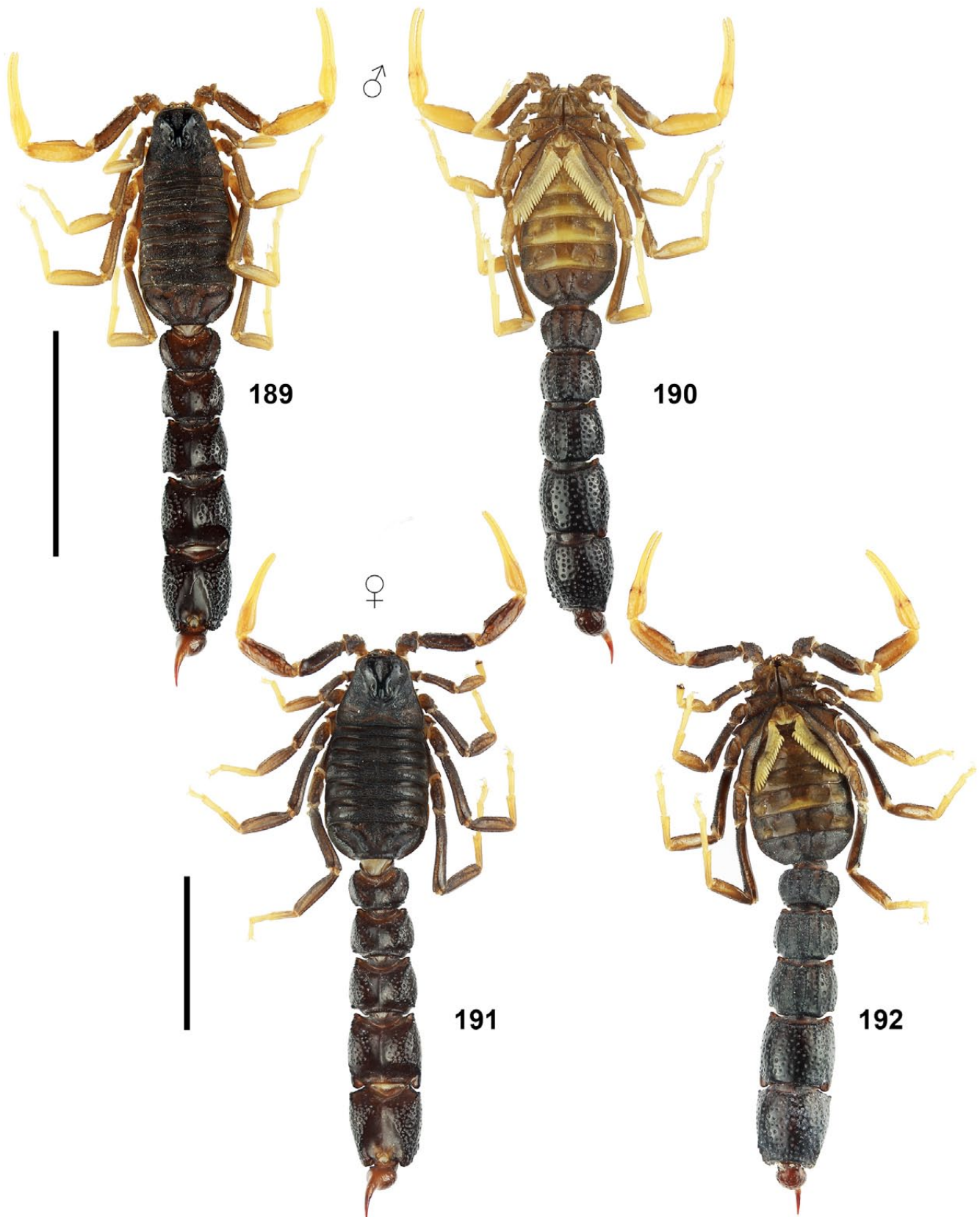
distinction between two subspecies (*O. s. scrobiculosus* and *O. s. melanurus*) has been made, and a number of specimens have the subspecies assignment. We can see that, in Birula’s opinion, the two subspecies were allopatric in Turkmenistan (“formed vicariant clusters”; Fet, 1994: 530). Of these, only the western form is now confirmed as *Orthochirus scrobiculosus* Grube, 1873). The populations further east, listed by Birula to *O. s. melanurus*, are assigned by us to *O. formozovi* sp. n. (Kopetdagh, Badkhyz) and *O. gromovi* Kovařík, 2004 (East Karakum). Therefore, we have no confirmed records of *O. melanurus* from Turkmenistan.

Note that Birula (1900b: 373) who compared two syntypes from Novoalexandrovskoe (ZISP-656, now presumed lost) to Bogdanov’s specimen (ZISP-667, now the lectotype) from the Kizylkum Desert, noted that the Novoalexandrovskoe specimens are ‘not typical’ since they possessed weak granulation on metasoma IV) Here, we place this outlier western Kazakhstan population tentatively under *O. melanurus*, but it requires further study, considering that all other records of *O. melanurus* confirmed here originate from the territories located much further east.

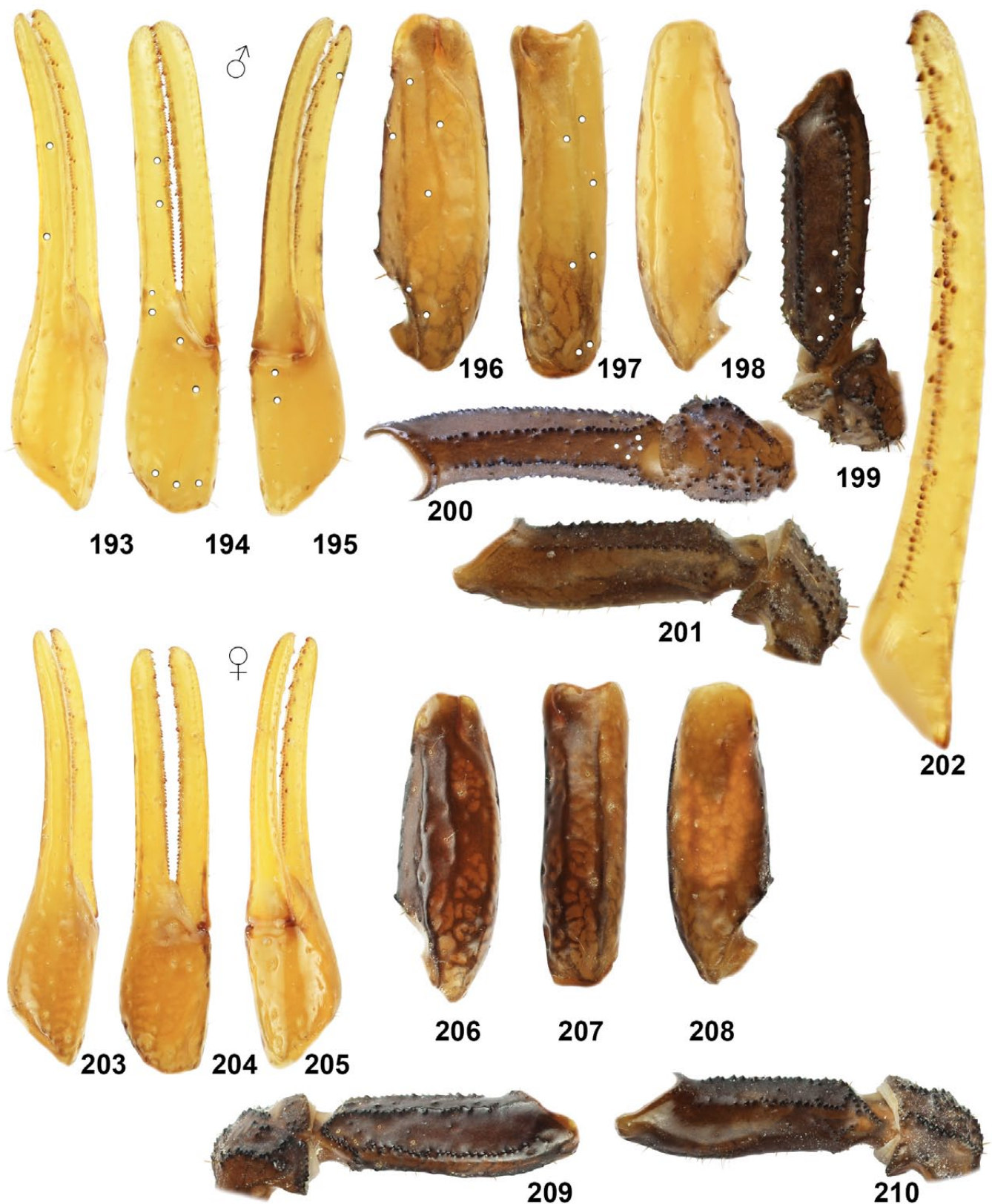
The identity of “forma  $\gamma$ ”, or *O. s. concolor* (Birula, 1898) (Uzbekistan), is unclear. Its only known type specimen (holotype female ZISP-645, collected in Karshi in May 1885 by G. T. Grumm-Grzhimailo), appears to be lost. Birula (1918: 39–40) clearly characterized this form as lacking OD on movable fingers (Kovařík, 2004: 20); we place it tentatively under *O. melanurus*.

**DISTRIBUTION.** Kazakhstan, Uzbekistan (Fig. 343). The northernmost record for the genus (at least to 45°27'N).

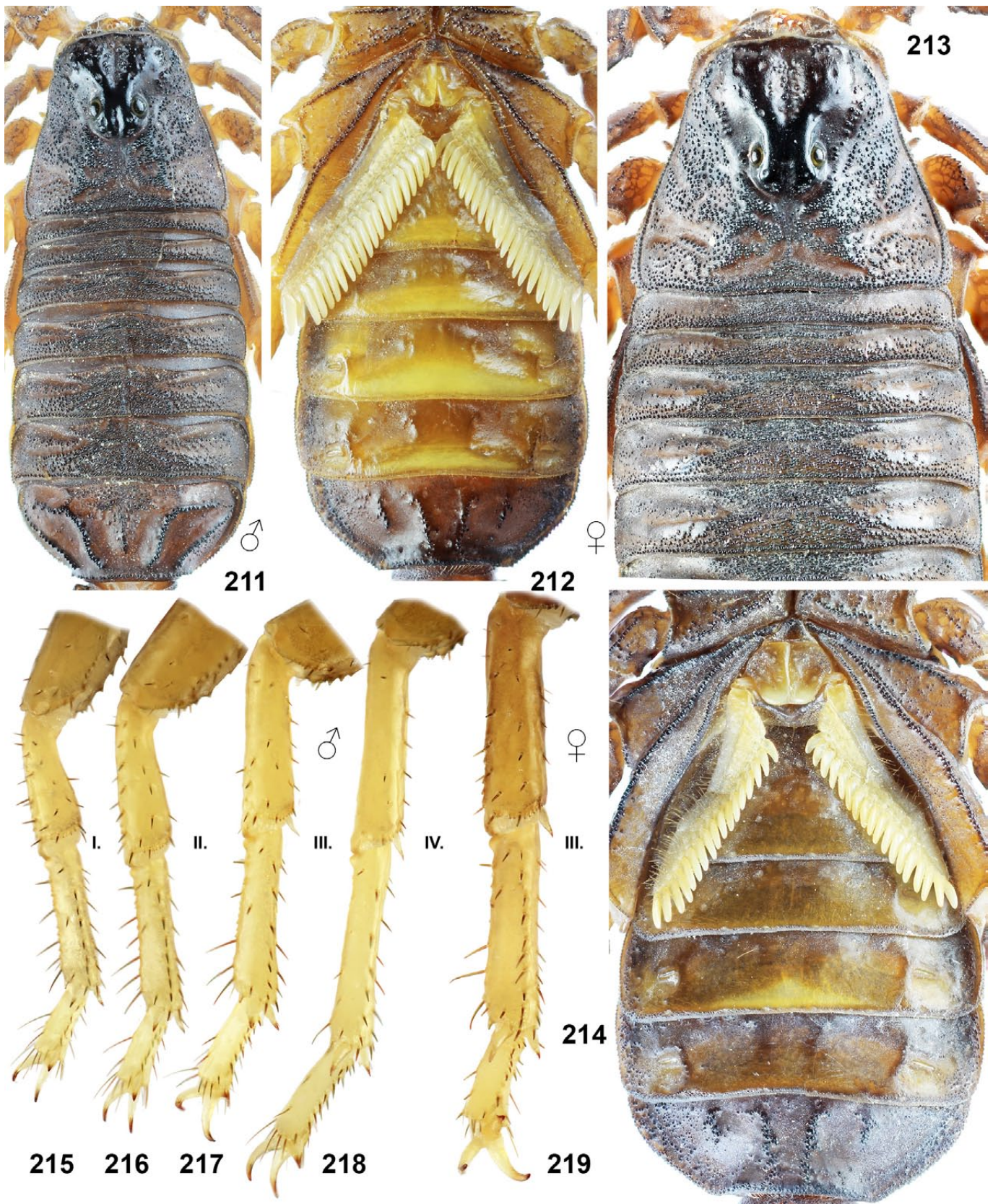




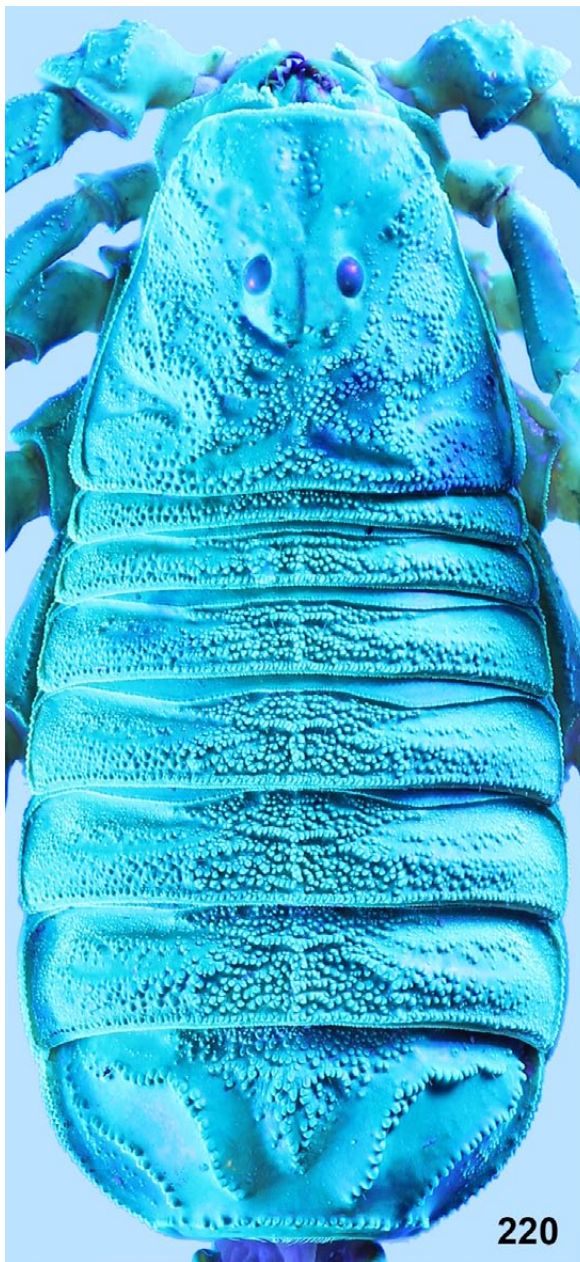
Figures 189–192: *Orthochirus nordmanni* sp. n. Figures 29–30. Holotype male, dorsal (189) and ventral (190) views. Figures 191–192. Paratype female from type locality, dorsal (191) and ventral (192) views. Scale bars: 10 mm.



**Figures 193–210:** *Orthochirus nordmanni* sp. n., segments of pedipalps. **Figures 193–202.** Holotype male. Pedipalp chela, dorsal (193), external (194), and ventral (195) views. Pedipalp patella, dorsal (196), external (197), and ventral (198) views. Pedipalp femur and trochanter, dorsal (199), internal (200) and ventral (201) views. Pedipalp chela, movable finger (202) dentate margin. **Figures 203–210.** Paratype female from type locality. Pedipalp chela, dorsal (203), external (204), and ventral (205) views. Pedipalp patella, dorsal (206), external (207), and ventral (208) views. Pedipalp femur and trochanter, dorsal (209) and ventral (210) views. The trichobothrial pattern is indicated in Figures 193–197, 199–200 (white circles).



**Figures 211–219:** *Orthochirus nordmanni* sp. n. **Figures 211–212, 215–218.** Holotype male, carapace and tergites (211), sternoplectinal region and sternites (212), and distal segments of right legs I–IV, retrolateral aspect (215–218 respectively). **Figures 213–214, 219.** Paratype female from type locality, carapace and tergites I–IV (213), sternoplectinal region and sternites (214), and distal segments of right leg III, retrolateral aspect (219).



Figures 220–221. *Orthochirus nordmanni* sp. n., holotype male, carapace and tergites (220) and sternopectinal region and sternites (221) under UV light.

***Orthochirus nordmanni* sp. n.**

(Figures 2, 189–235, 343, Table 3)

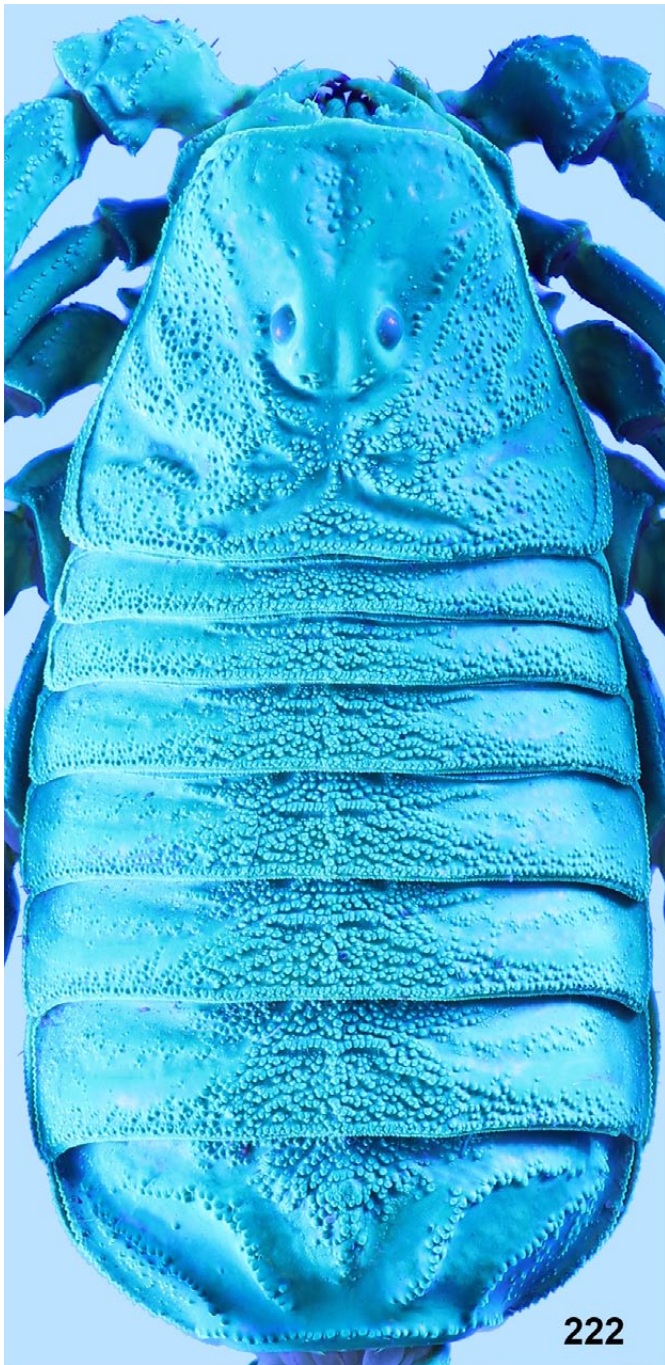
<http://zoobank.org/urn:lsid:zoobank.org:act:DF063D9A-CEEA-4ADF-B8FF-2B29CE06907B>

TYPE LOCALITY AND TYPE DEPOSITORY. **Afghanistan**, *Uruzgan Province*, Tarin Kowt District, Sosnak Village, 32°38'20"N 65°48'25"E; FKCP.

TYPE MATERIAL EXAMINED (FKCP). **Afghanistan**, *Daykundi Province*, Gizab [33.42°N 66.11°E], 2012, 1♂ (paratype), leg. M. Misch. *Kandahar Province* (border with Uruzgan Province), 32°10'36.59"N 65°44'12.45"E, 1798 m a. s. l.,

1♂2♀ (paratypes), April 2011, leg. M. Misch; Nesh Village, 32°07'30"N 65°45'10"E, 2011, 24♂5♀ 2juvs (paratypes), leg. M. Misch. *Uruzgan Province*, Tarin Kowt District, Sosnak Village, 32°38'20"N 65°48'25"E, 2011, 1♂ (holotype) 4♂1♀ (paratypes), leg. M. Misch; Tarin Kowt, 32°37'52.29"N 65°52'06.56"E, 1300 m a. s. l., May 2010, 27♂17♀2juvs. (paratypes), leg. M. Misch; Chora District, Chinarak Village, 32°50'20"N 65°53'30"E, 2011, 4♂1♀juv. (paratypes), leg. M. Misch.

ETYMOLOGY. The species epithet is a patronym honoring the Russian-Finnish zoologist Alexander von Nordmann (1803–1866) who described the scorpion species now called *Olivierus caucasicus* (Nordmann, 1840) (Buthidae).



222

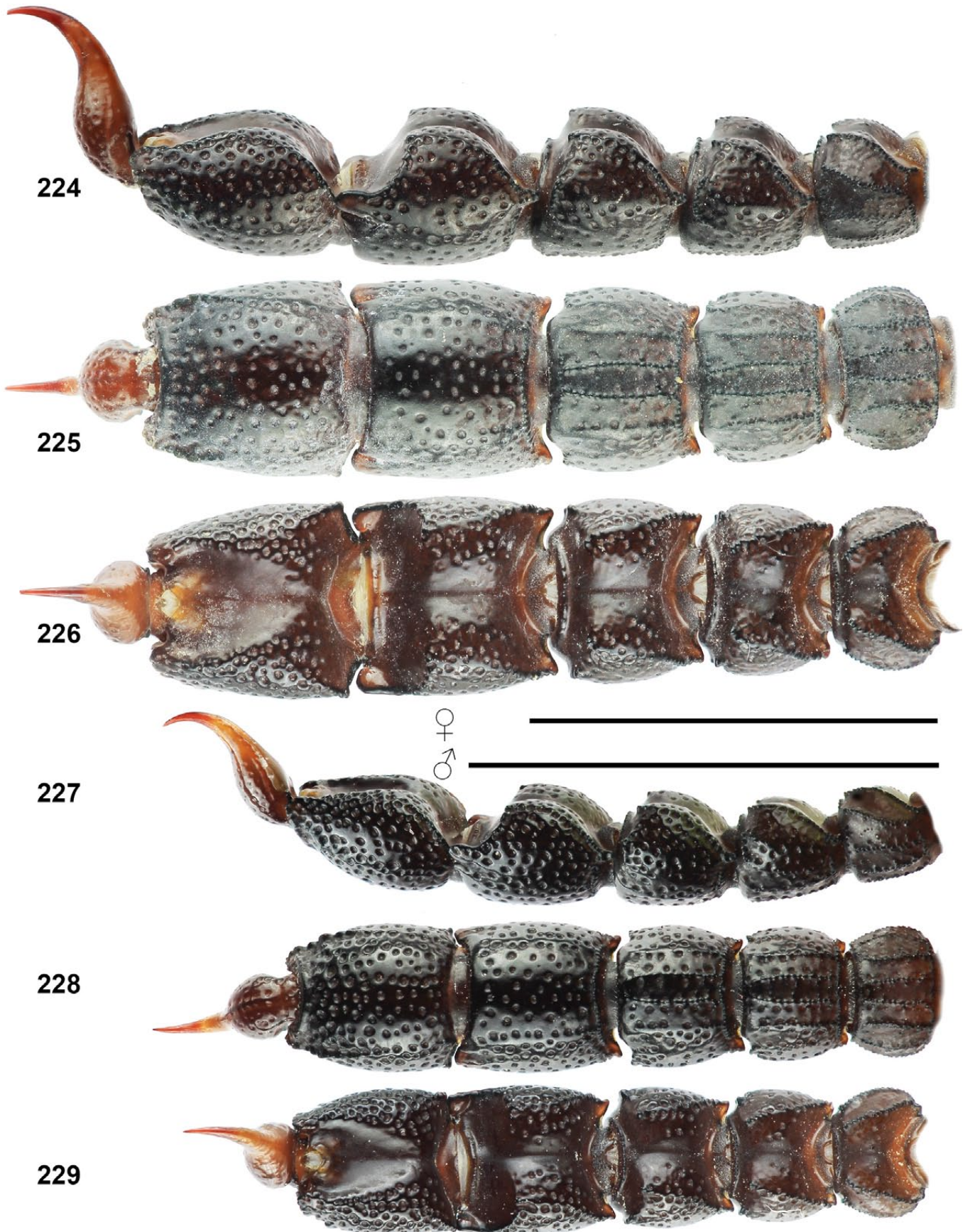


223

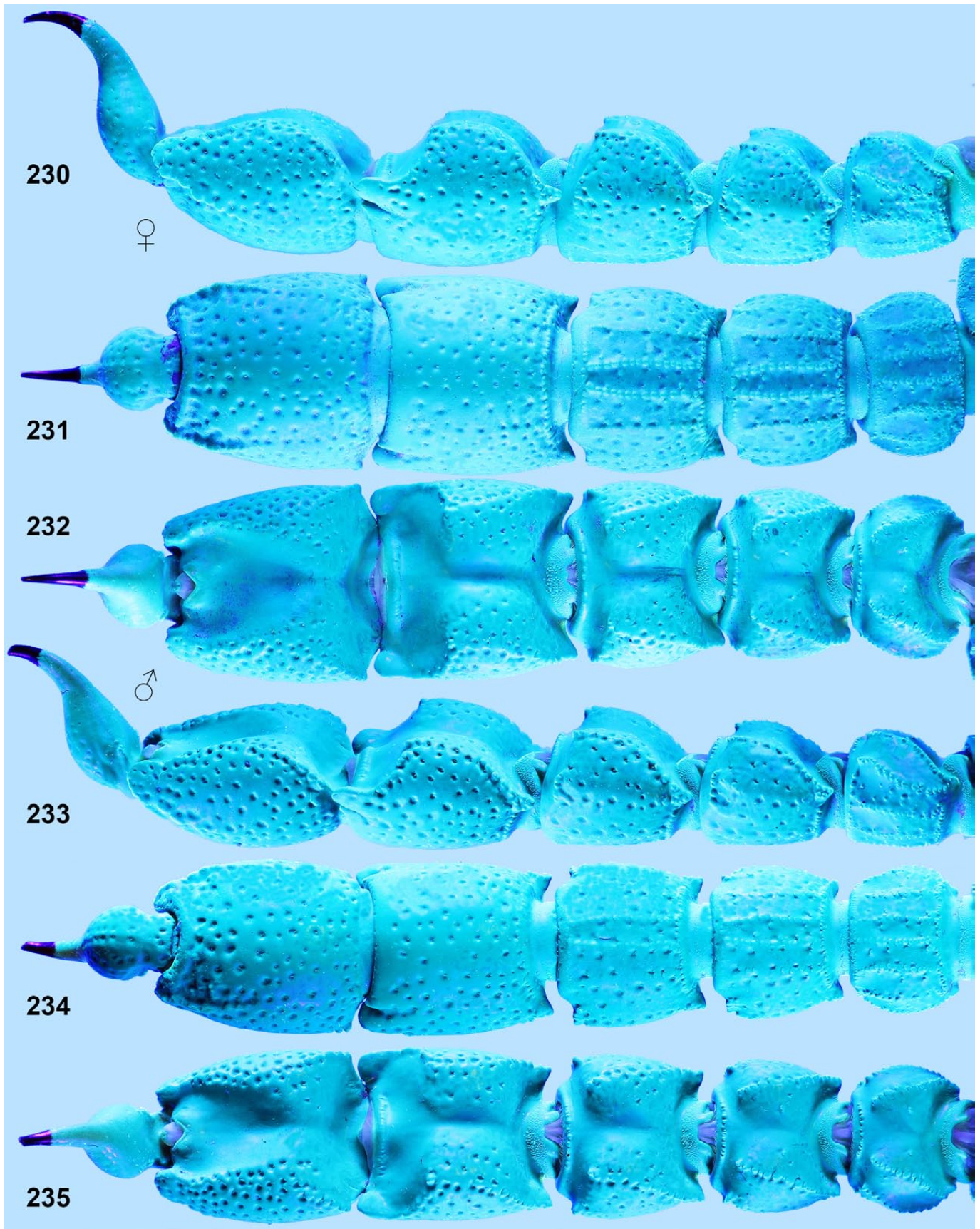
**Figures 222–223.** *Orthochirus nordmanni* sp. n., paratype female from type locality, carapace and tergites (222) and sternopectinal region and sternites (223) under UV light.

**DIAGNOSIS** (♂♀). Total length of adults 24–40 mm. Trichobothrium  $d_2$  on dorsal surface of pedipalp femur usually absent. Pectinal teeth number 18–23 in males and 16–18 in females. Movable finger of pedipalps with 8–9 rows of denticles, 8–9 ID and 7–9 OD. Dorsal carinae on pedipalp patella developed and smooth. Pedipalp femur dorsal smooth. Metasoma I with 10 carinae, metasoma II–III with 4–6 carinae, metasoma IV–V with 2 dorsolateral carinae and without ventrolateral carinae which are indicate on metasoma V. Ventral carinae of metasoma I–II consist of large granules. Metasoma II–V ventrally and laterally smooth

with fine punctation developed, spaces among punctae smooth; metasoma I ventrally and laterally smooth sparsely granulated by large granules with punctation reduced. Metasoma V dorsal surface mesially smooth; metasoma I dorsal surface with 0–5 large granules. Tergites roughly to finely granulated. Sternite VII granulated but medially smooth, with four granulated carinae present. Pedipalp, metasoma and telson glabrous. Moderate tibial spurs present on legs III and IV. Tarsomere I of legs I–III with 4–6 long setae in both sexes. Ratio length/width of metasoma V 1.08–1.16 in both sexes.



**Figures 224–229:** *Orthochirus nordmanni* sp. n., metasoma and telson under white light. **Figures 224–226.** Paratype female from type locality, lateral (224), ventral (225), and dorsal (226) views. **Figures 227–229.** Holotype male, lateral (227), ventral (228), and dorsal (229) views. Scale bars: 10 mm (224–226, 227–229).



Figures 230–235: *Orthochirus nordmanni* sp. n., metasoma and telson under UV light. **Figures 230–232.** Paratype female from type locality, lateral (230), ventral (231), and dorsal (232) views. **Figures 233–235.** Holotype male, lateral (233), ventral (234), and dorsal (235) views.

Dimensions (mm)		<i>O. persa</i>		<i>O. persa</i>	
		♂ lectotype	♀ paralectotype	♂ ZISP No. 679	♀ ZISP No. 679
Carapace	L / W	4.04 / 4.64	4.98 / 5.75	3.77 / 4.35	4.68 / 5.82
Mesosoma	L	8.87	11.01	7.93	11.08
Tergite VII	L / W	2.36 / 4.97	2.50 / 6.78	2.19 / 4.89	2.67 / 6.91
Metasoma + telson	L	21.45	25.18	20.93	25.36
Segment I	L / W / D	2.37 / 3.32 / 2.78	2.90 / 4.06 / 3.40	2.47 / 3.29 / 2.48	2.82 / 4.20 / 3.22
Segment II	L / W / D	2.81 / 3.69 / 2.70	3.14 / 4.06 / 3.68	2.76 / 3.43 / 2.48	3.09 / 4.43 / 3.34
Segment III	L / W / D	3.04 / 4.18 / 3.20	3.85 / 4.50 / 3.83	3.02 / 3.69 / 2.68	4.82 / 3.72 / 3.54
Segment IV	L / W / D	4.37 / 4.39 / 3.40	4.77 / 4.94 / 3.78	4.20 / 3.77 / 2.75	4.96 / 5.01 / 3.60
Segment V	L / W / D	4.77 / 4.25 / 3.35	5.10 / 4.91 / 3.62	4.50 / 3.86 / 2.59	4.92 / 4.71 / 3.37
Telson	L / W / D	4.09 / 1.70 / 1.47	5.42 / 2.21 / 1.83	3.98 / 1.52 / 1.34	4.75 / 1.92 / 1.67
Pedipalp	L	12.02	14.64	11.97	13.61
Femur	L / W	3.09 / 0.77	3.91 / 1.08	3.18 / 0.85	3.58 / 1.02
Patella	L / W	3.96 / 1.10	4.37 / 1.47	3.64 / 1.10	4.16 / 1.34
Chela	L	4.97	6.36	5.15	5.87
Manus	W / D	0.92 / 0.91	1.23 / 1.32	0.86 / 0.81	1.08 / 1.07
Movable finger	L	3.46	4.16	3.59	3.90
<b>Total</b>	<b>L</b>	<b>34.36</b>	<b>41.17</b>	<b>32.63</b>	<b>41.12</b>

**Table 4.** Comparative measurements of *Orthochirus persa* stat. n. specimens from ZISP. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

**DESCRIPTION.** Total length of adults 24–40 mm. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 3. For habitus, see Figs. 189–192.

**Coloration** (Figs. 2, 189–192). Carapace, tergites, metasoma, and femur or femur and patella of pedipalps and legs black. Patella of pedipalps and legs could be also yellow or yellowish brown. Chela of pedipalps and tarsomeres of legs yellowish brown. Sternites reddish black with yellow median area indicated in posterior margin of sternite IV and developed on sternite V. Telson reddish black.

**Mesosoma and carapace** (Figs. 213–214, 220–223). Tergites with a median carina and is roughly to finely granulated. Seventh sternite granulated but medially smooth, with four granulated carinae present, the other sternites rather smooth but with several areas partly granulated mainly in males. Pectine teeth number 18–23 (1 x 18, 13 x 19, 41 x 20, 37 x 21, 12 x 22, 3 x 23) in males and 16–18 (11 x 16, 13 x 17, 11 x 18) in females.

**Metasoma and telson** (Figs. 224–235). Metasoma I with 10, metasoma II–III with 4–6 granulated carinae. Metasoma II–V lacks lateral and metasoma IV–V ventromedian carinae. Ventrolateral carinae are developed on metasoma I–II and indicated or incomplete on metasoma III–V, dorsolateral carinae are present on metasoma I–III. Ventral carinae of metasoma I–II consist of large granules. Metasoma I granulated laterally, metasoma II–V laterally punctate and smooth. Granulation absent on dorsal surfaces of metasoma II–V; metasoma I dorsal with 0–5 large granules. Fine punctation on metasoma II–V ventrally

developed, spaces among punctae smooth. Entire metasoma and telson glabrous. Telson smooth with punctation present ventrally.

**Pedipalps** (Figs. 193–210). Trichobothrium  $d_2$  on pedipalp femur usually absent; trichobothrium  $e_1$  is situated in level with trichobothria  $d_4$ . Femur of pedipalps with five granulated carinae and is smooth. Patella has seven smooth carinae, and the chela has smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalps are glabrous with several setae only. Movable fingers with 8–9 rows of denticles, 8–9 ID and 7–9 OD.

**Legs** (Figs. 215–219). Moderate tibial spurs present on legs III and IV. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few setae. Tibia with setae on the outer side of legs I–III. Tarsomere I of legs I–III with 4–6 long setae in both sexes, legs IV with 2–4 setae. Tarsomeres I–II internal of all legs with two rather irregular rows of setae.

**Measurements.** See Table 3.

**AFFINITIES.** The combination of five characters (metasoma V dorsal surface mesially smooth; entire metasoma glabrous; sternite VII granulated but medially smooth, with four granulated carinae present; pedipalp movable finger with 8–9 ID and 7–9 OD; punctation on metasoma II–V ventral surface developed with the same intensity in male) is unique in the entire genus *Orthochirus*.

**DISTRIBUTION.** Afghanistan (Fig. 343).



***Orthochirus persa* (Birula, 1900), stat. n.**

(Figures 236–273, 343, Table 4)

*Butheolus melanurus persa* Birula, 1900b: 374.<http://zoobank.org/urn:lsid:zoobank.org:act:51089BA6-F1E6-4EF9-BDAD-A65209F240B6>

## SYNONYMS:

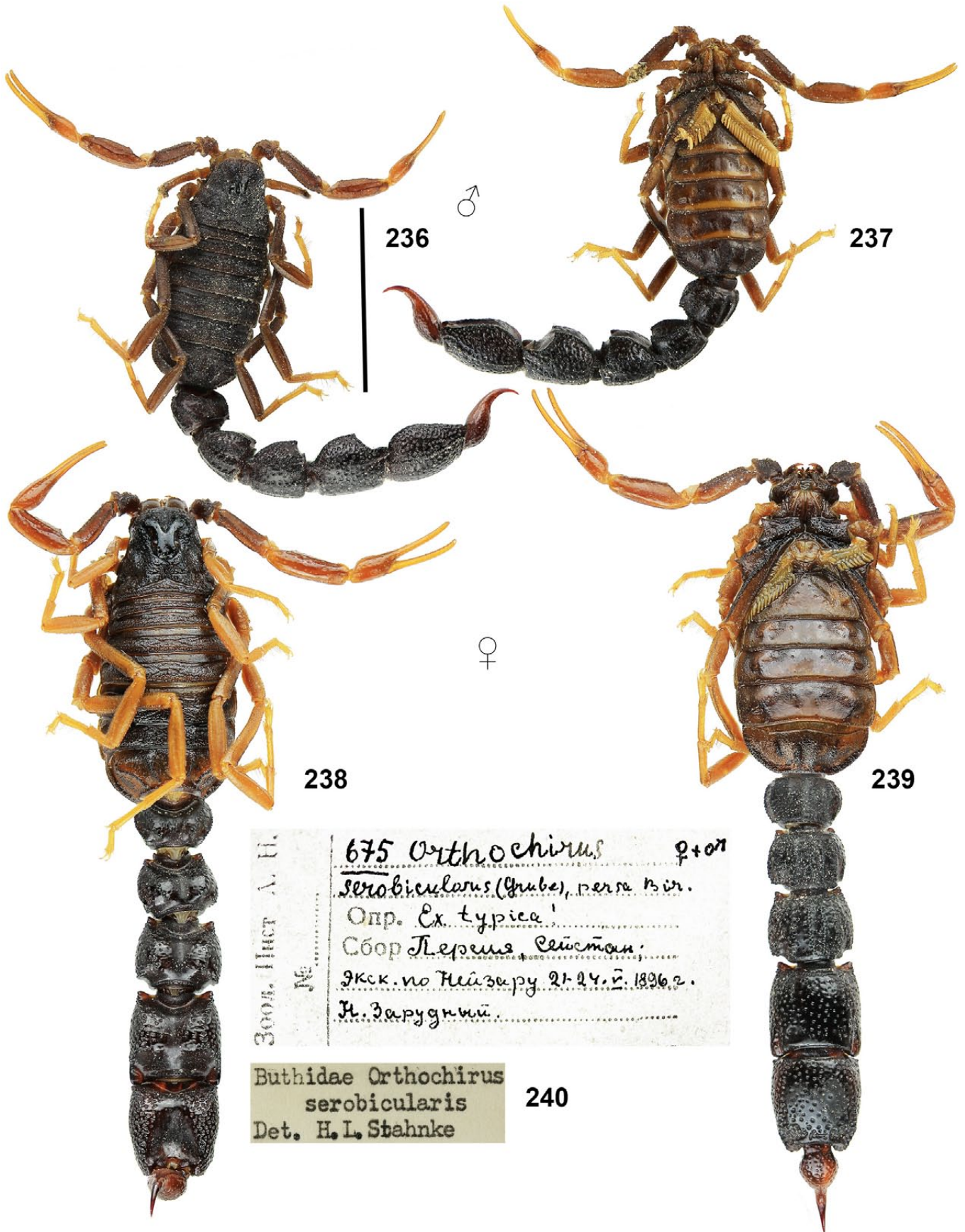
= ? *Butheolus melanurus dentatus* Birula, 1900b: 375 (type locality and type repository: **Iran**, *Sistan & Baluchestan Province*, Zahedan County, “Hussein-Abad” [an error; should be Nosratabad, 29.90°N 59.98°E, see below for clarification]; ZISP No. 653, holotype lost). **Syn. n.**<http://zoobank.org/urn:lsid:zoobank.org:act:9313F15E-017C-4F28-AD3E-F5D41F193D4B>= *Afghanorthochirus erardi* Lourenço & Vachon, 1997: 332, figs. 2c, 3, 4b (type locality and type repository: **Afghanistan**, ‘région sud á 95 km au NE de Zaran’; MNHN). **Syn. n.**<http://zoobank.org/urn:lsid:zoobank.org:act:60EAC52D-112D-4571-B0F8-671B62328563>

## REFERENCES:

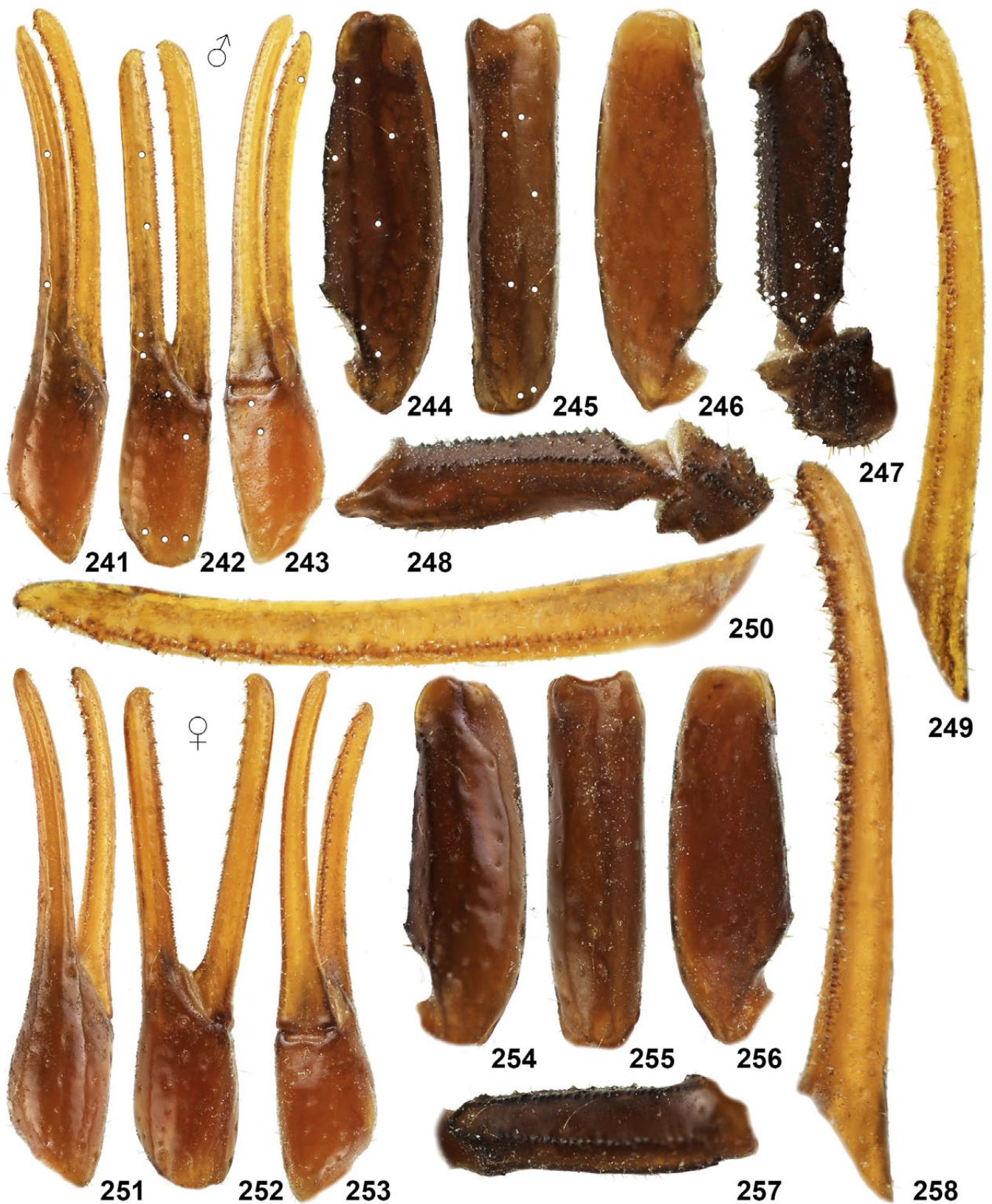
*Butheolus melanurus persa*: Birula, 1903: 75; Birula, 1905b: 145.*Butheolus scrobiculosus persa*: Birula, 1909: 359.*Orthochirus scrobiculosus persa*: Birula, 1917: 241; Fet, 1989: 116; Fet, 1994: 530; Kovařík, 1998: 116; Fet & Lowe, 2000: 199 (complete reference list until 1998).*Orthochirus persa* (in part): Vachon, 1966: 213.*Orthochirus scrobiculosus dentatus*: Fet, 1989: 116; Fet, 1994: 530; Kovařík, 1998: 116; Fet & Lowe, 2000: 198 (complete reference list until 1998).*Afghanorthochirus erardi* (in part): Kovařík, 1998: 102; Fet & Lowe, 2000: 57.*Orthochirus erardi*: Kovařík, 2004: 8.TYPE LOCALITY AND TYPE DEPOSITORY. **Iran**, *South Khorasan Province*, Bendun [now Bandan, Nehbandan County, 31.383°N 60.71°E]; ZISP No. 675 [original label ‘Sistan, Neizar’; see below for clarification].TYPE MATERIAL EXAMINED. **Iran**, *South Khorasan Province*, Bendun [now Bandan, Nehbandan County, 31.383°N 60.71°E], 1♂ (lectotype, designated here) 1♀ (paralectotype), 21–24 May 1896 [“Old Style” (Julian), 2–5 June “New Style” (Gregorian)], leg. N. Zarudny, ZISP No. 675. **Afghanistan**, “région sud á 95 km au NE de Zaran” [“southern region, 95 km NE of Zaran”], 4 April 1972, 1♀ (holotype of *Afghanorthochirus erardi*, Fig. 267), leg. C. Naumann, MNHN No. RS 8530.OTHER MATERIAL EXAMINED. **Iran**, *South Khorasan Province*, road between Neizar and Ali-Abad, 1♂♀, 1–10 June [“Old Style” (Julian), 14–24 June “New Style” (Gregorian)] 1901, leg. N. Zarudny, ZISP No. 679.DIAGNOSIS (♂♀). Total length of adults 32–42 mm. Coloration of carapace, tergites, sternites and metasoma reddish black to black; pedipalps and legs yellowish brown to reddish black. Trichobothrium  $d_2$  on dorsal surface of pedipalp femur present or absent. Pectinal teeth number 20–22 in males and 17–18 in females. Movable finger of pedipalps with 8–9 rows of denticles, 7–9 ID and 3–7 OD. Dorsal carinae on pedipalp patella developed and smooth. Pedipalp femur dorsal smooth. Metasoma I–II with 10 carinae, metasoma III with 8 carinae, metasoma IV–V with 2 dorsolateral carinae and incomplete ventrolateral carinae. Metasoma IV–V laterally granulated, ventrally smooth with fine punctation developed, spaces among punctae smooth; metasoma I–III ventrally and laterally granulated with punctation reduced. Metasoma V dorsal surface mesially smooth or with several fine granules only; metasoma I dorsal with 11–22 large granules. Tergites roughly to finely granulated. Sternite VII densely granulated, with four granulated carinae present. Pedipalp, metasoma and telson glabrous. Moderate tibial spurs present on legs III and IV. Tarsomere I of legs I–III with 10–14 long setae in both sexes. Ratio length/width of metasoma V 1.03–1.16 in both sexes.HISTORY OF STUDY. The syntype series of *O. persa* **stat. n.** was collected by the famous Russian ornithologist and traveler Nikolay A. Zarudny (1859–1919) who brought numerous scorpions for A. Birula’s ZISP collection, including many new species from the previously unexplored areas of Iran (then Persia). Zarudny (1900) published a detailed report (in Russian) of his two travels to the northeastern Persia in 1896 and 1898. Both expeditions followed the same route, heading for the great Hamun Lake (ca. 30°50’N 61°40’E) at the border with modern Pakistan, still an important wetland wildlife site. We can fairly well reconstruct the localities where *O. persa* **stat. n.** specimens were collected and clarify the relevant toponyms and dates.

Birula’s original description (Birula, 1900b: 374) listed five lots (syntypes) collected by Zarudny from Sistan and Kerman Provinces, as follows (all dates Old Style): Seistan: Neizar, 21–24 May 1898 [error; see below], six specimens; Hussein-Abad [error; see below], 2 June 1898, one specimen; Houzdar ruins, 7 June 1898, one specimen; Kirman, Bazman town, 5 August 1898, one specimen; Birjan, Rekuth Village, Bagaran-Kuh Mts., 2–6 May 1896, one specimen. All these lots are listed in Birula’s handwritten catalog (Fig. 140) with the following assigned numbers: ZISP-675 (Neizar, 3♂3♀), ZISP-676 (Hussein-Abad, 1♀ad), ZISP-677 (Houzdar, 1♂ad), and ZISP-678 (Bazman, 1♂juv). The next line in the catalog (Birjan) is crossed and has no assigned number.

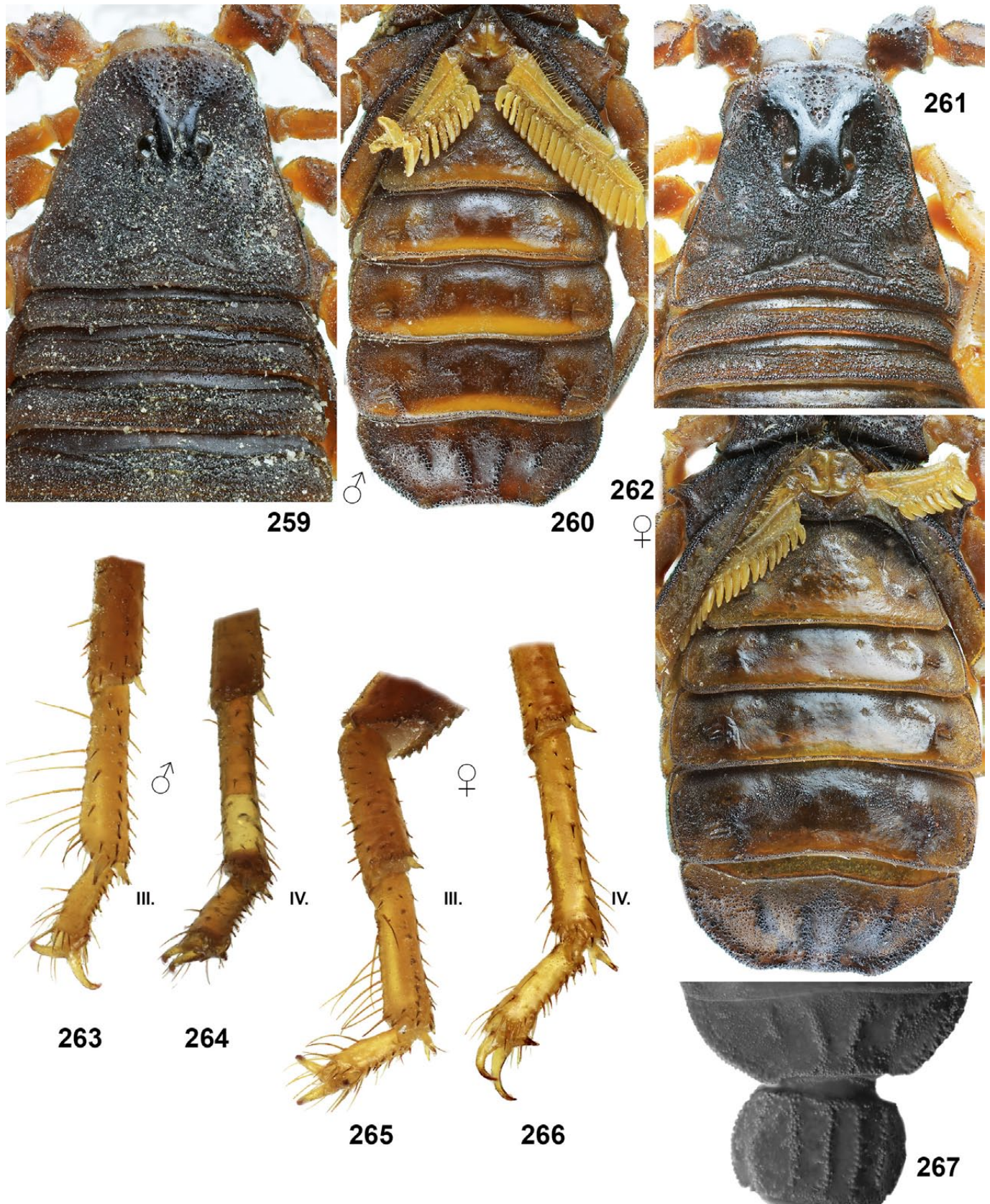
Most of the syntypes could not be now found in ZISP collection and appear to be lost. We found only two specimens (ZISP-675, Neizar, 1♂1♀), hereby designated as a lectotype (male) and a paralectotype (female). The handwritten catalog (Fig. 140) has a mark “ex. typica!” next to this lot but there was no designation of a holotype in Birula (1900b).



Figures 236–240: *Orthochirus persa* stat. n.. Figures 236–237. Lectotype male, dorsal (236) and ventral (237) views. Figures 238–239. Paralectotype female, dorsal (238) and ventral (239) views. Figure 240. Top: ZISP label (in Birula’s hand but not the original one, judging from post-1918 orthography); bottom: H. L. Stahnke’s identification (as ‘*serobicularis*’!). Stahnke loaned some ZISP material in the 1960s, to use in his key for Buthidae genera (Stahnke, 1972). Scale bars: 10 mm (236–239).



**Figures 241–258:** *Orthochirus persa* stat. n., segments of pedipalps. **Figures 241–250.** Lectotype male. Pedipalp chela, dorsal (241), external (242), and ventral (243) views. Pedipalp patella, dorsal (244), external (245), and ventral (246) views. Pedipalp femur and trochanter, dorsal (247) and ventral (248) views. Pedipalp chela, movable (249) and fixed (250) fingers dentate margin. **Figures 251–258.** Paralectotype female. Pedipalp chela, dorsal (251), external (252), and ventral (253) views. Pedipalp patella, dorsal (254), external (255), and ventral (256) views. Pedipalp femur, dorsal (257) view. Pedipalp chela, movable finger (258) dentate margin. The trichobothrial pattern is indicated in Figures 241–245, 247 (white circles).



**Figures 259–267:** Figures 259–260, 263–2164. Lectotype male of *Orthochirus persa* **stat. n.**, carapace and tergites I–IV (259), sternopectinal region and sternites (260), and distal segments of right legs III–IV, retrolateral aspect (263–264 respectively). **Figures 261–262, 265–266.** Paralectotype female of *Orthochirus persa* **stat. n.**, carapace and tergites I–II (261), sternopectinal region and sternites (262), and distal segments of right legs III–IV, retrolateral aspect (265–266 respectively). **Figure 267.** Holotype female of *Afghanorthochirus erardi*, sternite VII and metasoma I ventral under UV light.



**Figures 268–273:** *Orthochirus persa* stat. n., metasoma and telson under white light. **Figures 268–270.** Paralectotype female, lateral (268), ventral (269), and dorsal (270) views. **Figures 271–273.** Lectotype male, lateral (271), ventral (272), and dorsal (273) views. Scale bar: 10 mm.

According to the text of Birula (1900b: 374), these two specimens were collected “along the Neizar” on 21–24 May 1898 (Old Style). However, both the original label (Fig. 240) handwritten catalog (Fig. 140) say 1896, which seems to be correct. The confusion is clearly caused by the fact that Zarudny followed the same route in 1896 and 1898, around the same dates. Neizar is a river along which Zarudny traveled in May 1896 heading for the Hamun Lake. We can place the collection locality quite confidently at Bendun [now Bandan, Nehbandan County, *South Khorasan Province*, 31.383°N 60.71°E]. Zarudny arrived to Bendun on 24 May (Old Style) traveling for three days from Neh (now Nehbandan), before he approached the Neizar valley following the dry bed of the Bendun river (Zarudny, 1900).

Zarudny traveled to this area for the third time in 1901 and brought more specimens of the newly described *B. m. persa*, which were listed by Birula (1903: 75). We found and examined two specimens from one of these lots (not syntypes) ZISP-679 (1♂1♀), which originates from the same area (from Neizar to Ali-Abad), with the dates 1–10 June 1901. This date was given as 1890 by Birula (1903: 75) and is corrected to 1901 in the handwritten catalog (Fig. 140).

#### COMMENTS.

1. The identity of *Butheolus melanurus dentatus* Birula, 1900 (Iran), is unclear; we place it tentatively under *O. persa* **stat. n.** Its only known type specimen (holotype male ZISP-653) appears to be lost. According to Birula (1900b: 375), it was collected by Zarudny in ‘Sistan, Hussein-Abad’ on 2 June 1899 (‘Old Style’; 15 June ‘New Style’) but this date is clearly an error: Zarudny traveled in 1896 and 1898, and ‘Hussein-Abad’ was visited in 1898. The same locality but with the correct 2 June 1898 date is given for one of the syntypes of *O. persa* **stat. n.** (ZISP-676, now lost; Fig. 140).

Zarudny’s locality was identified as modern Hoseynabad (Sistan & Baluchistan Province, Zabol County, 30.800°N 61.383°E) by Roselaar & Aliabadia (2007). However, Zarudny (1900: 42) himself admitted that he confused the city’s name due to enormous travel fatigue. In reality, this was Nosratabad (now in Sistan & Baluchistan Province, Zahedan County, 29.90°N 59.98°E), a historically important city. In the late 19<sup>th</sup> century, it was the residence of British and Russian consuls (as noted by Zarudny) and served as the capital of the Sistan Province.

2. We compared the types of *Butheolus melanurus persa* Birula, 1900 with the holotype of *Afghanorthochirus erardi* Lourenço & Vachon, 1997. These taxa, in fact, belong to the same genus, *Orthochirus*, with their type localities relatively close (Fig. 343). These types match each other precisely in all characters used for species resolution inside genus *Orthochirus*. The undeniable conclusion is that the holotype of *A. erardi* Lourenço & Vachon, 1997 is a junior synonym of *O. persa* (Birula, 1900), **stat. n.**, **syn. n.** At the same time, the paratypes of *A. erardi* from Pakistan, in our opinion, belong to *Orthochirus fuscipes* (Pocock, 1900) (see above).

DISTRIBUTION. Afghanistan, Iran (Fig. 343).

### *Orthochirus scrobiculosus* (Grube, 1873)

(Figures 274–295, 343, 352, Table 2)

*Androctonus scrobiculosus* Grube, 1873: 56–57.

<http://zoobank.org/urn:lsid:zoobank.org:act:76F764E6-0ED1-4800-B953-05D701DA27B4>

#### SYNONYMS:

= *Buthus schneideri* L. Koch, 1878: 61–63, taf. II, fig. 4 (type locality and type repository: **Turkmenistan**, *Balkan Province*, Krasnovodsk [now Türkmenbashi, 40.02°N 52.97°E], BMHN) (syn. by Birula, 1898: 281 with *Butheolus melanurus*) (Fig. 352).

<http://zoobank.org/urn:lsid:zoobank.org:act:68DA255F-8BA4-475B-8006-6916DEECFC3E>

= *Butheolus conchini* Simon, 1889: 386 (type locality and type repository: **Turkmenistan**, *Balkan Province*, Bely-bugor [Ak-Tepe, 9.3 miles N of Chikishlyar, 37.57°N 53.9052°E]; 1♂ (lectotype, designated here), MNHN RS-1761, 1♂ (paralectotype), GNMT No 2584 (syn. by Birula, 1898: 281 and Birula, 1905a: 125 with *Butheolus melanurus*).

<http://zoobank.org/urn:lsid:zoobank.org:act:447F2371-83E7-4B10-AF16-A054028E6CFA>

#### REFERENCES:

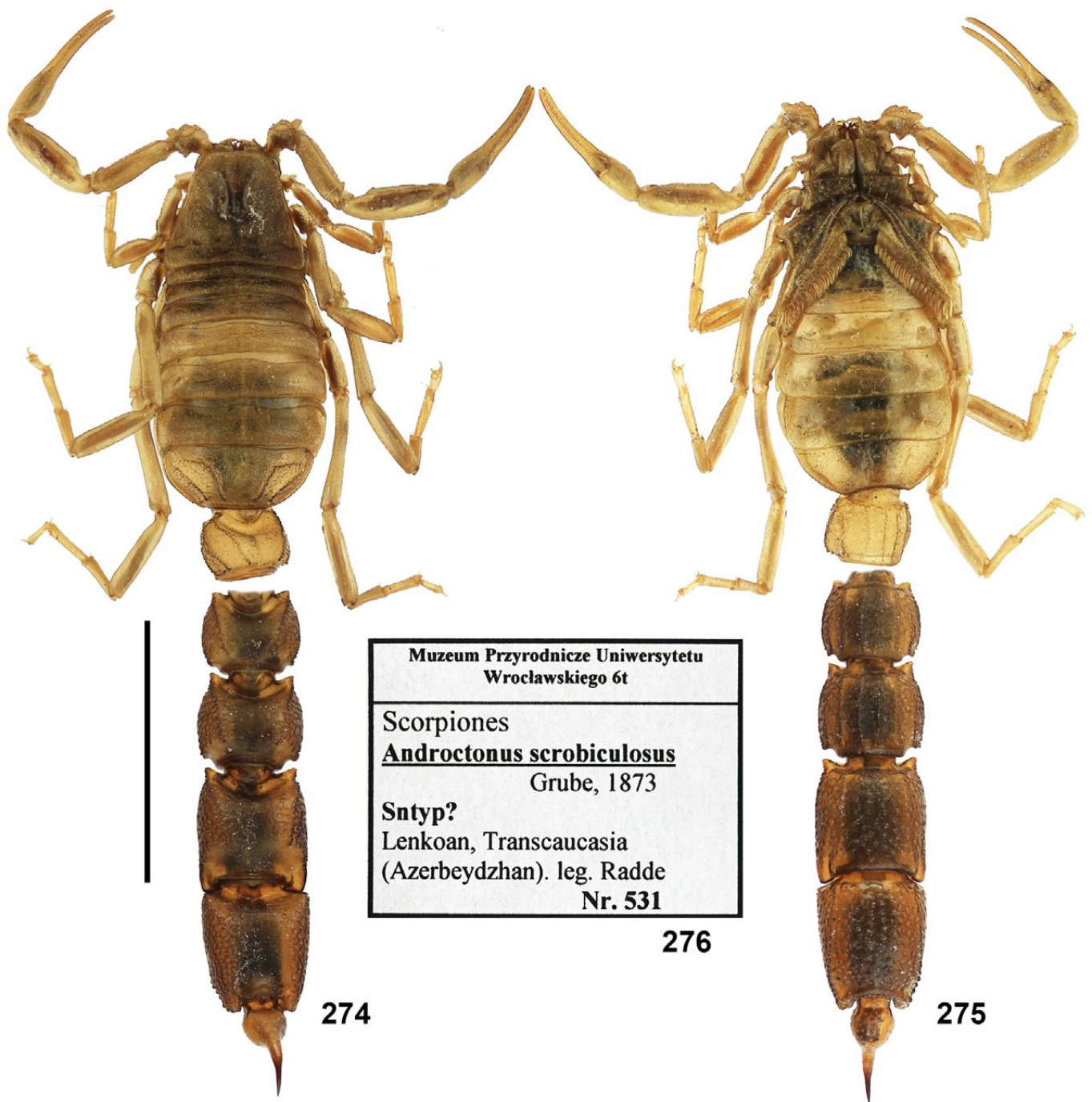
- Orthodactylus schneideri* (in part): Karsch, 1886: 76; Pocock, 1889: 117–118, pl. XIII, fig. 5; Kraepelin, 1891: 215–217.  
*Butheolus conchini*: Kraepelin, 1899: 36.  
*Butheolus schneideri*: Simon, 1889: 386.  
*Butheolus Conschini*: Birula, 1900a: 13.  
*Butheolus melanurus conchini*: Birula, 1900b: 374; Birula, 1904: 32; Birula, 1905a: 126.  
*Butheolus scrobiculosus scrobiculosus*: Birula, 1909: 359.  
*Orthochirus scrobiculosus* (in part): Birula, 1917: 241; Fet & Lowe, 2000: 196–197 (complete reference list until 1998).  
*Orthochirus scrobiculosus scrobiculosus*: Birula, 1917: 241; Birula, 1918: 39; Fet, 1989: 117; Fet, 1994: 129; Fet & Lowe, 2000: 198 (complete reference list until 1998).  
*Orthochirus conchini*: Levy & Amitai, 1980: 94.

TYPE LOCALITY AND TYPE DEPOSITORY. **Turkmenistan**, *Balkan Province*, Krasnovodsk [now Türkmenbashi, 40.02°N 52.97°E]; MNHW.

TYPE MATERIAL EXAMINED. **Turkmenistan** [not Lenkoran, now Länkarän in Azerbaijan, as erroneously stated in Grube, 1873], *Balkan Province*, Krasnovodsk [now Türkmenbashi, 40.02°N 52.97°E], 1♀ (lectotype, designated here), leg. Dr. [Gustav] Radde, [June 1870], MNHW No. 531.

OTHER TYPE MATERIAL (NOT EXAMINED). **Turkmenistan**, *Balkan Province*, Krasnovodsk [now Türkmenbashi], 1 paralectotype (designated here), sex unknown, leg. Sievers, [June 1870], GNMT.

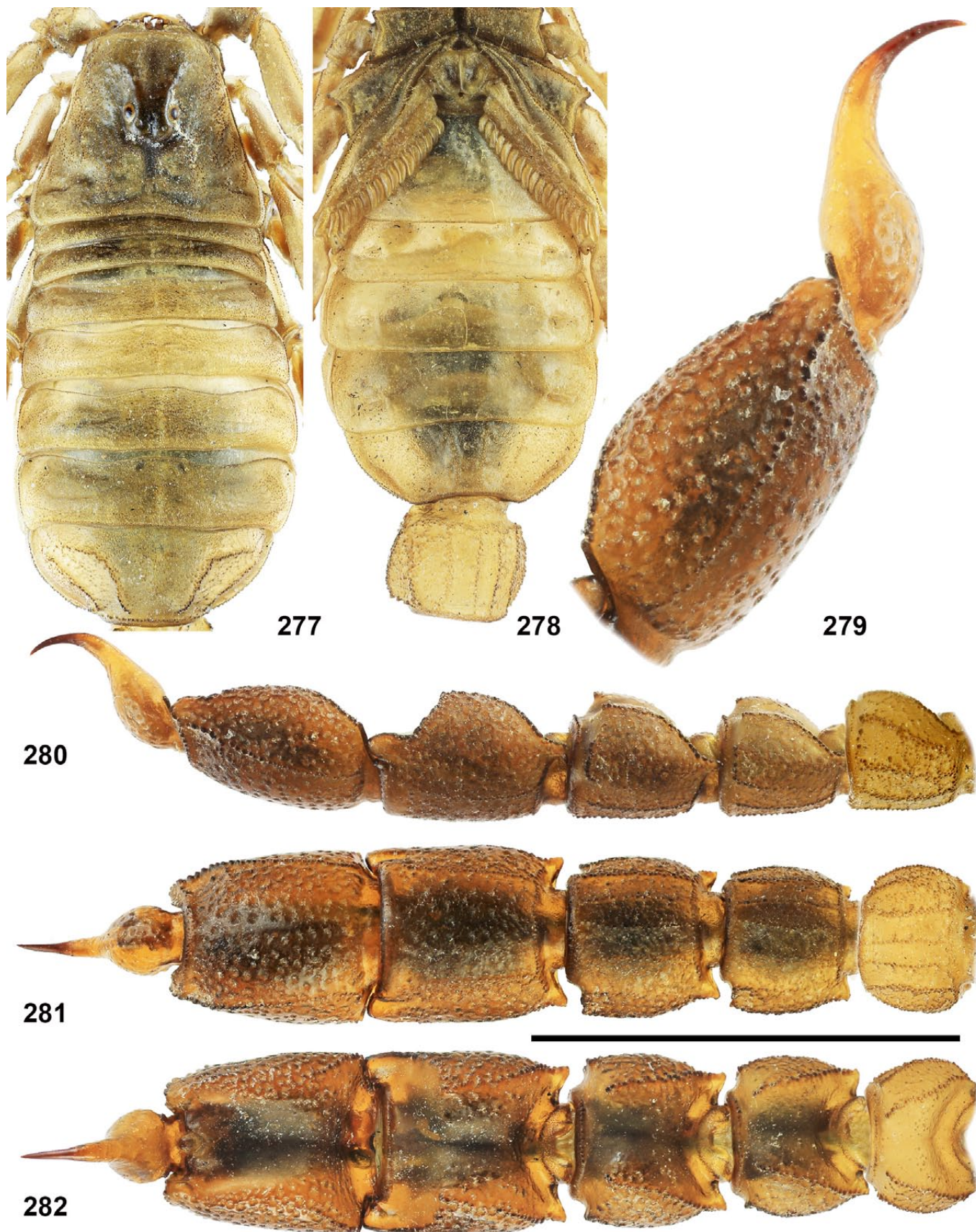
DIAGNOSIS (♀). Total length of female lectotype 36.39 mm.



**Figures 274–276.** *Orthochirus scrobiculosus*, lectotype female, dorsal (274) and ventral (275) views and MNHW label (276) (not the original one, 'Lenkoran' misspelled as 'Lenkoan'). Scale bar: 10 mm (274–275).

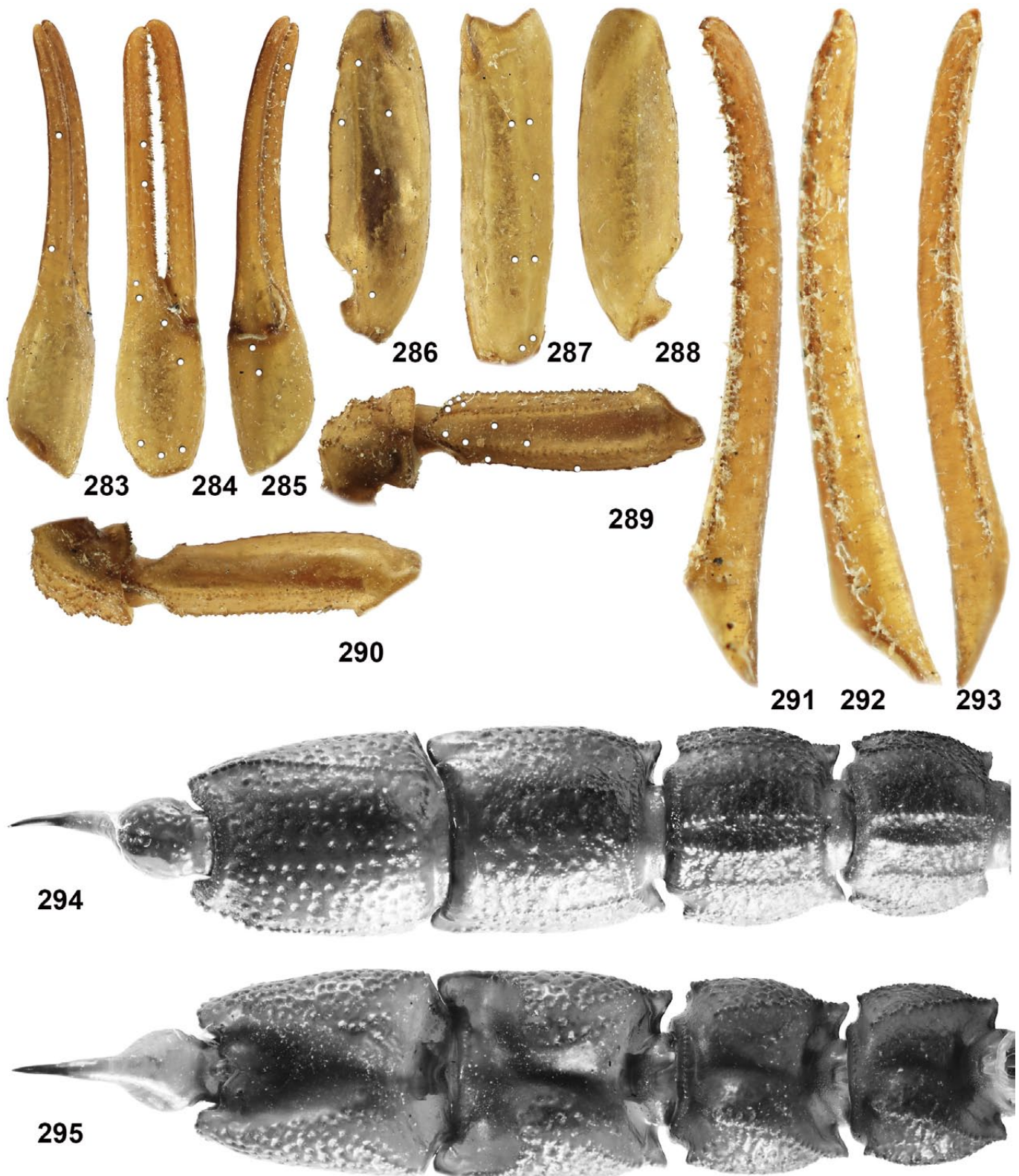
Coloration of carapace, tergites, and metasoma reddish black to black; sternites yellowish green to brown; pedipalps and legs yellow. Trichobothrium  $d_2$  on dorsal surface of pedipalp femur absent. Pectinal teeth number 17 in female lectotype. Movable finger of pedipalps with 8–9 rows of denticles, 7–8 ID and 0–1 OD. Dorsal carinae on pedipalp patella developed and smooth. Pedipalp femur dorsal smooth. Metasoma I–II with 10 carinae, metasoma III with 6 carinae, metasoma IV–V with 2 dorsolateral and ventrolateral carinae present. Ventral carinae of metasoma

I–III consist of granules in one or two rows. Metasoma V ventrally and laterally with fine punctation developed; metasoma I–V ventrally and laterally finely granulated with punctation reduced. Metasoma V dorsal surface mesially smooth; metasoma I dorsal surface with 11–22 granules. Tergites roughly to finely granulated. Sternite VII granulated, with four granulated carinae present. Pedipalp, metasoma and telson glabrous. Moderate to strong tibial spurs present on legs III and IV. Ratio length/width of metasoma V 1.21 in female lectotype.



Figures 277–282. *Orthochirus scrobiculosus*, lectotype female, carapace and tergites (277), sternopectinal region and sternites (278), metasoma V and telson lateral (279), and metasoma and telson, lateral (280), ventral (281), and dorsal (282) views. Scale bar: 10 mm (280–282).





**Figures 283–295:** *Orthochirus scrobiculosus*, lectotype female. **Figures 283–293.** Segments of pedipalps. Pedipalp chela, dorsal (283), external (284), and ventral (285) views. Pedipalp patella, dorsal (286), external (287), and ventral (288) views. Pedipalp femur and trochanter, dorsal (289) and ventral (290) views. Pedipalp chela, movable (291, 293) and fixed (292) fingers dentate margins. **Figures 294–295.** Metasoma II–V and telson, ventral (294) and dorsal (295) views under UV light. The trichobothrial pattern is indicated in Figures 283–287, 289 (white circles).

HISTORY OF STUDY. For more than 100 years, the name *O. scrobiculosus* was used as an umbrella for all Central Asian *Orthochirus* (see e.g. Fet, 1989; Fet & Lowe, 2000). Our present revision for the first time reveals that it is applicable, of all available material, only to the populations inhabiting the southeastern shores of the Caspian Sea in the southwestern Turkmenistan, not far from the Iranian border. Other lowland desert populations in Central Asia belong to *O. melanurus* (Kessler 1874) (Kazakhstan, Uzbekistan), which is restored here to species status (see above), *O. gromovi* Kovařík, 2004 (eastern Turkmenistan), or a new species described here as *O. formozovi* sp. n. (southern Turkmenistan, Tajikistan).

The convoluted story of Grube's single specimen, which survived two world wars, is nothing short of amazing. Along with the story of *O. melanurus* (see above), it personifies 150 years of zoological research in Central Asia done by many enthusiastic naturalists of diverse backgrounds. Adolph Grube (1812–1880) was a German zoologist at the Universität Breslau (then in Silesia, Germany; now Museum of Natural History Wrocław) (MNHW). This is the only scorpion described by Grube who worked on various animal groups, mainly on Polychaeta, and was one of the early explorers of the Adriatic Sea.

Grube's description was very brief; it mentioned that his specimen came from "Dr. Radde". Birula (1909) was the first researcher who re-examined this specimen, loaned to him from Breslau by Wilhelm Kükenthal. Grube obtained a small collection of "mostly Caucasian" arthropods from Gustav Radde (1831–1903). Radde was a famous Russian naturalist and geographer of German extraction who in 1865 founded the Caucasian Museum in Tiflis (now Georgian National Museum, Tbilisi, Georgia). Grube (1873: 57) also mentioned that his new species was found in "Lenkoran, at the altitude of 4000 feet" This was an obvious error; Lenkoran is an area in the southeastern Russian Transcaucasia (now Azerbaijan), and there are no *Orthochirus* species in Transcaucasia. Another, large black scorpion in Radde's collection, identified by Grube (1873: 56) as "*Androctonus bicolor*" was *Androctonus crassicauda* (Olivier, 1807) that indeed originated from the southern Transcaucasia (now Azerbaijan) (see Fet, 1989: 78). The original label, which was glued on the jar, seen by Birula (1909: 368), and probably written in Grube's hand, said "*Androctonus scrobiculosus* Gr. G. Radde Transcauc. Krasnowarsk." This label conflated "Transcauc[asia]" with Krasnovodsk [misspelled as "Krasnowarsk"], which is located in Transcaspia (not Transcaucasia!). Krasnovodsk (now Türkmenbashi, Turkmenistan) was, and still is, the most important port on the southeastern shore of the Caspian Sea, founded in 1869 as the Russian Empire began its annexation of the Transcaspian Region, now Turkmenistan.

Birula (1909) explained the confusion in detail. He ruled that Grube's species was the senior synonym of three other taxa: *Androctonus melanurus* Kessler, 1874; *Buthus schneideri* L. Koch, 1878; and *Butheolus conchini* Simon, 1889. After transferring Grube's species to *Butheolus*, Birula (1909: 359) assigned to it four subspecies: nominotypical *B. s. scrobiculosus* ("western Transcaspia"), *B. s. melanurus* ("eastern Transcaspia, northeastern Persia"), *B. s. concolor*, and *B. s. persa*. Later (Birula,

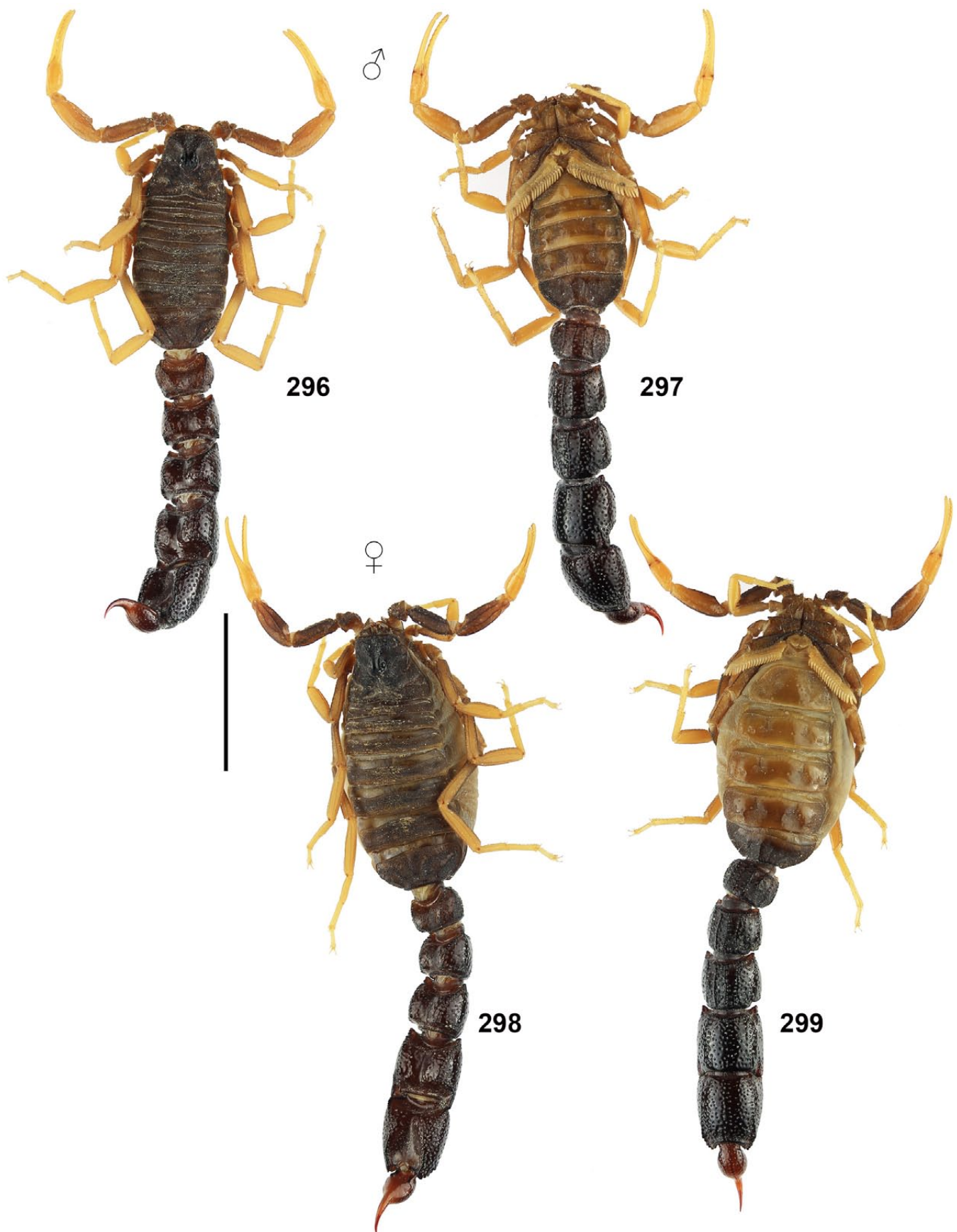
1917, 1918) he transferred this species to the genus *Orthochirus*.

Grube's specimen from Krasnovodsk was clearly collected by Radde himself in June 1870. As soon as Russian troops established themselves in Krasnovodsk in 1869, Radde was tasked by the Imperial Geographic Society with a geographic and biological survey of the newly annexed territory. Arriving from Tiflis to Baku (now Azerbaijan) right before Easter 1870, Radde and his associate Sievers, however, had to wait for a military convoy. Meanwhile they decided to collect in Lenkoran, the southeastern corner of Transcaucasia (hence, 'Lenkoran' in Grube's text!). This unexpected delay lasted for almost two months. Finally, the travelers crossed the Caspian Sea and arrived to Krasnovodsk on 5 June 1870 ["Old Style" (Julian), 17 June "New Style" (Gregorian)], in the scorching heat of the Transcaspian summer. They were not allowed to venture more than 3 miles from the military camp; collecting for three weeks, Radde and Sievers listed many reptiles, insects, "many wasps and even more scorpions" (Radde & Sievers, 1871: 221).

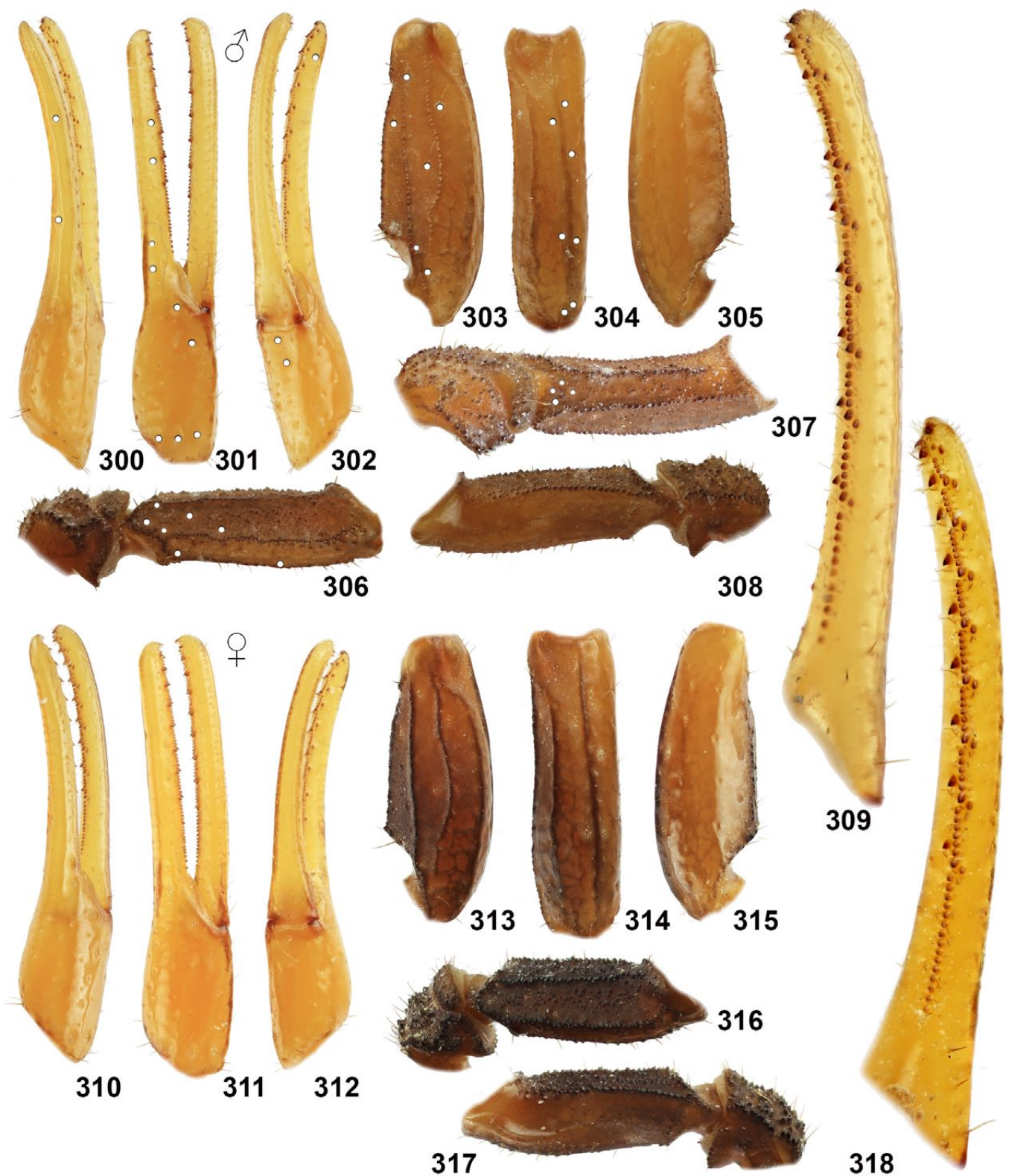
Birula (1905a: 125) noted that the Caucasian Museum (now GNMT) collection had several specimens from Krasnovodsk, of which one had a label "Transcaspi-Gebiet, Sievers leg.", i.e. was collected by Radde and Sievers in 1870 (Birula, 1905a: 125). Another specimen from the same series was obviously sent to Grube and became the type of *Androctonus scrobiculosus*. Since the second specimen existed from the same collection, the MNHW female is not a holotype but a syntype. We designate it here as a lectotype, and the GNMT specimen mentioned by Birula (1905a) (sex unknown) as a paralectotype.

Clearly without any knowledge of Grube's description, Kessler (1874) described *Androctonus melanurus* (see in detail above), which for the most of the next century was considered a synonym or a subspecies of *O. scrobiculosus*. The syntype series of *A. melanurus* in fact included several specimens from Krasnovodsk (ZISP-690, now lost). Kessler's publication (which was in Russian) remained unknown to the European researchers. Four years later, a renowned arachnologist Ludwig Koch (1825–1908) from Nuremberg published (Koch, 1878) a description of *Buthus schneideri*, again from Krasnovodsk (see our Fig. 352). This specimen was collected in 1875 by the geographer Oscar Schneider (1841–1903) during his six-month expedition, which provided rich zoological materials, mainly from the Caucasus, but also from Krasnovodsk across the Caspian Sea. Several of Koch's new spider species originate from there while others are from the Caucasus, including Lenkoran.

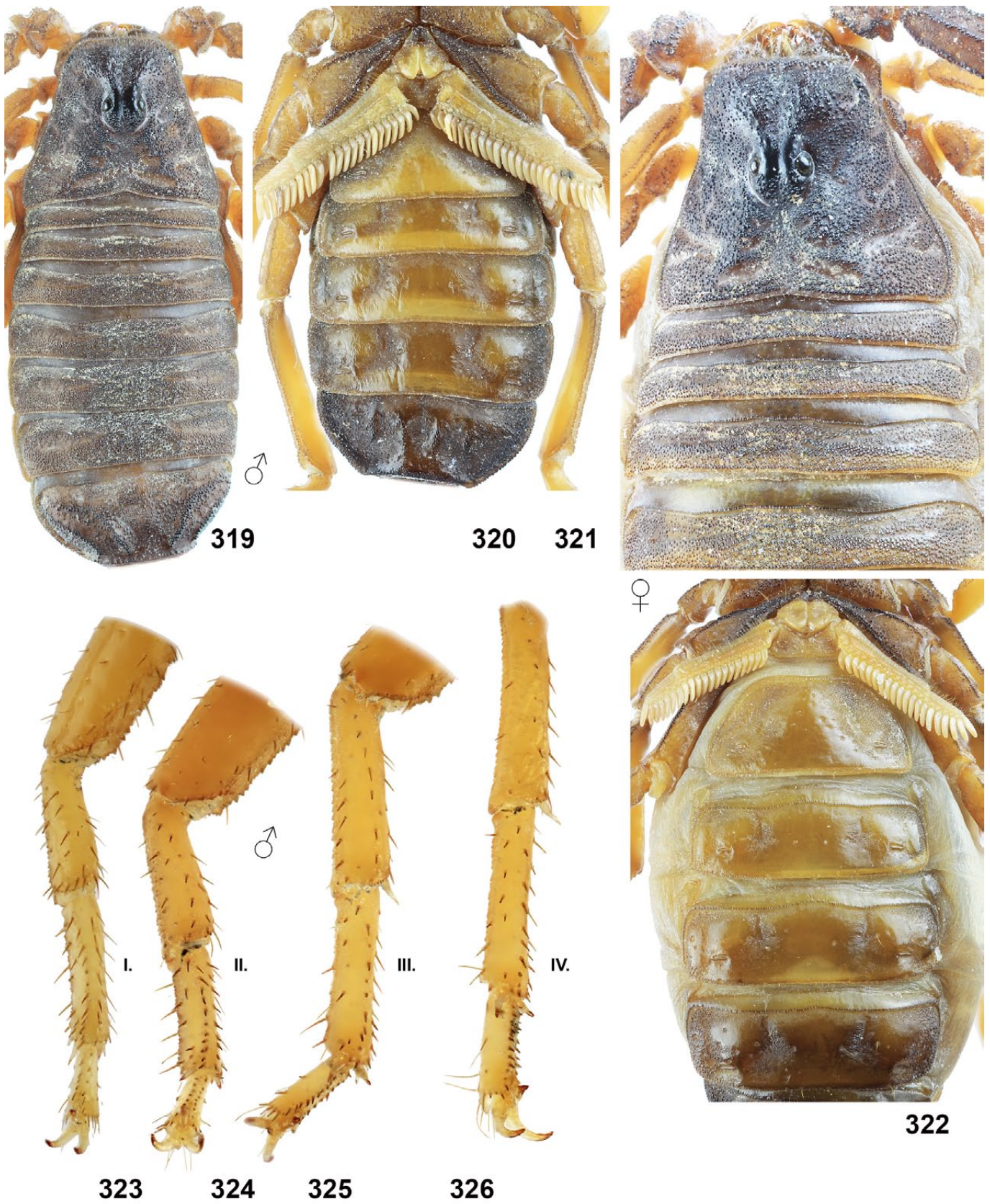
Finally, in 1889, the most famous arachnologist of all time, Eugène Simon (1848–1924), published the first paper specifically devoted to the Transcaspian arachnids (Simon, 1889). He studied collections made in 1886–1887 by the expedition led again by the same Dr. Gustav Radde of the Caucasian Museum who supplied Grube's specimen from Krasnovodsk collected in 1870. A detailed report was published (Radde, 1886). Simon (1889) described *Butheolus conchini*, collected at "Bely-Bugor" (Russ. Белый бугор, 'White Hill') on 27 April 1886 ["Old Style" (Julian), 10 May "New Style" (Gregorian)] by the geologist Afanasy M. Konshin (1854–after 1919), one of the early oil prospectors in the Caucasus and Transcaspia. This locality was erroneously interpreted by Fet (1989) as "Akdepe,



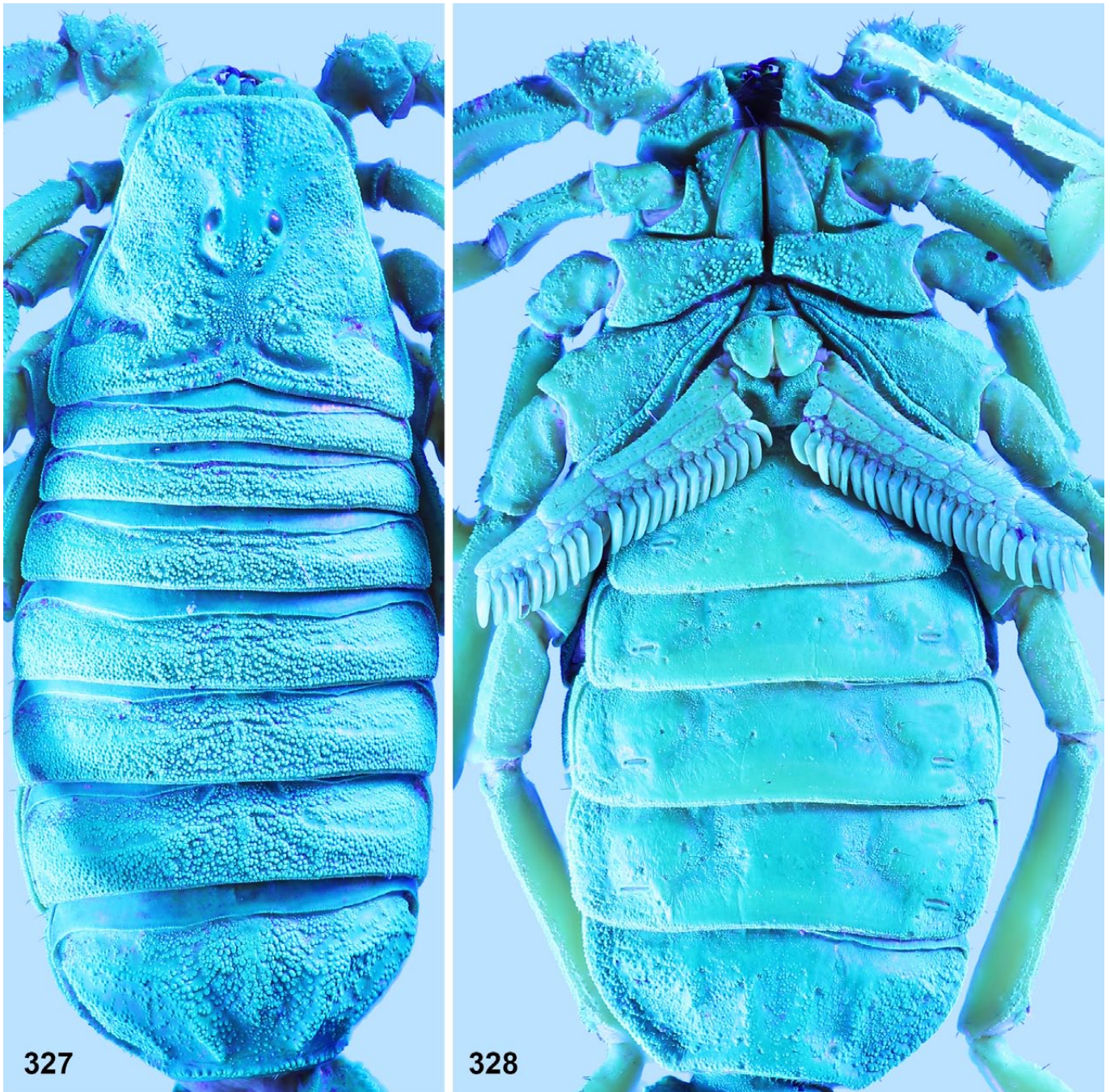
**Figures 296–299:** *Orthochirus sejnai* sp. n. **Figures 296–297.** Holotype male, dorsal (296) and ventral (297) views. **Figures 298–299.** Paratype female, dorsal (298) and ventral (299) views. Scale bar: 10 mm.



**Figures 300–318:** *Orthochirus sejnai* sp. n., segments of pedipalps. **Figures 300–310.** Holotype male. Pedipalp chela, dorsal (300), external (301), and ventral (302) views. Pedipalp patella, dorsal (303), external (304), and ventral (305) views. Pedipalp femur and trochanter, dorsal (306), internal (307) and ventral (308) views. Pedipalp chela, movable finger (309) dentate margin. **Figures 310–318.** Paratype female. Pedipalp chela, dorsal (310), external (311), and ventral (312) views. Pedipalp patella, dorsal (313), external (314), and ventral (315) views. Pedipalp femur and trochanter, dorsal (316) and ventral (317) views. Pedipalp chela, movable finger (318) dentate margin. The trichobothrial pattern is indicated in Figures 300–304, 306–307 (white circles).



**Figures 319–326:** *Orthochirus sejnai* sp. n. **Figures 319–320, 323–326.** Holotype male, carapace and tergites (319), sternoplectinal region and sternites (320), and distal segments of right legs I–IV, retrolateral aspect (323–326 respectively). **Figures 321–322.** Paratype female, carapace and tergites I–IV (321), sternoplectinal region and sternites III–VI (322).



Figures 327–328. *Orthochirus sejnai* sp. n., holotype male, carapace and tergites (327) and sternopectinal region and sternites (328) under UV light.

Ashkhabad Region”, Turkmenistan (a non-existing toponym). In fact, this name refers to a sandy hill (in Turkmen, Ak-Tepe, or Ak-Patlaukh), overlooking the Caspian Sea that served as a landmark for ship pilots. It was noted as early as 1836 by the very first Russian topographic survey led by Grigory Karelin (1801–1872) (Blaramberg, 1875). The landmark is located at 9.3 miles N of Chikishlyar (37.57°N 53.9052°E), still an important post on the Iranian border (Fig. 343).

Birula (1905a: 119), examining the collection of the Caucasian Museum (now GNMT), noted an original specimen of *Butheolus conchini* Simon from Bely-Bugor (a male with

20–21 pectinal teeth). This specimen was personally examined by one of the authors (V.F.) in 1985; it was labeled “27.04.1886, *Butheolus melanurus conchini*, No 2584, det. A. Birula” (Fet, 1989: 113). This date is the same as listed by Simon (1889: 386) who based his description on another male (with 20–22 pectinal teeth), now deposited in MNHN. Since the second specimen existed from the same type series, the MNHN male is not a holotype but a syntype. We designate it here as a lectotype, and the GNMT No 2584 male as a paralectotype.

DISTRIBUTION. Turkmenistan (Fig. 343).



Figures 329–330. *Orthochirus sejnai* sp. n., paratype female, carapace and tergites (329) and sternopectinal region and sternites (330) under UV light.

***Orthochirus sejnai* sp. n.**

(Figures 296–342, 343, Table 3)

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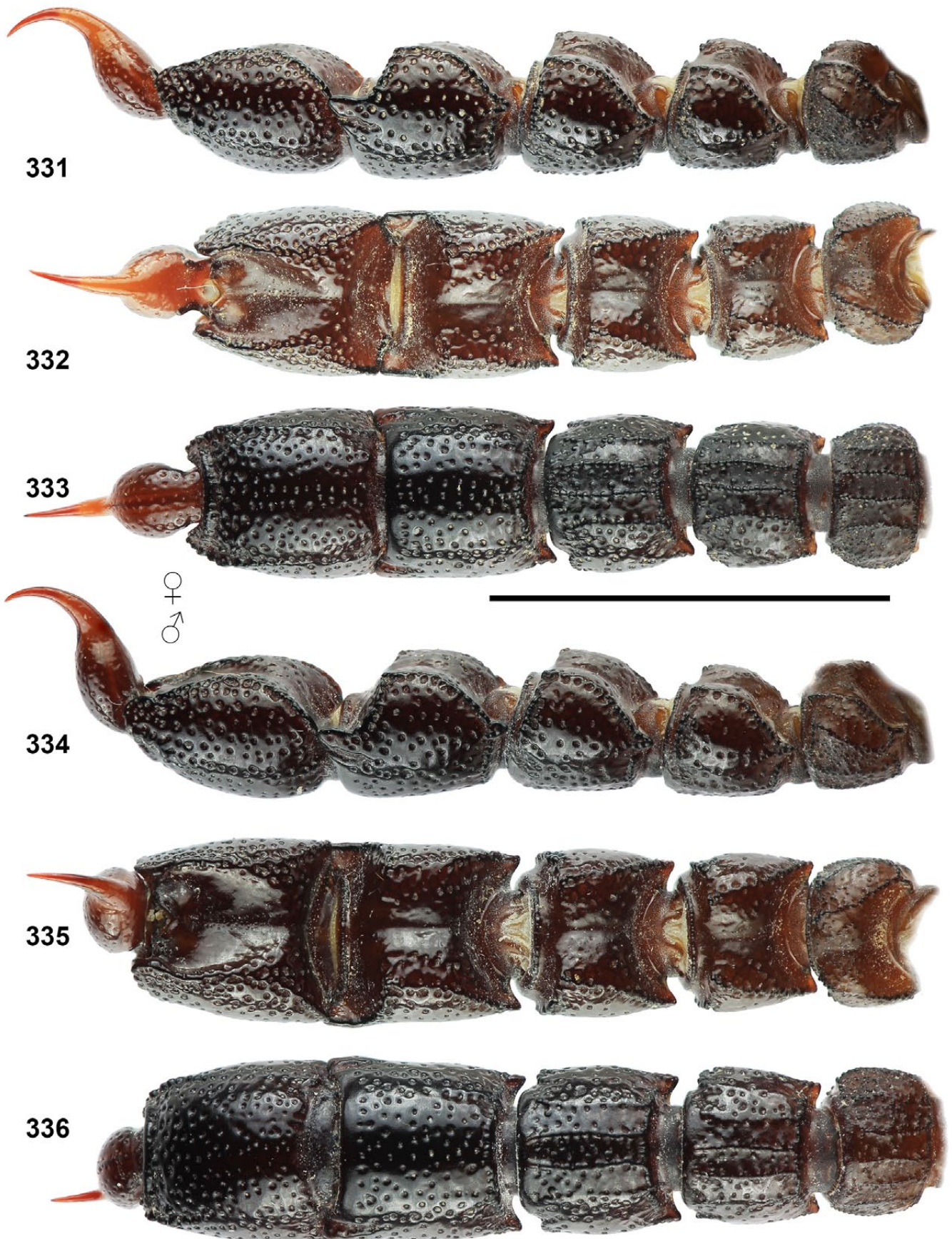
TYPE LOCALITY AND TYPE DEPOSITORY. **Iran**, *Hamadan Province*, ca. 2000 m a. s. l., 35 km SE of Hamadan, Gonbad Village, [34°41'10"N 48°44'38"E]; FKCP.

TYPE MATERIAL EXAMINED. **Iran**, *Hamadan Province*, ca. 2000 m a. s. l., 35 km SE of Hamadan, Gonbad Village,

[34°41'10"N 48°44'38"E], 7–8 May 1996, 1♂ (holotype) 1♀1juv. (paratypes), leg. V. Šejna, FKCP.

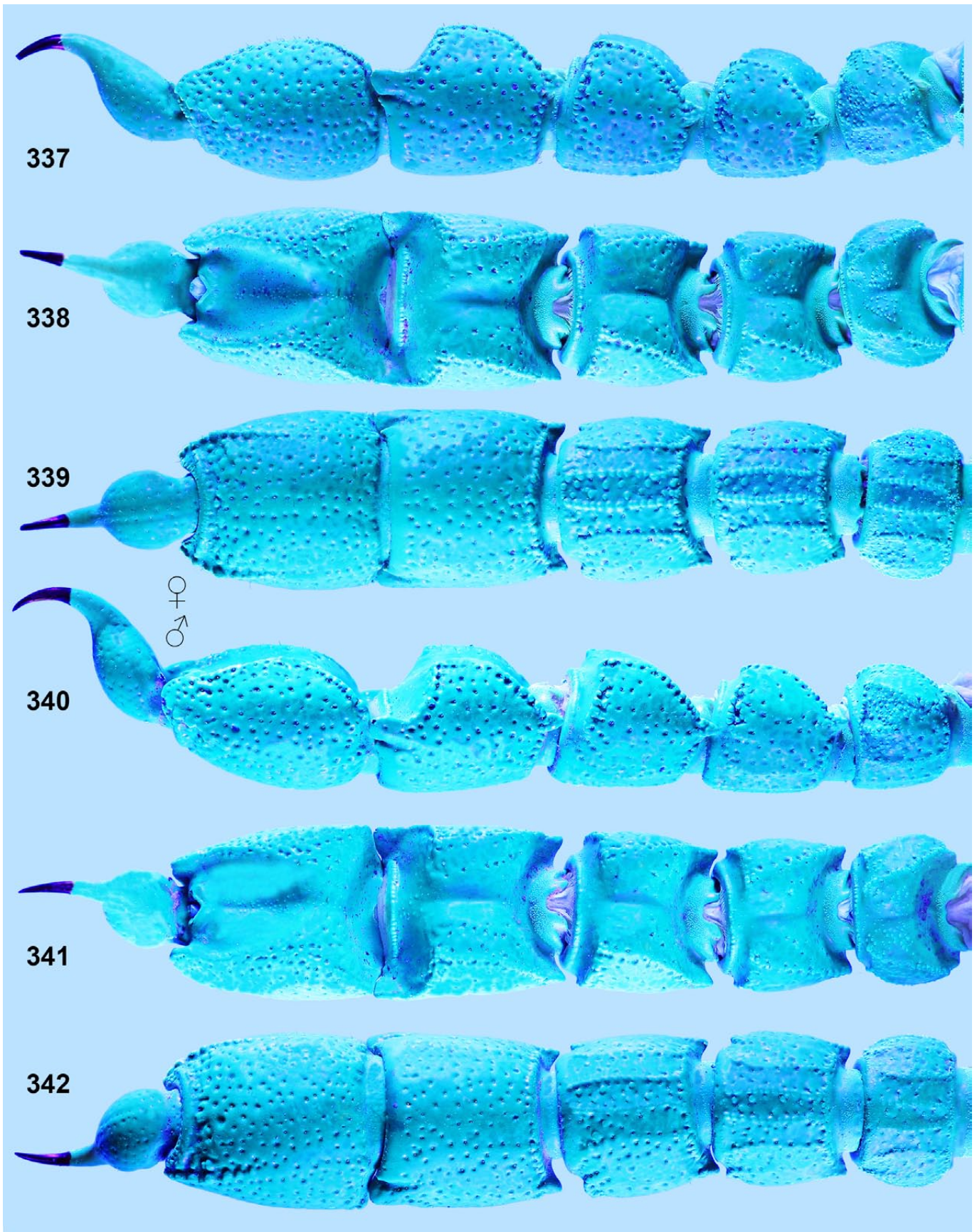
ETYMOLOGY. The species epithet is a patronym honoring a Czech arachnologist Vladimír Šejna, the collector of types of the new species.

DIAGNOSIS (♂♀). Total length of adults 37–39 mm. Pedipalp manus yellow. Femur and patella of legs yellow. Trichobothrium  $d_2$  on dorsal surface of pedipalp femur present. Pectinal teeth number 24 in male and 20 in female.



Figures 331–336: *Orthochirus sejnai* sp. n., metasoma and telson under white light. Figures 331–333. Paratype female, lateral (331), dorsal (332), and ventral (333) views. Figures 334–336. Holotype male, lateral (334), dorsal (335), and ventral (336) views. Scale bar: 10 mm.





Figures 337–342: *Orthochirus sejnai* sp. n., metasoma and telson under UV light. Figures 337–339. Paratype female, lateral (337), dorsal (338), and ventral (339) views. Figures 340–342. Holotype male, lateral (340), dorsal (341), and ventral (342) views.

Movable finger of pedipalps with 8–9 rows of denticles, 8–9 ID and OD. Dorsal carinae on pedipalp patella developed and granulated. Pedipalp femur dorsal granulated. Metasoma I with 10 carinae, metasoma II–III with 6 carinae, metasoma IV–V with incomplete dorsolateral and ventrolateral carinae. Ventral carinae of metasoma I–III consist of large granules in one row. Metasoma II–V ventrally and laterally smooth with fine punctation developed laterally and reduced ventrally on metasoma II–III, spaces among punctae smooth with large granules ventrally between median carinae on metasoma II–III; metasoma I ventrally and laterally granulated with punctation reduced. Metasoma V dorsal surface mesially granulated; metasoma I dorsal with more 40, metasoma II with 2–16 large granules. Tergites roughly to finely granulated. Sternite VII granulated, with four granulated carinae present. Pedipalp, metasoma and telson glabrous. Moderate to strong tibial spurs present on legs III and IV. Tarsomere I of legs I–III with 4–6 setae in both sexes. Pedipalp patella length/width ratio 2.96–2.98 in both sexes. Ratio length/width of metasoma V 1.12–1.18 in both sexes.

**DESCRIPTION.** Total length of adults 37–39 mm in both sexes. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 3. For habitus, see Figs. 296–299.

**Coloration** (Figs. 296–299). Carapace, tergites, metasoma, and femur or femur and patella of pedipalps and legs reddish black to lack. Patella of pedipalps and legs could be also yellow or yellowish brown. Chela of pedipalps and tarsomeres of legs yellowish brown. Sternites reddish black with yellow median area indicated in posterior margin of sternites III–IV. Telson reddish black.

**Mesosoma and carapace** (Figs. 319–322, 327–330). Tergites with a median carina and is roughly to finely granulated. Seventh sternite densely granulated mainly in posterior part with four granulated carinae, the other sternites almost smooth in female and partly granulated with smooth areas mainly in middle and posteriorly in male. Pectine teeth number 24 in male and 20 in female.

**Metasoma and telson** (Figs. 331–342). Metasoma I with 10, metasoma II–III with 6 granulated carinae. Metasoma II–V lacks lateral and metasoma IV–V ventromedian carinae. Ventrolateral carinae are developed on metasoma I–III and indicated or incomplete on metasoma IV–V, dorsolateral carinae are present on metasoma I–III and indicated on other segments. Ventral carinae of metasoma I–II consist of large granules. Metasoma I granulated laterally, metasoma II–V laterally punctate and smooth; granulation absent on dorsal surfaces of metasoma III–IV; metasoma V dorsal surface mesially granulated; metasoma I dorsal with more 40, metasoma II with 2–16 large granules. Fine punctation on metasoma IV–V ventrally developed, spaces among punctae smooth. Entire metasoma and telson glabrous. Telson smooth with punctation present ventrally and laterally.

**Pedipalps** (Figs. 300–318). Trichobothrium  $d_2$  on dorsal surface of pedipalp femur present; trichobothrium  $e_1$  is situated between trichobothria  $d_2$  and  $d_4$ . Femur of pedipalps with five

granulated carinae and is dorsally granulated. Patella has seven smooth carinae, and the chela has smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalps are glabrous with several setae only. Movable fingers with 8–9 rows of denticles, 8–9 ID and 8–9 OD.

**Legs** (Figs. 323–326). Moderate tibial spurs present on legs III and IV. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few setae. Tibia with setae on the outer side of legs I–II. Tarsomere I of legs I–III with 4–6 setae in both sexes, legs IV with 2–4 setae. Tarsomeres I–II internal of all legs with two rather irregular rows of setae.

**Measurements.** See Table 3.

**AFFINITIES.** The combination of eight characters (metasoma I laterally granulated or bumpy with punctation reduced; metasoma II–V lateral smooth, without granules, punctation developed; metasoma I dorsal with more than 40 large granules in adults (Fig. 338); tarsomere I of legs with 4–6 long setae; entire metasoma glabrous; pedipalp movable finger with 8–9 ID and 8–9 OD; sternite VII densely granulated; pedipalp patella with dorsal carinae granulated) is unique in the entire genus *Orthochirus*.

**DISTRIBUTION.** Iran (Fig. 343). Known only from the type locality.

### Key to *Orthochirus* found from Turkey to India

1. Metasoma I–II (or I–III) yellow or yellowish brown. ... 2
  - Metasoma I–III black or brownish/reddish black. .... 3
2. Metasoma IV–V and telson brownish or reddish black, darker than metasoma I–III. .. *O. bicolor* (Pocock, 1897)
  - The entire metasoma yellow (Figs. 120–122). .... 42
3. Dorsal surface of metasoma V mesially densely granulated (figs. 159–160 in Kovařík et al., 2019: 27). .... 4
  - Dorsal surface of metasoma V mesially smooth or with several fine granules only (fig. 161 in Kovařík et al., 2019: 27). .... 11
4. Lateral surface of metasoma I punctate with similar intensity as in metasoma IV–V. .... *O. flavescens* (Pocock, 1897)
  - Lateral surface of metasoma I granulated or bumpy, with punctation reduced. .... 5
5. Lateral surfaces of metasoma II–III smooth, without granules (except several large granules between ventral median carinae), punctate and bumpy (fig. 171 in Kovařík et al., 2019: 28). .... 6
  - Lateral surfaces of metasoma II–III granulated (fig. 173 in Kovařík et al., 2019: 28). . .... 9
6. Tarsi of legs I–III with bristlecombs composed of 4–8 setae. .... 7
  - Complete lack on bristlecombs on legs. .... *O. bastawadei* Zambre et al., 2011

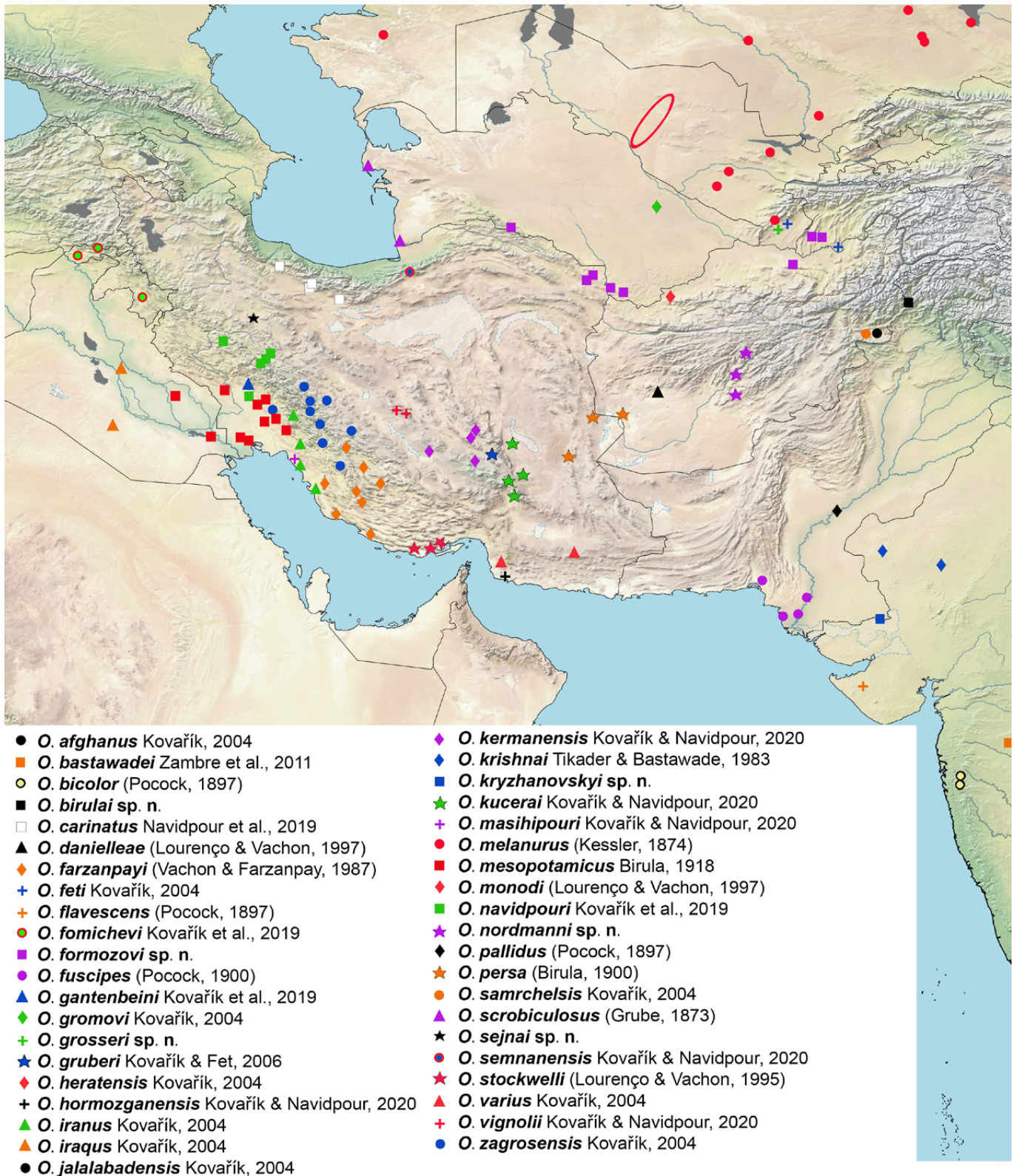
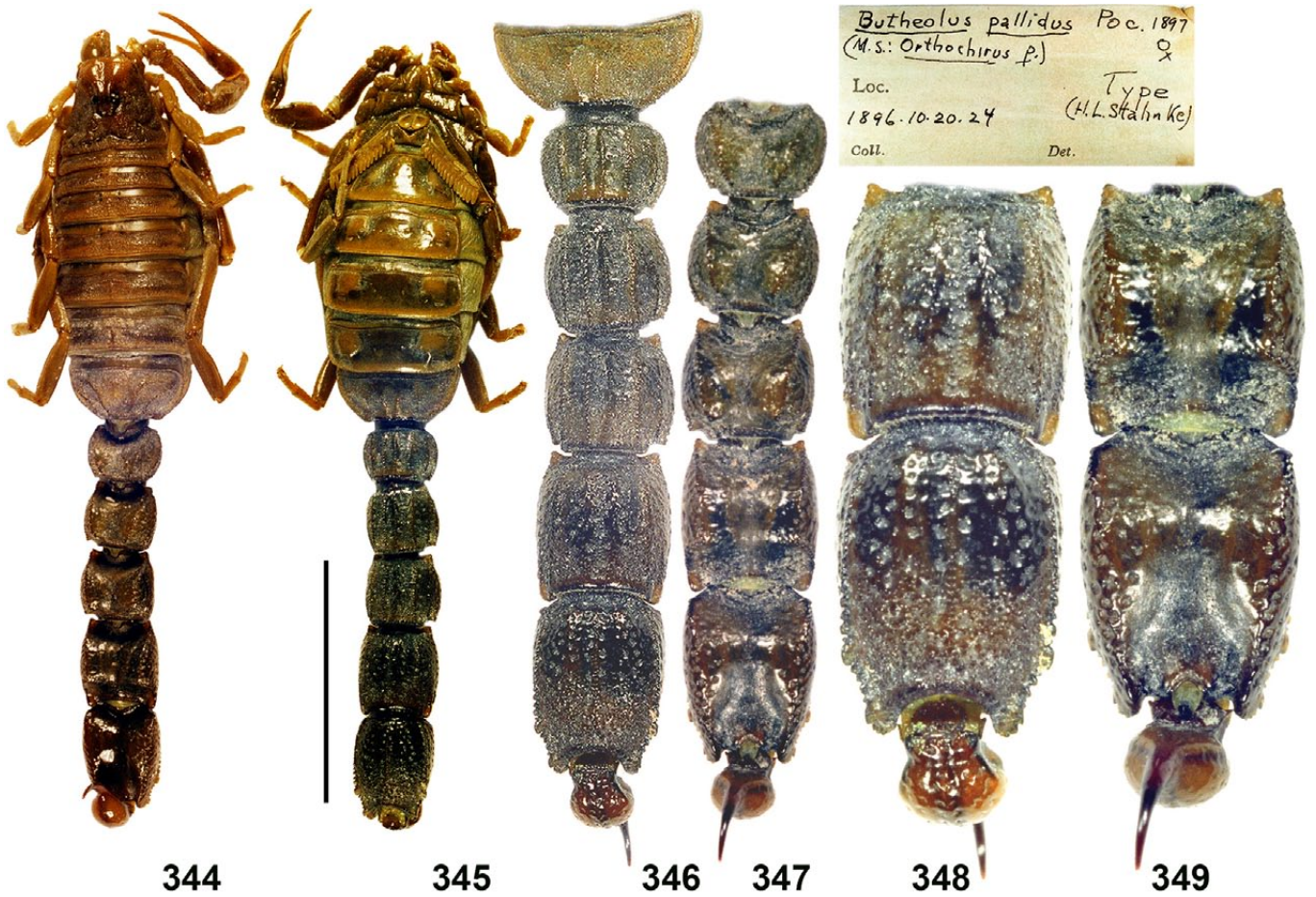


Figure 343. Geographic distribution of the *Orthochirus* spp. found from Turkey to India. An approximate area where the lectotype of *O. melanurus* was collected is marked by red ellipse.



**Figures 344–349:** *Orthochirus pallidus*, lectotype female, dorsal (344) and ventral (345) views, sternite VII, metasoma and telson ventral (346), metasoma and telson dorsal (347), metasoma IV–V and telson ventral (348) and dorsal (349) views. Scale bars: 10 mm (344–345).

- |   |   |
|---|---|
| <p>7. Dorsal surface of metasoma I with 0–10 large granules in adults. .... 8</p> <p>– Dorsal surface of metasoma I with more than 40 large granules in adults (Figs. 338, 341). .... <i>O. sejnai</i> sp. n.</p> <p>8. Metasoma III with laterodorsal carinae punctate. Known from Iraq and Turkey. . <i>O. fomichevi</i> Kovařík et al., 2019</p> <p>– Metasoma III with laterodorsal carinae not punctate. Known from Pakistan. .... <i>O. fuscipes</i> (Pocock, 1900)</p> <p>9. Ventral surface of metasoma IV densely granulated, without smooth areas. .... <i>O. pallidus</i> (Pocock, 1897)</p> <p>– Ventral surface of metasoma IV almost smooth (<i>O. mesopotamicus</i>) or partly granulated (<i>O. iranus</i>) but always with at least central portion smooth. .... 10</p> <p>10. Metasomal segments wide (fig. 159 in Kovařík et al., 2019: 27), ratio length/width of metasoma V is in males 1.06–1.11. Ventral and lateral surfaces of metasoma IV–V partly granulated (fig. 173 in Kovařík et al., 2019: 28). ...</p> <p>..... <i>O. iranus</i> Kovařík, 2004</p> <p>– Ratio length/width of metasoma V is in males 1.18–1.24. Ventral and lateral surfaces of metasoma IV–V almost smooth (fig. 116 in Kovařík et al., 2019: 20). ....</p> <p>..... <i>O. mesopotamicus</i> Birula, 1918</p> | <p>11. Metasoma hirsute. .... 12</p> <p>– Entire metasoma glabrous (short, thin setae may issue from some punctae)..... 20</p> <p>12. Metasoma densely hirsute. .... 17</p> <p>– Metasoma sparsely hirsute. .... 13</p> <p>13. Pedipalp movable finger with 0–1 outer (OD) denticles. 14</p> <p>– Pedipalp movable finger with 5–7 outer (OD) denticles. 16</p> <p>14. Ventral surface of metasoma IV shallowly punctate, with lateroventral carinae present with row of granules on posterior margin. . <i>O. monodi</i> (Lourenço &amp; Vachon, 1997)</p> <p>– Ventral surface of metasoma IV with punctuation developed, lateroventral carinae absent. .... 15</p> <p>15. Pedipalp movable finger with 5 inner denticles (ID). Pedipalp patella with more than 30 setae. Metasoma V longer than wide in male, length/width ratio is 1.14. ....</p> <p>..... <i>O. gromovi</i> Kovařík, 2004</p> <p>– Pedipalp movable finger with 7 inner denticles (ID). Pedipalp patella with less than 15 setae. Metasoma V as long as wide in male, length/width ratio is 1.0 ....</p> <p>..... <i>O. heratensis</i> Kovařík, 2004</p> |
|---|---|

16. Metasoma V wider than long in female, length/width ratio is 0.93. .... *O. danielleae* (Lourenço & Vachon, 1997)  
– Metasoma V longer than wide in female, length/width ratio is 1.17. .... *O. gruberi* Kovařík & Fet, 2006
17. Pedipalp movable finger with outer denticles (OD). .... 18  
– Pedipalp movable finger without outer denticles (OD). ...  
..... *O. feti* Kovařík, 2004
18. Pedipalp patella with dorsal carinae granulated (fig. 58 in Kovařík et al., 2019: 11). ....  
..... *O. gantenbeini* Kovařík et al., 2019  
– Pedipalp patella with dorsal carinae smooth (fig. 146 in Kovařík & Navidpour, 2020: 26). .... 19
19. Pedipalp femur dorsally granulated (fig. 149 in Kovařík & Navidpour, 2020: 26). Sternite VII densely granulated. ..  
..... *O. mashipouri* Kovařík & Navidpour, 2020  
– Pedipalp femur dorsally smooth (fig. 70 in Kovařík et al., 2019: 11). Sternite VII rather sparsely granulated (fig. 48 in Kovařík et al., 2019: 9). ....  
..... *O. stockwelli* (Lourenço & Vachon, 1995)
20. Sternite VII smooth, without granulated carinae developed (fig. 156 in Kovařík et al., 2019: 27). ....  
..... *O. iraqus* Kovařík, 2004  
– Sternite VII usually at least partly granulated, always with four developed granulated carinae. .... 21
21. Pedipalp movable finger with 0–1 outer (OD) denticles. ... 38  
– Pedipalp movable finger with 3–10 outer (OD) denticles. 22
22. Ventral surfaces of metasoma IV–V only shallowly punctate and in males punctuation may be altogether absent. .... 23  
– Ventral surfaces of metasoma IV–V with developed punctuation. .... 24
23. Ventral carinae of metasoma I–III consist of a row of large granules. .... *O. varius* Kovařík, 2004  
– Ventral carinae of metasoma I–III consist of small granules, placed irregularly in two or three rows. ....  
..... *O. hormozganensis* Kovařík & Navidpour, 2020
24. Tergites roughly granulated in the middle but laterally smooth, with several small granules, at least in male (Fig. 65). .... *O. kermanensis* Kovařík & Navidpour, 2020  
– Entire tergites roughly granulated, at least in male (Fig. 160). .... 25
25. Sternite VII densely granulated among carinae. .... 26  
– Sternite VII medially smooth with several solitary granules among carinae. .... 32
26. Lateral surface of metasoma III granulated (Fig. 26). .27  
– Spaces among punctae on the lateral surface of metasoma III entirely smooth. .... 29
27. Pedipalp movable finger with 3–8 outer (OD) denticles. 28  
– Pedipalp movable finger with 9–10 outer (OD) denticles.  
..... *O. birulai* sp. n.
28. Pedipalp patella with dorsal carinae finely granulated. ....  
..... *O. krishnai* Tikader & Bastawade, 1983  
– Pedipalp patella with dorsal carinae smooth (Fig. 244). ..  
..... *O. persa* (Birula, 1900), stat. n.
29. Pedipalp patella with dorsal carinae smooth. .... 31  
– Pedipalp patella with dorsal carinae granulated. .... 30
30. Pedipalp patella length/width ratio 2.96–2.98 in both sexes. Metasoma II–III with small reduced punctae and smooth. Pedipalp manus yellow. Femur and patella of legs yellow. .... *O. sejnai* sp. n.  
– Pedipalp femur length/width ratio 2.5–2.77 in both sexes. Metasoma II–III with large punctae and bumpy. Pedipalp manus reddish brown to black. Femur and patella of legs black. .... *O. navidpourii* Kovařík et al., 2019
31. Tarsi of legs III with 7–14 setae, long in both sexes. ....  
..... *O. carinatus* Navidpour et al., 2019  
– Tarsi of legs III with 4–6 setae, long in female and short in male. .... *O. vignolii* Kovařík & Navidpour, 2020
32. Tarsi of legs III with 9–16 setae. .... 37  
– Tarsi of legs III with 4–6 setae. .... 33
33. Metasoma II–III ventral strongly punctate in male with the same intensity as in metasoma IV–V (Fig. 234). ....  
..... *O. nordmanni* sp. n.  
– Metasoma II–III ventral granulated or bumpy, with punctuation reduced. .... 34
34. Metasoma I–II dorsal granulated by 14–18 strong granules in male. .... *O. samrchelsis* Kovařík, 2004  
– Metasoma I–II dorsal smooth without granules in both sexes. .... 35
35. Pedipalp femur length/width ratio 4.1–4.3 in male, 3.3–3.5 in female. .... *O. kucerai* Kovařík & Navidpour, 2020  
– Pedipalp femur length/width ratio 2.7–3.0 in both sexes. 36
36. Tarsi of leg III with long setae, which form a reduced bristlecombs. At least femur of legs dark. Pedipalp chela dark. .... *O. zagrosensis* Kovařík, 2004  
– Tarsi of leg III with short setae, which do not form a bristlecomb. Legs usually yellow. Pedipalp chela yellow. *O. farzanpayi* (Vachon & Farzanpay in Farzanpay, 1987)
37. Pedipalp femur yellow. Spaces among punctae on ventral surface of metasoma V granulated in adults. ....  
..... *O. jalalabadensis* Kovařík, 2004.  
– Pedipalp femur black. Spaces among punctae on ventral surface metasoma V smooth in adults. ....  
..... *O. afghanus* Kovařík, 2004

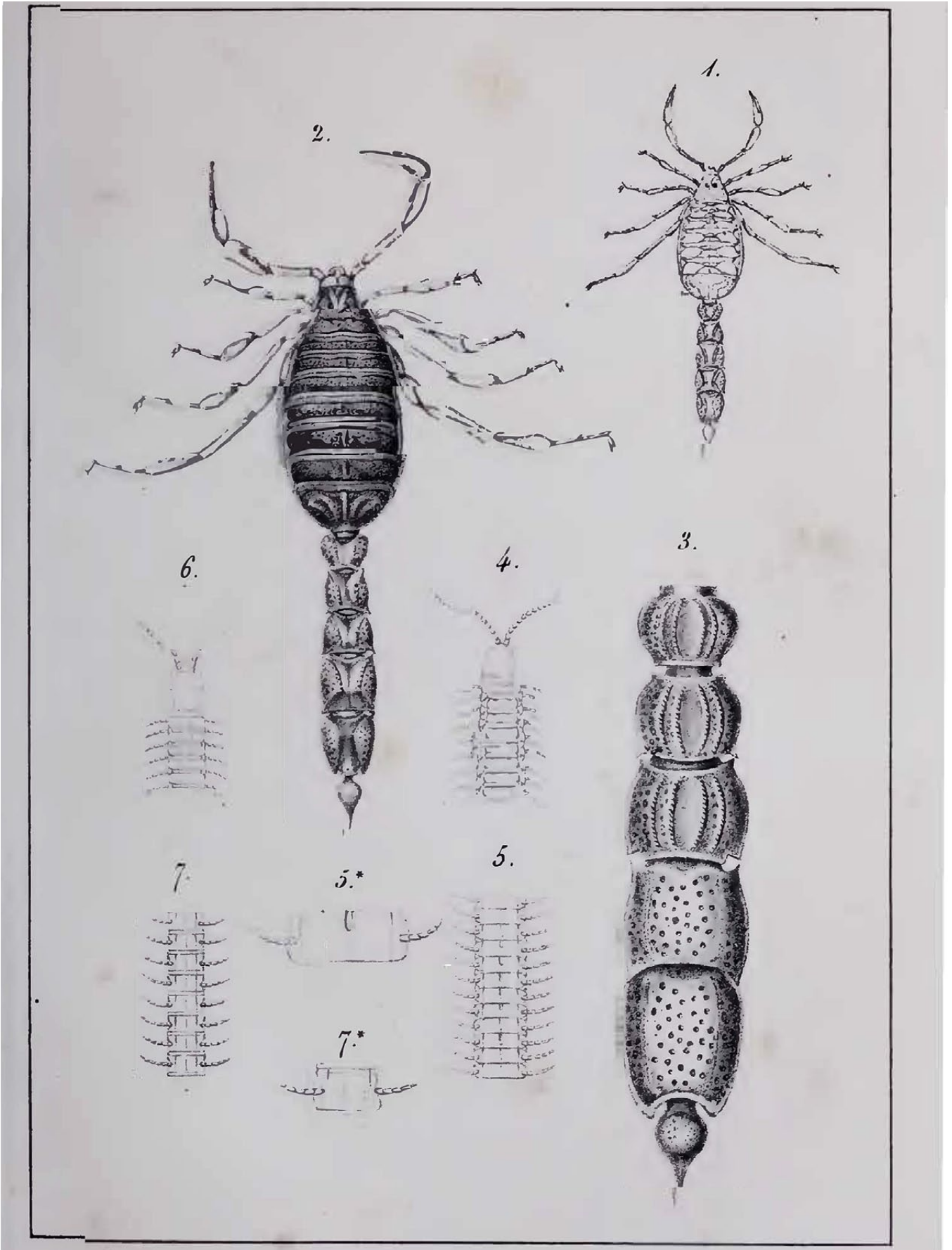
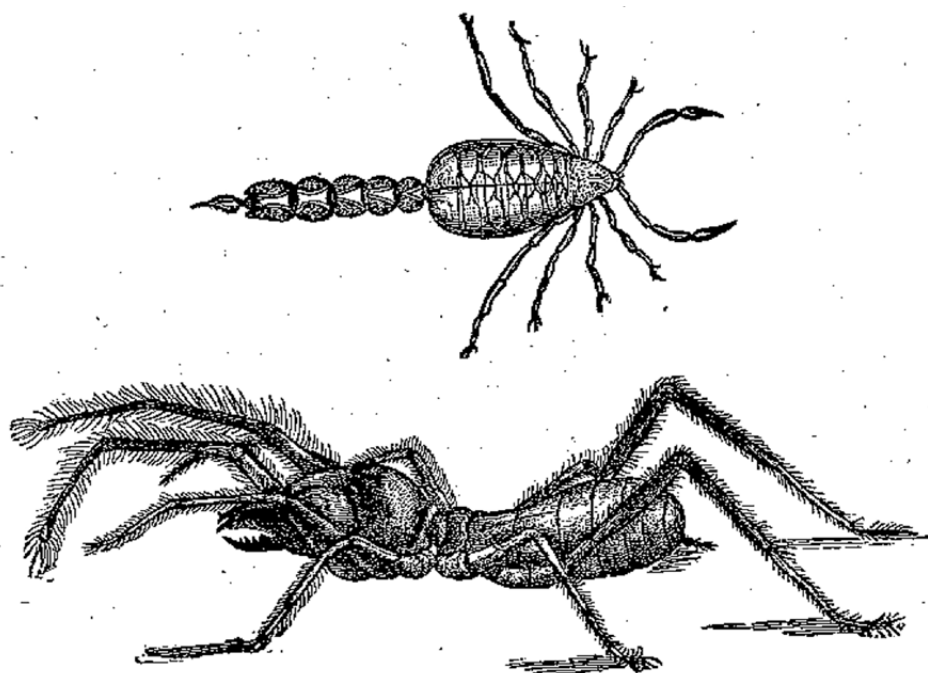


Figure 350. *Orthochirus melanurus* (Kessler, 1874), reproduced from Kessler (1874, Tab. I).



Скорпионъ и фаланга.

**Figure 351.** *Orthochirus melanurus* (Kessler, 1874) from the Kizylkum Desert, reproduced from Bogdanov (1882, fig. on p. 48), accompanied by a *Galeodes* sp. (Solifuga: Galeodidae).

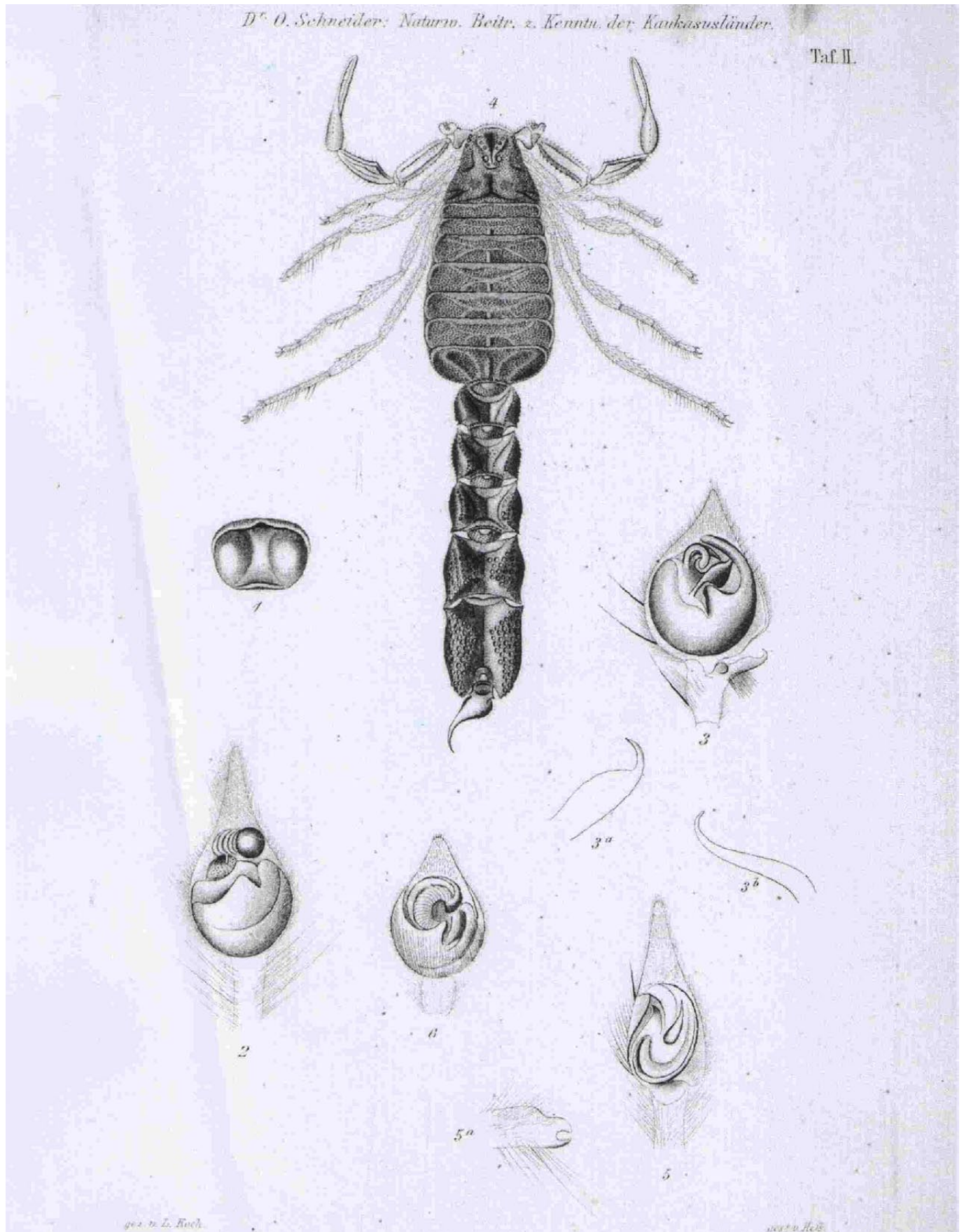
38. Ventral surface of metasoma IV strongly granulated, with punctation reduced. .... *O. scrobiculosus* (Grube, 1873)  
 – Ventral surface of metasoma IV punctate, with spaces among punctae smooth. .... 39
39. Pedipalp movable finger with 6 inner denticles (ID). ....  
 ..... *O. semnanensis* Kovařík & Navidpour, 2020  
 – Pedipalp movable finger with 7–10 inner denticles (ID).  
 ..... 40
40. Dorsal surface of metasoma I with 3–8 large granules in adults (Fig. 62). .... *O. formozovi* sp. n.  
 – Dorsal surface of metasoma I with 11–22 large granules in adults (Figs. 104, 173)..... 42
41. Femur and patella of pedipalps and legs black. Ratio length/width of metasoma V in female 1.03. Trichobothrium  $d_2$  of pedipalp femur is located on the internal surface (Figs. 93–94). .... *O. grosseri* sp. n.  
 – At least patella of legs, but usually the entire pedipalps and legs, yellow. Ratio length/width of metasoma V in females 1.20–1.22. Trichobothrium  $d_2$  of pedipalp femur is present on the dorsal surface (Fig. 151) or absent (Fig. 162). .... *O. melanurus* (Kessler, 1874)
42. Dorsal surfaces of metasoma I–III rather smooth and bumpy (Fig. 347). .... *O. pallidus* (Pocock, 1897)  
 – Dorsal surfaces of metasoma I–III granulated (Fig. 118).  
 ..... *O. kryzhanovskiyi* sp. n.

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## References

- BIRULA, A. A. 1898. Miscellanea Scorpiologica. III. Zur Synonymie der russischen Skorpione (Fortsetzung). *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Petersbourg*, 3: 276–283.



**Figure 352.** *Buthus schneideri* L. Koch, 1878, a junior synonym of *Orthochirus scrobiculosus* (Grube, 1873), reproduced from Koch (1878, Taf. II).



- BIRULA, A. A. 1900a. Scorpiony Sredizemnomorskoj podoblasti, khranyashchiesya v Zoologicheskome Muzeje Imperatorskago Moskovskago Universiteta. (Scorpiones mediterranei Musei Zoologici Mosquensis). *Izvestiya Imperatorskago Obshchestva Lyubitelei Prirody, Istorii, Antropologii i Etnografii*, 98: 8–20.
- BIRULA, A. A. 1900b. Beiträge zur Kenntniss der Scorpionenfauna Ost-Persiens. *Bulletin de l'Académie Impériale des Sciences de St.-Petersbourg*, 12(1): 355–375.
- BIRULA, A. A. 1903. Beiträge zur Kenntniss der Scorpionenfauna Persiens (Zweiter Beitrag). *Bulletin de l'Académie Impériale des Sciences de St.-Petersbourg*, 19: 67–80.
- BIRULA, A. A. 1905a. Miscellanea Scorpiologica. VIII. Zur Synonymie der russischen Skorpione (Fortsetzung). Bemerkungen ueber die Skorpionen-Sammlung des Kaukasischen Museum zu Tiflis. *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Petersbourg*, 10: 119–131.
- BIRULA, A. A. 1905b. Beiträge zur Kenntniss der Scorpionenfauna Persiens (Dritter Beitrag). *Bulletin de l'Académie Impériale des Sciences de St.-Petersbourg*, 23: 119–148.
- BIRULA, A. A. 1909. Scorpiologische Beiträge. 6. *Butheolus scrobiculosus* (Grube). *Zoologischer Anzeiger*, 34(11–12): 356–359.
- (BIRULA, A. A.) BYALYNITSKII-BIRULYA, A. A. 1917. Arachnoidea Arthrogastra Caucasia. Pars I. Scorpiones. *Zapiski Kavkazskogo Muzeja (Mémoires du Musée du Caucase)*, Tiflis: Imprimerie de la Chancellerie du Comité pour la Transcaucasie, A(5), 253 pp. (in Russian; published August 1917). English translation: Byalynitskii-Birulya, A. A. 1964. *Arthrogastric Arachnids of Caucasia. 1. Scorpions*. Jerusalem: Israel Program for Scientific Translations, 170 pp.
- BIRULA, A. A. 1918. Miscellanea scorpiologica. XI. Materialy k scoriofaune nizhnei Mesopotamii, Kurdistana i Severnoi Persii (Matériaux pour servir à la scoriofaune de la Mésopotamie inférieure, du Kurdistan et de la Perse septentrionale). *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Petersbourg*, 22(1917): 1–44 (in Russian).
- BLARAMBERG, I. F. 1875. *Erinnerungen aus dem Leben des Kaiserlich Russischen General-Lieutenant Johann von Blaramberg: nach dessen Tagebüchern von 1811–1871*. Berlin: Schroeder.
- BOGDANOV, M. N. 1882. *Ocherki prirody Khivinskogo oazisa i pustyni Kizyl-Kum* [A Survey of the Nature of the Khiva Oasis and the Kyzyl-Kum Desert]. Tashkent, 155 pp. (in Russian).
- FARZANPAY, R. 1987 (1366). [*Knowing Scorpions*]. Teheran: Central University Publications, No. 312, Biology 4, 231 pp. (in Farsi, with Latin index).
- FARZANPAY, R. 1988. A catalogue of the scorpions occurring in Iran, up to January 1986. *Revue Arachnologique*, 8(2): 33–44.
- FET, E. V., D. NEFF, M. R. GRAHAM & V. FET. 2003. Metasoma of *Orthochirus* (Scorpiones: Buthidae): are scorpions evolving a new sensory organ? *Revista Ibérica de Aracnología*, 8: 69–72.
- FET, V. 1989. A catalogue of scorpions (Chelicerata: Scorpiones) of the USSR. *Rivista del Museo Civico di Scienze Naturali "Enrico Caffi"* (Bergamo), 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*. Boston–Dordrecht: Kluwer Academic Publishers.
- FET, V. & G. LOWE. 2000. Family Buthidae C. L. Koch, 1837. Pp. 54–286 in Fet, V., W. D. Sissom, G. Lowe & M. E. Braunwalder. *Catalog of the Scorpions of the World (1758–1998)*. New York: The New York Entomological Society, 689 pp.
- GROMOV, A. V. & Y. Y. KOPDYKBAEV. 1994. [The fauna of the scorpions and solpugids (Arachnida: Scorpiones, Solifugae) in Kazakhstan]. *Selevinia*, 2(2): 19–23 (in Russian).
- GRUBE, A. E. 1873. Über eine Zusendung transkaukasischer Arachniden und Myriapoden. *Jahresbericht der Schlesischen Gesellschaft für Vaterländische Naturkunde in Breslau* (1872), 50: 56–57.
- KARSCH, F. 1881. Uebersicht der europäischen Skorpione. *Berliner Entomologische Zeitschrift*, 25: 89–91.
- KARSCH, F. 1886. Skorpionologische Beiträge. *Berliner Entomologische Zeitschrift*, 30: 75–79.
- KARSCH, F. 1892. Arachniden von Ceylon und von Minikoy, gesammelt von den Herren Doctoren P. und F. Sarasin. *Berliner Entomologische Zeitschrift*, 36(1891): 267–310.

- 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; separatim first available in 1874].
- 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. 1998. *Štíři [Scorpiones]*. Jihlava (Czech Republic): Publishing House “Madagaskar”. 175 pp. (in Czech).
- KOVAŘÍK, F. 2004. Revision and taxonomic position of genera *Afghanorthochirus* Lourenço & Vachon, *Baloorthochirus* Kovařík, *Butheolus* Simon, *Nanobuthus* Pocock, *Orthochiroides* Kovařík, *Pakistanorthochirus* Lourenço, and Asian *Orthochirus* Karsch, with descriptions of twelve new species (Scorpiones, Buthidae). *Euscorpius*, 16: 1–33.
- 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. & V. FET. 2006. Taxonomic position of the genus *Simonoides* Vachon et Farzanpay, 1987, and description of a new species of *Orthochirus* Karsch from Iran (Scorpiones, Buthidae). *Euscorpius*, 38: 1–10.
- KOVAŘÍK, F. & S. NAVIDPOUR. 2020. Six new species of *Orthochirus* Karsch, 1892 from Iran (Scorpiones: Buthidae). *Euscorpius*, 312: 1–41.
- 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., E. A. YAĞMUR, V. FET & F. S. HUSSEN. 2019. A review of *Orthochirus* from Turkey, Iraq, and Iran (Khoozestan, Ilam and Lorestan Provinces), with description of three new species (Scorpiones: Buthidae). *Euscorpius*, 278: 1–31.
- KRAEPELIN, K. 1891. Revision der Skorpione. I. Die Familie des Androctonidae. *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten*, 8(1890): 144–286 (1–144).
- KRAEPELIN, K. 1895. Nachtrag zu Theil I der Revision der Skorpione. *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten*, 12(1894): 73–96.
- KRAEPELIN, K. 1899. Scorpiones und Pedipalpi. In: DAHL, F. (ed.), *Das Tierreich. Herausgegeben von der Deutschen Zoologischen Gesellschaft*. Berlin: R. Friedländer und Sohn Verlag, 8. Lieferung. 265 pp.
- 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).
- LEVY, G. & P. AMITAI. 1980. *Fauna Palaestina, Arachnida I. Scorpiones*. Jerusalem: The Israel Academy of Sciences and Humanities, 132 pp.
- LOURENÇO, W. R. & M. VACHON. 1995. Un nouveau genre et deux nouvelles espèces de scorpions Buthidae d’Iran. *Bulletin du Muséum National d’Histoire Naturelle*, 17: 297–305.
- LOURENÇO, W. R. & M. VACHON. 1997. Un nouveau genre et quatre nouvelles espèces de scorpions (Buthidae) du Moyen-Orient. *Zoosystema*, 19(2–3): 327–336.
- NAVIDPOUR, S., F. KOVAŘÍK, M. E. SOLEGLAD & V. FET. 2008. Scorpions of Iran (Arachnida, Scorpiones). Part I. Khoozestan Province. *Euscorpius*, 65: 1–41.
- POCOCK, R. I. 1889. Arachnida, Chilopoda and Crustacea. In: Dr. J. E. T. Aitchison – On the zoology of the Afghan delimitation commission. *Transactions of the Linnaean Society of London, Zoology*, 5(3): 110–122.
- 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.
- RADDE, G. I. 1886. *Predvaritel’nyi otchët o snariazhënnoi po Vysochaishemu povelëniu ekspeditsii v Zakaspiiskii Krai i Severnyi Khorassan v 1886 godu. Sost. G. I. Radde, A. Walter, A.M. Konshin*. [A preliminary report of the expedition to the Transcaspian Region and North Khorassan conducted by the Royal decree in 1886. Compiled by G. I. Radde, A. Walter, A.M. Konshin]. Tiflis, 115 pp. (in Russian).
- RADDE, G. I. & G. I. SIEVERS. 1871. Issledovaniia v iugovostochnoi chasti Zakavkaz’ia i Krasnovodske v 1870 godu [Studied in the southeastern part of Transcaucasia and in Krasnovodsk in 1870]. *Izvestiia Imperatorskago Russkago geograficheskago obshchestva* [Proceedings of the Imperial Russian Geographical Society], 7: 218–222 (in Russian).

- ROSELAAR, C. S. & M. ALIABADIA. 2007. A century of breeding bird assessment by western travellers in Iran, 1876–1977. Appendix 1. *Podoces*, 2(2): 77–96.
- SIMON, E. 1889. Arachnidae transcaspicae ab ill. dr. G. Radde, dr. A. Walter et A. Conchin inventae (annis 1886–1887). *Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien*, 39: 373–386.
- SOLEGLAD, M. E. & W. D. SISSOM. 2001. Phylogeny of the family Euscorpiidae Laurie, 1896 (Scorpionales): a major revision. Pp. 25–111 in: Fet, V. & P. A. Selden (eds). *Scorpions 2001. In Memoriam Gary A. Polis. Burnham Beeches*, Bucks.: British Arachnological Society, 404 pp.
- STAHNKE, H. L. 1971. Scorpion nomenclature and mensuration. *Entomological News*, 81: 297–316.
- STAHNKE, H. L. 1972. A key to the genera of Buthidae (Scorpionida). *Entomological News*, 83(5): 121–133.
- TIKADER, B. K. & D. B. BASTAWADE. 1983. Scorpions (Scorpionida: Arachnida). In: *The Fauna of India*, Vol. 3. (Edited by the Director). Calcutta: Zoological Survey of India, 671 pp.
- 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. 1966. Liste des scorpions connus en Égypte, Arabie, Israël, Liban, Syrie, Jordanie, Turquie, Irak, Iran. *Toxicon*, 4: 209–218.
- VACHON, M. 1974. Étude 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*, 140: 857–958.
- WERNER, F. 1916. Über einige Skorpione und Gliederspinnen des Naturhistorischen Museum in Wiesbaden. *Jahrbücher des Nassauischen Verein für Naturkunde*, 69: 79–97.
- 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.-Pétersbourg]*, sér. 8, 10(1): 1–262 (in Russian).