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New Species of the Digger Scorpions, *Odontobuthus* Vachon, 1950 (Buthidae) from Southern Iran

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Odontobuthus Vachon, 1950, with nine described species, is a genus of digger scorpions in the Buthidae family, which can be distinguished by having large tooth-like processes on the ventrosubmedian carinae of the second and third metasomal segments. Morphological and molecular investigation of coastal specimens from the Hormozgan province in Iran led to the discovery of a new species named *Odontobuthus persicus* sp. nov. that is described here. It is closely related to *O. chabaharensis* morphologically. The new *Odontobuthus* species has two large and conical tooth-like processes on ventrosubmedian carinae of the second and third metasomal segments, while *O. chabaharensis* has three or four medium to large tooth-like processes. Based on phylogenetic analysis using partial *COI* sequences, the new species is placed as a sister taxon of *O. brevidigitus*. Genetic differences with the other species of *Odontobuthus* (mean = 0.107) confirmed the validity of this species.

Key words: *Odontobuthus*, *COI*, Genetic distance, Hormozgan, Taxonomy

BACKGROUND

Odontobuthus Vachon, 1950 is a genus of scorpions in the Buthidae family. Members of this genus are diggers that rest in burrows during the day, leaving at night to hunt, but they do not go far from it. They are medium to large-sized scorpions with large tooth-like processes on ventrosubmedian carinae of the second and third metasomal segments (Lourenço and Pézier 2002; Lowe 2010; Barahoei et al. 2022). They are easily recognizable by this character and named based on this character (Vachon 1950; Dupré 2016).

Odontobuthus, with two species, was separated from *Buthus* by Vachon (1950). Now, this genus consists of nine species, of which six species are distributed in Iran (*Odontobuthus baluchicus* Barahoei et al., 2022, *Odontobuthus chabaharensis* Barahoei et al., 2022, *Odontobuthus doriae* Thorell, 1876, *Odontobuthus kermanus* Barahoei et al., 2022, *Odontobuthus tavighiae* Navidpour et al., 2013, *Odontobuthus tirgari* Mirshamsi et al., 2013), one species in Iraq and Iran (*Odontobuthus bidentatus* Lourenço & Pézier, 2002), one species in Pakistan and India (*Odontobuthus odonturus* Pocock, 1897), and one species in Oman and the United Arab Emirates (*Odontobuthus brevidigitus* Lowe, 2010) (Barahoei et al. 2020 2022). According to the literature, seven species have been described for this genus in the last two decades (Lourenço and Pézier 2002; Lowe 2010; Mirshamsi et al. 2013; Navidpour et al. 2013; Barahoei et al. 2022). The validity of all species was confirmed by Barahoei et al (2022).

The Zagros mountains' uplift led to lacertid lizards speciation (Macey et al. 1998). eological events in the south of Iran caused separation and speciation

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in terrestrial fauna; the same was happened for as the population of *Odontobuthus* species (Lowe 2010). For this reason, the greatest species diversity of *Odontobuthus* is in the south of Iran, where *O. tavighiae* and *O. baluchicus* have been described from the west and east of the Hormozgan province, respectively (Navidpour et al. 2013; Barahoei et al. 2022).

The purpose of this research was morphological and molecular investigation of specimens collected from the southern coast of Iran in Hormozgan province.

MATERIALS AND METHODS

Sampling locality

Hormozgan province, in the southern part of Iran, is located between 25°23'–28°57'N and 52°41'–59°15'E (http://www.hormozgan.doe.ir). Specimens were collected by digging in the day in the east of Bandar Abbas county, south of Iran (Fig. 1). Some samples were loaned from the Children's Hospital, Bandar Abbas, Hormozgan province, Iran (delivered by people who were stung by these scorpions).

Specimens were placed in 80% ethanol and deposited in the collection of the Research Institute of Zabol, Zabol, Iran (RIZ) and Zoological Museum, Ferdowsi University of Mashhad, Mashhad, Iran (ZMFUM).

Morphometric measurements done based on Stahnke (1970) and Sissom (1990) using a graduated lens mounted on an Optika stereo-microscope (Italy). Photography done using a Canon® EOS 800D digital camera (Japan). Photographes were edited with Adobe Lightroom version 6.0 and Adobe Photoshop CS5. A distribution map for type specimens of *Odontobuthus* species was constructed in SimpleMappr (https://www.simplemappr.net).

Molecular analysis

The DNA was extracted from the dissecting muscle tissue of legs using the Favorgen genomic DNA Extraction kit (Taiwan). The partial sequence of the

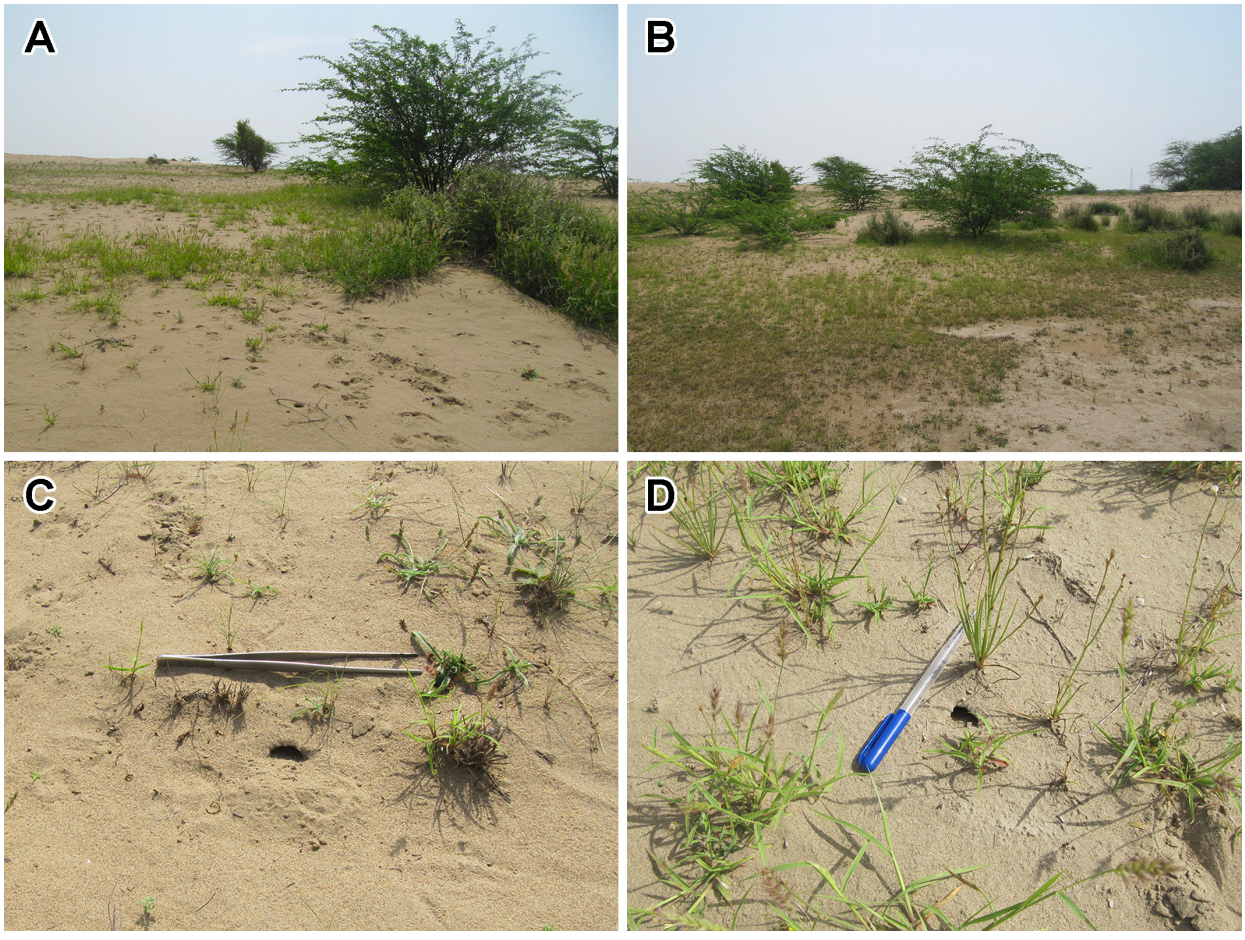

Fig. 1. Recorded occurrence of *Odontobuthus persicus* sp. nov.: A, B) General habitat, C, D) Nest entrance.

mitochondrial cytochrome *c* oxidase, subunit I (*COI*) gene, was amplified using LCO1490 and HCO2198 (Folmer et al. 1994) under a three-step thermocycling protocol (Barahoei et al. 2022). Each PCR reaction contained 12 µl of master mix (Ampliqon, Denmark), 8 µl deionized H_2O, 1 µl of each primer, and 3 µl of DNA template. Sequencing was carried out using a FlexCycler (Analytikjena, Germany).

Purification and sequencing of amplified genes were done by Niagene Noor Company (Tehran). Five new *COI* sequences were deposited in GenBank [ncbi.nlm.nih.gov] with the accession numbers PQ212541 to PQ212545.

Sequences were edited and aligned using Bioedit version 7.1.9 (Hall 1999). Genetic distances within and between species were investigated with MEGA 7.0 (Kumar et al. 2016). Bayesian inference (50.000.000 generations, burn-in = 5000) using MrBayes 3.2.7a (on the website http://www.phylo.org) and Maximum likelihood (10,000 iterations, with GTR+G substitution model) using PhyML 3.0 software (on the website http://www.atgc-montpellier.fr/phyml) (Guindon et al. 2010) were done. FigTree v1.4.0 was used in order to edit and view the generated trees (tree.bio.ed.ac.uk/software/figtree). *Buthus occitanus* (Amoreux 1789) and *B. paris* (C. L. Koch 1837) (the most primitive species), considered closely related to *Odontobuthus*, were used as outgroups.

RESULTS

Phylogenetic analysis

A phylogenetic tree was constructed based on 38 sequences of the genus *Odontobuthus* (33 from NCBI and five new) and two sequences of the genus *Buthus* as outgroups (Table 1). Sequence length was 627 bp, including 453 conserved (72.25%), 174 variable (27.75%), and 146 parsimonious (23.28%) nucleotides.

The trees generated using Maximum likelihood (ML) and Bayesian interference (BI) revealed that *O. kermanus* and *O. tirgari* were placed sister to all other *Odontobuthus* species, and the *Odontobuthus persicus* sp. nov. was found as youngest species and sister to *O. brevidigitus* (Fig. 2).

Genetic differences between this species and other *Odontobuthus* species (average distance = 0.107) (Table 2) supported the validity of this species. The intraspecific distance for this species is 0.012 (Table 2).

Among *Odontobuthus* members, the lowest genetic difference was between *O. kermanus* and *O. tirgari* (0.054), and the highest was between *O. persicus* sp. nov. and *O. doriae* (0.129) (Table 2).

TAXONOMY

Order Scorpiones C. L. Koch, 1837
Family Buthidae C. L. Koch, 1837
Genus *Odontobuthus* Vachon, 1950

Odontobuthus persicus sp. nov.

(Figs. 3, 4, Table 3)
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Type material: *Holotype*: ♀ (Figs. 3, 4), IRAN, Hormozgan Province, Bandar Abbas County, Baghu village, 27°19'N, 56°27'E, 15 m a.s.l (Fig. 1), daytime excavation, 09 March 2013, leg. M. Shahi (RIZ-Odo-015).

Paratypes: Hormozgan Province: 1♀ (RIZ-Odo-012), Bandar Abbas County, Baghu village, 27°19'N, 56°27'E, 15 m a.s.l, 2014, leg. H. Ahmadi; 1♂ (RIZ-Odo-004), 26 August 2015, leg. A. Jafari; 1♂ (RIZ-Odo-065) (Figs. 5, 6), 06 January 2023, leg. M. Moradi and M. Shahi; 1♀ subadult (RIZ-Odo-113), 04 March 2023, leg. M. Shahi - 1♂ (RIZ-Odo-063), Jallabi village, 27°20'N, 56°31'E, 22 m a.s.l, 14 June 2022, leg. M. Shahi; 1♂ (RIZ-Odo-059) (Fig. 7), 13 August 2022, leg. M. Shahi; 1♂ (RIZ-Odo-058), 14 September 2022, leg. M. Ghoreyshi; 2♀, 1♂ (RIZ-Odo-057), 27 October 2022, H. Barahoei and M. Shahi.

Etymology: The species name is derived from the term 'Persia' that has been used for centuries and originated from a region of southern Iran formerly known as Persis.

Diagnosis: Scorpions of small to medium size, adults ranging from 48.7–57 mm in females and 55.1–62.5 mm in males; general colouration light yellow; dentate margins of fixed and movable fingers of pedipalps with 10–12 rows of oblique denticles; pectinal teeth 31–33 in males and 21–23 in females; ventrosubmedian carinae of metasomal segments II–III with two pairs of large tooth-like processes; metasomal segment IV L/W 1.62–2.05; ventrolateral carinae of metasomal segment V with two strong lobate denticles; lateral anal arch armed with three strong lobes; posterior ventral margin of metasomal segment V with two large lobes; small and wide telson (L/W 2.38–2.72; L/D 2.48–2.85), oval vesicle (L/W 1.25–1.59; L/D 1.33–1.66; W/D 1.03–1.07) (Table 3).

Description: Female holotype (ZMFUM-Odo-015) (Figs. 3, 4)

Colour: Light brown to yellow, median and lateral eyes and end of telson dark, other parts yellow (Fig. 3).

Chelicerae: Two basal denticles on the ventral surface of the fixed finger, with equally sized external and internal distal denticles.

Table 1. Data from scorpion specimens that were used for sequencing the *COI* gene and NCBI sequences of *Odontobuthus* spp. and two species of *Buthus* as outgroups

Species	Collection	Locality	GenBank
O. bidentatus Lourenço & Pézier, 2002	ZMFUM	IRAN, Fars Province	KF701317
		IRAN, Khuzestan Province	KF701314 MW655776
		IRAN, Bushehr Province	MW655752
O. baluchicus Barahoei et al., 2022	ZMFUM	IRAN, Sistan and Baluchistan Province	MW655753 MW655754 MW655755
		IRAN, Hormozgan Province	MW655756
O. brevidigitus Lowe, 2010	AMCC, ZMFUM	OMAN	MW655773 MW655777 MW655778
O. chabaharensis Barahoei et al., 2022	ZMFUM	IRAN, Sistan and Baluchistan Province	MW655757 MW655758
O. doriae Thorell, 1876	AMCC, ZMFUM	IRAN, Yazd Province	MW655779
		IRAN, Tehran Province	MW655780
		IRAN, Semnan Province	MW655795
O. kermanus Barahoei et al., 2022	AMCC, ZMFUM	IRAN, Kerman Province	KF701326 MW655759 MW655760 MW655775
O. odonturus Pocock, 1897	AMCC	PAKISTAN	MW655781 MW655782 MW655783 MW655784
O. persicus sp. nov.	RIZ-Odo-57A RIZ-Odo-57B RIZ-Odo-57C RIZ-Odo-058	IRAN, Hormozgan Province, Jallabi village	PQ212541 PQ212542 PQ212543 PQ212544
	RIZ-Odo-063	IRAN, Hormozgan Province, Baghu village	PQ212545
O. tavighiae Navidpour et al., 2013	ZMFUM	IRAN, Hormozgan Province	MW655761 MW655762
		IRAN, Fars Province	MW655763 MW655764
O. tirgari Mirshamsi et al., 2013	ZMFUM	IRAN, Razavi Khorasan Province	KF701319 KF701322
		IRAN, Sistan and Baluchistan Province	MW655765 MW655768
		IRAN, South Khorasan Province	MW655766
B. paris (C.L. Koch, 1837)	-	MOROCCO	KF548111
B. occitanus (Amoreux, 1789)	-	SPAIN	GQ168524

AMCC: Ambrose Monell Cryocollection at the American Museum of Natural History.

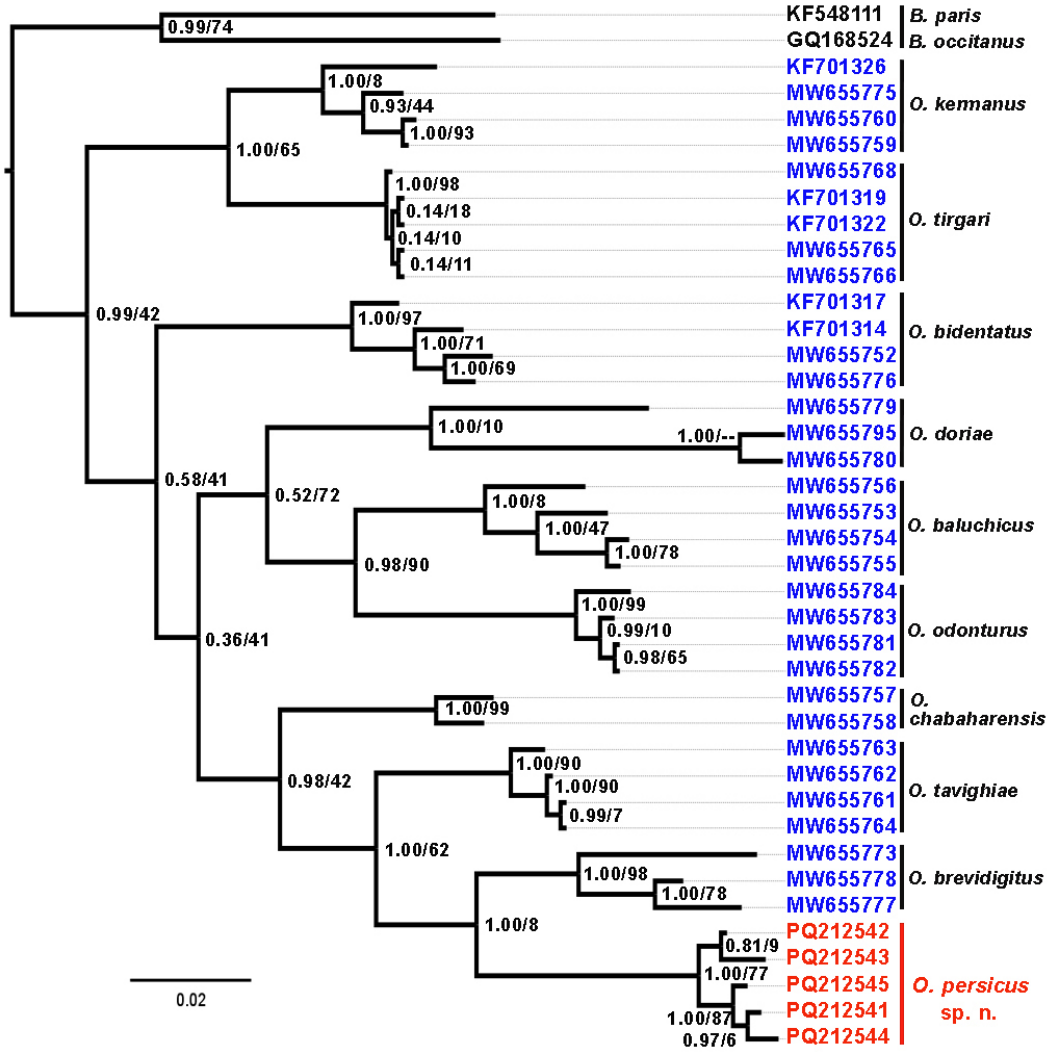

Fig. 2. Bayesian inference tree obtained by sequences of mitochondrial *COI* gene from *Odontobuthus*. Two sequences of the genus *Buthus* were used as outgroups. The numbers above branches represent posterior probability and bootstrap values from Bayesian inference and maximum likelihood analyses, respectively.

Table 2. Average Kimura 2-parameter (K2P) genetic distance among and within (bold) species of *Odontobuthus* and two species of *Buthus* based on *COI* gene sequences

	1	2	3	4	5	6	7	8	9	10	11
1. *O. bidentatus*	**0.023**										
2. *O. baluchicus*	0.092	**0.029**									
3. *O. brevidigitus*	0.100	0.103	**0.040**								
4. *O. chabaharensis*	0.092	0.095	0.083	**0.017**							
5. *O. doriae*	0.123	0.118	0.128	0.114	**0.012**						
6. *O. kermanus*	0.102	0.099	0.109	0.106	0.126	**0.021**					
7. *O. odonturus*	0.100	0.084	0.109	0.100	0.118	0.107	**0.009**				
8. *O. persicus* sp. nov.	0.113	0.110	0.082	0.088	0.129	0.119	0.127	**0.012**			
9. *O. tavighiae*	0.086	0.098	0.077	0.079	0.112	0.093	0.115	0.086	**0.006**		
10. *O. tirgari*	0.098	0.090	0.110	0.104	0.118	0.054	0.107	0.110	0.093	**0.0**	
11. *B. paris*	0.129	0.122	0.129	0.115	0.137	0.124	0.126	0.125	0.128	0.117	-
12. *B. occitanus*	0.107	0.144	0.132	0.127	0.134	0.114	0.123	0.135	0.119	0.126	0.129

Pedipalps: Femur: three times longer than wide with four complete granular carinae; intercarinal surfaces smooth. Patella: 2.71 times longer than wide. Chela: three times longer than manus; manus wider than patella; fingers not very long, 1.9 times longer than manus; number of primary denticle subrows: fixed finger 10 right, 10 left; movable finger 10 right, 10 left; all oblique rows of denticles except proximal flanked by external and internal accessory granules; movable finger with five subdistal granules, one internal and four external; trichobothrium *et* adjacent to the mid part of denticle subrow 6; *est* adjacent to proximal end of denticle subrow 8.

Carapace: Trapezoid shaped; ocular tubercle located on anterior half of prosoma, five pairs of lateral ocelli; wider than long (CWA/CL:0.71; CWP/CL: 1.15); carination developed, central lateral and posterior median carinae completely aligned; anteromedian and posteromedian sulcus shallow; posterolateral furrow wide and curved (Fig. 4A).

Mesosoma: Tergites I–VI tricarinate; tergite VII pentacarinate, median carinae on tergite VII granulate, incomplete in posterior one-third (Fig. 4A); sternites III–VI without carinae; sternite VII with four moderately developed carinae (Figs. 3B, 4B); pectines not extending beyond the coxa-trochanter joint of the leg IV; with three marginal and seven median lamellae; fulcra present; pectinal tooth count 23|23; sternum type *I* sub-pentagonal and longer than wide with a deep median depression; genital operculum completely divided longitudinally (Figs. 3B, 4B).

Legs: Ventral surface of tarsi with two rows of fine setae, legs III–IV with tibial spurs, legs III–IV with 17–18 and 4–5 long setae on the tarsus, respectively (Fig. 3).

Metasoma: Segment I with 10 carinae; segment II–IV with eight carinae; median lateral carinae of segment II nearly complete; lateral inframedian carinae of segment III incomplete and present only on posterior half with four separate granules; ventral carinae on segments II–III strongly dentate with two distinct posterior conical denticles (Fig. 4C–E); anterior ventral margin of segments III–IV with six large and conical denticles; segment V with five carinae; ventrolateral carinae on segment V dentate without large posterior denticles; ventral posterior margin of metasomal segment V with two large conical denticles; lateral anal arch with three large separate conical lobes (Fig. 4D–E).

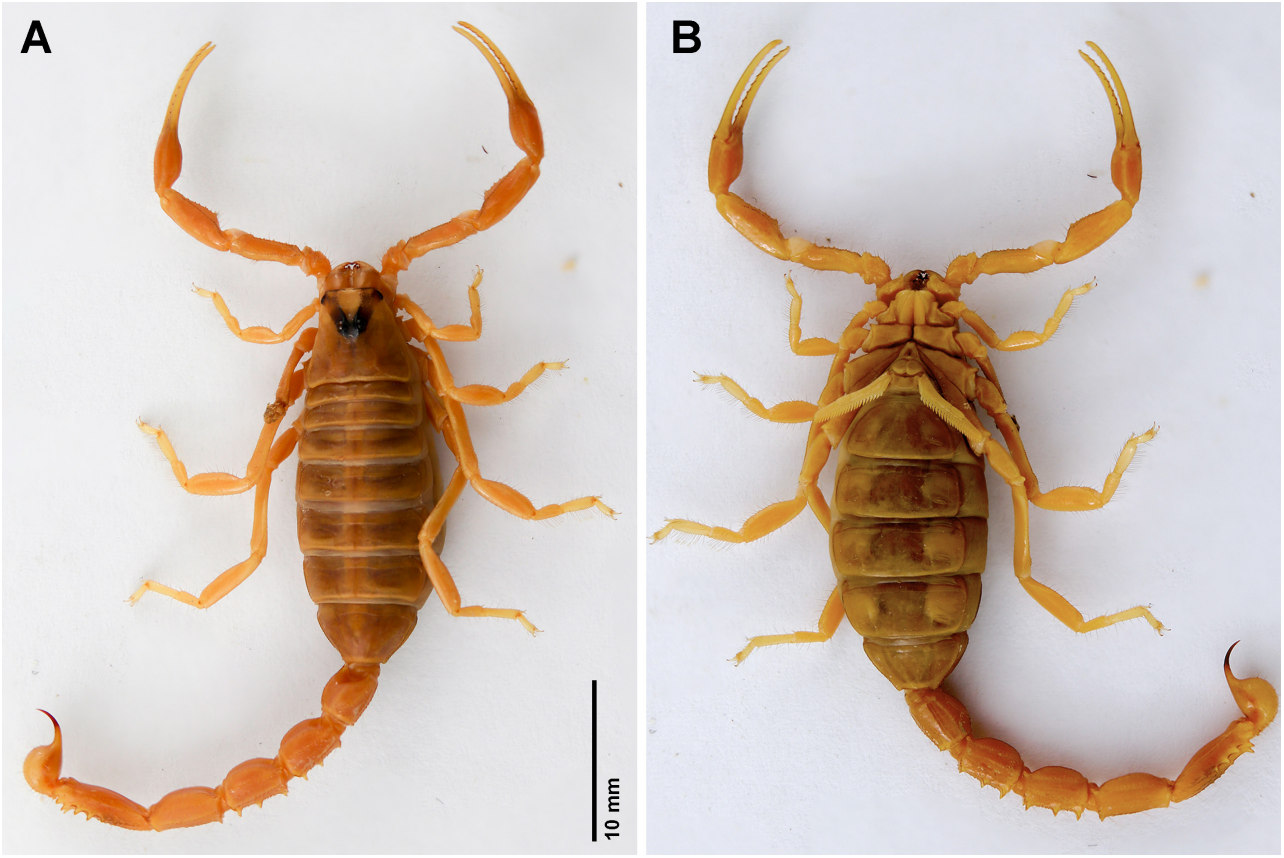

Fig. 3. Female specimen of *Odontobuthus persicus* sp. nov. A) dorsal view, B) ventral view (RIZ-Odo-015).

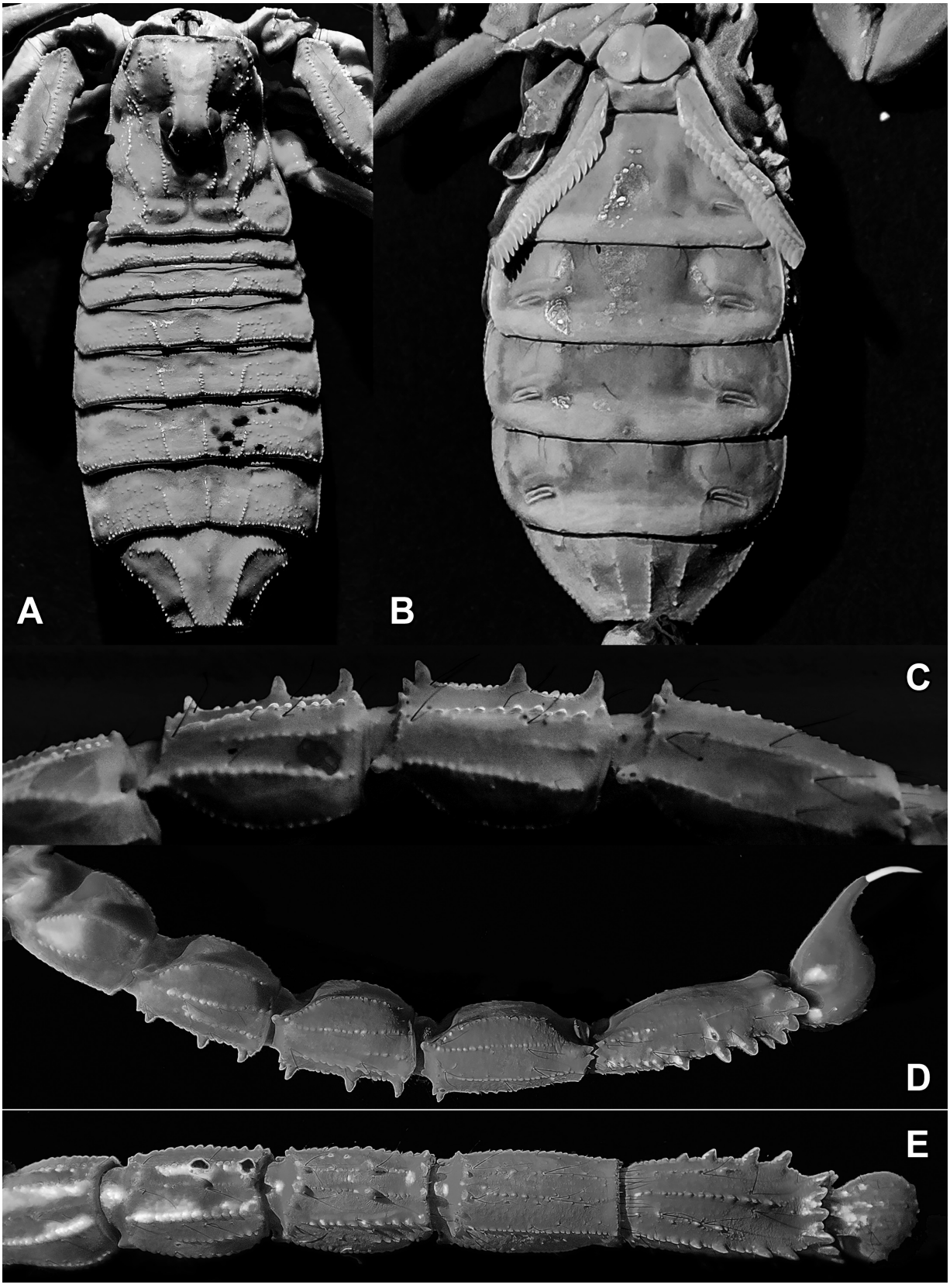

Fig. 4. Female specimen of *Odontobuthus persicus* sp. nov. A, carapace and tergites; B, sternites; C, lateral view of metasomal segments II and III; D, lateral view of metasomal segments and telson, E) ventral view of metasomal segments and telson (RIZ-Odo-015).

Table 3. Morphometric data of *Odontobuthus persicus* sp. nov.

Dimensions (mm)			*Odontobuthus persicus* sp. nov.					
			12 ♀	**15** ♀	**57** ♀	**04** ♂	**59** ♂	**65** ♂
Pedipalp	Femur	L	5.8	4.8	5.2	5.7	6.2	6.7
		W	2	1.6	1.7	1.7	1.7	1.9
	Patella	L	6.7	5.7	6.3	6.6	7.1	7.5
		W	2.2	2.1	2.1	2.3	2.3	2.4
	Manus	L	4.3	3.7	3.9	3.9	4.5	5
		W	2.5	2.2	2	2.3	2.5	3.2
		D	2.8	2.4	2.2	2.5	2.7	3.6
	Movable finger	L	8	7.2	7.6	7.6	8.1	9
Carapace		L	7.1	5.9	6	6.6	7	7.6
		WA	5.2	4.2	4.3	4.6	5.7	5.2
		WP	8.8	6.8	7	7.6	7.8	8.6
Mesosoma	Total	L	14.2	13	12.7	12.6	14.2	15
	Tergite 4	W	10.6	8.5	8.5	8.5	9.6	10.3
Metasomal Segments	I	L	4.5	3.8	3.5	4	4.7	5
		W	4.4	3.3	3.5	4.5	4.6	4.5
		D	3.6	2.7	3	3.6	3.8	3.7
	II	L	5	4.3	4.2	5.1	5.2	5.7
		W	4.2	3	3.2	4.1	4.1	4
		D	3.5	2.6	2.8	3.7	3.7	3.5
	III	L	5.3	4.4	4.5	5.5	5.5	6
		W	4	2.8	3.1	3.9	3.8	3.6
		D	3.5	2.6	2.8	3.8	3.7	3.5
	IV	L	6	5	5.3	6.7	6.6	7.2
		W	3.7	2.8	3	3.5	3.5	3.5
		D	3.1	2.4	2.6	3.3	3.4	3.2
	V	L	7.5	6.5	6.5	7.8	7.7	8.1
		W	3.5	3.1	2.6	3	3.1	3.1
		D	2.7	2.1	2.2	2.9	3	2.8
Telson	Vesicle	L	4.4	3.6	3.5	4.1	4.2	4.7
		W	3.4	2.6	2.2	2.9	3	3.2
		D	3.3	2.5	2.1	2.8	2.8	3.1
	Aculus	L	3	2.6	2.5	2.7	2.8	3.2
Pectinal teeth	Left	No.	23	23	21	32	32	31
	Right	No.	23	23	21	33	32	32
Chela Denticle Row Number	Movable finger	Left	10	10	10	10	11	12
		Right	10	10	10	10	11	12
	Fixed finger	Left	10	10	10	10	10	11
		Right	10	10	10	10	10	-
Total length			**57**	**49.1**	**48.7**	**55.1**	**57.9**	**62.5**

D: depth, L: length, W: width, WA: wide in anterior part, WP: wide in posterior part.

Telson: Oblong-ovoid, with dorsal surface flat (TD/TL: 0.40; TW/TL: 0.41); ventral surface of telson smooth; not wider than metasomal segment V (TW/Mt(V)W: 0.84) (Fig. 4D–E).

Measurements (holotype: ZMFUM-Odo-015): Given in the table 3.

Male (paratype: RIZ-Odo-065) (Figs. 5, 6)

Same as female [holotype] with differences below:

Femur: 3.5 times longer than wide; patella: 3.1 times longer than wide; manus wider than patella; fixed finger, 11 left; movable finger 12 right, 12 left; trichobothrium *et* adjacent to denticle subrow 7; *est* adjacent to denticle subrow 9; Carapace wider than long (CWA/CL: 0.68; CWP/CL: 1.13) (Fig. 6A); pectinal tooth count 31|32 (Figs. 5B, 6B, Table 3); Telson narrower than female (TD/TL: 0.39; TW/TL: 0.40); wider than metasomal segment V (dorsal part wide) (TW/Mt(V)W: 1.03) (Fig. 6C, Table 3).

Measurements: Given in the table 3.

Distribution: Hormozgan province, south of Iran.

Affinities: *Odontobuthus persicus* sp. nov. is separated from *O. baluchicus*, *O. doriae*, *O. kermanus*, and *O. tirgari* by having three long triangular lobes (Figs. 4D, 6C) in the lateral part of the anal arch (against two lobes, figs. 7A, 13A, 20A, 20C, 20F in Barahoei et al. 2022). This species can be distinguished from *O. bidentatus* and *O. tavighiae* by having two large lobes in the ventral part of the 5th metasomal segment (Fig. 4E) against four to six short lobes (figs. 21A, 21E in Barahoei et al. 2022). In addition, this species has 10–12 rows of oblique teeth on the movable finger of the manus, while the above two species have 13–14 rows of oblique teeth. *Odontobuthus persicus* sp. nov. is smaller than all the species mentioned above and lives in low altitudinal, coastal areas, whereas all other species mentioned above are found in mountainous areas.

This species can be distinguished from *O. brevidigitus* by having a narrow manus and a relatively long movable finger (Fig. 3) against a short and wide movable finger in *O. brevidigitus* (fig. 16A–D in Barahoei et al. 2022). *O. brevidigitus* is also distributed in Oman and UAE, but there are no records from Iran (Lowe 2010).

The anal arch of metasomal segment V of *O. odonturus* has six reduced lobes (figs. 16E and 21D in Barahoei et al. 2022) and is distributed in India and Pakistan, while the anal arch has two distinct lobes in *O. persicus* sp. nov. (Fig. 4E), which is only distributed in

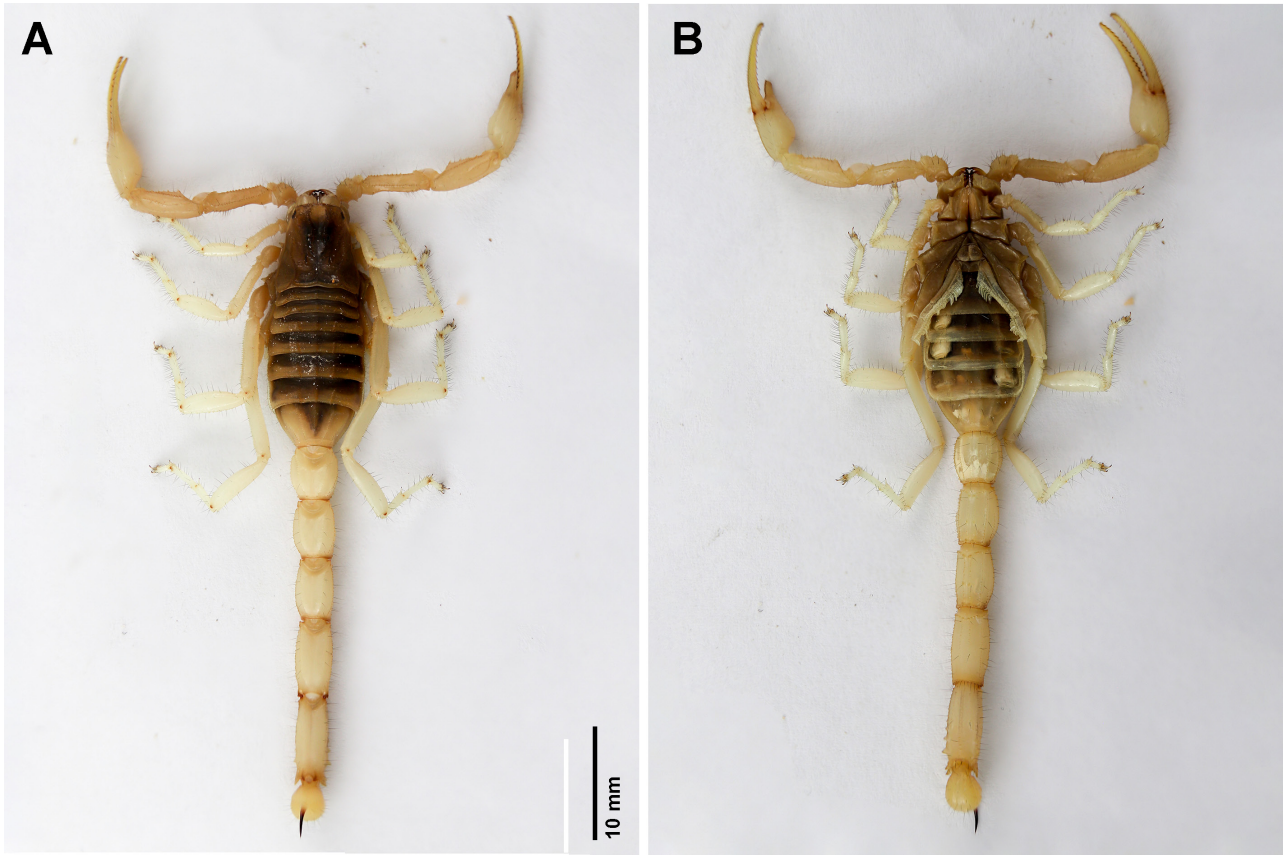

Fig. 5. Male specimen of *Odontobuthus persicus* sp. nov. A) dorsal view, B) ventral view (RIZ-Odo-065).

Fig. 6. Male specimen of *Odontobuthus persicus* sp. nov. A, carapace and tergites I–VI; B, sternites; C, lateral view of metasomal segment IV and V and telson (RIZ-Odo-065).

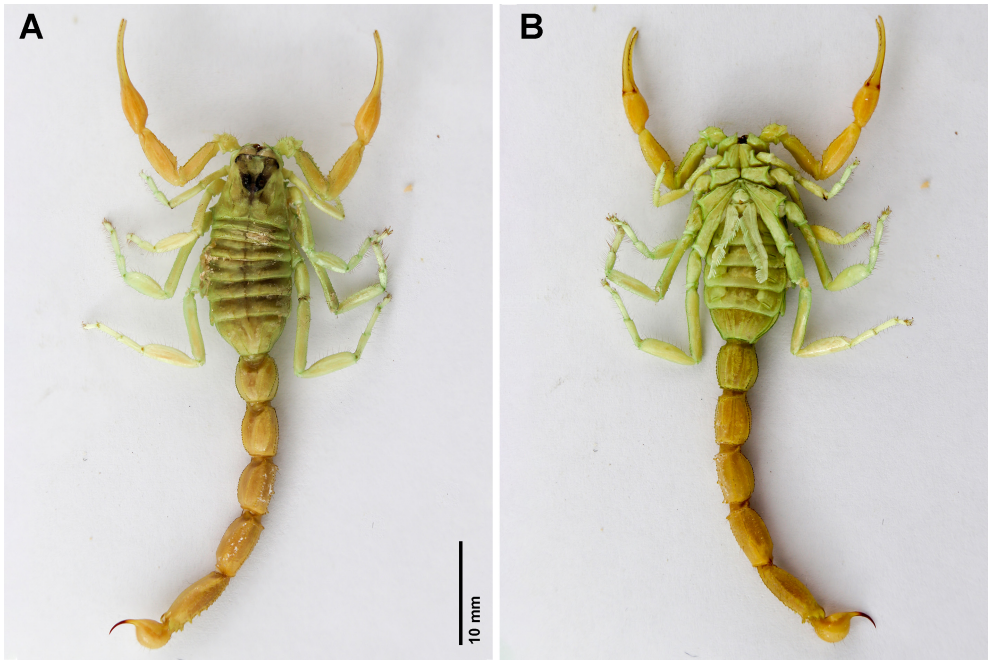

Fig. 7. Male specimen of *Odontobuthus persicus* sp. nov. A, dorsal view; B, ventral view (RIZ-Odo-059).

southern Iran.

Odontobuthus persicus sp. nov. is similar (in all traits mentioned above) to *O. chabaharensis* Barahoei et al., 2022 (Fig. 8). *Odontobuthus persicus* sp. nov. has two large and conical tooth-like processes on ventrosubmedian carinae of the second and third metasomal segments (Fig. 4C–E), while *O. chabaharensis* has three or four medium to large tooth-like processes (Fig. 8B–C). The carinae of the mesosomal tergites (especially tergites V and VI) in males of *O. persicus* sp. nov. project beyond the posterior margin as spiniform processes (Fig. 6A), while this character is not present in *O. chabaharensis* (Fig. 8A). The number of pectinal teeth in female specimens ranges between 21–23 in *O. persicus* sp. nov. (Table 3) and 18–20 in *O. chabaharensis*.

Updated identification key for the *Odontobuthus* species

1. Anal arch of metasomal segment V with two lateral lobes 2
- Anal arch of metasomal segment V with three lateral lobes 4
2. Ventrosubmedian carinae of metasomal segment II with three pairs of tooth-like processes; Occurs in North of Iran .. *O. doriae*
- Ventrosubmedian carinae of metasomal segment II with 4–5 pairs of tooth-like processes 3
3. Metasomal segment I longer than wide; Boly length of Adults 66–68 mm in males and 56–82 mm in females; Occurs in the southeast of Iran ..... *O. baluchicus*
- Metasomal segment I equal to or wider than long; Boly length of Adults 43–55 mm in males and 48–68 mm in females; Occurs in south central of Iran ..... *O. kermanus*

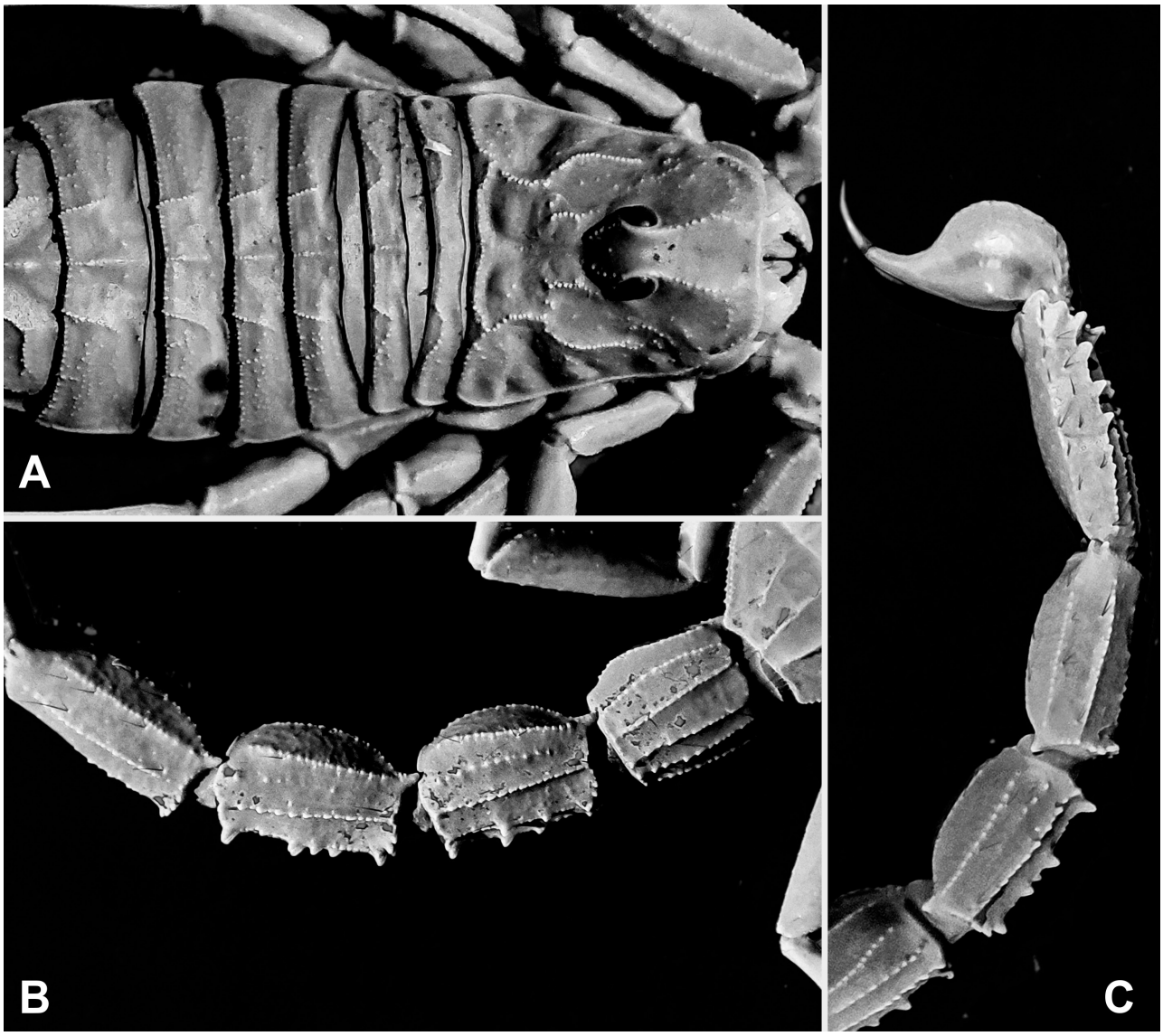

Fig. 8. Male specimen of *Odontobuthus chabaharensis* Barahoei et al., 2022, A, carapace and tergites I–IV; B, pedipalp; C, lateral view of metasomal segments II and III; D, lateral view of metasomal segment V and telson (RIZ-Odo-051).

4. Anal arch of metasomal segment V with two large and one small lateral lobes; Color greenish brown; Ventrosubmedian carinae of metasomal segment III with 4–5 pairs of tooth-like processes; Occurs in east of Iran ..... *O. tirgari*
- Anal arch of metasomal segment V with three large lateral lobes; Color light brown to yellow; Ventrosubmedian carinae of metasomal segment III with 2–3 pairs of tooth-like processes .. 5
5. Color light brown; Movable finger of pedipalp chela with 13–14 subrows; Metasomal segment I equal to or wider than long; Ventrosubmedian carinae of metasomal segments II and III with two pairs of tooth-like processes 6
- Color yellow; Movable finger of pedipalp chela with 10–12 subrows; Metasomal segment I longer than wide; Ventrosubmedian carinae of metasomal segments II and III with three or more pairs of tooth-like processes 7
6. Anal arch of metasomal segment V with four reduced ventral lobes; Occurs in west to southwest of Iran and east of Iraq .... *O. bidentatus*
- Anal arch of metasomal segment V with six reduced ventral lobes; Occurs in the south of Iran ..... *O. tavighiae*
7. Anal arch of metasomal segment V with six ventral lobes; Boly length of adults length less than 50 mm; Occurs in India and Pakistan countries ..... *O. odonturus*
- Anal arch of metasomal segment V with two distinct triangular lobes; Boly length of adults more than 50 mm 8
8. Pedipalp chela movable finger short relative to chela manus (MFL/ML = 1.40–1.75); Pectinal tooth count 20–25 in females; Occurs in Oman and United Arab Emirates ..... *O. brevidigitus*
- Pedipalp chela movable finger long relative to chela manus (MFL/ML = 1.80–2.30); Pectinal tooth count 18–23 in females; Occurs in Iran 9
9. Ventrosubmedian carinae of metasomal segments II and III with three or more pairs of tooth-like processes; The carinae of mesosomal tergites not project beyond the posterior margin of tergits; Pectinal tooth count 18–20 in females .... *O. chabaharensis*
- Ventrosubmedian carinae of metasomal segments II and III with two pairs of large and conical tooth-like processes; The carinae of mesosomal tergites V and VI project beyond the posterior margin as spiniform processes in males; Pectinal tooth count 21–23 in females ..... *O. persicus* sp. nov.

DISCUSSION

Prior to the present study, *Odontobuthus* had nine described species (Barahoei et al. 2022). With investigation of the specimens collected from the southern coast of Iran (Fig. 9), a tenth species is here described as *O. persicus* sp. nov.

The four species of coastal areas, including *O. brevidigitus*, *O. chabaharensis*, *O. persicus* sp. nov.,

Fig. 9. Type locality for the *Odontobuthus* species known and described from Iran.

and *O. odonturus*, are more similar to each other and are small to medium-sized scorpions (less than 65 mm). Populations of *O. odonturus* and *O. brevidigitus* are distributed in the southern coast of Pakistan and coast of Oman and the United Arab Emirates, respectively (Fig. 9). Two species from Iran, including *O. chabaharensis* and *O. persicus* sp. nov. are distributed in the southeastern (Chabahar) and southern (Bandar Abbas) coasts of Iran (Fig. 9). These two species dig nests in silty clay soil (Fig. 1).

Odontobuthus persicus sp. nov. exhibits morphological differences (Table 3) and a suitable genetic distance from other species (Table 2). This species was placed in a clade with *O. brevidigitus* which was the sister to *O. tavighiae*. *Odontobuthus persicus* sp. nov. has the lowest interspecific genetic distance between these two species (0.082 and 0.086, respectively). Is it compatible with the biogeographic scenario which has been represented by Lowe (2010).

Morphologically, however, it is most similar to *O. chabaharensis*, and the genetic distance between *O. persicus* sp. nov. and *O. chabaharensis* is 0.088. The colour of living specimens is light yellow. The blackness in the mesosoma of the male specimen (Figure 5) is the result of dead tissue.

CONCLUSIONS

The investigation of digger scorpions collected from the coast of the Hormozgan province, in the south of Iran, led to the description of the tenth species of the genus *Odontobuthus*, named as *O. persicus* sp. nov. Determination of the distribution of this species is useful and necessary for the prevention of scorpion stings and treatment management.

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