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Article

Oribatid mites (Acari: Oribatida) from southeastern Iran, with supplementary description of *Verachthonius* cf. *laticeps* (Brachychthoniidae)

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ABSTRACT
A survey was conducted on the fauna of oribatid mites (Oribatida) in Sistan and Baluchestan province (southeastern Iran). In total, 23 species belonging to 20 genera and 15 families were collected and identified. According to the results, Cosmochthoniidae, Haplochthoniidae, Galumnidae, *Cosmochthonius*, and *Haplochthonius* are the families and genera with the highest number of species. *Sellnickochthonius immaculatus* (Forsslund, 1942) and *Verachthonius* cf. *laticeps* (Strenzke, 1951) are newly recorded for the fauna of Iran. Additional morphological information and new illustrations of the latter species are provided on the basis of new material.

KEYWORDS: Fauna, identification key, new record, Palaearctic, Sistan and Baluchestan, *Verachthonius*.

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INTRODUCTION

According to the checklist presented by Akrami (2015), 380 species, 191 genera and 86 families belonging to suborder Oribatida, from 23 provinces out of 33 provinces of Iran are reported. The Sistan and Baluchestan (25° 03'–31° 27' N, 58° 50'– 63° 21' E), as the second largest province of Iran, is comprised of two different land structures. In the north, the lowland of Dasht-e Sistan formed by Hirmand alluvium holds the largest freshwater lake in the country. Strong winds are another distinct feature of the region, with constant 120-windy days during summer (Miri *et al.* 2007). The southern part is mostly mountainous with a variety of climates affected by the Makoran highlands (with a peak of about 4000 m. a.s.l) which extends into the Oman sea.

To date, only a single species of oribatid mites, *Bicyrthermannia duodentata* Hammer, 1979 (Nanhermanniidae) is recorded from the Sistan and Baluchestan province (Akrami 2015). No further investigation was carried out bearing the contribution to the knowledge of the suborder Oribatida in this region. The present work is the first comprehensive study on the fauna of Oribatida emphasizing the northern area of Sistan and Baluchestan province.

The main and primary purpose of the present work was to provide significant knowledge of the oribatid mites recorded from Sistan and Baluchestan province. Also, additional morphological

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information and new illustrations for a newly discovered species in the Iran, *Verachthonius* cf. *laticeps* (Strenzke, 1951) is given.

MATERIALS AND METHODS

Soil samples bearing leaf litter were collected from different locations of Sistan and Baluchestan province, southeastern part of Iran (Fig. 1), during 2016–2019. Mite specimens were collected by extraction from soil samples through a modified Berlese-Tullgren funnel. Collected mites were cleared in Nesbitt's fluid, and then mounted in Hoyer's medium on microscope slides (Krantz 2009). The slides were placed in an oven at 45 °C for two weeks. The examinations of the specimens were performed with an Olympus BX41 and an Olympus BX51 phase-contrast microscope equipped with a drawing tube and magnification changer. The examined materials and data on their locality and habitat are given for each species. Illustrations were made using a drawing tube attached to the microscopes.

Figure 1. Left: map of Iran, specifying Sistan and Baluchestan province – Right: map of Sistan and Baluchestan province, specifying its counties (Sampling areas are marked in blue).

Body length was measured from the tip of the rostrum to the posterior edge of the notogaster, body width refers to the maximum width of the prodorsum and notogaster in dorsal aspect and lateral height was done, from genital sclerite to base of seta d_1 in lateral view. Measurements were done using an ocular micrometer and are given in micrometers (μm). Some measurements are given as a range. Formulae for leg setation are given in parentheses according to the sequence trochanter–femur–genu–tibia–tarsus (famulus included). Formulae for leg solenidia are given in square brackets according to the sequence genu–tibia–tarsus. In leg setation, Roman letters refer to normal setae, Greek letters to famulus and solenidia. Single prime (′) marks setae on anterior and double prime (″) setae on posterior side of the given leg segment and parentheses refer to a pair of setae. Taxonomic classification follows Subías (2022). Morphological terminology used in this paper follows that of F. Grandjean (e.g. 1963): see Travé and Vachon 1975, Norton (1977), and also that summarized by Norton and Behan-Pelletier (2009). Data on both local and zoogeographical regions were compiled from the relevant records (Akrami 2015; Akrami and Shahedi 2020; Subías 2022). All specimens were deposited in the collection of the mites in the Department of Plant Protection, College of Agriculture, Zabol University, Zabol, Iran. A series of voucher specimens were also deposited in the Acarological collection of the Department of Plant Protection, School of Agriculture, Shiraz University, Shiraz, Iran.

Following abbreviations are used: *NA*, *NM*, *NP* — anterior, median, posterior notogastral sclerites; *AD*, *AN*, *PR* — adanal, anal, peranal sclerites; *SpE* — suprapleural sclerite; *PA*, *PP* — anterior, posterior pleural sclerites; *ro*, *le*, *il*, *bs*, *exa* — rostral, lamellar, interlamellar, bothridial, anterior exobothridial seta; *exp* — posterior exobothridial porus; *bo* — Bothridium; *op* — lateral tubercle; $c_{1\text{-}3}$, $d_{1\text{-}3}$, e_1, e_2, f_1, f_2, $h_{1\text{-}3}$, $p_{1\text{-}3}$ — notogastral setae; *ia*, *im*, *ih*, *ip*, *ips* — notogastral lyrifissures; *1a-c*, *2a*, *3a-c*, *4a-d* — epimeral setae; g_1-g_7 — genital setae; *ag* — aggenital seta; $ad_{1\text{-}3}$ — adanal setae; $an_{1\text{-}2}$ — anal setae; *pe* — peranal seta; *ru* — rutellum; *αf* — abaxial (antiaxial) fissure of rutellar manubrium; *br* — rutellar brush (= ciliary comb); *en* — line of attachment for cheliceral frame; *l.or* — lamellated organ; *op′* — adaxial oncophysis; *h*, *m*, *ma*, *a* — subcapitular setae; *or* — adoral seta; ω — solenidion on palp; *d*, *l*, *v*, *cm*, *acm*, *u*, *su* — setae on palp; σ, φ, ω — solenidia on leg genu, tibia, tarsus; *d*σ, *d*φ — seta *d* and solenidion coupled; ε — famulus on tarsus of leg I; *ft*, *pl*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *d*, *l*, *v* — setae on legs I–IV.

RESULTS

A total of 23 species belonging to 20 genera and 15 families of the oribatid mites were collected and identified from Sistan and Baluchestan province. The list of species together with general distribution of all species (Subías 2022) are given:

Family Ctenacaridae Grandjean, 1954
Genus *Ctenacarus* Grandjean, 1939

Ctenacarus araneola (Grandjean, 1932)

Material examined – 1♀, Iran, Sistan and Baluchestan province, Adimi, Nimrooz county (31° 08' 71" N, 61° 43' 47" E, 470 m a.s.l.), Orchard undergrowth, *Punica granatum* L., *Ficus carica* L. and *Morus* sp., 14 August 2019, leg.: F. Ordouni.

Distribution in Iran – Yazd, East Azarbaijan, Fars and Razavi Khorasan provinces (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Pantropical (Australian, Oriental, Neotropical and Ethiopian) and Subtropical (Southern and Eastern Palaearctic, Neotropical, Southern Holarctic, Nearctic and Ethiopian).

Family Adelphacaridae Grandjean, 1954
Genus *Aphelacarus* Grandjean, 1932

Aphelacarus acarinus acarinus (Berlese, 1910)

Material examined – 1♀, Iran, Sistan and Baluchestan province, Kur-Ekelkian village, Iranshahr county (27° 15' 85" N, 60° 66' 25" E, 591 m a.s.l.), under growth of *Phoenix dactylifera* L., 1 September 2019, leg.: F. Ordouni.

Distribution in Iran – Yazd, Hamedan, West Azerbaijan, Fars and Razavi Khorasan provinces (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Semicosmopolitan (Holarctic: less frequent in the North, Ethiopian and Neotropical).

Family Brachychthoniidae Thor, 1934
Genus *Sellnickochthonius* Krivolutsky, 1964

Sellnickochthonius immaculatus (Forsslund, 1942)

Material examined – 4♀♀, Iran, Sistan and Baluchestan province, Dehpabid village, Khash county (28° 61' 57" N, 60° 78' 44" E, 1410 m a.s.l.), *Morus* sp., 1 September 2019, leg.: F. Ordouni.

Distribution in Iran – Sistan and Baluchestan province (New record for Iran).

Zoogeographical distribution – Holarctic (frequent) and Neotropical.

Genus *Verachthonius* Moritz, 1976

Verachthonius cf. *laticeps* (Strenzke, 1951)

Material examined – 3♀♀, Iran, Sistan and Baluchestan province, Dehpabid village, Khash county (28° 61' 57" N, 60° 78' 44" E, 1410 m a.s.l.), *Morus* sp., 1 September 2019 and, 2 May 2022, leg.: F. Ordouni.

Distribution in Iran – Sistan and Baluchestan (New record for Iran).

Zoogeographical distribution – Palaearctic (Europe and East of Asia Russia) and Bolivia

Family Cosmochthoniidae Grandjean, 1947
Genus *Cosmochthonius* Berlese, 1910

Cosmochthonius asiaticus Gordeeva, 1980

Material examined – 4♀♀, Iran, Sistan and Baluchestan province, Ebrahim-Abad village, Hamoon county (30° 91' 26" N, 61° 43' 87" E, 480 m a.s.l.), *Desmostachya bipinnata* L., 17 March 2019, leg.: F. Ordouni.

Distribution in Iran – Khuzestan and East Azarbaijan provinces (Akrami 2015).

Zoogeographical distribution – Southern Palaearctic (west-central Asia and Spain).

Cosmochthonius lanatus (Michael, 1885)

Material examined – 2♀♀, Iran, Sistan and Baluchestan province, Education research farm, Nimrooz county (31° 08' 71" N, 61° 43' 47" E, 470 m a.s.l.), *Tamarix* sp. and *Elymus repens* (L.), 14 August 2019, leg.: F. Ordouni.

Distribution in Iran – Yazd and East Azarbaijan provinces (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Cosmopolitan (except Australian and Antarctic).

Genus *Phyllozetes* Gordeeva, 1978

Phyllozetes emmae (Berlese, 1910)

Material examined – 7♀♀, Iran, Sistan and Baluchestan province, Ebrahim-Abad village, Hamoon county (30° 91' 26" N, 61° 43' 87" E, 480 m a.s.l.), *Desmostachya bipinnata* L., 31 July 2019; Education research farm, *Tamarix* sp. and *Elymus repens* (L.), 14 August 2019 and Kur-Ekelkian, Iranshahr county (27° 15' 85" N, 60° 66' 25" E, 591 m a.s.l.), *Phoenix dactylifera* L., 1 September 2019, leg.: F. Ordouni.

Distribution in Iran – Yazd, West Azerbaijan, Mazandaran, Khuzestan, Fars, Razavi Khorasan and East Azarbaijan provinces (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Pantropical (except Ethiopian) and Subtropical.

Family Haplochthoniidae Hammen, 1959
Genus *Haplochthonius* Willmann, 1930

Haplochthonius longiapophysus Ordouni, Akrami & Ramroodi, 2021

Material examined – 6♀♀, Iran, Sistan and Baluchestan province, Mohammad Ghasem village, Hirmand county (31° 04' 24.38" N, 61° 74' 32.48" E, 470 m a.s.l.), *Prunus* sp., Education research farm, Nimrooz county (31° 08' 71.52" N, 61° 43' 47.43" E, 488 m a.s.l.), *Elymus repens* (L.), 14 August 2019 and Kurekelkian village, Iranshahr county (27° 15' 85" N, 60° 66' 25" E, 591 m a.s.l.), *Phoenix dactylifera* (L.), 1 September 2019, leg.: F. Ordouni.

Zoogeographical distribution – Iran.

Haplochthonius chamela Mahunka & Mejía-Recamier, 1998

Material examined – 1♀, Iran, Sistan and Baluchestan province, Hamoon wetland, Hamoon county (31° 08' 71" N, 61° 43' 47" E, 609 m a.s.l.), 16 April 2018, leg.: S. Saravani Rad.

Distribution in Iran – Fars province (Akrami 2015). This is the second record for the fauna of Iran.

Zoogeographical distribution – Mexico and Iran.

Haplochthonius simplex (Willmann, 1930)

Material examined – 2♀♀, Iran, Sistan and Baluchestan province, Education research farm, Nimrooz county (31° 08' 71" N, 61° 43' 47" E, 470 m a.s.l.), *Tamarix* sp. and *Elymus repens* (L.), 14 August 2019, leg.: F. Ordouni.

Distribution in Iran – Yazd, Hamedan, Zanjan, Fars and East Azarbaijan (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Semicosmopolitan: Holarctic, Ethiopian, Oriental and Brazil.

Family Lohmanniidae Berlese, 1916
Genus *Cryptacarus* Grandjean, 1950

Cryptacarus promecus Grandjean, 1950

Material examined – 2♀♀, Iran, Sistan and Baluchestan province, Khamak village, Zahak county (30° 55' 37" N, 61° 37' 22" E, 483 m a.s.l.), *Convolvulus arvensis* L., 3 November 2019, leg.: Z. Daneshzaei.

Distribution in Iran – Fars and Khuzestan provinces (Akrami 2015).

Zoogeographical distribution – Southern Palaearctic (Mediterranean and western central Asia), Ethiopian and Mexico.

Genus *Thamnacarus* Grandjean, 1950

Thamnacarus smirnovi Bulanova-Zachvatkina, 1978

Material examined – 6♀♀, Iran, Sistan and Baluchestan province, Jazinak forest, Zahak county (30° 54' 06" N, 61° 34' 44" E, 483 m a.s.l.), ant (*Pheidole pallidula*) and termite (*Microcerotermes* sp.) nests, 4 January 2018, leg.: S. Saravani Rad.

Distribution in Iran – Yazd province (Akrami and Shahedi 2020). This is the second record for the fauna of Iran.

Zoogeographical distribution – Central West Asia.

Family Epilohmanniidae Oudemans, 1923
Genus *Epilohmannia* Berlese, 1910

Epilohmannia cylindrica cylindrica (Berlese, 1904)

Material examined – 11 ♀♀, Iran, Sistan and Baluchestan province, Golkhani village, Nimrooz county (31° 03' 69" N, 61° 39' 72" E, 470 m a.s.l.), *Morus* sp. 1 February 2019; Ebrahim-Abad village, Hamoon county, orchard fruit trees, *Punica granatum* L., *Phoenix dactylifera* L., and *Morus* sp., 25 May 2018; Dehpabid village (28° 61' 57" N, 60° 78' 44" E, 1410 m a.s.l.), *Morus* sp., and Khash county, Taftan mountain (28° 57' 58" N, 61° 02' 36" E, 3941 m a.s.l.), 1 September 2019 and, 24 August 2019, respectively; leg.: F. Ordouni.

Distribution in Iran – Yazd, East Azarbaijan, Kurdistan, West Azerbaijan, Mazandaran, Fars, Markazi, Guilan, Khuzestan, Tehran and Zanjan provinces (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Cosmopolitan (Palaearctic: Less frequent in the North, Nearctic, Ethiopian (Chad and Yemen), Eastern, Australian (Hawaii) and Neotropical).

Family Euphthiracaridae Jacot, 1930
Genus *Acrotritia* Jacot, 1923

Acrotritia ardua (Koch, 1841)

Material examined – 12 ♀♀, Iran, Sistan and Baluchestan province, Culture complex, *Morus* sp., and Chah-Nimeh recreational, Zahak county (30° 50' 39" N, 61° 43' 07" E, 483 m a.s.l.), *Morus* sp., *Olea europaea* L., and *Tamarix* sp., 11 May 2018, leg.: F. Ordouni and Kahir village, Konarak county (25° 59' 00" N, 60° 12' 57" E, 5 m a.s.l.), *Mangifera* sp., 27 February 2019, leg.: A. Arjmandi-Nezhad.

Distribution in Iran – Isfahan, East Azarbaijan, Hamedan, Ardabil, Mazandaran, Fars, Markazi, Guilan, Kurdistan, Khuzestan, Razavi Khorasanand Zanjan provinces (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Cosmopolitan.

Family Phthiracaridae Perty, 1841
Genus *Atropacarus* Ewing, 1917

Atropacarus striculus (Koch, 1835)

Material examined – 1♀, Iran, Sistan and Baluchestan province, Khash county, Taftan mountain (28° 57' 58" N, 61° 02' 36" E, 3941 m a.s.l.), 24 August 2019, leg.: F. Ordouni.

Distribution in Iran – Yazd, Mazandaran, Fars and East Azarbaijan provinces (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Semicosmopolitan (Holarctic, Eastern, Northern Neotropical, Australian, and Madagascar).

Family Nothridae Berlese, 1896
Genus *Nothrus* Koch, 1835

Nothrus anauniensis Canestrini and Fanzago, 1877

Material examined – 2♀♀, Iran, Sistan and Baluchestan province, Dehpabid village, Khash county (28° 61' 57" N, 60° 78' 44" E, 1410 m a.s.l.), *Morus* sp., *Punica granatum* L. and *Prunus armeniaca* L., 27 July 2018 and Rikapout village, Iranshahr county (27° 11' 57" N, 60° 29' 52" E, 591 m a.s.l.), *Phoenix dactylifera* L., *Olea europaea* L., and *Punica granatum*, 18 October 2018, leg.: F. Ordouni.

Distribution in Iran – West Azerbaijan, Hamadan, Yazd, Mazandaran, Fars, Markazi, Guilan, Khuzestan and Zanjan provinces (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Cosmopolitan (except Antarctica) – frequent in Palaearctic.

Family Gymnodamaeidae Grandjean, 1954
Genus *Jacotella* Banks, 1947

Jacotella frondeus (Kulijev, 1979)

Material examined – 2♀♀, Iran, Sistan and Baluchestan province, Taftan mountain, Khash county (28° 57' 58" N, 61° 02' 36" E, 3941 m a.s.l.), 24 August 2019, leg.: F. Ordouni.

Distribution in Iran – Hamadan, Yazd, Mazandaran, Fars, Markazi, Kurdistan, Zanjan and East Azarbaijan provinces (Akrami 2015; Akrami and Shahedi 2020).

Zoogeographical distribution – Southern Palaearctic (Eastern Mediterranean and Iran) and Ethiopia.

Family Oppiidae Sellnick, 1937
Subfamily Oppiellinae Seniczak, 1975
Genus *Oppiella* Jacot, 1937

Oppiella nova (Oudemans, 1902)

Material examined – 7♀♀, Iran, Sistan and Baluchestan province, Chah-Nimeh recreational, Zahak county (30° 50' 39" N, 61° 43' 07" E, 483 m a.s.l.), *Morus* sp., 11 May 2018, leg.: F. Ordouni.

Distribution in Iran – Mazandaran, Markazi, East Azarbaijan, Guilan, Fars, Zanjan, Isfahan and Alborz provinces (Akrami 2015).

Zoogeographical distribution – Cosmopolitan.

Family Tectocepheidae Grandjean, 1954
Genus *Tectocepheus* Berlese, 1896

Tectocepheus velatus (Michael, 1880)

Material examined – 11 ♀♀, Iran, Sistan and Baluchestan province, Mohammad-Abad town, Hamoon county (30° 88' 19" N, 61° 46' 50" E, 480 m a.s.l.), 25 July 2016; Niatak forest, Hirmand county (31° 11' 88" N, 61° 61' 93" E, 488 m a.s.l.), *Tamarix* sp., 25 August 2016; Chah-Nimeh recreational, *Morus* sp. *Olea europaea* L. and *Tamarix* sp. and Culture complex, Zahak county (30° 50' 39" N, 61° 43' 07" E, 483 m a.s.l.), *Morus* sp., 11 May 2018 and March 2016, respectively; leg.: F. Ordouni.

Distribution in Iran – East Azarbaijan, Hamadan, Yazd, Mazandaran, Fars, Markazi, Khuzestan, Guilan and Zanjan provinces (Akrami 2015).

Zoogeographical distribution – Cosmopolitan.

Family Scheloribatidae Grandjean, 1933
Genus *Scheloribates* Berlese, 1908

Scheloribates fimbriatus Thor, 1930

Material examined – 53 ♀♀, Iran, Sistan and Baluchestan province, Taftan mountain, Khash county (28° 57' 58" N, 61° 02' 36" E, 3941 m a.s.l.), 24 August 2019; Mohtaram-Abad village, Fanouj county (26° 70' 71" N, 59° 24' 40" E, 185 m a.s.l.), *Nerium oleander* L., 22 June 2018, leg.: F. Ordouni; Ramin village (25° 27' 27" N, 60° 74' 76" E, 7 m a.s.l.), *Ficus religiosa* L., *Avicennia marina* (Forssk.) Vierh., 28 February 2019 and Mangrove forest, Chabahar county (25° 03' 33" N, 62° 31' 66" E, 7 m a.s.l.), 30 February 2019, respectively; leg.: A. Arjmandi-Nezhad.

Distribution in Iran – Yazd, West Azerbaijan, Mazandaran, Guilan, Fars, Bushehr, Hormozgan, Razavi Khorasan and Khuzestan provinces (Akrami 2015).

Zoogeographical distribution – Pantropical and Subtropical.

Family Galumnidae Jacot, 1925
Genus *Pergalumna* Grandjean, 1936

Pergalumna sistanbaluchestanica Akrami, 2021

Material examined – 6♀♀ and 3♂♂, Iran, Sistan and Baluchestan province, Ebrahim-Abad village, Hamoon county (30° 91' 26" N, 61° 43' 87" E, 480 m a.s.l.), orchard fruit trees, *Malus* sp., *Ficus carica* L., *Ziziphus* sp., *Elaeagnus* sp., and *Tamarix* sp., 23 March 2019 and 9 June 2019 and Education research farm, Nimrooz county (31° 08' 71.52" N, 61° 43' 47.43" E, 470 m a.s.l.), *Tamarix* sp., 14 August 2019, leg.: F. Ordouni.

Zoogeographical distribution – Iran.

Genus *Pilogalumna* Grandjean, 1956

Pilogalumna tenuiclava (Berlese, 1908)

Material examined – 1♀, Iran, Sistan and Baluchestan province, Ebrahim-Abad village,

Hamoon county (30° 91' 26" N, 61° 43' 87" E, 480 m a.s.l.), *Tamarix* sp., 9 June 2019, leg.: F. Ordouni.

Distribution in Iran – Yazd, Fars and Markazi provinces (Akrami 2015).

Zoogeographical distribution – Holarctic and Mexico.

Genus *Galumna* Heyden, 1826

Galumna flabellifera flabellifera Hammer, 1958

Material examined – 1♀, Iran, Sistan and Baluchestan province, Ebrahim-Abad village, Hamoon county (30° 91' 26" N, 61° 43' 87" E, 480 m a.s.l.), *Phoenix dactylifera* L., 22 June 2018. leg.: F. Ordouni.

Distribution in Iran – Fars, Alborz, Kerman, Kermanshah and Yazd provinces (Akrami and Shahedi 2020).

Zoogeographical distribution – Pantropical (frequent) and Subtropical.

Remarks

In the study of the oribatid mite fauna of Sistan and Baluchestan province, totally, 23 species from 20 genera and 15 families were collected, of which two species represented new records for the mite fauna of Iran; it should be noted that all species are recorded for the first time from Sistan and Baluchestan province. According to the results, Cosmochthoniidae, Haplochthoniidae and Galumnidae (each with 3 species), *Cosmochthonius* (with 2 species), and *Haplochthonius* (with 3 species) are the families and genera with the highest number of species. A rare species, *Thamnacarus smirnovi*, previously known from Central Asia, is reported for the second time for the fauna of Iran. The knowledge about the diversity and distribution of the oribatid mites of Sistan and Baluchestan province is limited and more research is needed for a better understanding of the diversity of Iranian oribatid mites. Among them, the finding of *Verachthonius* cf. *laticeps* (Strenzke, 1951) is the first record for fauna of Iran. We give an additional description and new illustrations of the adult of this species based on material collected from Sistan and Baluchestan province, Iran.

Verachthonius cf. *laticeps* (Strenzke, 1951) (Figs. 2–11)

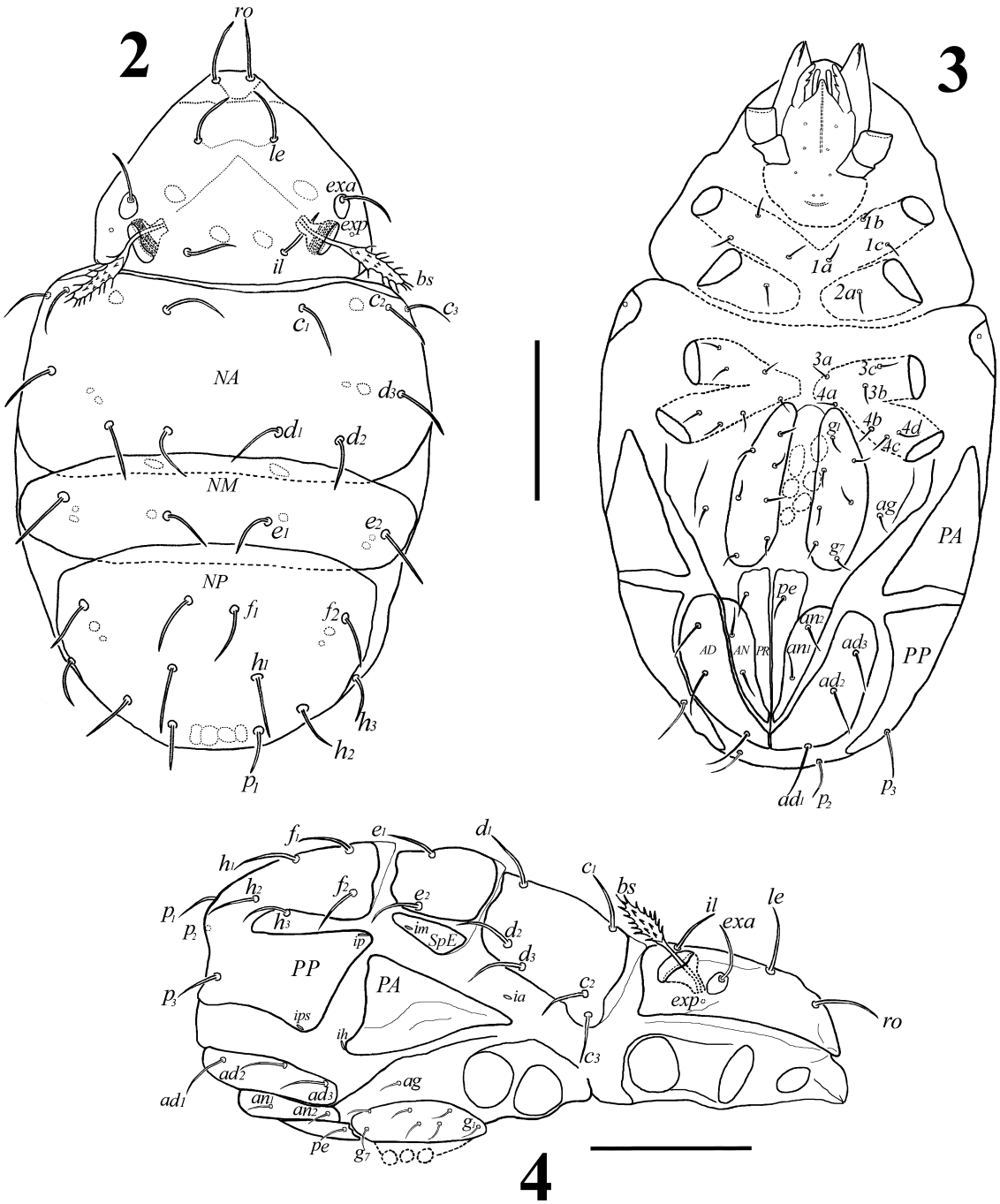
Supplementary description

Measurements (n = 3) – Body length 210–218 (length of prodorsum 65–68; length of notogaster 145–150: *NA* 53–54, *NM* 27–29, *NP* 65–67); width of prodorsum 82–84; width of notogaster 128–130. Lateral height 90–94. Bothridial seta (peduncle 20–22, head 19–20). Bothridium: diameter 13, length 10–11. *Op* 5 × 7.5. Prodorsal setae *ro* 18–19, *le* 17, *il* 16, *exa* 17. Notogastral setae c_1 17, c_2 16, c_3 16, d_1 18, d_2 16, d_3 18, e_1 15, e_2 19, f_1 18, f_2 17, h_1 18, h_2 16, h_3 15, p_1 15, p_2 13, p_3 15. Intervals of setae: *ro-ro* 10, *le-le* 23, *il-il* 30, *exa-exa* 66–67, c_1-c_1 44, d_1-d_1 38, e_1-e_1 31, f_1-f_1 14–15, h_1-h_1 26–28, h_2-h_2 53–55, p_1-p_1 27. Epimeral setae 6–7. Anogenital setae *pe* 7–8, an_1 and an_2 9–10, ad_1 16, ad_2 14, ad_3 13, $g_{1\text{-}7}$ and *ag* 5–6. Chelicera 40. Cheliceral seta 10–11. Palp 50–52. Subcapitulum 54–56 × 24–25. Subcapitular setae *h* and *ma* 7–8, *m* and *a* 9–10. Adoral seta *or* 10.

Integument – Body yellowish in color; integumental surface smooth, not sculptured. Cuticle of body smooth, not sculptured, only with numerous round or oval muscle sigillae on dorsal plates and legs.

Prodorsum (Fig. 2) – Broader than long and slightly narrower than the notogaster. Rostrum widely rounded and rostral apex without teeth. Prodorsal setae thick, setiform and smooth, rostral seta (*ro*) larger setae, situated near tip of rostrum, close together and parallel to each other. Another

three pairs of prodorsal setae (except bothridial seta) nearly equal in length, and smooth. Longitudinal, transversal and curved ridges visible between rostral, lamellar and exobothridial setae. Both lamellar (*le*) and interlamellar (*il*) setae slightly shorter than their mutual distance. Anterolaterad of each bothridium, a spherical, robust lateral tubercle (*op*) present; anterior exobothridial seta (*exa*) inserted on its anterior rim, nearly as long as other prodorsal setae (except *ro*); posterior exobothridial pore (*exp*) lateral to bothridium. Bothridium (*bo*) cup-shaped, with wide opening, directed posterolaterally. Bothridial seta (*bs*) spindle-shaped and barbed. One pair of mascle sigillae in the exobothridial regions and two pairs of oblong or oval-shape mascle sigillae in the between of interlamellar setae.

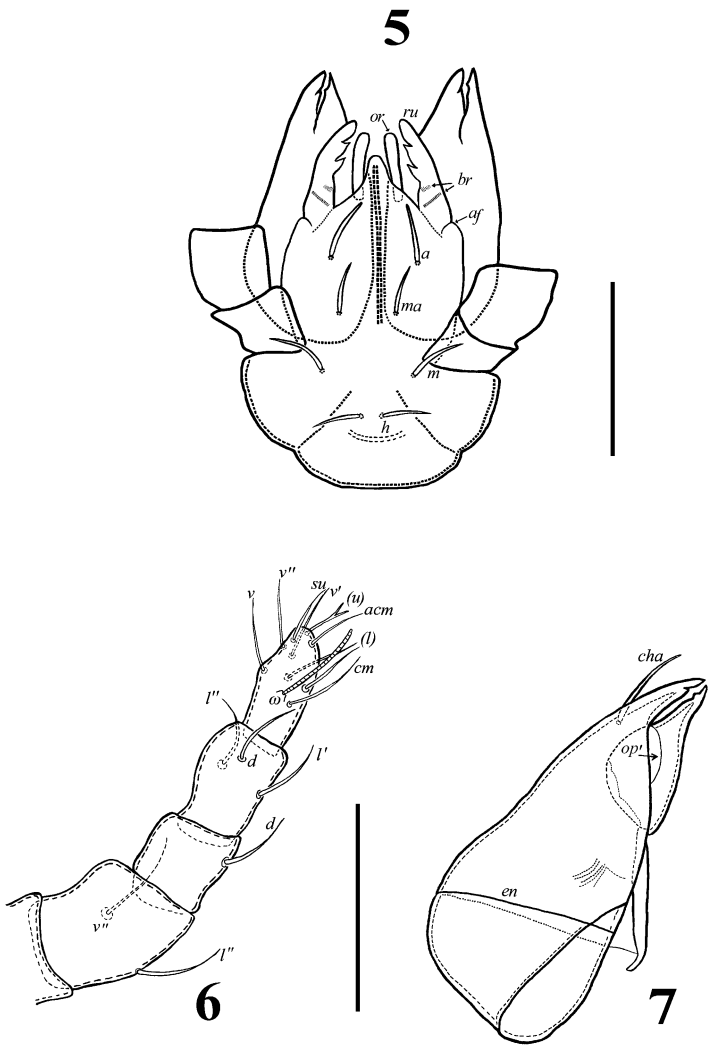


Figures 2–4. *Verachthonius* cf. *laticeps* (Strenzke, 1951) – 2. Dorsal view of body; 3. Ventral view of body (legs and distal palp segments not shown); 4. Lateral view of body (legs and palp not shown). Scale bar 50 μm.

Notogaster (Fig. 2) – Parallel-sided laterally, almost evenly rounded posteriorly with 16 pairs of medium long, stout and smooth setae. Setal row *c* and *d* (6 pairs) on anterior notogastral sclerite (*NA*), row *e* (2 pairs) on medial (*NM*), and rows *f*, *h* and *p* (8 pairs) on posterior sclerite (*NP*). Seta d_2 close to d_1, setae p_2 and p_3 visible in lateral and ventral view. *NA* bearing four mascle sigillae on each side, middle two mascle sigillae near each other; *NM* with three small mascle sigillae on each side and *NP* bearing two near and small spots on each side addition four large spots, touching each other between setae *p1*.

Pleural region (Fig. 4) – Only one pair of suprapleural plate (*SpE*) present. Anterior pleural sclerite (*PA*) triangular, with weak ridges, anterior apex reaching close to region of lyrifissure *ia*. posterior pleural sclerite (*PP*) wider, smooth and fused to ended of *NP*. Sclerites *PA* and *PP* separated from each other. Lyrifissures (*ia*, *im*, *ih*, *ip* and *ips*) as small cupules, in usual position.

Gnathosoma (Figs. 3, 5–7) – Subcapitulum bearing subcapitular setae (*a*, *ma*, *m* and *h*), setae *h* and *ma* short and setae *h* longer than their mutual distance. Adoral setae (*or*) square-tipped and flated at apex. Rutellum (*ru*) tri-dentated directed anteromedial and bears two independent brushes (*br*) on its dorsal face, that one shorter than the other. Palp five-segmented with formula: 0-2-1-3-10(+1ω), setae (*u*) fused, bifid; all setae smooth. Chelicerae weakly dentate, with one setiform and smooth seta (*cha*) on dorsum of fixed digit that directed anteriad. Movable digit small. Chelicera proximally inserted in body wall and adaxially emarginated; lamellated organ (*l.or*), oncophysis *op′* and the cheliceral frame attachment (line *en*) present.

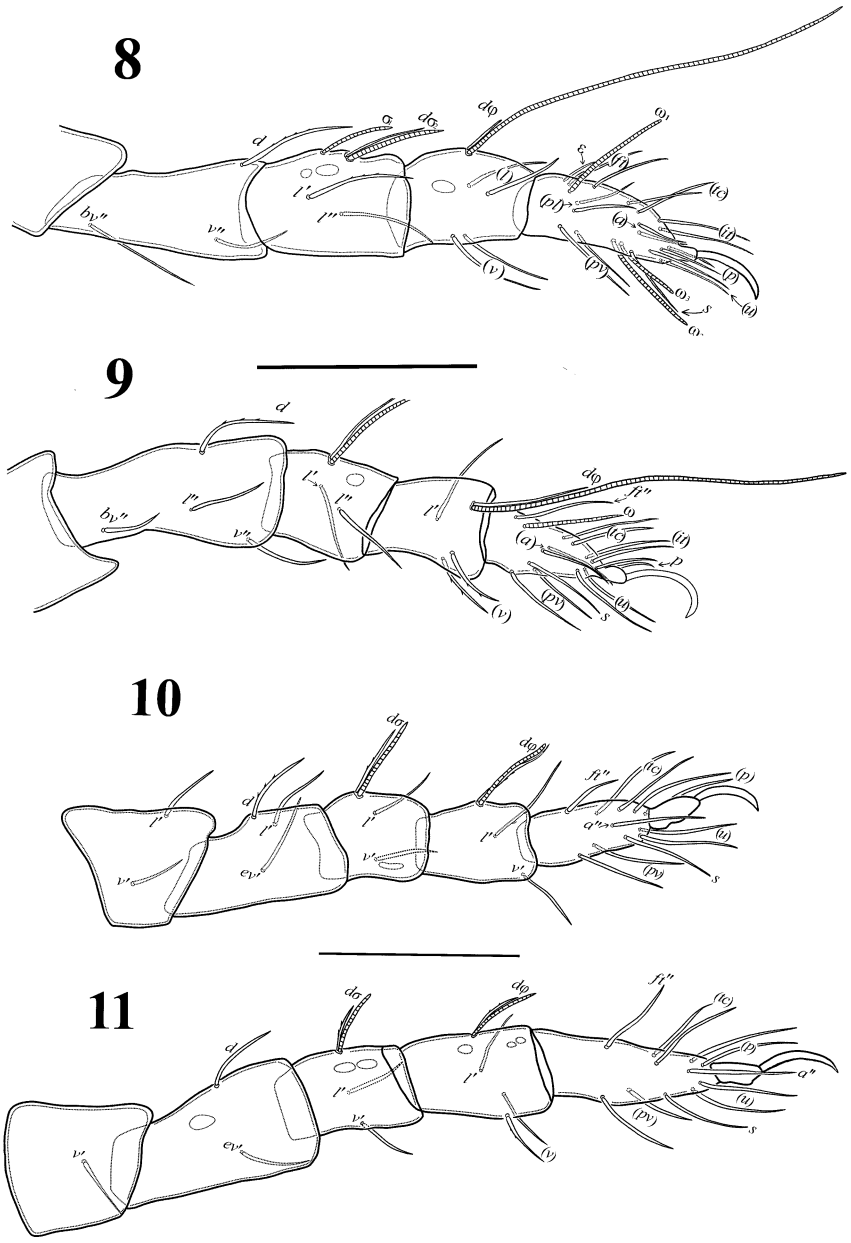


Figures 5–7. *Verachthonius* cf. *laticeps* (Strenzke, 1951) – 5. Subcapitulum, ventral view, distal palp segments (genu-tarsus) omitted; 6. Left palp, dorsoabaxial view; 7. Left chelicera, adaxial view. Scale bars 25 μm.

Epimeral region (Fig. 3) – Epimeral setal formula: 3-1-3-4. All setae short, thin and almost equal in length.

Anogenital region (Fig. 3) – Genital plates large, bearing seven pairs of short, smooth and thin setae (g_1-g_7) in two longitudinal rows (four medially and three laterally); one pair aggenital setae (*ag*) present on unsclerotized integument (aggenital sclerite absent). Peranal sclerites broad with one pair of peranal setae (*pe*). Ano-adanal sclerites with two pairs of equal, smooth and thin anal setae (an_1-an_2); three pairs of long, thicker and smooth adanal setae (ad_1-ad_3), progressively shorter from ad_1 to ad_3; adanal sclerites fused posteriorly, forming a U-shaped plate.

Legs (Figs. 8–11) – All tarsi monodactylous; claws rather slender. Formulae of leg setation (solenidia): I: 0-3-3-4-18 (2-1-3), II: 0-4-3-4-14 (1-1-1), III: 2-3-3-3-11 (1-1-0), IV: 1-2-3-4-11 (1-1-0); solenidion φ of tibia I and II very long; solenidia ω of tarsi I and II long, famulus ε of tarsus I short, inserted beside ω_1. Coupled setae and solenidia on genua and tibiae I–IV. Oval-shape mascle sigillae present on some segments. Homology of leg setae and solenidia as shown in Table 1.



Figures 8–11. *Verachthonius* cf. *laticeps* (Strenzke, 1951) – 8. Leg I, left, adaxial view; 9. Leg II, right, abaxial view; 10. Leg III, right, adaxial view; 11. Leg IV, right, adaxial view. Scale bar 25 μm.

Table 1. Homology of leg setae and solenidia of adult *Verachthonius* cf. *laticeps*.

Leg	Trochante	Femur	Genu	Tibia	Tarsus
I	-	*d, bv'', v''*	*(l),* σ_1*,* $d\sigma_2$	*(l), (v),* $d\varphi$	*(ft), (tc), (it), (p), (u), (a), s, (pl),(pv),* ε*,* ω_1*,* ω_2*,* ω_3
II	-	*d, l'', bv'', v''*	*(l),* $d\sigma$	*l', (v),* $d\varphi$	*ft'', (tc), (it), (p), (u), (a), s, (pv),* ω
III	*l', v'*	*d, l', ev'*	*l', v',* $d\sigma$	*l', v',* $d\varphi$	*ft'', (tc), (p), (u), a'', s, (pv)*
IV	*v'*	*d, ev'*	*l', v',* $d\sigma$	*l', (v),* $d\varphi$	*ft'', (tc), (p), (u), a'', s, (pv)*

Remarks

The genus *Verachthonius* was erected by Moritz (1976) and then fully defined by Lee (1982) based on a limited number of species. To date, six species are included in *Verachthonius* (Subías 2022) that are closely related and some of which can be distinguished only with difficulty. One problem in classifying this genus is that the descriptions of some included species are too brief and mainly based on the dorsal view of body, thus more of differentiating characteristics were overlooked. Distinguishing characteristics are found in the combination of body dimensions; form, relative length and distance between of dorsal setae; form of sensillus; dorsal mascle sigillae and ridges.

We consider the Iranian specimens similar to *Verachthonius moritzi* (Lee 1982: p. 343), *Verachthonius pseudolaticeps* (Subías 1977: p. 65), *Verachthonius congruus* (Moritz 1976: p. 164), *Verachthonius diversus* (Moritz 1976: p. 159) and *Verachthonius montanus* (Hummer 1952: p. 17 & 1958: p. 19).

Verachthonius moritzi is the smallest species of the genus (158) and beside possessing more notal ridges than the other 5 nominal species, differs by having conspicuously large and fine notal setae that some of which on tubercle ("S_5"), adanal shields not posteriorly merged together, aggenital sclerite present and some difference in leg cheatotaxy (tibia and tarsus I; tibia II and IV).

Verachthonius pseudolaticeps is the largest species of the genus (255) and differs by having fine and setiform dorsal setae that narrow towards the end, setae on *NP* longer than other notal setae and size and form of mascle sigillae (3 between *il*, 2 on each side *NA* and 1 on each side *NM* and *NP*).

Verachthonius congruus differs by having the dorsal setae being long, thin, faintly curved and stand away from the body, the pleural sclerites (*PP* and *PA*) overlapping, the number and position of the mascle sigillae (5 on prodorsum & 4 on *NA*), the structure of the sensillus and the distance between dorsal setae.

Verachthonius diversus differs by having short, simple and stout the dorsal setae, separation the pleural sclerites (*PP* and *PA*), the number and position of the mascle sigillae (only 5 on prodorsum), short stalk and stout fusiform club the bothridium.

Although the original description of *Verachthonius montanus* is not very detailed, according to the illustrations, the overall body shape, form and size of sensillus, relative length and distance between of dorsal setae, it has similarities with Iranian specimens however differs by having relatively large body size (240 × 140), lanceolate dorsal setae, adanal shields not posteriorly merged together, the number and position of the mascle sigillae, two bends just behind the rostral setae and connect the lamellar setae with a curved line. Present and number of the suprapleural sclerites are characters heavily weighted in diagnosing the genus (Schatz 2021: p. 376). Hammer (1952: p. 17) states in his generic diagnosis of *Verachthonius montanus* that "*On the ventral side three of the four lateral plates characteristic of the genus are seen (to the left on the figure 5 a)*", which contradicts the characteristics of *Verachthonius*.

According to the original description of *Verachthonius laticeps* (Strenzke 1951: p. 240) and supplementary description of this species by Moritz (1976: p. 155), Iranian specimens show the most similarities with this palearectic species by having medium long and stout dorsal setae, same distance between the dorsal setae, adanal sclerites fused caudally and simple and thin the adanal

setae. Also it seems that there are some morphological differences such as body size, absent transverse bulge arching in front of the bases of setae *h2* and *h3*, and curved ridges in the middle of prodorsum in Iranian specimens.

The resolution of some ambiguities by examining type specimens or in some cases must wait for the collection of new samples from the type localities and the creation of a neotype. In conclusion, the following key can be used to identify adults of all known species of *Verachthonius*.

Key to species of the genus *Verachthonius*

1. Dorsal setae lanceolate (body length: 240) ..... ***V. montanus*** (Hammer, 1952)
   Distribution: North of Nearctic, Argentina
– Dorsal setae setiform 2
2. Notogastral setae long, at least ½ of notogastral setae reaching the next row 3
– Notogastral setae short 4
3. Setae of series *e* extending beyond insertions of setae of subsequent row *f* (body length: 145–165) ..... ***V. moritzi*** Lee, 1982
   Distribution: Australia
– Setae of serie *e* far from insertion of setae of subsequent row *f* (body length: 200–222) .... ***V. congruus*** Moritz, 1976
   Distribution: Germany
4. Surface of pygidium with some ridges or cuticular elevations (body length: 255) .... ***V. pseudolaticeps*** (Subías, 1977)
   Distribution: Spain
– Notogaster smooth, without depressions or elevations 5
5. Bothridial seta with very short stalk, which extends only slightly beyond the bothridium; three pairs of muscle sigillae between interlamellar setae (body length: 215–227) .... ***V. diversus*** Moritz, 1976
   Distribution: Central Western Europe
– Bothridial seta with comparatively long stalk,which is completely distant from the bothridium; two pairs of muscle sigillae between interlamellar setae (body length: 189–207) .... ***V. laticeps*** (Strenzke, 1951)
   Distribution: Palaearctic (Europe, East of Asian Russia), Bolivia

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کنه‌های اریباتید (Acari: Oribatida) جنوب شرقی ایران همراه با توصیف تکمیلی گونهٔ *Verachthonius* cf. *laticeps* (Brachychthoniidae)

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چکیده

بررسی فون کنه‌های اریباتید (Oribatida) در استان سیستان و بلوچستان (جنوب شرقی ایران) برای نخستین بار طی سال‌های ۱۳۹۵ تا ۱۳۹۸ انجام شد. در این مطالعه، در مجموع ۲۳ گونه از ۲۰ جنس و ۱۵ خانواده جمع‌آوری و شناسایی شدند که از این میان، خانواده‌های Cosmochthoniidae، Haplochthoniidae و Galumnidae و جنس‌های *Cosmochthonius* و *Haplochthonius*، بیشترین تعداد گونه را داشتند. گونه‌های *Sellnickochthonius immaculatus* (Forsslund, 1942) و *Verachthonius* cf. *laticeps* (Strenzke, 1951) نیز برای فون کنه‌های اریباتید ایران گزارش جدیدند. هم چنین اطلاعات ریخت‌شناسی تکمیلی و تصاویر ترسیم شدهٔ جدید از گونهٔ آخر، بر اساس نمونه‌های جمع‌آوری شده ارایه شده است.

واژگان کلیدی: فون، کلید شناسایی، گزارش جدید، پالئارکتیک، سیستان و بلوچستان، *Verachthonius*.

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