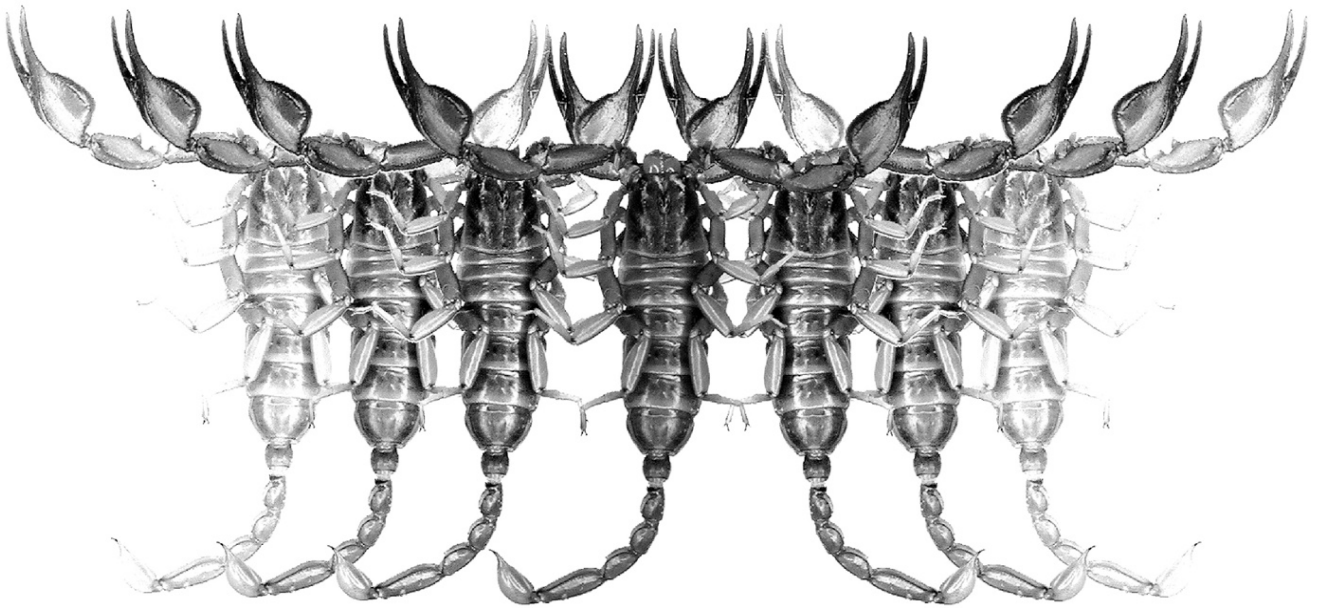


# *Euscorpius*

Occasional Publications in Scorpiology



**Six new species of *Orthochirus* Karsch, 1892  
from Iran (Scorpiones: Buthidae)**

**František Kovařík & Shahrokh Navidpour**

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# *Euscorpius*

## *Occasional Publications in Scorpiology*

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## Six new species of *Orthochirus* Karsch, 1892 from Iran (Scorpiones: Buthidae)

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<http://zoobank.org/urn:lsid:zoobank.org:pub:12025A0B-A642-417A-8E4B-70D40CEC53FD>

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### Summary

Six new scorpion species from Iran, *Orthochirus hormozganensis* sp. n. (Hormozgan Province), *O. kermanensis* sp. n. (Kerman Province), *O. kucerai* sp. n. (Kerman Province), *O. mashipouri* sp. n. (Bushehr Province), *O. semnanensis* sp. n. (Semnan Province), and *O. vignolii* sp. n. (Yazd Province) are described, compared with other Iranian *Orthochirus* species, and fully illustrated with color photographs. A key and a distribution map of *Orthochirus* of Iran, Turkey, and Iraq (18 species) are included.

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### Introduction

This paper continues a comprehensive field study of the scorpion fauna of Iran by the RRLS team under Shahrokh Navidpour which led to a series of publications on separate Iranian provinces (Navidpour et al., 2008a, 2008b, 2008c, 2008d, 2010, 2011, 2012, 2019; Pirali-Kheirabadi et al., 2009). We summarize the information about Iranian scorpions of the genus *Orthochirus* in a distribution map (Fig. 228) and a key. Six new species are described, collected primarily by the RRLS team but also by Czech and Italian zoologists. This paper also continues a broader study of the genus *Orthochirus*, which included a number of apparently morphologically uniform species found in the large area from North Africa through the Middle East to India. Fet & Lowe (2000) listed 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 the genus. Among other publications focused on the Asian *Orthochirus*, see primarily Kovařík & Fet (2006) and Kovařík et al. (2019).

### Methods, Material & Abbreviations

Nomenclature and measurements follow Stahnke (1971), Sologlad & Sissom (2001), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for cheliceral dentition (Vachon, 1963) and trichobothriotaxy (Vachon, 1974).

*Specimen Depositories*: All examined specimens are deposited in the first author's collection (FKCP), which will in future be merged with the collections of the National Museum of Natural History, Prague, Czech Republic.

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

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

### Systematics

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

#### *Orthochirus* Karsch, 1892

(Figures 1–234, Tables 1–3)

*Orthochirus* Karsch, 1892: 306; 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., 2008a: 14–22, figs. 19, 23–30, 93–102; Kovařík, 2009: 31; Kovařík et al., 2019: 1–31, figs. 1–176, tabs. 1–2.

= *Orthodactylus* Karsch, 1881: 90, a junior homonym of *Orthodactylus* Hitchcock, 1858 (Reptilia), type species: *Orthodactylus olivaceus* Karsch, 1881 = *Orthochirus scrobiculosus* (Grube, 1873) (syn. by Kraepelin, 1895: 84).

= *Simonoides* Vachon et Farzanpay in Farzanpay, 1987: 162, type species: *Simonoides farzanpayi* Vachon et Farzanpay, 1987; Farzanpay, 1988: 40; Fet & Lowe, 2000: 223 (syn. by Kovařík & Fet, 2006: 2).

= *Afghanorthochirus* Lourenço & Vachon, 1997: 330, type species: *Afghanorthochirus erardi* Lourenço & Vachon, 1997; Kovařík, 1998: 120; Fet & Lowe, 2000: 57 (syn. by Kovařík, 2004: 5).

= *Paraorthochirus* Lourenço & Vachon, 1995: 299, type species: *Paraorthochirus stockwelli* Lourenço et Vachon, 1995; Lourenço & Vachon, 1997: 329; Fet & Lowe, 2000: 211 (syn. by Navidpour et al., 2008a: 17).

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

Type species. *Orthodactylus olivaceus* Karsch, 1881 = *Orthochirus scrobiculosus* (Grube, 1873).



**Figures 1–4:** *Orthochirus hormozganensis* sp. n. **Figures 1–2.** Holotype male, dorsal (1) and ventral (2) views. **Figures 3–4.** Paratype female from type locality, dorsal (3) and ventral (4) views. Scale bar: 10 mm.

Dimensions (mm)		<i>O. hormozganensis</i> sp. n.	<i>O. hormozganensis</i> sp. n.
		♂ holotype	♀ paratype
Carapace	L / W	3.40 / 3.76	4.04 / 4.81
Mesosoma	L	6.29	12.03
Tergite VII	L / W	1.88 / 4.09	2.84 / 5.67
Metasoma + telson	L	18.59	20.92
Segment I	L / W / D	2.09 / 3.08 / 2.11	2.26 / 3.37 / 2.51
Segment II	L / W / D	2.54 / 3.12 / 2.18	2.76 / 3.28 / 2.43
Segment III	L / W / D	2.97 / 3.29 / 2.45	3.20 / 3.47 / 2.55
Segment IV	L / W / D	3.84 / 3.45 / 2.62	3.96 / 3.72 / 2.63
Segment V	L / W / D	3.70 / 3.31 / 2.62	4.25 / 3.60 / 2.57
Telson	L / W / D	3.45 / 1.07 / 0.89	4.49 / 1.44 / 1.35
Pedipalp	L	11.27	12.22
Femur	L / W	3.05 / 0.75	3.19 / 0.92
Patella	L / W	3.61 / 0.85	3.88 / 1.07
Chela	L	4.61	5.15
Manus	W / D	0.69 / 0.70	0.85 / 0.85
Movable finger	L	3.18	3.31
<b>Total</b>	<b>L</b>	<b>28.28</b>	<b>36.99</b>

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

**DIAGNOSIS.** Total length of adults 22–55 mm. Patella of pedipalp without ventral trichobothria. 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 third and fourth legs. Pectines with fulcra, densely hirsute. Movable fingers of pedipalps with 7–10 rows of denticles and 2–5 subterminal denticles. Carapace in lateral view distinctly inclined downward from median eyes to anterior margin. First and second metasomal segments with carinae. Metasomal segments IV and V ventrally punctate. Telson elongate, aculeus as long as or longer than vesicle.

***Orthochirus hormozganensis* sp. n.**

(Figures 1–40, 222, 228–230, Table 1)

<http://zoobank.org/urn:lsid:zoobank.org:act:B22A452D-E09D-4688-96F9-7AFA7AE369E4>

**TYPE LOCALITY AND TYPE DEPOSITORY.** Iran, *Hormozgan Province*, Shahre Babak, Jask–Bashagard road, 25°50'53.1"N 57°50'40.7"E, 178 m a. s. l.; FKCP.

**TYPE MATERIAL (FKCP).** Iran, *Hormozgan Province*, Shahre Babak, Jask–Bashagard road, 25°50'53.1"N 57°50'40.7"E, 178 m a. s. l. (Locality No. HO-120), V.2008, 1♂ (holotype) 1♀ (paratype), leg. Masihpour, Bahrani & Habibzadeh; Bandare Jask–Bashagard road, 25°50'11.4"N 57°50'14.6"E, 146 m a. s. l. (Locality No. HO-119, Fig. 229), V.2008, 1♀ (paratype), leg. Masihpour, Bahrani & Habibzadeh; Jask–Bashagard road, 25°55'18.4"N 57°49'42.3"E, 274 m a. s. l. (Locality No. HO-

121), V.2008, 1♂1juv. (paratypes), leg. Masihpour, Bahrani & Habibzadeh; Jask–Minab road, 25°52'34.9"N 57°29'47.4"E, 46 m a. s. l. (Locality No. HO-126, Fig. 230), V.2008, 1juv. (paratype), leg. Masihpour, Bahrani & Habibzadeh.

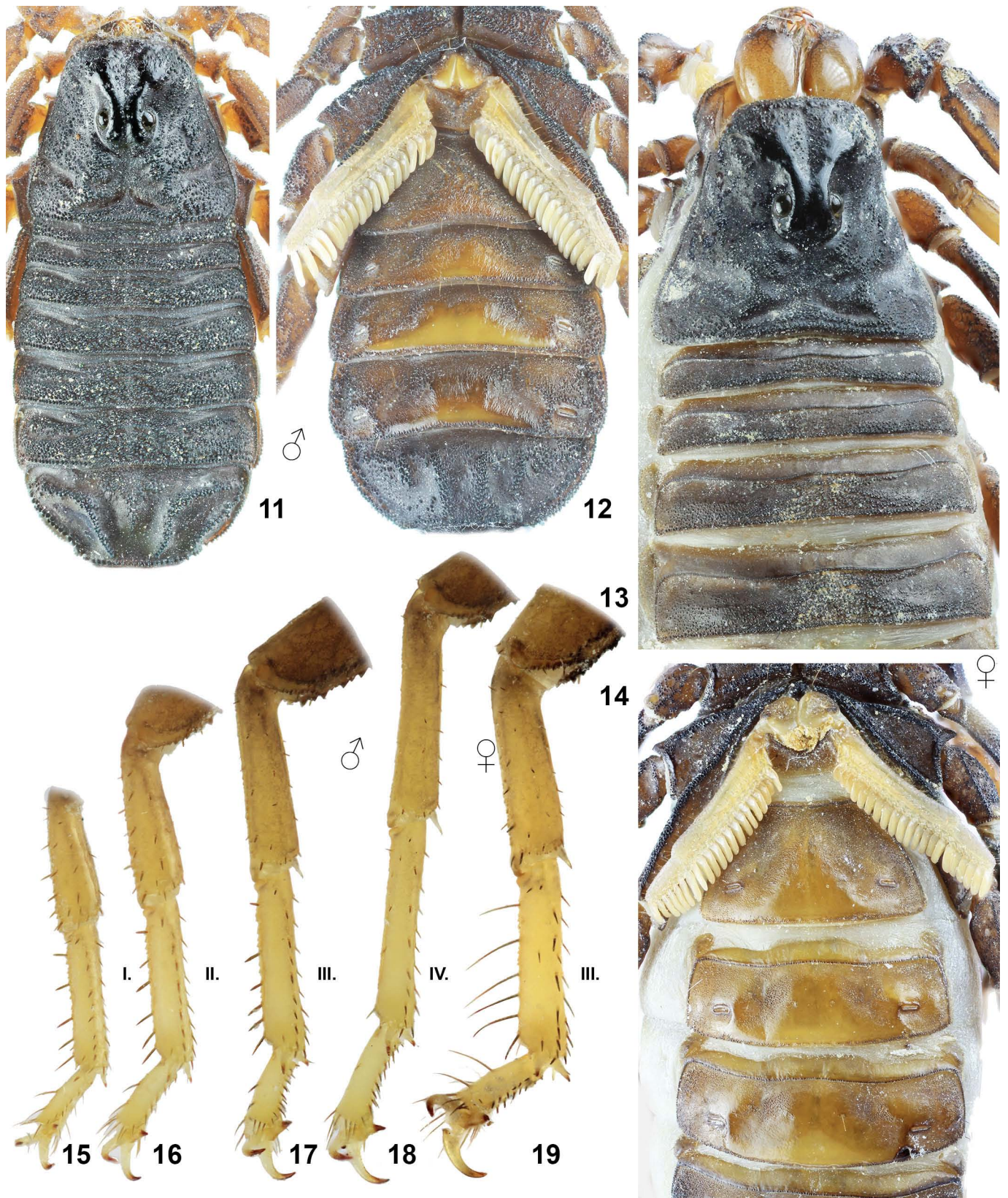
**ETYMOLOGY.** Named after the province of occurrence.

**DIAGNOSIS (♂♀).** Total length of adults 28–38 mm. Trichobothrium  $d_2$  on the dorsal surface of pedipalp femur absent or reduced. Moderate tibial spurs present on third and fourth legs. Pectinal teeth number 20–22 in both sexes. Movable finger of pedipalps with 8 rows of denticles, 8–9 ID and 7–8 OD. Dorsal carinae on pedipalp patella present and smooth. Metasoma V dorsal surface mesially smooth. Metasoma I–II with 10 carinae, metasoma III with 8 carinae. Metasoma V with weak/reduced ventrolateral carinae, at least in the male. Metasoma IV–V ventrally and laterally shallowly punctate; spaces among punctae smooth ventrally and granulated laterally; metasoma II–III ventrally and laterally granulated and bumpy with punctation reduced; ventral carinae of metasoma I–III consist of small granules irregularly in two or three rows. Sternite VII roughly irregularly granulated, with wide granulated carinae developed. Pedipalp, metasoma and telson glabrous. Tarsomere I of legs with bristlecombs composed of 5–7 bristles. Ratio length/width of metasoma V 1.12–1.18 in both sexes.

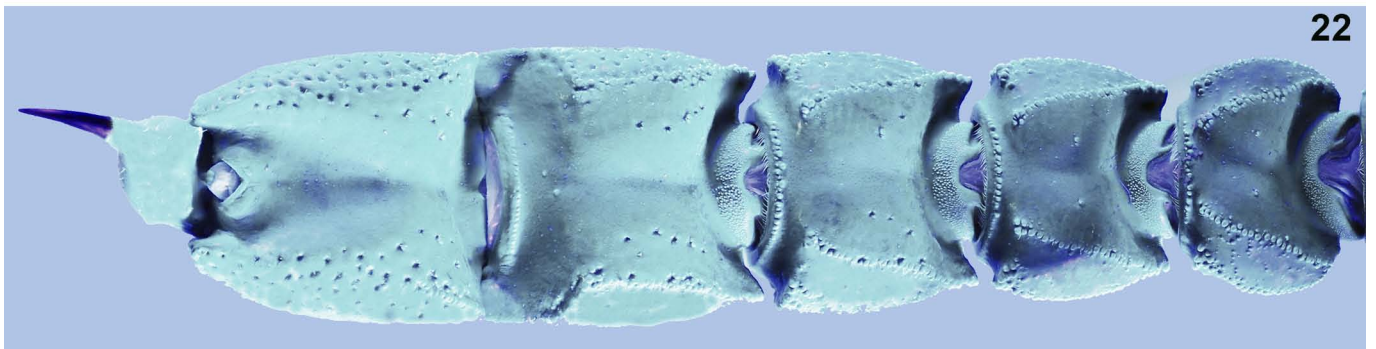
**DESCRIPTION.** Total length of adults 28–38 mm in both sexes. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 1. For habitus, see Figs. 1–4.



**Figures 5–10:** *Orthochirus hormozganensis* sp. n. **Figures 5–7.** Paratype female from type locality, metasoma and telson, lateral (5), dorsal (6), and ventral (7) views. **Figures 8–10.** Holotype male, metasoma and telson, lateral (8), dorsal (9), and ventral (10) views. Scale bar: 10 mm.



**Figures 11–19:** *Orthochirus hormozganensis* sp. n. **Figures 11–12, 15–18.** Holotype male, carapace and tergites (11), sternopectinal region and sternites (12), and distal segments of right legs I–IV, retrolateral aspect (15–18 respectively). **Figures 13–14, 19.** Paratype female from type locality, carapace and tergites I–IV (13), sternopectinal region and sternites III–V (14), and distal segments of right leg III, retrolateral aspect (19).



Figures 20–22. *Orthochirus hormozganensis* sp. n., holotype male, carapace and tergites (20), sternopectinal region and sternites (21), and metasoma and telson dorsal (22) under UV light.





**Figures 23–40:** *Orthochirus hormozganensis* sp. n., segments of pedipalps. **Figures 23–31.** Holotype male. Pedipalp chela, dorsal (23), external (24), and ventral (25) views. Pedipalp patella, dorsal (26), external (27), and ventral (28) views. Pedipalp femur and trochanter, dorsal (29), and ventral (30) views. Pedipalp chela, movable finger dentate margin (31). **Figures 32–40.** Paratype female from type locality. Pedipalp chela, dorsal (32), external (33), and ventral (34) views. Pedipalp patella, dorsal (35), external (36), and ventral (37) views. Pedipalp femur and trochanter, dorsal (38), internal (39), and ventral (40) views. The trichobothrial pattern is indicated in Figures 33–36, 38–39 (white circles).

**Coloration** (Figs. 1–4). Carapace, tergites, metasoma and usually femur of pedipalps and legs black, tibia and tarsomeres of legs and fingers of pedipalps yellow. Patella of legs and pedipalps and pedipalp chela yellowish brown to brown. Sternite VII black, other sternites reddish brown to black with yellow median area present in posterior margin of sternites IV–VI. Telson reddish brown.

**Mesosoma and carapace** (Figs. 11–14, 20–21). Mesosoma with a median carina, densely granulated. Carapace roughly granulated with smooth areas, mainly around medial eyes. Carination of carapace reduced to absent. The seventh sternite granulated, with four wide granulated carinae, the other sternites are granulated except smooth median area. Pectinal teeth number 20–22 in both sexes.

**Metasoma and telson** (Figs. 5–10, 22, 222). Metasoma I–II with 10 granulated carinae. Metasoma II–V lack lateral carinae, ventromedian carinae present on metasoma I–III, ventrolateral carinae present on all metasomal segments, dorsolateral carinae present on metasoma I–III and reduced to absent on metasoma IV–V. Ventral carinae of metasoma I–III consist of small granules irregularly forming two or three rows. All metasomal segments are granulated laterally, more in metasoma I–III; granulation absent on dorsal surfaces of all metasomal segments and ventral surfaces of segments IV–V. Segments IV–V ventrally and laterally are shallowly punctate; spaces among punctae are smooth. The entire metasoma and telson glabrous; short, thin setae might issue from some punctae. Telson shallowly punctate and lacks granules.

**Pedipalps** (Figs. 23–40). The distance between trichobothria  $d_1$  and  $d_3$  on the femur of pedipalp approximately equals that between  $d_3$  and  $d_4$ ; trichobothrium  $e_1$  is situated in level with  $d_4$ . Trichobothrium  $d_2$  on the dorsal surface of pedipalp femur absent or reduced. Femur of pedipalp with five granulated carinae. Patella with seven smooth reduced carinae; chela with smooth carinae, which might be discernible throughout the length of the fixed finger. The entire pedipalp only very sparsely hirsute. Movable fingers with 8 rows of denticles, 8–9 ID and 7–8 OD.

**Legs** (Figs. 15–19). Moderate tibial spurs present on third and fourth legs. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few bristles. Tibia with bristles on the outer side of legs I–II. Tarsomere I of first to third legs with bristlecombs composed of 5–7 bristles, short in male and long in female; fourth legs lack bristlecombs. Tarsomeres I–II of all legs with two rather irregular rows of bristles.

**Measurements.** See Table 1.

**AFFINITIES.** The described features distinguish *O. hormozganensis* sp. n. from all other species of the genus. They are recounted in the key below. *O. hormozganensis* sp. n. is similar to *O. varius* Kovařík, 2004. These two species can be distinguished according to the metasoma morphology. In the key below, we used the difference in granulation of carinae. Another difference is in the

granulation of the ventral surfaces on metasoma I–III, which are densely granulated in the male of *O. hormozganensis* sp. n. (Fig. 10) and rather smooth with several granules in *O. varius*.

**DISTRIBUTION.** Iran, Hormozgan Province (Fig. 228).

***Orthochirus kermanensis* sp. n.**

(Figures 41–87, 223, 228, Table 2)

<http://zoobank.org/urn:lsid:zoobank.org:act:D261993A-EB6B-4A67-821C-045235B88779>

**TYPE LOCALITY AND TYPE DEPOSITORY.** Iran, Kerman Province, Shahre Babak–Anar road, 30°10'53"N 55°04'56"E, 1906 m a. s. l.; FKCP.

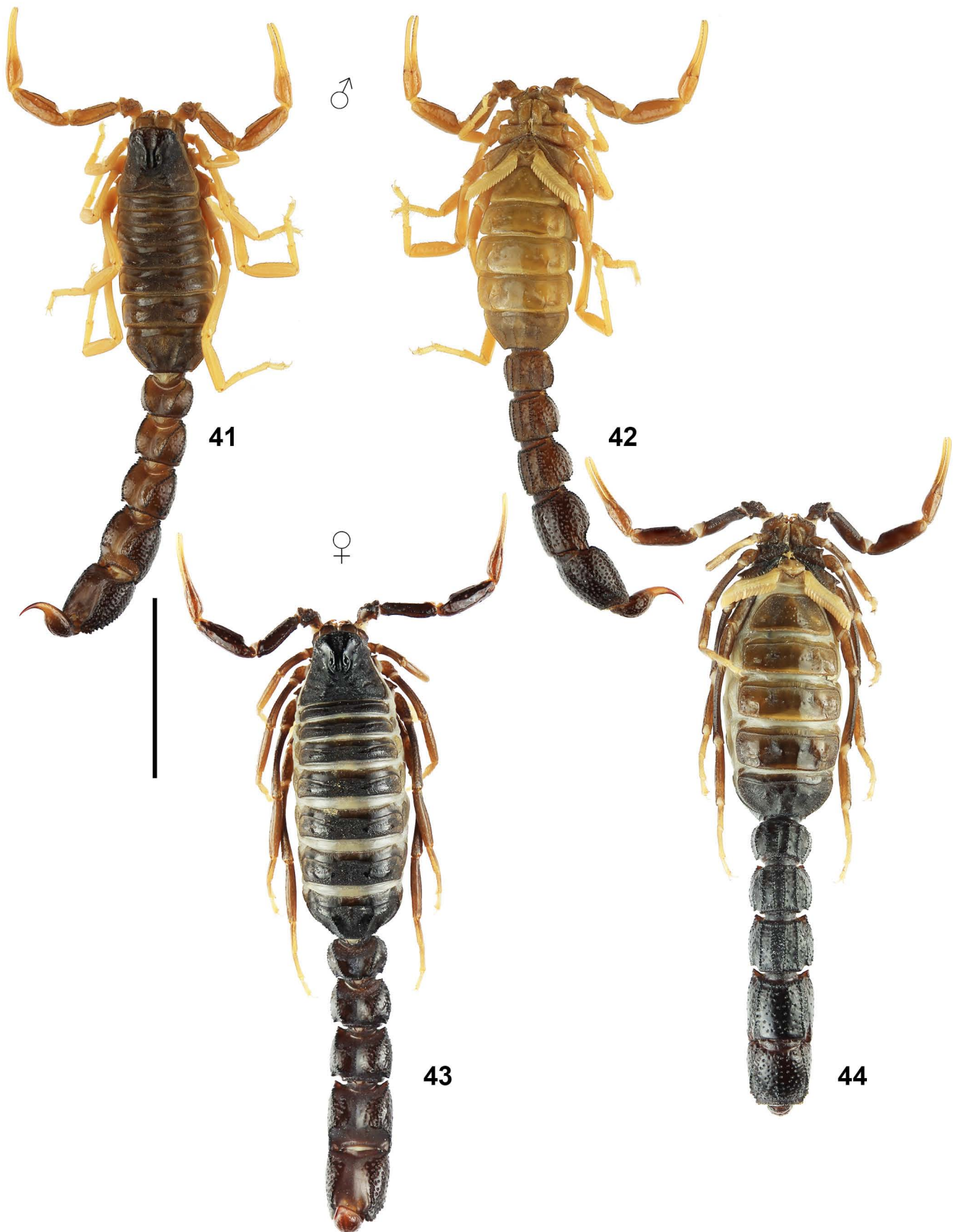
**TYPE MATERIAL (FKCP).** Iran, Kerman Province, Shahre Babak–Anar road, 30°10'53"N 55°04'56"E, 1906 m a. s. l. (Locality No. KE-52), V.2009, 1♂ (holotype) 1♀juv. (paratype), leg. KooHPaye, Jamalizadeh & Ebrahimi; Dehdasht, Pabdana, 30°57'24"N 56°32'23"E, 1975 m a. s. l. (Locality No. KE-34), V.2009, 1♀ (paratype), leg. KooHPaye, Jamalizadeh & Ebrahimi; Zarand, 30°47'42"N 56°35'19"E, 1678 m a. s. l. (Locality No. KE-36), V.2009, 1♀ (paratype), leg. KooHPaye, Jamalizadeh & Ebrahimi; Bardsir–Sirjan road, 29°56'59"N 56°38'17"E, 2036 m a. s. l. (Locality No. KE-103), V.2009, 1♀ (paratype), leg. KooHPaye, Jamalizadeh & Ebrahimi.

**ETYMOLOGY.** Named after the province of occurrence.

**DIAGNOSIS** (♂♀). Total length of adults 33–40 mm. Trichobothrium  $d_2$  at pedipalp femur dorsal surface absent or reduced. Moderate to strong tibial spurs present on third and fourth legs. Pectinal teeth number 17–19 in both sexes. Movable finger of pedipalps with 7–8 rows of denticles, 6–8 ID and 4–6 OD. Dorsal carinae on pedipalp patella present and smooth. Metasoma V dorsal surface mesially smooth. Metasoma I–II with 10 carinae, metasoma III with 8 carinae, metasoma IV–V with four granulated carinae present. Ventral carinae of metasoma I–III consist of a row of large granules, at least in the male. Metasoma IV–V ventrally and laterally with developed punctation; spaces among punctae smooth; metasoma II–III ventrally and laterally granulated and bumpy with punctation reduced. Sternite VII finely granulate, with granulate carinae developed. Pedipalp, metasoma and telson very sparsely hirsute, rather glabrous. Tarsomere I of legs with bristlecombs composed of 5–7 long bristles. Ratio length/width of metasoma V in males 1.33.

**DESCRIPTION.** Total length of adults 33–40 mm in both sexes. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 2. For habitus, see Figs. 41–44.

**Coloration** (Figs. 41–44). Carapace, tergites, and metasoma



**Figures 41–44:** *Orthochirus kermanensis* sp. n. **Figures 41–42.** Holotype male, dorsal (41) and ventral (42) views. **Figures 43–44.** Paratype female from locality KE-34, dorsal (43) and ventral (44) views. Scale bar: 10 mm.

Dimensions (mm)		<i>O. kermanensis</i> sp. n.	<i>O. kermanensis</i> sp. n.	<i>O. kucerai</i> sp. n.	<i>O. kucerai</i> sp. n.
		♂ holotype	♀ paratype	♂ holotype	♀ paratype
Carapace	L / W	3.85 / 4.55	3.98 / 4.85	3.29 / 3.56	4.74 / 5.53
Mesosoma	L	9.59	13.33	7.47	15.22
Tergite VII	L / W	2.47 / 4.63	2.47 / 5.42	2.09 / 3.93	3.26 / 6.66
Metasoma + telson	L	19.61	21.62	18.83	24.15
Segment I	L / W / D	2.19 / 2.98 / 2.45	3.36 / 2.31 / 2.54	2.05 / 2.77 / 2.24	2.50 / 3.78 / 2.92
Segment II	L / W / D	2.66 / 3.06 / 2.65	2.83 / 3.45 / 2.76	2.56 / 2.87 / 2.19	3.22 / 3.90 / 3.07
Segment III	L / W / D	3.00 / 3.23 / 2.78	3.23 / 3.50 / 2.92	2.99 / 3.01 / 2.27	3.67 / 4.15 / 3.35
Segment IV	L / W / D	3.69 / 3.28 / 2.80	3.89 / 3.54 / 2.91	3.49 / 3.15 / 2.36	4.65 / 4.33 / 3.55
Segment V	L / W / D	4.24 / 3.18 / 2.48	4.27 / 3.45 / 2.51	3.89 / 3.12 / 2.21	5.04 / 4.24 / 3.36
Telson	L / W / D	3.83 / 1.52 / 1.20	4.04 / 1.44 / 1.28	3.85 / 1.31 / 0.94	5.07 / 1.73 / 1.57
Pedipalp	L	11.48	11.66	10.62	13.31
Femur	L / W	2.90 / 0.94	3.17 / 0.86	2.82 / 0.68	3.50 / 1.03
Patella	L / W	3.67 / 1.25	3.62 / 1.16	3.31 / 0.88	4.15 / 1.38
Chela	L	4.91	4.87	4.49	5.66
Manus	W / D	0.94 / 0.92	0.90 / 0.89	0.70 / 0.70	1.03 / 1.09
Movable finger	L	3.19	2.96	2.97	3.75
<b>Total</b>	<b>L</b>	<b>33.05</b>	<b>38.93</b>	<b>29.59</b>	<b>44.11</b>

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

brown to black. Pedipalps and legs yellow, yellowish brown, or black. Sternite VII brown or black, other sternites yellowish or reddish brown to black, with yellow median area in posterior margin of sternites IV–VI reduced or absent. Telson reddish brown.

**Mesosoma and carapace** (Figs. 51–54, 65–66). Mesosoma with a median carina and is roughly granulated in middle but laterally smooth with several fine granules in males; females can have roughly granulated whole tergites. Carapace without carinae, roughly granulated posteriorly and laterally, interocular triangle is smooth. The seventh sternite is finely granulated and with four wide granulated carinae, the other sternites are rather smooth, sparsely granulated mainly in anterior parts. Pectinal teeth number 19 in male and 17–19 in females.

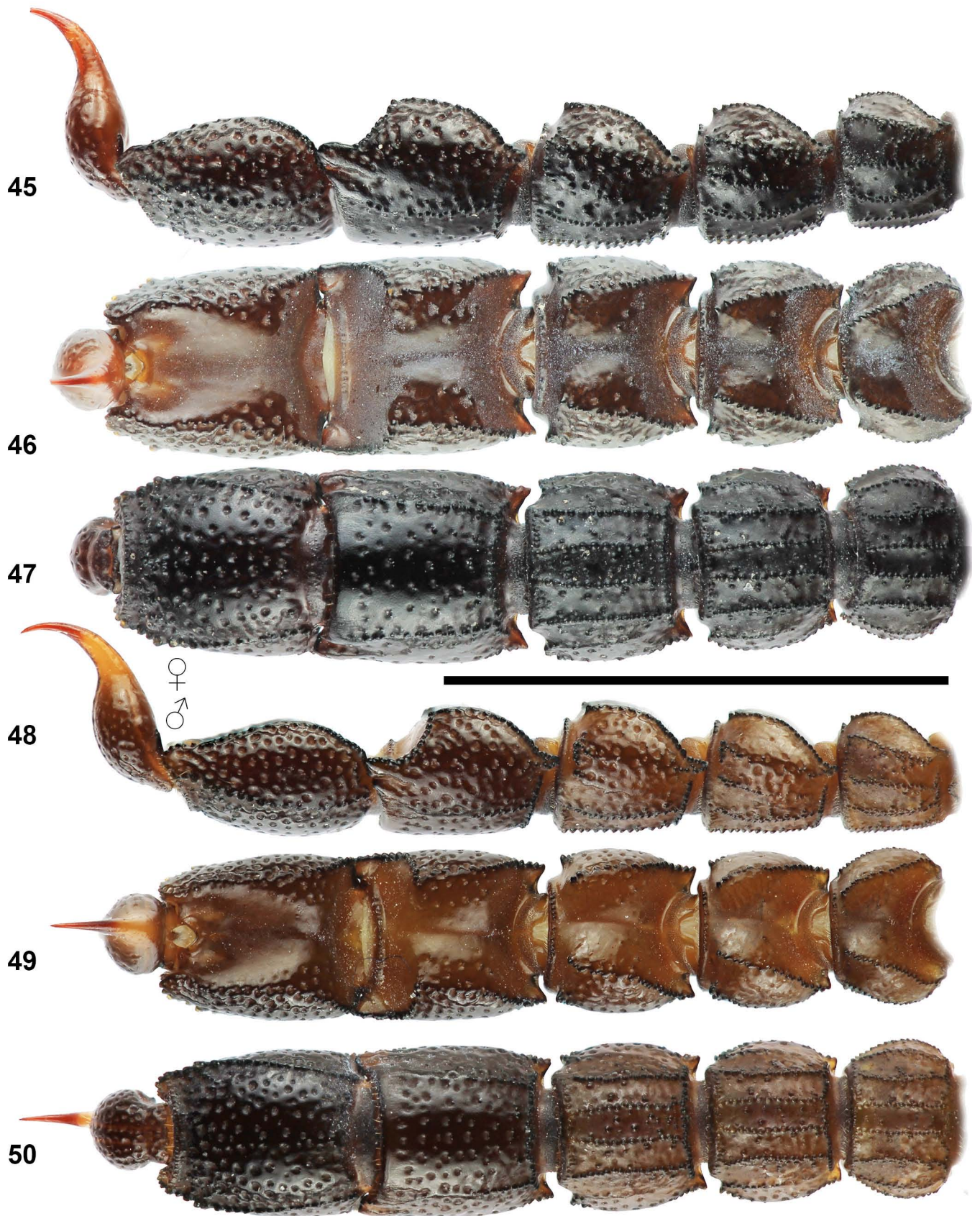
**Metasoma and telson** (Figs. 45–50, 63–64, 67, 223). Metasoma I–II with 10 granulated carinae. Metasoma III–V lack lateral carinae, ventromedian carinae present on metasoma I–III, ventrolateral carinae present on all metasomal segments, dorsolateral carinae present on metasoma I–IV and reduced to absent on metasoma V. Ventral carinae of metasoma I–III consist of a row of large granules. Metasoma I granulated laterally, other segments are laterally smooth; granulation absent on dorsal surfaces of all metasomal segments except several fine granules on metasoma V dorsal mesially. Punctuation on metasoma IV–V is ventrally and laterally developed, spaces among punctae are smooth. The entire metasoma and telson glabrous; short, thin setae might issue from some punctae. Telson shallowly punctate and lacks granules.

**Pedipalps** (Figs. 68–87). Trichobothrium  $d_2$  on the dorsal surface of pedipalp femur is absent or reduced; trichobothrium  $e_1$  is situated in level with  $d_4$ . Femur of pedipalp with five granulate carinae. Patella with seven smooth carinae; the chela with smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalp only very sparsely hirsute. Movable fingers with 7–8 rows of denticles, 6–8 ID and 4–6 OD.

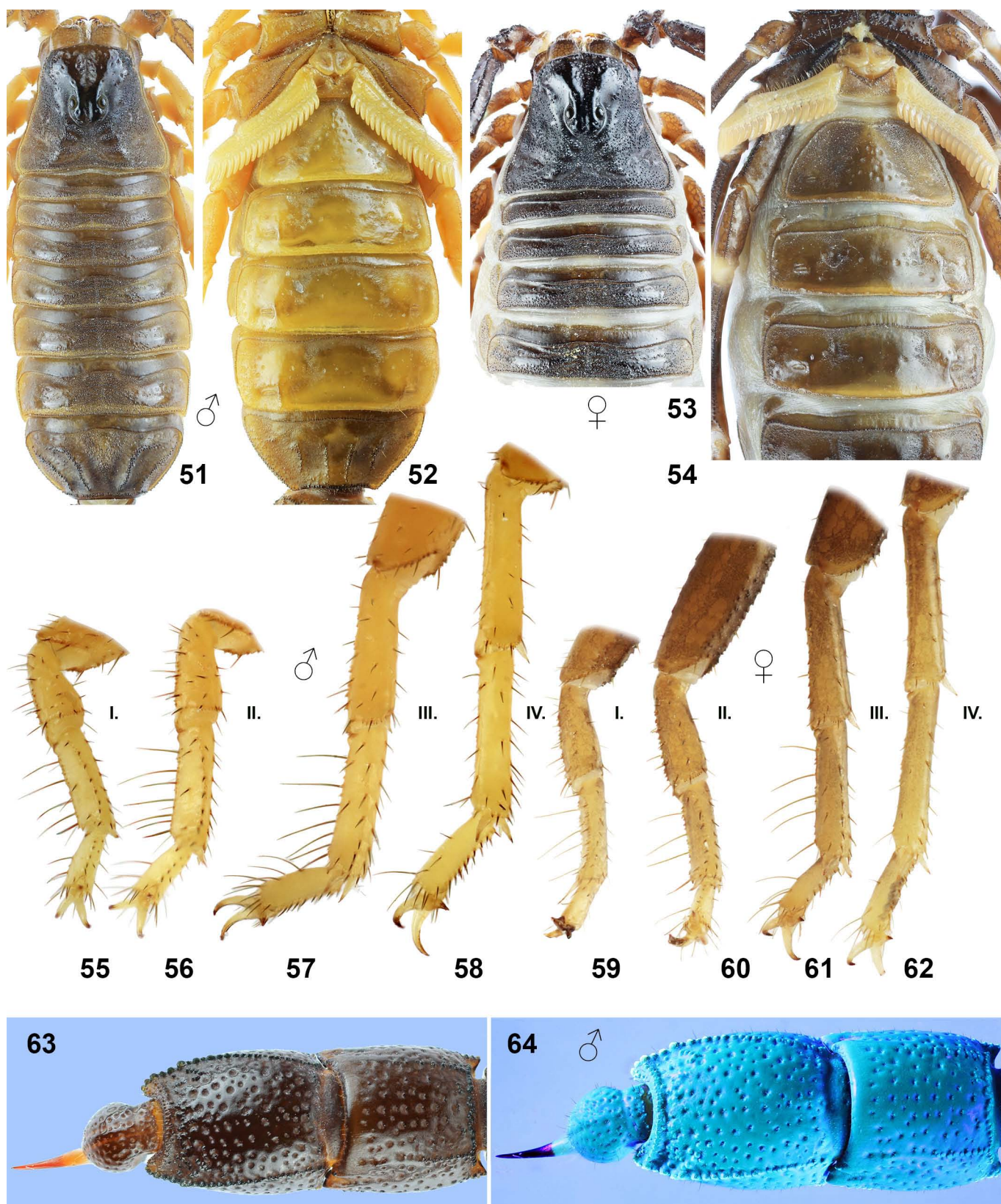
**Legs** (Figs. 55–62). Moderate to strong tibial spurs present on third and fourth legs. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few bristles. Tibia with bristles on the outer side of legs I–II. Tarsomere I of first to third legs with bristlecombs composed of 5–7 bristles long in both sexes, fourth legs lack bristlecombs. Tarsomeres I–II of all legs with two rather irregular rows of bristles.

**Measurements.** See Table 2.

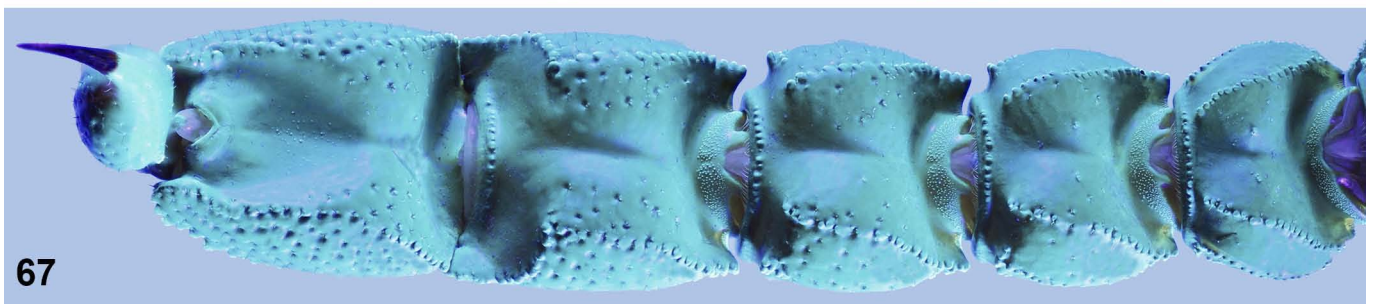
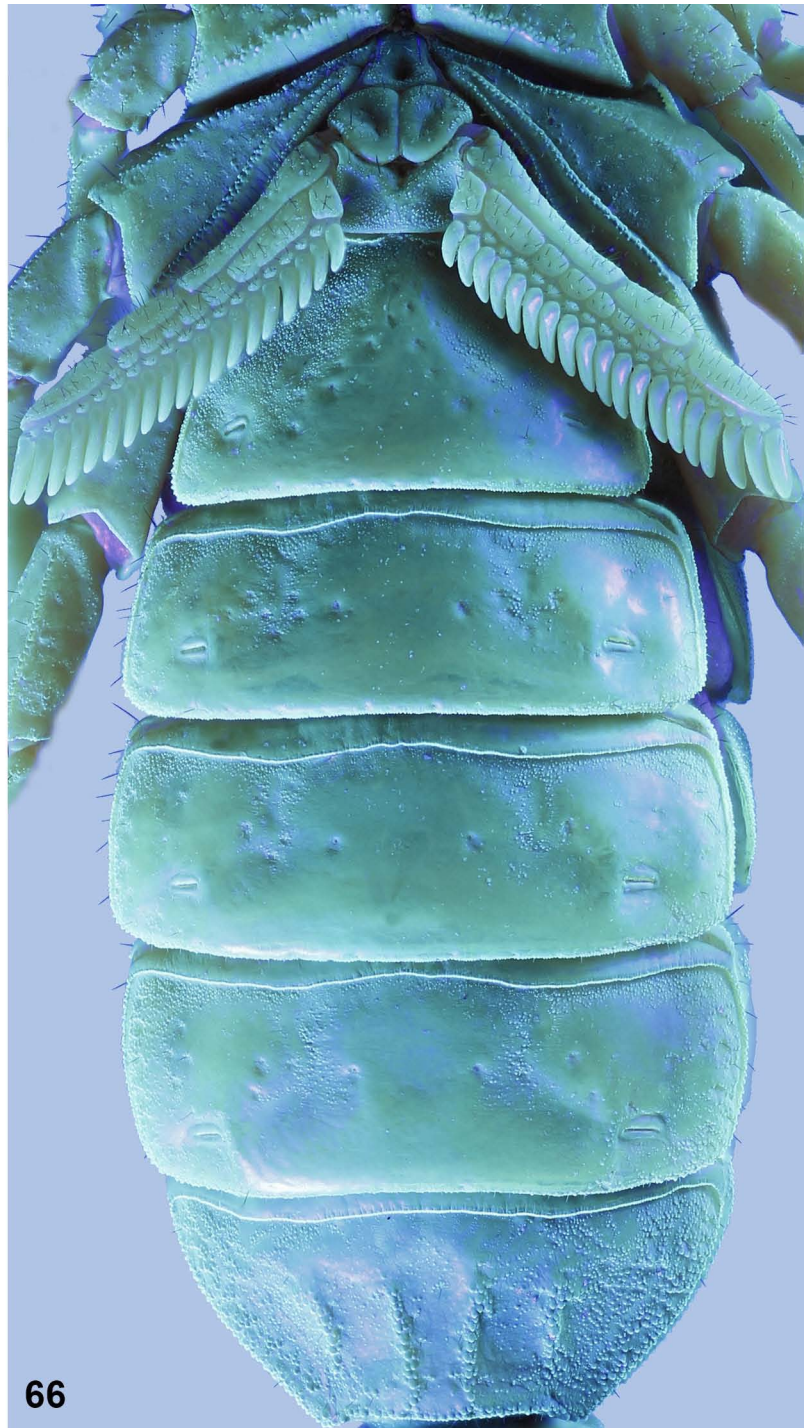
**AFFINITIES.** The described features distinguish *O. kermanensis* sp. n. from all other species of the genus. They are recounted in the key below. *O. kermanensis* sp. n. is similar to *O. zagrosensis* Kovařík, 2004. These two species can be differentiated according to the metasoma morphology. Metasomal segments II–III are laterally smooth and punctate with lateral carinae absent or smooth in *O. zagrosensis* versus granulated and bumpy with lateral carinae present and granulated at least on metasoma II in *O. kermanensis* sp. n. (Figs. 45 and 48). Pedipalp movable finger has 4–6 OD outside of MD row in *O. kermanensis* sp. n. and 8 OD in *O. zagrosensis*.



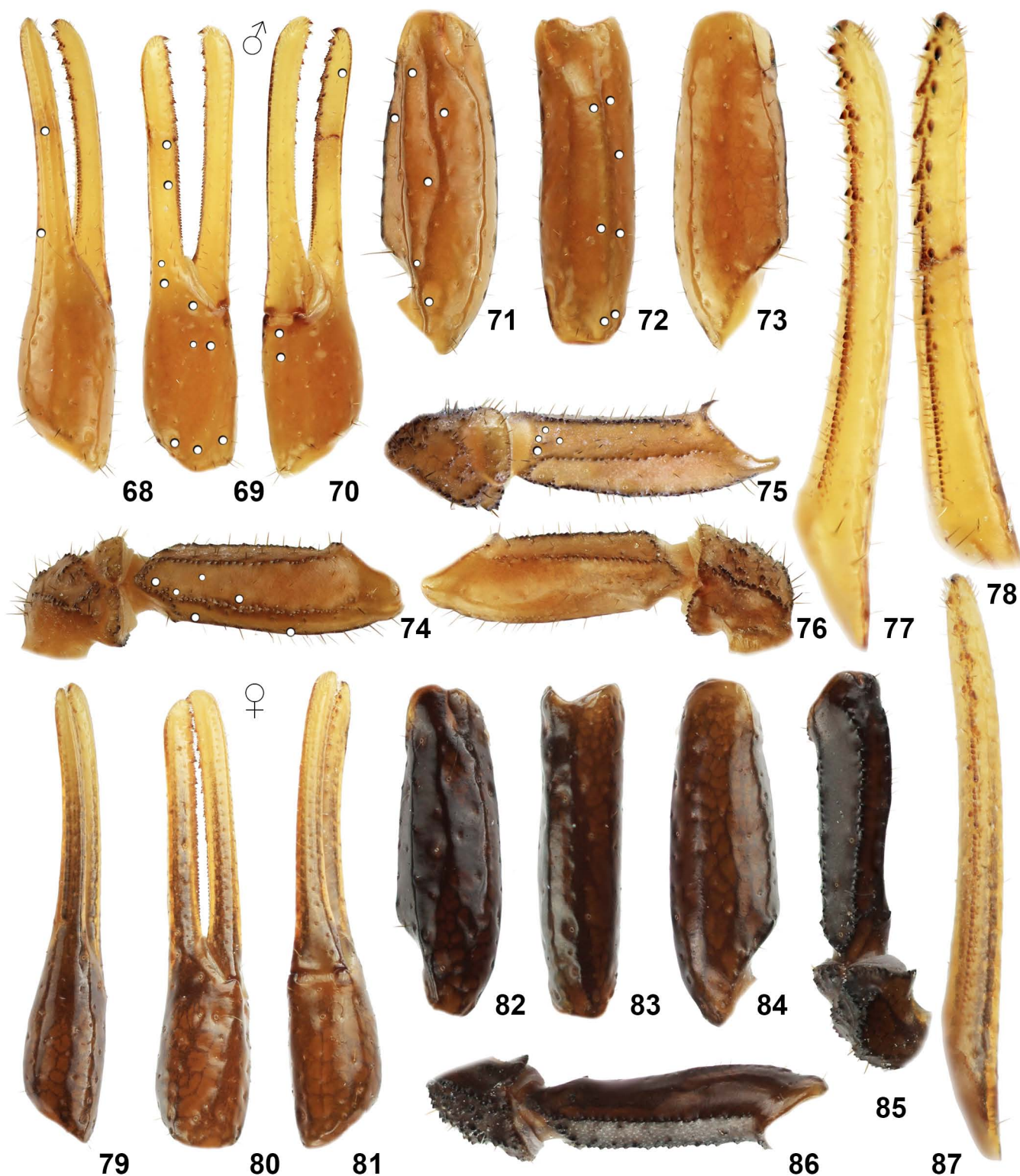
**Figures 45–50:** *Orthochirus kermanensis* sp. n. **Figures 45–47.** Paratype female from locality KE-34, metasoma and telson, lateral (45), dorsal (46), and ventral (47) views. **Figures 48–50.** Holotype male, metasoma and telson, lateral (48), dorsal (49), and ventral (50) views. Scale bar: 10 mm.



**Figures 51–64:** *Orthochirus kermanensis* sp. n. **Figures 51–52, 55–58, 63–64.** Holotype male, carapace and tergites (51), sternopectinal region and sternites (52), distal segments of right legs I–IV, retrolateral views (55–58 respectively), metasoma IV–V and telson under white light (63) and UV light (64). **Figures 53–54, 59–62.** Paratype female from locality KE-34, carapace and tergites I–IV (53), sternopectinal region and sternites III–V (54), and distal segments of right legs I–IV retrolateral aspect (59–62 respectively).



Figures 65–67. *Orthochirus kermanensis* sp. n., holotype male, carapace and tergites (65), sternopectinal region and sternites (66), and metasoma and telson dorsal (67) under UV light.



**Figures 68–87:** *Orthochirus kermanensis* sp. n., segments of pedipalps. **Figures 68–78.** Holotype male. Pedipalp chela, dorsal (68), external (69), and ventral (70) views. Pedipalp patella, dorsal (71), external (72), and ventral (73) views. Pedipalp femur and trochanter, dorsoexternal (74), internodorsal (75) and ventrointernal (76) views. Pedipalp chela, movable (77) and fixed (78) fingers dentate margins. The trichobothrial pattern is indicated in Figures 68–72, 74–75 (white circles). **Figures 79–87.** Paratype female from locality KE-34. Pedipalp chela, dorsal (79), external (80), and ventral (81) views. Pedipalp patella, dorsal (82), external (83), and ventral (84) views. Pedipalp femur and trochanter, dorsal (85), and ventrointernal (86) views. Pedipalp chela, movable finger dentate margin (87).



***Orthochirus kucerai* sp. n.**

(Figures 88–127, 224, 228, 231, Table 2)

<http://zoobank.org/urn:lsid:zoobank.org:act:54B82FC4-2C77-4160-850B-58966A50CCFB>

TYPE LOCALITY AND TYPE DEPOSITORY. **Iran**, *Kerman Province*, Sar Telo, Khajeh Askar Village, 29°10'01"N 58°16'27"E, 1155 m a. s. l.; FKCP.

TYPE MATERIAL (FKCP). **Iran**, *Kerman Province*, Bam, Sar Telo, Khajeh Askar Village, 29°10'01"N 58°16'27"E, 1155 m a. s. l. (Locality No. KE-27), V.2009, 3♂2♀ (holotype and paratypes, ), leg. Koochpaye, Jamalizadeh & Ebrahimi; Deh Bakri, 7.-8.IV.2000, 29°05'37"N 57°55'53"E, 6422 ft., 1♀ (paratype), leg. M. Kaftan; Shahdad, 30°29'06"N 57°48'28"E, 331 m a. s. l. (Locality No. KE-116, Fig. 231), V.2009, 1♂ (paratype), leg. Koochpaye, Jamalizadeh & Ebrahimi; Deh Bakri, Gebal Barez Mts, 29°08'N 57°91'E, 2300 m a. s. l., 2.VI.2010, 1♀ (paratype), leg. W. Grosser; Jabel Barez Mt., Mijan, 25 km E Jiroft, 28°42'27"N 57°57'33"E, 1650 m a. s. l., 27.V.2014, 1♂ (paratype), leg. P. Kučera.

ETYMOLOGY. The species epithet is a patronym honoring Pavel Kučera, an entomologist and friend of the first author, the collector of one of the paratypes of the new species.

DIAGNOSIS (♂♀). Total length of adults 26–45 mm. Trichobothrium  $d_2$  at pedipalp femur dorsal surface absent or reduced. Moderate to strong tibial spurs present on third and fourth legs. Pectinal teeth number 21 in males and 19–20 in females. Movable finger of pedipalps with 8 rows of denticles, 7 ID and 8–9 OD. Dorsal carinae on pedipalp patella present and smooth. Metasoma V dorsal surface mesially smooth or with only several granules present. Metasoma I–II with 10 carinae, metasoma III with 6–8 carinae, metasoma IV–V with 2–4 carinae. Ventral carinae of metasoma I–III consist of irregular rows of granules. Metasoma IV–V ventrally and laterally with punctation developed; spaces among punctae smooth; metasoma II–III ventrally and laterally granulated and bumpy with punctation reduced. Entire tergites roughly granulate, at least in the male. Sternite VII finely granulated, medially smooth, with granulate carinae developed. Pedipalp, metasoma and telson very sparsely hirsute, rather glabrous. Tarsomere I of legs with 4–7 moderate bristles. Ratio length/width of metasoma V 1.18–1.26 in both sexes. Pedipalp femur length/width ratio 4.1–4.3 in male, 3.3–3.5 in female.

DESCRIPTION. Total length of adults 26–45 mm in both sexes. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 2. For habitus, see Figs. 88–91.

**Coloration** (Figs. 88–91). Carapace, tergites, metasoma and femur of pedipalps and legs are black. Patella of pedipalps

and legs yellowish brown to brown. Sternite VII black, other sternites yellowish brown with yellow median area in posterior margin of sternites IV–VI present. Telson reddish brown.

**Mesosoma and carapace** (Figs. 98–101, 106–107). Mesosoma with a median carina and is roughly granulated. Carapace with carinae indicated, roughly granulated except smooth interocular triangle. The seventh sternite is finely granulated laterally, medially smooth and with four granulated carinae, the other sternites are rather smooth in middle, granulated in anterior and lateral parts. Pectinal teeth number 21 in males and 19–20 in females.

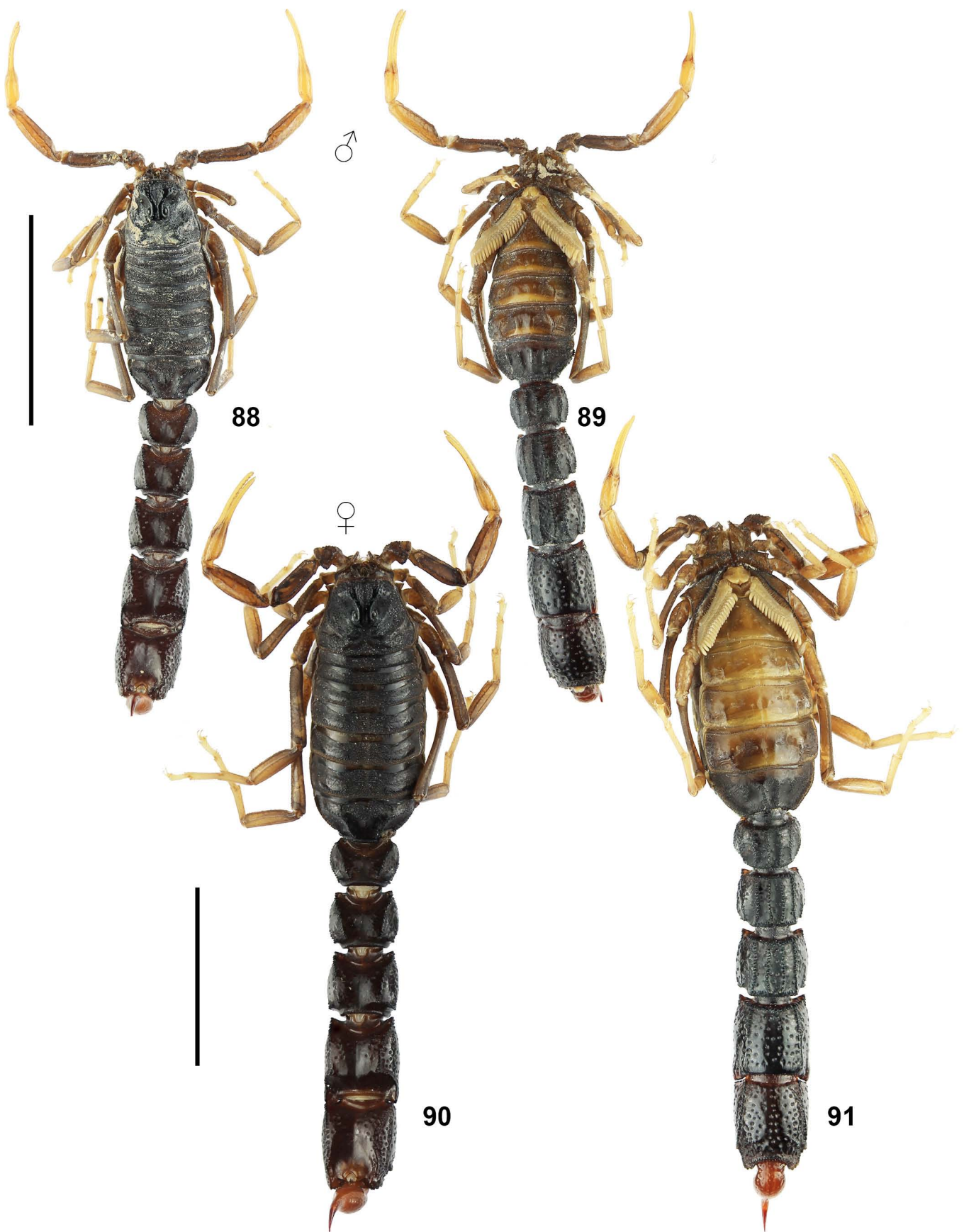
**Metasoma and telson** (Figs. 92–97, 108, 224). Metasoma I–II with 10 granulated carinae. Metasoma III–V lack lateral carinae, ventromedian and ventrolateral carinae are present on metasoma I–III, dorsolateral carinae are present on all metasomal segments but reduced to absent on metasoma IV–V. Ventral carinae of metasoma I–III consist of irregular rows of granules. Metasoma I–II are rather smooth laterally with several granules, metasoma III–V laterally smooth and punctate; granulation absent on dorsal surfaces of all metasomal segments except several fine granules on metasoma V dorsal mesially. Punctation on metasoma IV–V is developed ventrally and laterally; spaces among punctae are smooth. The entire metasoma and telson are glabrous; short, thin setae might issue from some punctae. Telson shallowly punctate and lacks granules.

**Pedipalps** (Figs. 109–127). Trichobothrium  $d_2$  on the dorsal surface of pedipalp femur is absent or reduced; trichobothrium  $e_1$  is situated in level with  $d_4$ . Femur of pedipalp with five granulate carinae. Patella has seven smooth carinae, and the chela has smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalp only very sparsely hirsute. Movable fingers with 8 rows of denticles, 7 ID and 6–8 OD.

**Legs** (Figs. 102–105). Moderate to strong tibial spurs present on third and fourth legs. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few bristles. Tibia with bristles on the outer side of legs I–II. Tarsomeres I of first to third legs with 4–7 moderate bristles; fourth legs usually lack bristles. Tarsomeres I–II of all legs with two rather irregular rows of bristles.

**Measurements.** See Table 2.

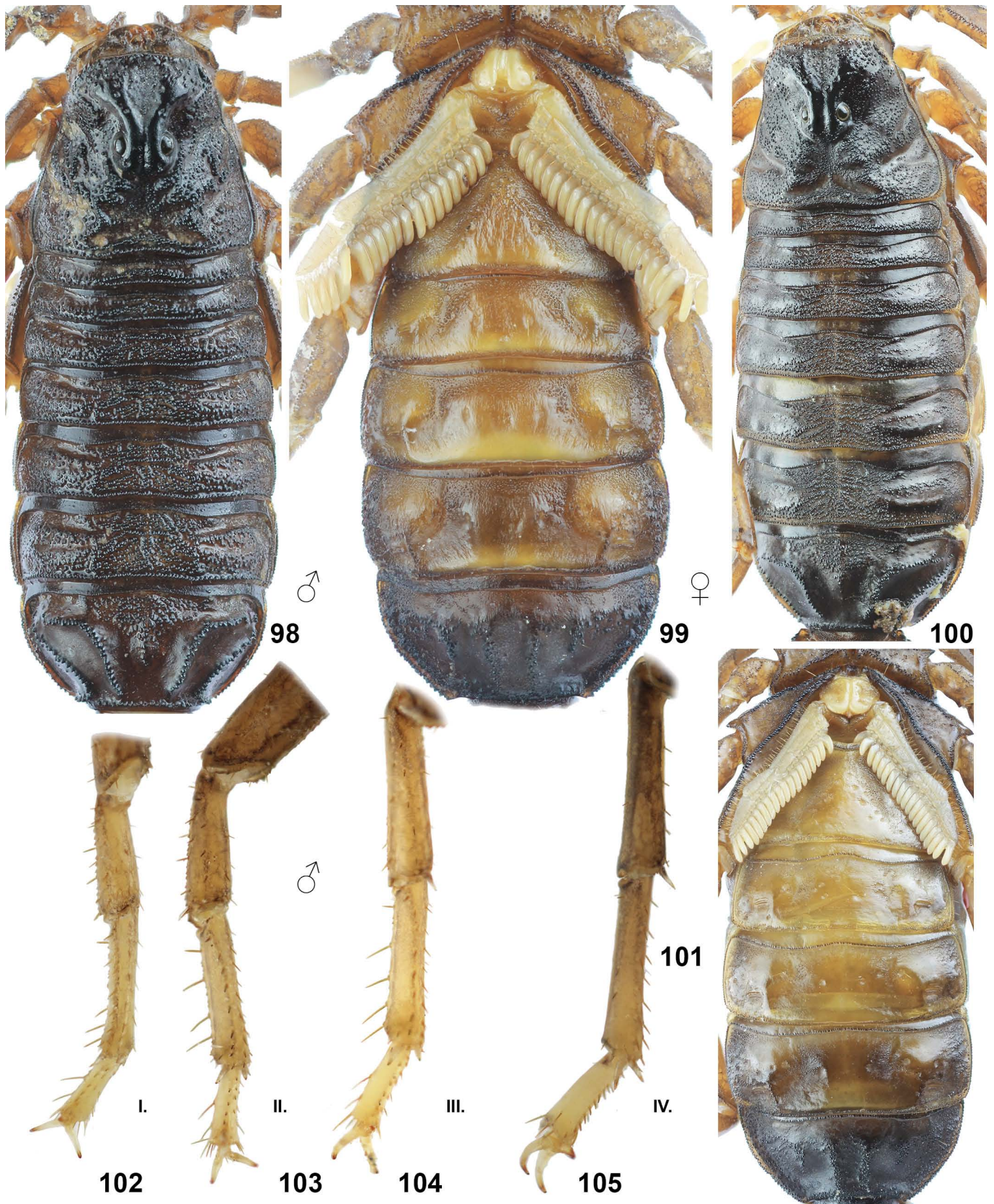
AFFINITIES. The described features distinguish *O. kucerai* sp. n. from all other species of the genus. They are recounted in the key for the Iranian species below. *O. kucerai* sp. n. is similar to *O. zagrosensis* Kovařík, 2004. In the key below, we used the difference in the shape of pedipalp femur. Another difference is in granulation of metasomal carinae: ventral carinae of metasoma I consist of irregular rows of granules in *O. kucerai* sp. n. (Fig. 97), and a row of large granules in *O. zagrosensis*.



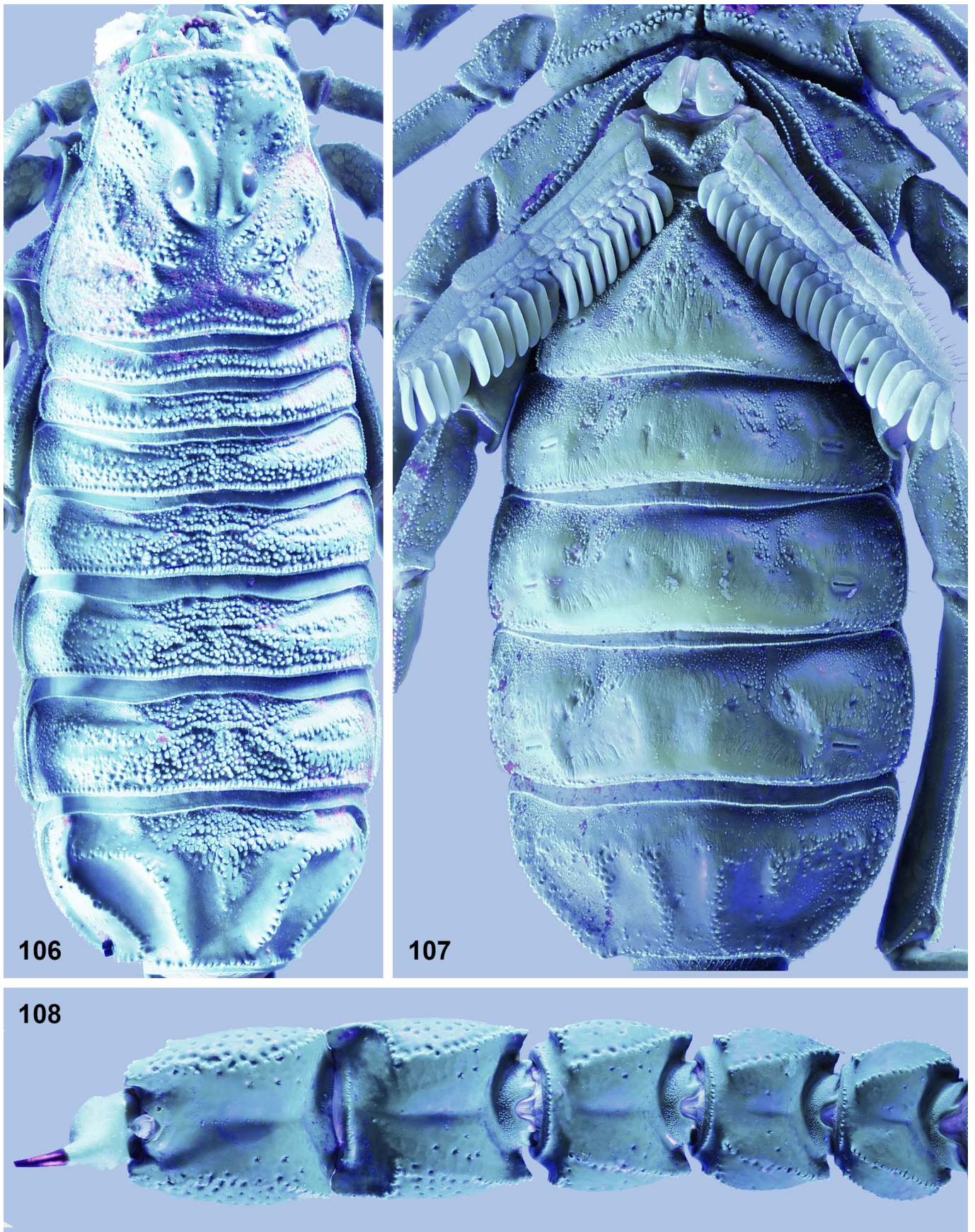
**Figures 88–91:** *Orthochirus kucerai* sp. n. Figures 88–89. Holotype male, dorsal (88) and ventral (89) views. Figures 90–91. Paratype female from type locality, dorsal (90) and ventral (91) views. Scale bars: 10 mm.



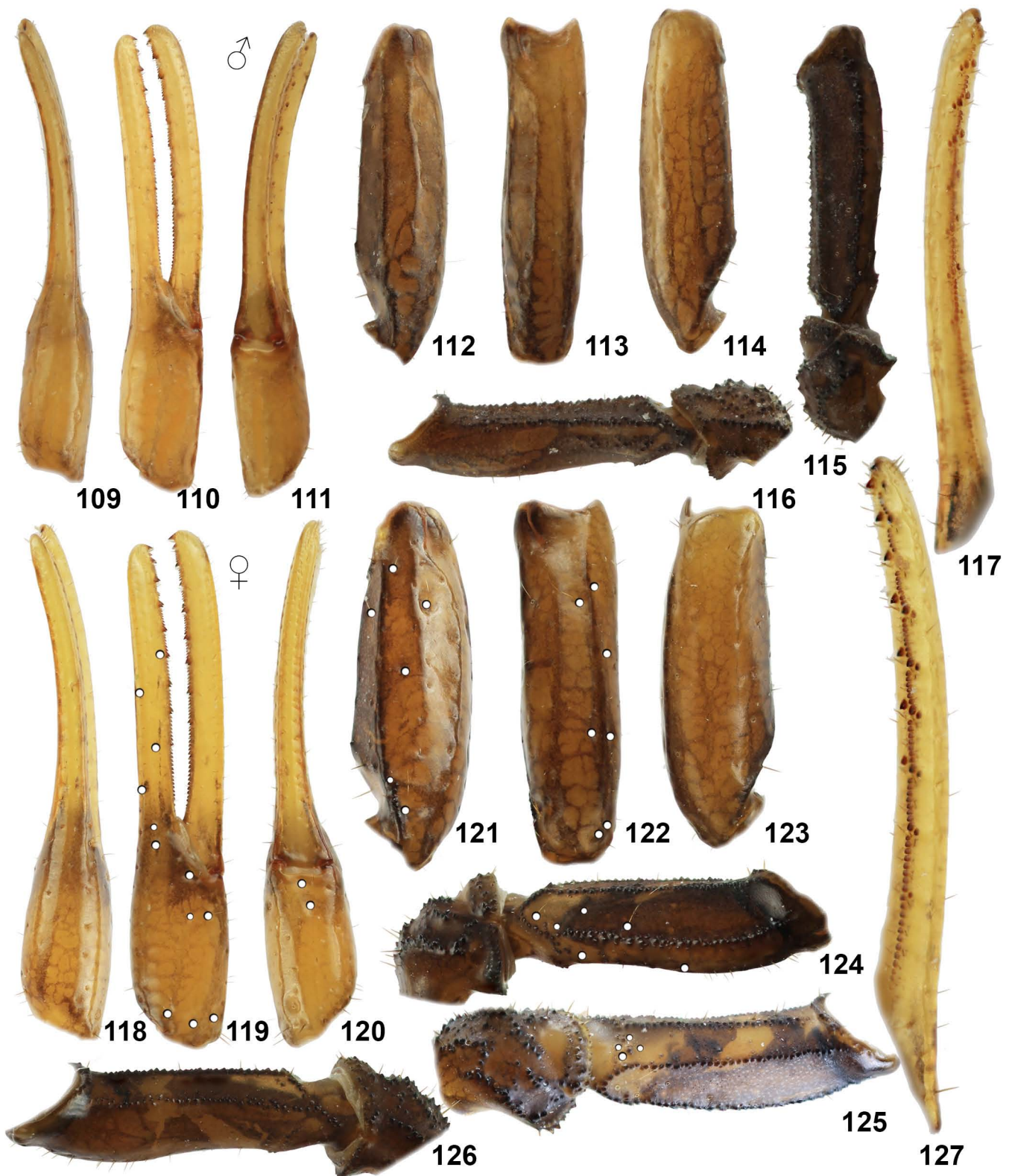
**Figures 92–97:** *Orthochirus kucerai* sp. n. **Figures 92–94.** Paratype female from type locality, metasoma and telson, lateral (92), dorsal (93), and ventral (94) views. **Figures 95–97.** Holotype male, metasoma and telson, lateral (95), dorsal (96), and ventral (97) views. Scale bars: 10 mm.



**Figures 98–105:** *Orthochirus kucerai* sp. n. **Figures 98–99, 102–105.** Holotype male, carapace and tergites (98), sternopleural region and sternites (99), and distal segments of right legs I–IV, retrolateral aspect (102–105 respectively). **Figures 100–101.** Paratype female from type locality, carapace and tergites (100), sternopleural region and sternites (101).



Figures 106–108. *Orthochirus kucerai* sp. n., holotype male, carapace and tergites (106), sternopectinal region and sternites (107), and metasoma and telson dorsal (108) under UV light.



**Figures 109–127:** *Orthochirus kucerai* sp. n., segments of pedipalps. **Figures 109–117.** Holotype male. Pedipalp chela, dorsal (109), external (110), and ventral (111) views. Pedipalp patella, dorsal (112), external (113), and ventral (114) views. Pedipalp femur and trochanter, dorsal (115), and ventral (116) views. **Figures 118–127.** Paratype female from type locality. Pedipalp chela, dorsal (118), external (119), and ventral (120) views. Pedipalp patella, dorsal (121), external (122), and ventral (123) views. Pedipalp femur and trochanter, dorsaloexternal (124), internodorsal (125), and ventral (126) views. Pedipalp chela, movable finger dentate margin (127). The trichobothrial pattern is indicated in Figures 119–122, 124–125 (white circles).

***Orthochirus masihipouri* sp. n.**

(Figures 128–153, 225, 228, 232, Table 3)

<http://zoobank.org/urn:lsid:zoobank.org:act:397424AB-6BFE-4E25-917F-E23E1368C0D8>*Orthochirus stockwelli*: Navidpour et al., 2008b: 17, figs. 6, 23, 69–72.TYPE LOCALITY AND TYPE DEPOSITORY. **Iran**, *Bushehr Province*, Behbahan–Genaveh road, 29°40.71'N 50°24.04'E, 17 m a. s. l.; FKCP.TYPE MATERIAL (FKCP). **Iran**, *Bushehr Province*, Behbahan–Genaveh road, 29°40.71'N 50°24.04'E, 17 m a. s. l. (Locality. No. B-G803, Fig. 232), VII.2007, 1♀ (holotype), leg. Navidpour & Masihipour.

ETYMOLOGY. The species epithet is a patronym honoring Behzad Masihipour, who helped the second author in the field studies of scorpions of Iran for about 15 years.

DIAGNOSIS (♀). Total length 40 mm of female holotype. Trichobothrium  $d_2$  at the dorsal surface of pedipalp femur reduced. Moderate tibial spurs present on third and fourth legs. Pectinal teeth number 22–23 in female. Movable finger of pedipalps with 8 rows of denticles, 8–9 ID and 8–9 OD. Dorsal carinae on pedipalp patella present and smooth. Pedipalp femur dorsal granulated. Metasoma V dorsal surface mesially smooth or with only several granules present. Metasoma I–II with 10 carinae, metasoma III with 8 carinae, metasoma IV–V with 2 dorsolateral carinae; ventrolateral carinae indicated on metasoma V. Ventral carinae of metasoma I–III consist of a row of large granules. Metasoma IV–V ventrally and laterally with fine punctation developed, spaces among punctae smooth ventral and granulated lateral; metasoma II–III ventrally and laterally granulated and bumpy with punctation reduced. Tergites roughly to finely granulated. Sternite VII densely granulated, with granulated carinae developed. Pedipalp, metasoma and telson densely hirsute. Tarsomere I of legs with 6–9 long bristles in female. Ratio length/width of metasoma V 1.14 in female holotype. Pedipalp femur length/width ratio 3 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 3. For habitus, see Figs. 128–129.

**Coloration** (Figs. 128–129). Carapace, tergites, and metasoma black. Femur of pedipalps and legs yellowish brown, other segments of pedipalps and legs yellow. Sternite VII black, other sternites yellowish brown with yellow median area in posterior margin of sternites IV–VI indicated. Telson reddish brown.

**Mesosoma and carapace** (Figs. 135–138). Mesosoma with a median carina and is roughly to finely granulated. Carapace without carinae, roughly granulated except smooth interocular triangle. The seventh sternite densely granulated and with four granulated carinae, the other sternites are granulated but smooth in middle and posteriorly. Pectinal teeth number 22–23 in female holotype.

**Metasoma and telson** (Figs. 130–134, 225). The metasoma I–II with 10 granulated carinae. The metasoma III–V lacks lateral carinae, ventromedian and ventrolateral carinae are present on metasoma I–III, dorsolateral carinae are present on all metasomal segments but reduced to absent on metasoma V. Ventral carinae of metasoma I–III consist of a row of large granules. Metasoma I–III and partly metasoma IV are granulated laterally, metasoma III–V laterally punctate; granulation absent on dorsal surfaces of all metasomal segments except several fine granules on metasoma V dorsal mesially. Fine punctation on metasoma IV–V ventrally developed, spaces among punctae are smooth. The entire metasoma and telson are densely hirsute. The telson shallowly punctate, without granules.

**Pedipalps** (Figs. 143–153). Trichobothrium  $d_2$  on the dorsal surface of pedipalp femur is present; trichobothrium  $e_1$  is situated between trichobothria  $d_3$  and  $d_4$ . Femur of pedipalps with five granulate 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 hirsute. Movable fingers with 8 rows of denticles, 8–9 ID and OD.

**Legs** (Figs. 139–142). Moderate tibial spurs present on third and fourth legs. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few bristles. Tibia with bristles on the outer side of legs I–II. Tarsomere I of first to third legs with 6–9 long bristles, fourth legs with 3 or 4 bristles. Tarsomeres I–II of all legs with two rather irregular rows of bristles.

**Measurements.** See Table 3.

**AFFINITIES.** The described features distinguish *O. masihipouri* sp. n. from all other species of the genus. They are recounted in the key below. *O. masihipouri* sp. n. is similar to *O. stockwelli* (Lourenço & Vachon, 1995) with which it was initially confused (see Navidpour et al., 2008b). These two species are possible differentiate according to several characters. In the key below, we used difference in granulation of pedipalp femur and sternites but these two species differ also in the shape of metasoma, which is wider in *O. masihipouri* sp. n., and in the shape of pedipalp patella, which is narrower in *O. stockwelli*. Ratio length/width of pedipalp patella is 2.9 in *O. masihipouri* sp. n. vs. 3.2–3.9 in *O. stockwelli*. Punctation of metasoma IV–V is finer in *O. masihipouri* sp. n. (Fig. 225) than in *O. stockwelli* (fig. 54 in Kovařík et al., 2019: 10).



Figures 128–129. *Orthochirus mashipouri* sp. n., holotype female, dorsal (128) and ventral (129) views. Scale bar: 10 mm.



Dimensions (mm)		<i>O. mashipouri</i> sp. n.	<i>O. semnanensis</i> sp. n.	<i>O. vignolii</i> sp. n.	<i>O. vignolii</i> sp. n.
		♀ holotype	♂ holotype	♂ holotype	♀ paratype
Carapace	L / W	4.77 / 5.59	3.59 / 4.16	3.33 / 3.88	4.12 / 4.86
Mesosoma	L	10.84	6.38	7.45	9.63
Tergite VII	L / W	2.72 / 6.09	1.79 / 4.68	2.17 / 4.03	2.61 / 5.38
Metasoma + telson	L	24.88	19.55	18.32	21.44
Segment I	L / W / D	2.70 / 3.93 / 3.51	2.18 / 3.24 / 2.71	2.08 / 2.80 / 2.14	2.24 / 3.52 / 2.87
Segment II	L / W / D	3.39 / 4.00 / 3.59	2.62 / 3.28 / 2.69	2.41 / 2.82 / 2.24	2.81 / 3.49 / 2.65
Segment III	L / W / D	3.75 / 4.27 / 3.62	3.08 / 3.53 / 2.92	2.77 / 3.04 / 2.36	3.37 / 3.72 / 2.86
Segment IV	L / W / D	4.90 / 4.48 / 3.54	3.75 / 3.68 / 3.00	3.56 / 3.06 / 2.65	4.18 / 3.71 / 3.20
Segment V	L / W / D	5.08 / 4.44 / 3.19	4.06 / 3.55 / 2.71	3.92 / 3.00 / 2.47	4.65 / 3.57 / 2.82
Telson	L / W / D	5.06 / 1.98 / 1.72	3.86 / 1.46 / 1.17	3.58 / 1.35 / 1.08	4.19 / 1.65 / 1.47
Pedipalp	L	13.13	11.14	10.66	11.72
Femur	L / W	3.25 / 1.09	2.98 / 0.75	2.76 / 0.77	3.05 / 0.91
Patella	L / W	4.12 / 1.44	3.48 / 1.01	3.26 / 0.99	3.69 / 1.24
Chela	L	5.76	4.68	4.64	4.98
Manus	W / D	0.96 / 1.05	0.88 / 0.79	0.78 / 0.77	1.05 / 0.96
Movable finger	L	3.92	2.92	3.11	3.29
<b>Total</b>	<b>L</b>	<b>40.49</b>	<b>29.52</b>	<b>29.10</b>	<b>35.19</b>

**Table 3.** Comparative measurements of *Orthochirus mashipouri* sp. n., *O. semnanensis* sp. n., and *O. vignolii* sp. n. types. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

***Orthochirus semnanensis* sp. n.**

(Figures 154–178, 226, 228, 233, Table 3)

<http://zoobank.org/urn:lsid:zoobank.org:act:C880BD3F-0025-4DC4-A669-F9C90F28FA42>

TYPE LOCALITY AND TYPE DEPOSITORY. **Iran**, *Semnan Province*, Garmsar, Ghasre-Bahram, 36°22'N 54°23'E; FKCP.

TYPE MATERIAL (FKCP). **Iran**, *Semnan Province*, Garmsar, Ghasre-Bahram, 36°22'N 54°23'E (Locality No. SE-61, Fig. 233), VI.2011, 2♂ (holotype and paratype), leg. Saeed Adibi.

ETYMOLOGY. Named after the province of occurrence.

DIAGNOSIS (♂). Total length 27–30 mm of males. Trichobothrium  $d_2$  at pedipalp femur dorsal surface absent. Moderate tibial spurs present on third and fourth legs. Pectinal teeth number 21–23 in males. Movable finger of pedipalps with 8–9 rows of denticles, 6 ID and 0–1 OD. Dorsal carinae on pedipalp patella present and smooth. Metasoma V dorsal surface mesially smooth with only several fine granules present. Metasoma I with 10 carinae, metasoma II–III with 6–8 carinae, metasoma IV–V with 2–4 carinae. Ventral carinae of metasoma II–III consist of a row of large granules. Metasoma IV–V ventrally and laterally with punctation developed, spaces among punctae smooth; metasoma II–III ventrally and laterally sparsely granulated and bumpy with punctation present. Entire tergites roughly granulated. Sternite VII densely granulated, with granulated wide carinae developed. Pedipalp, metasoma and telson very sparsely hirsute, rather

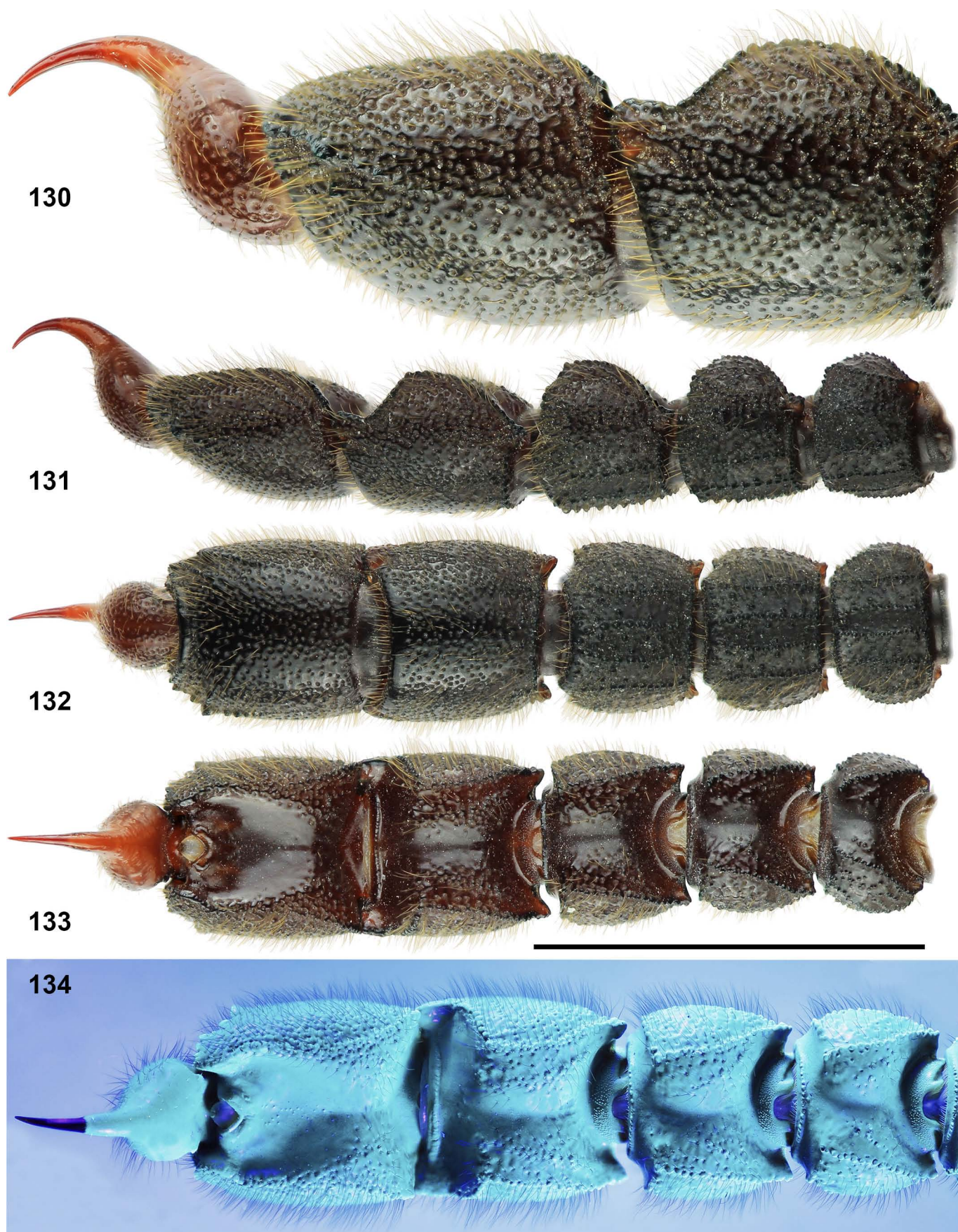
glabrous. Tarsomere I of legs with 5–8 bristles long in males. Ratio length/width of metasoma V 1.14 in males. Pedipalp femur length/width ratio 3.9–4 in males.

DESCRIPTION. Total length of adult males 27–30 mm. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 3. For habitus, see Figs. 154–155.

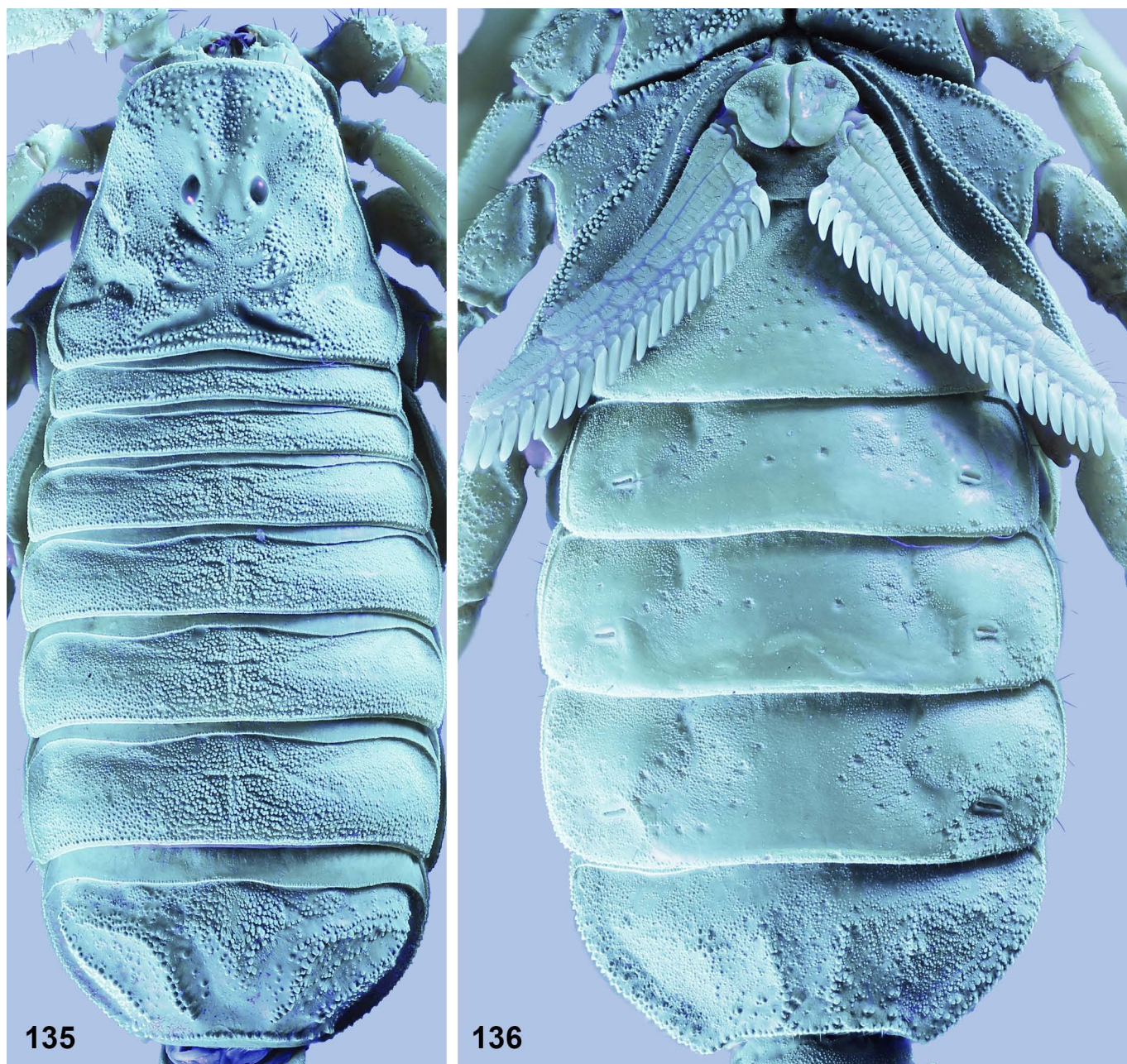
**Coloration** (Figs. 154–155). Carapace, tergites, metasoma and femur of pedipalps and legs are black. Patella of pedipalps and legs brown to black. Pedipalp chela reddish brown with yellowish brown tip of fingers. Tarsomeres of legs are yellow to yellowish brown. Sternite VII black, other sternites reddish brown to black with yellow median area in posterior margin of sternites IV–VI. Telson reddish brown to black.

**Mesosoma and carapace** (Figs. 160–163). Mesosoma with a median carina and is roughly granulated. Carapace without carinae, roughly granulated except smooth interocular area. The seventh sternite granulated and with four wide granulated carinae, the other sternites are smooth in the middle, granulated in anterior and lateral parts. Pectinal teeth number 21–23 in males.

**Metasoma and telson** (Figs. 156–159, 226). Metasoma I with 10 granulated carinae. Metasoma II–V lacks lateral carinae, ventromedian and ventrolateral carinae are present on metasoma I–III, ventrolateral carinae are also developed on metasoma V, dorsolateral carinae are present on metasoma I–III and reduced to absent on metasoma IV–V. Ventral carinae of metasoma II–III consist of a row of large granules. Metasoma I granulate laterally, other segments laterally smooth; granulation absent on dorsal surfaces of all metasomal



**Figures 130–134.** *Orthochirus mashipouri* sp. n., holotype female, metasoma IV–V and telson lateral (130), metasoma and telson, lateral (131), ventral (132), and dorsal under white light (133) and UV light (134). Scale bar: 10 mm (131–133).



Figures 135–136. *Orthochirus mashipouri* sp. n., holotype female, carapace and tergites (135), and sternopectinal region and sternites (136) under UV light.

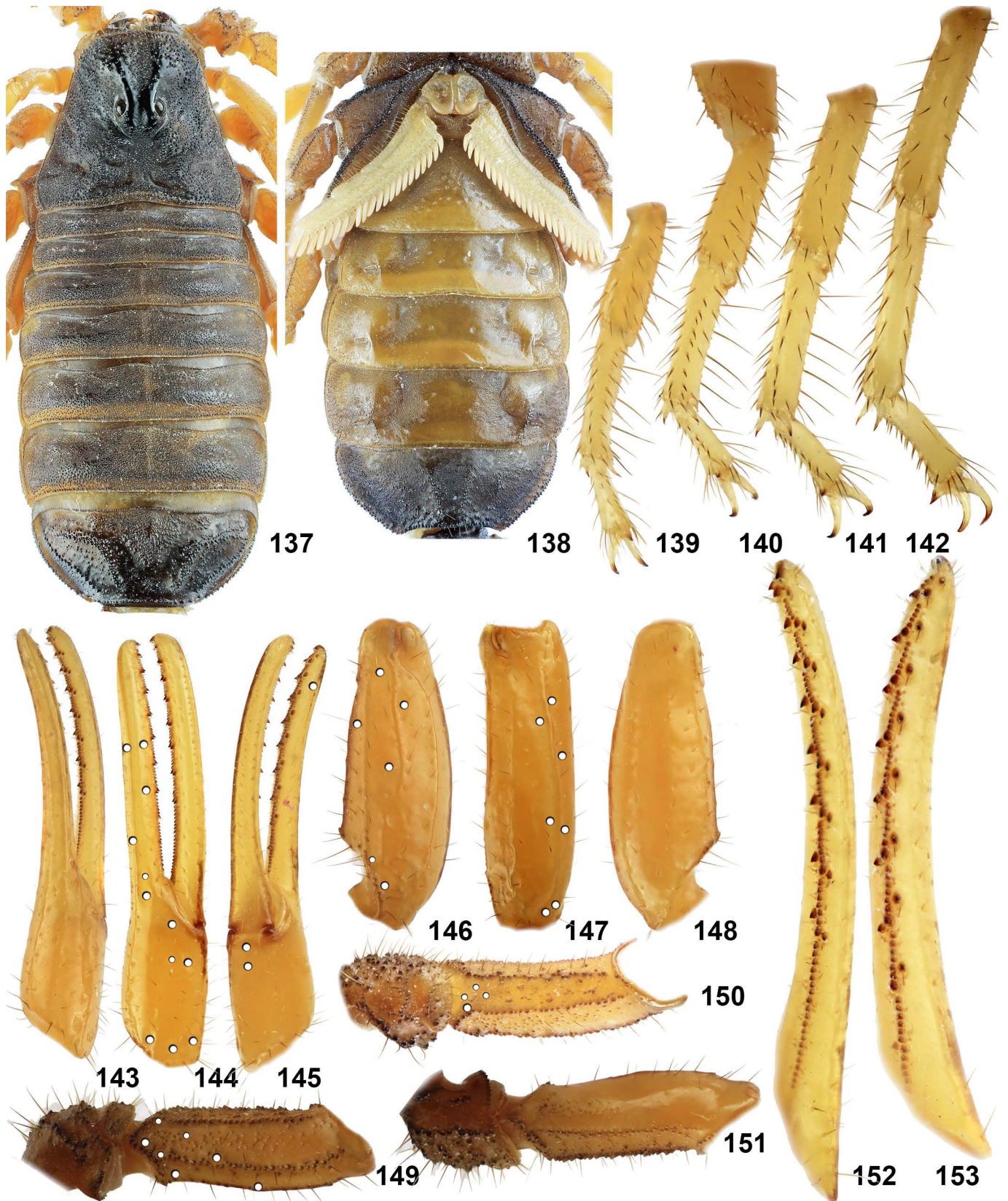
segments except several fine granules on metasoma V dorsal mesially. Punctuation on metasoma IV–V ventrally and laterally developed; spaces among punctae are smooth. The entire metasoma and telson are glabrous; short, thin setae might issue from some punctae. Telson shallowly punctate and lacks granules.

**Pedipalps** (Figs. 168–178). Trichobothrium  $d_2$  on the dorsal surface of pedipalp femur is absent; trichobothrium  $e_1$  is situated between trichobothria  $d_3$  and  $d_4$ . Femur of pedipalp with five granulated carinae. Patella has seven smooth carinae, and the chela has smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalp only very sparsely hirsute. Movable fingers with 8–9 rows of denticles, 6 ID and 0–1 OD.

**Legs** (Figs. 164–167). Moderate tibial spurs present on third and fourth legs. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia smooth. Patella with only a few bristles. Tibia with bristles on the outer side of legs I–II. Tarsomere I of first to third legs with bristlecombs composed of 5–8 long bristles; fourth legs lack bristlecombs. Tarsomeres I–II of all legs with two rather irregular rows of bristles.

**Measurements.** See Table 3.

**AFFINITIES.** The described features distinguish *O. semnanensis* sp. n. from all other species of the genus. They are recounted in the key below. *O. semnanensis* sp. n. differs from all species of the region by absence of OD on pedipalp movable



**Figures 137–153:** *Orthochirus mashipouri* sp. n., holotype female. **Figures 137–138.** Carapace and tergites (137), and sternoplectinal region and sternites (138). **Figures 139–142.** Left legs I–IV, retrolateral aspect. **Figures 143–153.** Segments of pedipalps. Pedipalp chela, dorsal (143), external (144), and ventral (145) views. Pedipalp patella, dorsal (146), external (147), and ventral (148) views. Pedipalp femur and trochanter, dorsal (149), internal (150), and ventral (151) views. Pedipalp chela, movable (152) and fixed (153) fingers dentate margins. The trichobothrial pattern is indicated in Figures 144–147, 149–150 (white circles).



Figures 154–155. *Orthochirus semnanensis* sp. n., holotype male, dorsal (154) and ventral (155) views. Scale bar: 10 mm.

finger (Fig. 177), the character typical for *O. scrobiculosus* (Grube, 1873) which is cited mainly from Turkmenistan and Uzbekistan.

***Orthochirus vignolii* sp. n.**

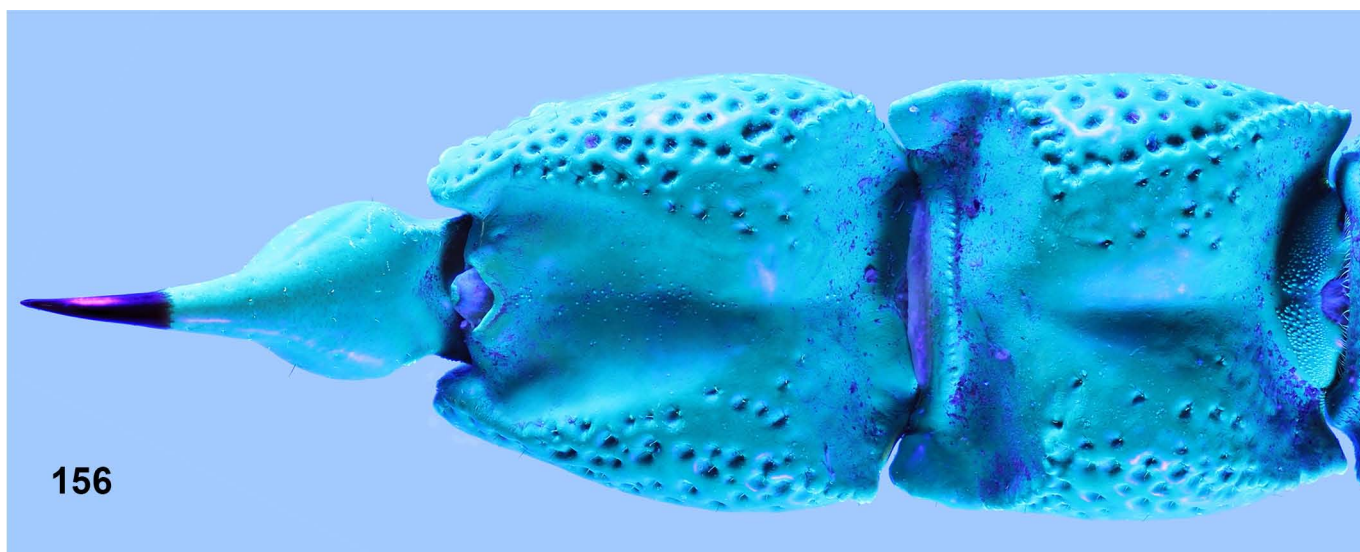
(Figures 179–221, 227, 228, 234, Table 3)

<http://zoobank.org/urn:lsid:zoobank.org:act:AAF8A509-26EC-43B5-B17D-618635757A65>

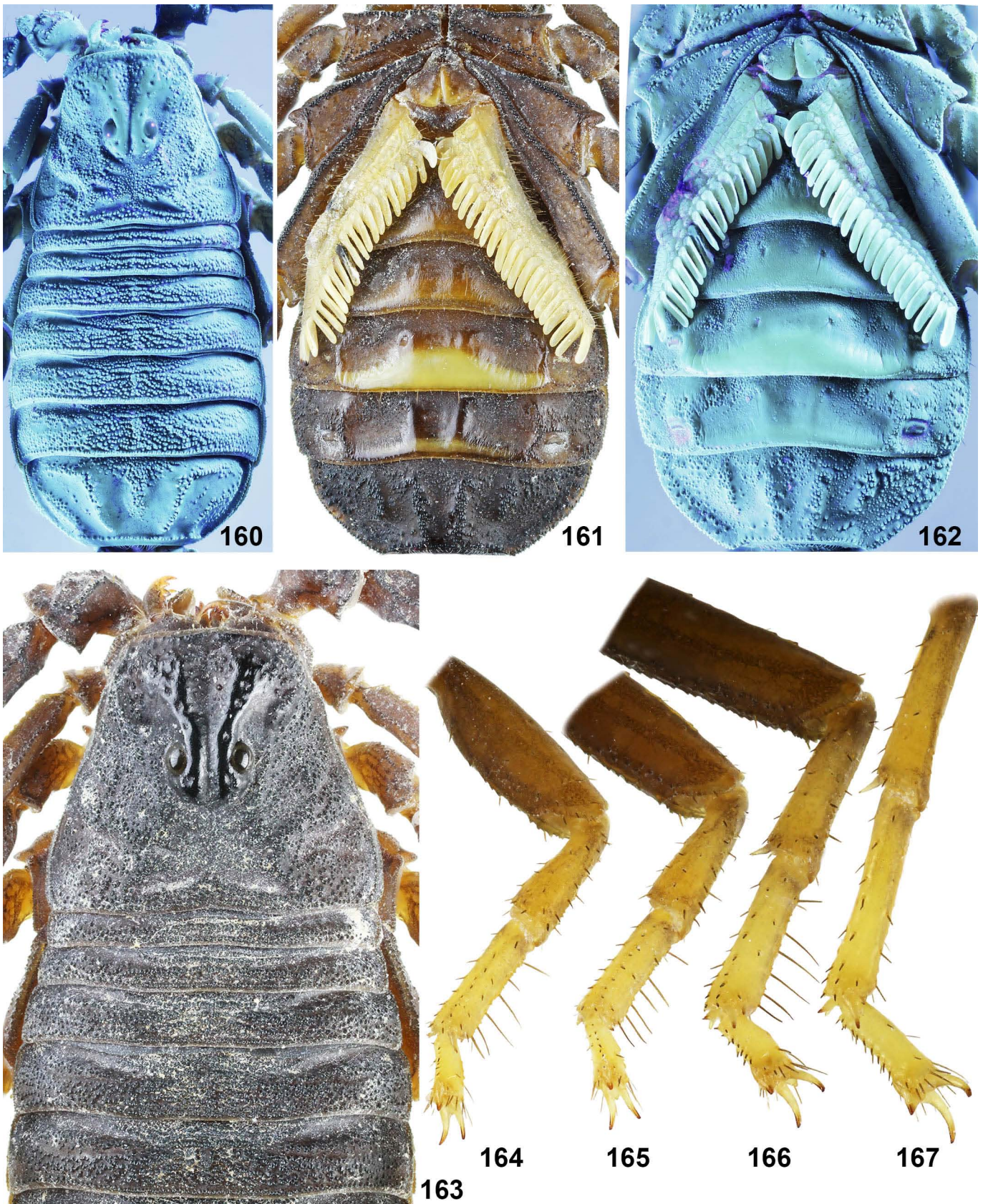
*Orthochirus zagrosensis* (in part) Kovařík, 2004: 22 (paratypes from Yazd Province).

TYPE LOCALITY AND TYPE DEPOSITORY. **Iran**, *Yazd Province*, Kosk Abad Village, 31°43'52"N 53°17'12"E, 2023 m a. s. l.; FKCP.

TYPE MATERIAL (FKCP). **Iran**, *Yazd Province*, Kosk Abad Village, 31°43'52"N 53°17'12"E, 2023 m a. s. l. (Locality No. Ya-11, Fig. 234), V.2016, 1♂ (holotype), leg. Saeed Abadi; Bafgh–Tehran road, 31°36'26"N 54°14'22"E, 1843 m a. s. l. (Locality No. Ya-01), V.2016, 1♀ (paratype), leg. Saeed Abadi; Chenar–Mehriz road, 31°34'26"N 54°28'30.9"E, 2023 m a. s. l. (Locality No. Ya-26), V.2016, 1♂1♀ (paratypes),



Figures 156–159. *Orthochirus semnanensis* sp. n., holotype male, metasoma IV–V and telson dorsal under UV light (156), metasoma and telson, lateral (157), dorsal (158), and ventral (159) views under white light.



**Figures 160–167:** *Orthochirus semnanensis* sp. n., holotype male. **Figures 160–163.** Carapace and tergites under UV light (160) and white light (161), and sternopectinal region and sternites under UV light (162) and white light (163). **Figures 164–167.** Left legs I–IV, retrolateral aspect.



**Figures 168–178.** *Orthochirus semnanensis* sp. n., holotype male, segments of pedipalps. Pedipalp chela, dorsal (168), external (169), and ventral (170) views. Pedipalp patella, dorsal (171), external (172), and ventral (173) views. Pedipalp femur and trochanter, dorsoexternal (174), internal (175), and ventral (176) views. Pedipalp chela, movable (177) and fixed (178) fingers dentate margins. The trichobothrial pattern is indicated in Figures 168–172, 174–175 (white circles).

leg. Saeed Abadi; Kord Abad Village, 31°44'27"N 53°55'47"E, 2135 m a. s. l. (Locality No. Ya-27), V.2016, 1♀ (paratype, Figs. 181–182, 186–188, 190, 192, 195–198, 212–221, Table 3), leg. Saeed Abadi; E of Taft, 31°44'N 54°13'E, 1542 m a. s. l., 7.IV.2004, 1♂juv. (paratype of *O. zagrosensis*), leg. V. Vignoli & P. Crucitti; Yazd Province, W of Baghdadabad, Taft, 31°35'N 54°24'E, 1502 m a. s. l., 9.IV.2004, 1♀ (paratype of *O. zagrosensis*), leg. V. Vignoli & P. Crucitti.

**ETYMOLOGY.** The species epithet is a patronym honoring the Italian arachnologist Valerio Vignoli, the collector of two specimens initially identified as *O. zagrosensis*.

**DIAGNOSIS** (♂♀). Total length of adults 29–44 mm. Trichobothrium  $d_2$  at pedipalp femur dorsal surface absent or reduced. Moderate tibial spurs present on third and fourth legs. Pectinal teeth number 19–22 in males and 18–20 in females. Movable finger of pedipalps with 7–8 rows of denticles, 7–8 ID and 5–8 OD. Dorsal carinae on pedipalp patella present and smooth. Metasoma V dorsal surface mesially smooth or with only several granules present. Metasoma I–II with 10 carinae, metasoma III with 8 carinae, metasoma IV–V with 2–4 carinae. Ventral carinae of metasoma I–III consist of a

row of large granules. Metasoma IV–V ventrally and laterally with punctation developed, spaces among punctae smooth; metasoma II–III ventrally and laterally granulated and bumpy with punctation reduced. Entire tergites roughly granulate at least in male. Sternite VII densely granulated, with granulate carinae developed. Pedipalp, metasoma and telson very sparsely hirsute, rather glabrous. Tarsomere I of legs with 4–6 bristles longer in female. Ratio length/width of metasoma V 1.30–1.32 in both sexes. Pedipalp femur length/width ratio 3.3–3.7 in both sexes.

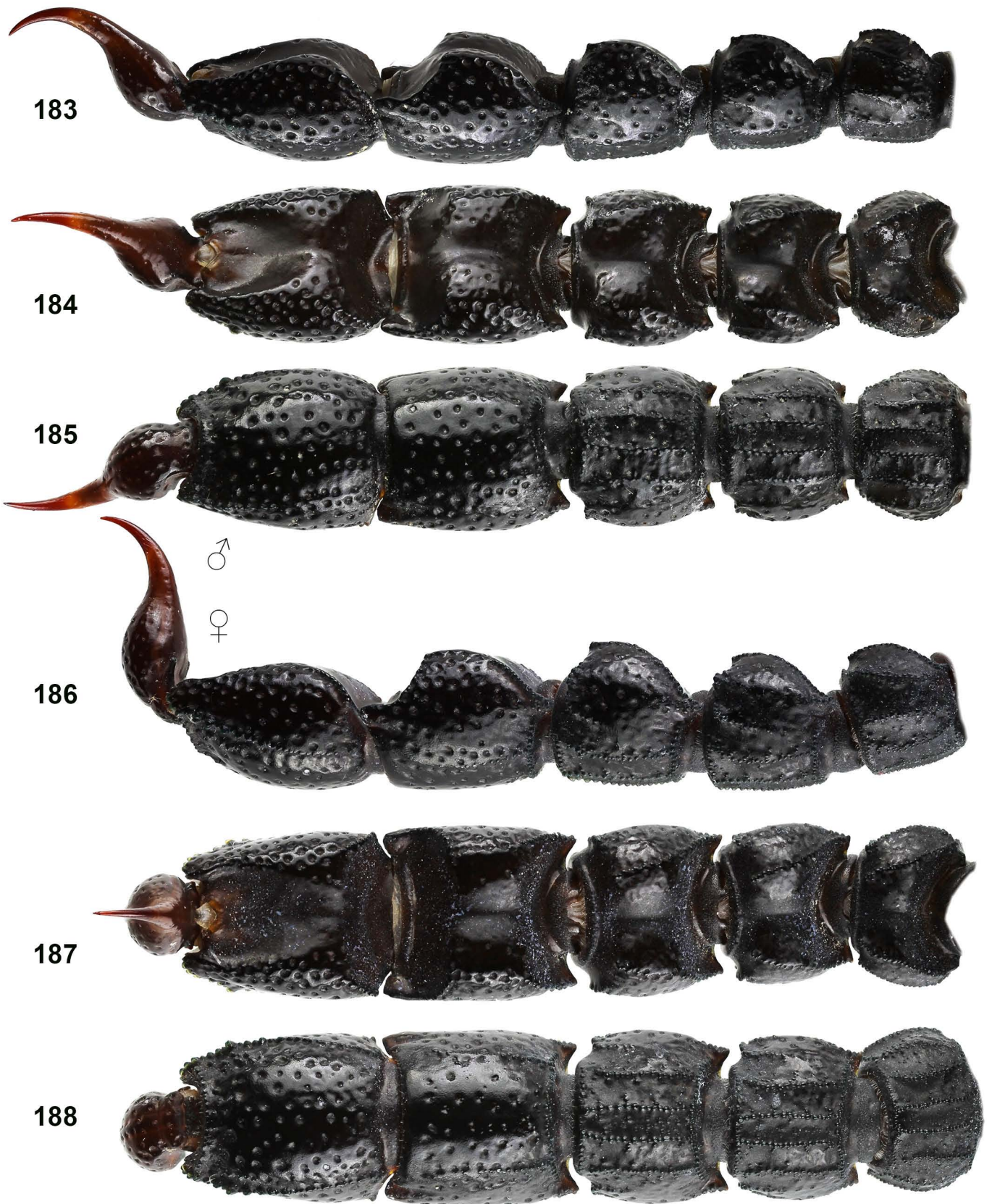
**DESCRIPTION.** Total length of adults 29–44 mm in both sexes. Measurements of the carapace, telson, segments of the metasoma and segments of the pedipalps are given in Table 3. For habitus see Figs. 179–182.

**Coloration** (Figs. 179–182). Carapace, tergites, metasoma and femur of pedipalp and legs usually black. Patella of pedipalps and legs reddish brown, with yellowish brown fingertips. Tarsomeres of legs yellow to yellowish brown. Sternite VII is black, other sternites reddish brown to black with yellow median area in posterior margin of sternites IV–VI. Telson reddish brown to black.

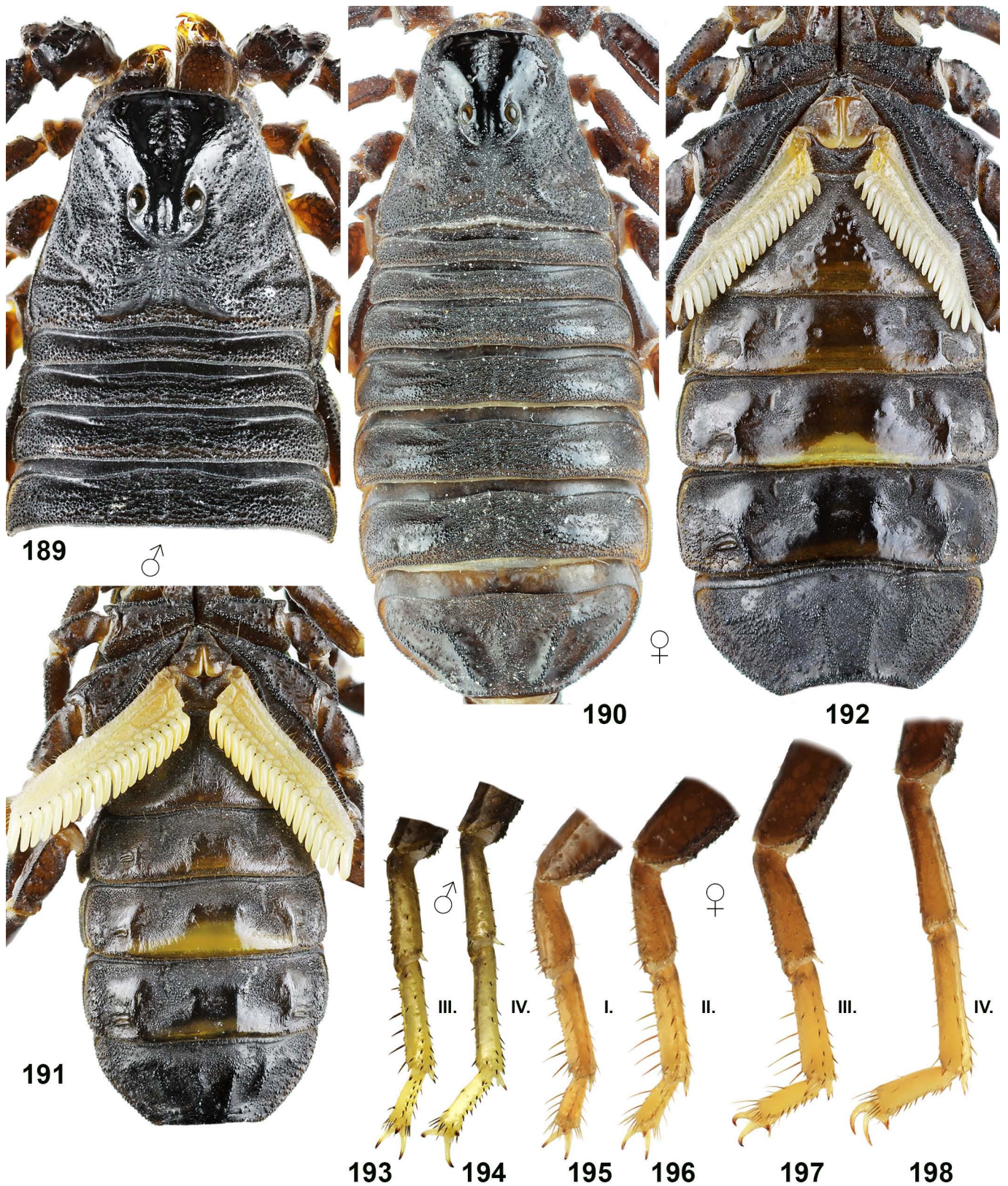




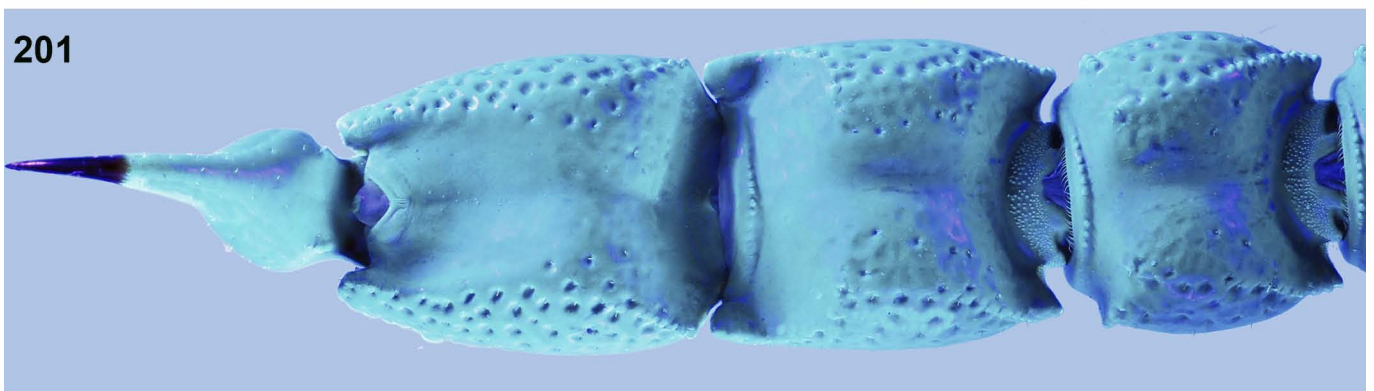
Figures 179–182: *Orthochirus vignolii* sp. n. Figures 179–180. Holotype male, dorsal (179) and ventral (180) views. Figures 181–182. Paratype female from locality Ya-27, dorsal (181) and ventral (182) views. Scale bar: 10 mm.



**Figures 183–188:** *Orthochirus vignolii* sp. n. **Figures 183–185.** Holotype male, metasoma and telson, lateral (183), dorsal (184), and ventral (185) views. **Figures 186–188.** Paratype female from locality Ya-27, metasoma and telson, lateral (186), dorsal (187), and ventral (188) views.



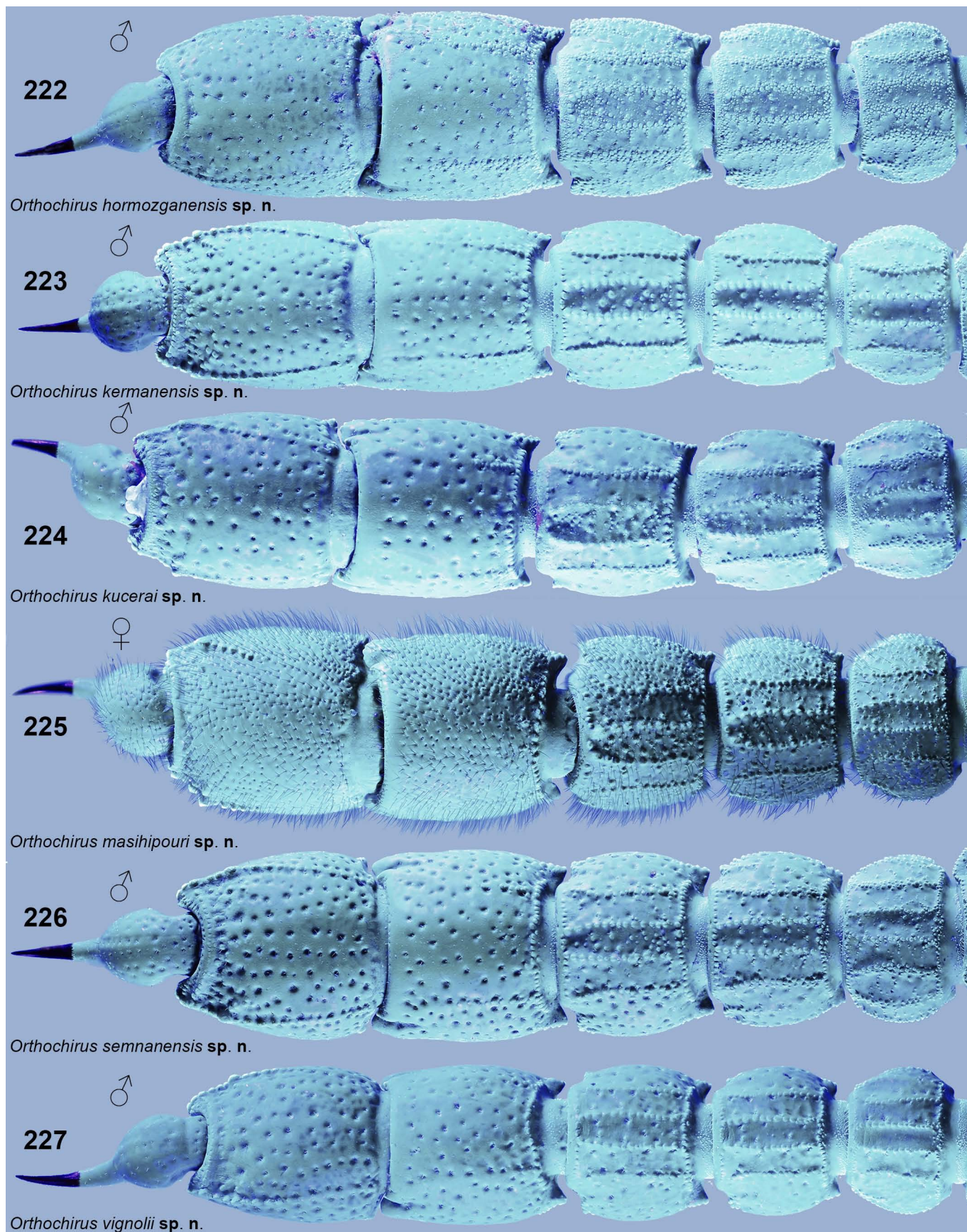
**Figures 189–198:** *Orthochirus vignolii* sp. n. **Figures 189, 191, 193–194.** Holotype male, carapace and tergites I–IV (189), sternopectinal region and sternites (191), distal segments of right legs III–IV, retrolateral views (193–194 respectively). **Figures 190, 192, 195–196.** Paratype female from locality Ya-27, carapace and tergites (190), sternopectinal region and sternites (192), and distal segments of right legs I–IV retrolateral aspect (195–198 respectively).



**Figures 199–201.** *Orthochirus vignolii* sp. n., holotype male, carapace and tergites (199), sternopectinal region and sternites (200), and metasoma and telson dorsal (201) under UV light.



**Figures 202–221:** *Orthochirus vignolii* sp. n., segments of pedipalps. **Figures 202–211.** Holotype male. Pedipalp chela, dorsal (202), external (203), and ventral (204) views. Pedipalp patella, dorsal (205), external (206), and ventral (207) views. Pedipalp femur and trochanter, dorsoexternal (208), internal (209) and ventral (210) views. Pedipalp chela, movable finger dentate margin (211). The trichobothrial pattern is indicated in Figures 202–206, 208–209 (white circles). **Figures 212–221.** Paratype female from locality Ya-27. Pedipalp chela, dorsal (212), external (213), and ventral (214) views. Pedipalp patella, dorsal (215), external (216), and ventral (217) views. Pedipalp femur and trochanter, dorsal (218), and ventral (219) views. Pedipalp chela, movable (220) and fixed (221) fingers dentate margins.



**Figures 222–227:** Metasoma and telson in ventral views under UV light, holotypes of newly described species. **Figure 222.** *Orthochirus hormozganensis* sp. n., male. **Figure 223.** *O. kermanensis* sp. n., male. **Figure 224.** *O. kucerai* sp. n., male. **Figure 225.** *O. masihipouri* sp. n., female. **Figure 226.** *O. semnanensis* sp. n., male. **Figure 227.** *O. vignolii* sp. n., male.

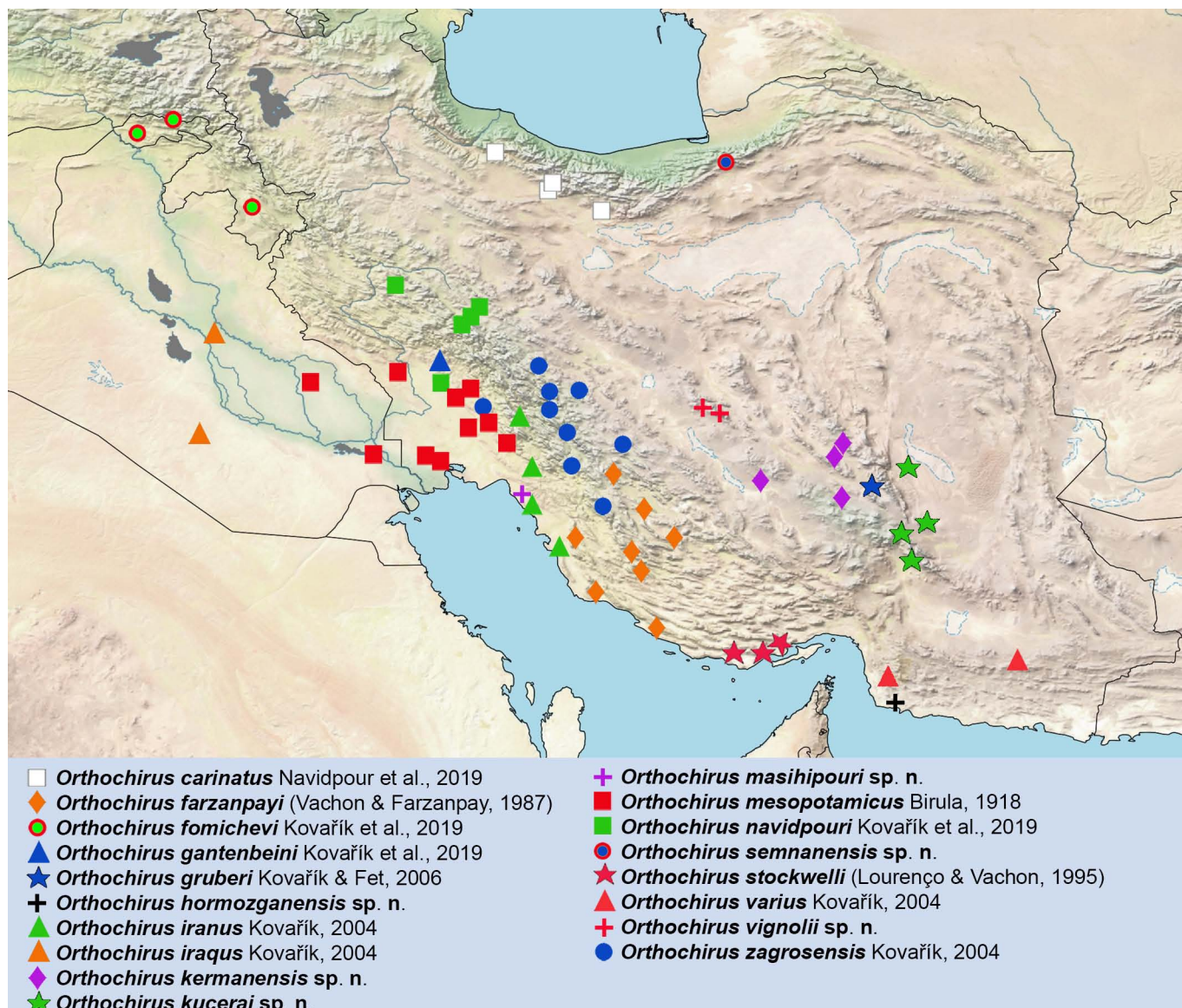


Figure 228. Geographic distribution of the *Orthochirus* spp. in Iran, Turkey and Iraq.

**Mesosoma and carapace** (Figs. 189–192, 199–200). Mesosoma with a median carina and is roughly granulated. Carapace is without carinae, roughly granulated except smooth interocular triangle. Sternites granulated except the median area in posterior margin. Pectinal teeth number 19–22 in males and 18–20 in females.

**Metasoma and telson** (Figs. 183–188, 201, 227). Metasoma I–II with 10 granulated carinae. Metasoma III–V lacks lateral carinae, ventromedian and ventrolateral carinae are present on metasoma I–III, dorsolateral carinae are present on metasoma I–III and strongly reduced to absent on metasoma IV–V. Ventral carinae of metasoma I–III consist of a row of large granules. Metasoma I is granulate laterally, metasoma II–V laterally smooth; granulation absent on dorsal surfaces of all metasomal segments. Punctuation on metasoma IV–V is ventrally and laterally developed, spaces among punctae are smooth. The entire metasoma and telson are glabrous, short, thin setae might issue from some punctae. Telson is shallowly

punctate and lacks granules.

**Pedipalps** (Figs. 202–221). Trichobothrium  $d_2$  on the dorsal surface of pedipalp femur is absent or reduced; trichobothrium  $e_1$  is situated in level with  $d_4$ . Femur of pedipalp with five granulate carinae. Patella has seven smooth carinae, and the chela has smooth carinae which may be discernible throughout the length of the fixed finger. The entire pedipalp only very sparsely hirsute. Movable fingers with 7–8 rows of denticles, 7–8 ID and 5–8 OD.

**Legs** (Figs. 193–198). Moderate tibial spurs present on third and fourth legs. Femur with four partly granulated carinae; patella with five rather smooth carinae; tibia is smooth. Patella with only a few bristles. Tibia with bristles on the outer side of legs I–II. Tarsomere I of first to third legs with 4–6 bristles which are longer in female, fourth legs usually lack bristles. Tarsomeres I–II of all legs with two rather irregular rows of bristles.

**Measurements.** See Table 3.

AFFINITIES. The described features distinguish *O. vignolii* sp. n. from all other species of the genus. They are recounted in the key below. *O. vignolii* sp. n. was confused with *O. zagrosensis* Kovařík, 2004, two here cited specimens of *O. vignolii* sp. n. from Yazd Province are part of type series of *O. zagrosensis*. However, these two morphologically very similar species differ by granulation of sternite VII (see key below).

### Key to *Orthochirus* of Iran, Turkey and Iraq

1. Metasoma V dorsal mesially densely granulated (figs. 159–160 in Kovařík et al., 2019: 27). ..... 2
  - Metasoma V dorsal mesially smooth or with several fine granules only (Fig. 134). ..... 4
2. Metasoma II–III ventrally and laterally smooth, without granules, punctate and bumpy (fig. 171 in Kovařík et al., 2019: 28). ..... *O. fomichevi* Kovařík et al., 2019
  - Metasoma II–III ventrally and laterally granulate (fig. 173 in Kovařík et al., 2019: 28). ..... 3
3. 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 are densely granulate (fig. 173 in Kovařík et al., 2019: 28). ..... *O. iranensis* Kovařík, 2004
  - Ratio length/width of metasoma V is in males 1.18–1.24. Ventral and lateral surfaces of metasoma IV–V are sparsely granulate (fig. 116 in Kovařík et al., 2019: 20). . ..... *O. mesopotamicus* Birula, 1918
4. Metasoma hirsute. .... 5
  - Entire metasoma glabrous (short, thin setae might issue from some punctae) (Figs. 222–224). ..... 8
5. Metasoma densely hirsute (Fig. 225). ..... 6
  - Metasoma sparsely hirsute. .... *O. gruberi* Kovařík & Fet, 2006
6. 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). 7
7. Pedipalp femur dorsal granulated (Fig. 149). Sternite VII densely granulated (136). ..... *O. mashipouri* sp. n.
  - Pedipalp femur dorsal 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)
8. Sternite VII smooth, without developed granulate carinae (fig. 156 in Kovařík et al., 2019: 27). ..... *O. iraqensis* Kovařík, 2004
  - Sternite VII usually at least partly granulated, always with four developed granulated carinae (Figs. 21 and 66). ... 9
9. Pedipalp movable finger dentition with 0–1 external (OD/OAD) denticles. .... *O. semnanensis* sp. n.
  - Pedipalp movable finger dentition with 3–9 external (OD/OAD) denticles. .... 10
10. Metasoma IV–V ventrally only shallowly punctate and in males punctation may be altogether absent. .... 11
  - Punctation on metasoma IV–V ventrally developed. .. 12
11. 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 irregularly in two or three rows. .... *O. hormozganensis* sp. n.
12. Tergites roughly granulated in middle but laterally smooth with several small granules at least in the male (Fig. 65). ..... *O. kermanensis* sp. n.
  - Entire tergites roughly granulated at least in the male (Fig. 160). ..... 13
13. Sternite VII densely granulated among carinae. .... 14
  - Sternite VII smooth medially with several solitary granules among carinae. .... 16
14. Pedipalp patella with dorsal carinae smooth. Anterior median part of carapace smooth, with granules medially only (Fig. 199). ..... 15
  - Pedipalp patella with dorsal carinae granulated. Anterior median part of carapace densely granulated. .... *O. navidpouri* Kovařík et al., 2019
15. Tarsi of third legs with 7–10 bristles, long in both sexes. .... *O. carinatus* Navidpour et al., 2019
  - Tarsi of third legs with 4–6 bristles, long in female and short in male. .... *O. vignolii* sp. n.
16. Pedipalp femur length/width ratio 4.1–4.3 in male, 3.3–3.5 in female. .... *O. kucerai* sp. n.
  - Pedipalp femur length/width ratio 2.7–3.0 in both sexes. .... 17
17. Tarsi of leg III with long bristles, which form a reduced bristlecomb. At least femur of legs dark. Pedipalp chela dark. .... *O. zagrosensis* Kovařík, 2004
  - Tarsi of leg III with short bristles, which do not form a bristlecomb. Legs usually yellow. Pedipalp chela yellow. .... *O. farzanpayi* (Vachon & Farzanpay, 1987)

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229



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**Figures 229–234:** Localities of *Orthochirus* spp., Iran. **Figures 229–230.** *O. hormozganensis* sp. n., Hormozgan Province, Bandare Jask-Bashagard road, 25°50'11.4"N 57°50'14.6"E, 146 m a. s. l. (229) and Jask to Minab road, 25°52'34.9"N 57°29'47.4"E, 46 m a. s. l. (230). **Figure 231.** *O. kucerai* sp. n., Kerman Province, Jamalizadeh and Ebrahimi; Shahdad, 30°29'06"N 57°48'28"E, 331 m a. s. l. **Figure 232.** *O. mashipouri* sp. n., Bushehr Province, Behbahan–Genaveh road, 29°40.71'N 50°24.04'E, 17 m a. s. l. **Figure 233.** *O. semnanensis* sp. n., Semnan Province, Garmsar, Ghasre-Bahram, 36°22'23"N 50°23'08"E. **Figure 234.** *O. vignolii* sp. n., Yazd Province, Kosk Abad village, 31°43'52"N 53°17'12"E, 2023 m a. s. l.

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