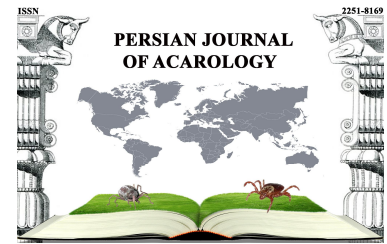




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Article

Some mesostigmatic mites (Acari: Parasitiformes) of Khuzestan province, southwestern Iran

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ABSTRACT

Animal droppings constitute an ephemeral habitat where specialized invertebrate communities including significant abundance of mites live together. In order to study the Mesostigmata mites associated with manure, samples were taken from different manure types of domestic animals and poultry in Ahvaz and its vicinity in Khuzestan Province, southwestern of Iran, over a period of two years (2015-2017). Here we report 20 species belonging to eight families of Mesostigmata, among which 14 species are new records for the fauna of Khuzestan Province. The genus and species *Leitneria pugio* (Karg, 1961) is newly recorded from Iran. The genus and species were previously only recorded in Europe. Also, *Uroobovella varians* Hirschmann & Zirngiebl-Nicol, 1962 is recorded for the first time from Iran based on deutonymph stage. We further provide collection data for each species along with a key for known Iranian species of the genus *Uroobovella*.

KEY WORDS: Mesostigmata; Manure-inhabiting mites; *Uroobovella*; Ahvaz; Iran.

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INTRODUCTION

Animal manures possess a rich fauna of arthropods including significant abundance of mites. Hundreds of mite species, representing some 25 families of Acari, occur as predators, fungivores, detritivores, and bacteriophages in dung substrates (Krantz 1983). For example, *Fuscuropoda vegetans* (De Geer) (Uropodidae) is an active predator of the eggs and first-instar larvae of the house fly *Musca domestica* L. (O'Donnell and Axtell 1965). Leitner (1946 a, b) conducted the first comprehensive study in Europe on manure mites and their ecological role, together with reporting more than a hundred mite species from manure and describing new taxa. Subsequently, other researchers worked on the acarine fauna and their population dynamics occurring in manure (e.g. Axtell 1963; Ito 1970; Rodriguez *et al.* 1970; Halliday and Holm 1987; Cicolani 1992).

The first catalogue of mites and ticks (Acari) of Iran included 16 Mesostigmata species which were collected from manure (Kamali *et al.* 2001). Recently, interests on manure mites resulted in specific studies on such fauna in Iran. For instance, Zakeri *et al.* (2012) collected eight macrochelid species from manure in Golestan province, north Iran. Babaeian (2011) recorded 15 species of Macrochelidae and Laelapidae from manure in Shahrekord, central Iran. Then, Ahangaran *et al.* (2012) identified 14 species of Eviphidoidea from manure in Nowshahr, north of Iran. One year later, Arjomandi *et al.* (2013) reported 36 species belonging to 14 families by studying the fauna of manure-

inhabiting mesostigmatic mites in Kerman province, southeastern Iran. Kazemi and Rajaei (2013) listed 72 manure-inhabiting Mesostigmata from some Iranian provinces which were collected from cow, sheep, chicken, poultry and camel manures.

Mesostigmata as a large cosmopolitan assemblage of parasitiform mites includes an unusually diverse variety of lifestyles and habitats. Mesostigmatic mites may be found in association with soil, litter, rotting wood, compost, manure, carrion, nests, house dust and similar detritus-based niches, fungi, aerial niches on plants, and animals (Lindquist *et al.* 2009). Nemati *et al.* (2018) updated the checklist of Iranian Mesostigmata which currently includes 620 species of 172 genera and 47 families. As Iran is a vast country with different types of climate and extreme variations of temperatures, we expected that further faunal investigations would result in a longer list of mesostigmatic mites.

In the present work, we aim to report some records of mesostigmatic mites associated with manure from Khuzestan Province, southwestern Iran, with two new records for Iran mite fauna. We also provide a key to known Iranian species of *Uroobovella*.

MATERIAL AND METHODS

Samples were collected from different manure types of domestic animals and poultry in Ahvaz and its vicinity in Khuzestan province, southwestern Iran, over a period of two years (2015–2017). Mites were extracted from samples using Berlese funnels. The specimens were fixed and preserved in 75% ethanol and placed in Nesbitt's solution and lactophenol for clearing and then mounted in Hoyer's medium on permanent microslides for microscopic examination. Species were identified according to available literature and material. Specimens were deposited in the Insect and Mite Collection of Ahvaz (IMCA), Department of Plant Protection, Shahid Chamran University of Ahvaz, Ahvaz, Iran. Host/habitats of previous records from literature are presented in parentheses under “distribution and habitats in Iran”. Key to the known species of the genus *Uroobovella* in Iran according to recent checklists of Iranian Mesostigmata (Kazemi and Rajaei 2013; Nemati *et al.* 2018) were made based on illustrations in Karg (1989) and our material.

RESULTS

Here we report some manure-inhabiting mesostigmatic mites in Khuzestan Province including 20 species belonging to eight families of Mesostigmata, among which 14 species are new records for the fauna of Khuzestan province and three species are the second ever record from Iran.

The species *Leitneria pugio* (Karg, 1961) is newly recorded from Iran. The genus and species are also new records for Asia. *Uroobovella varians* Hirschmann & Zirngiebl-Nicol, 1962 is also new for west Asia from Iran.

Digamasellidae Evans, 1957

***Dendrolaelaps* Halbert, 1915**

***Dendrolaelaps acriluteus* Athias-Henriot, 1961**

Dendrolaelaps acriluteus – Athias-Henriot (1961): 468.

Dendrolaelaps acriluteus – Hirschmann and Wiśniewski (1982): 12.

Distribution and habitats in Iran – Chaharmahal va Bakhtiari province (soil) (Nemati *et al.* 2018). This is the second record from Iran and new to the Khuzestan province fauna.

Material examined – Two deutonymphs, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 8 April 2015 (sheep manure), four deutonymphs, 23 October 2016 (cow manure); three deutonymphs, Ahvaz, Gavmish Abad, 31° 17' 34.77" N, 48° 40' 05.05" E, 15 m a.s.l., 24 April 2015 (buffalo manure); five deutonymphs, Ahvaz, dairy farm at the Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 17 November 2015 (cow manure), two deutonymphs, 17 November 2015 (cow manure); Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., two deutonymph, 22 April 2016 (buffalo manure); one deutonymph, Shushtar, Arab Hassan, 31° 49' 44" N, 48° 53' 55" E, 30 m a.s.l., 13 May 2016 (cow manure); one deutonymph, Shush, Khavar-e Seyyed Khalaf, 31° 31' 23" N, 48° 49' 31" E, 25 m a.s.l., 9 October 2016 (cow manure).

Note – Characters of the Iranian specimens agreed with data presented in Hirschmann and Wiśniewski (1982).

Dendrolaelaps multidentatus (Leitner, 1949)

Digamasellus multidentatus – Leitner (1949): 23.

Dendrolaelaps multidentatus – Hirschmann and Wiśniewski (1982): 67.

Distribution and habitats in Iran – Alborz province (compost and mushroom) (Kazemi and Rajaei 2013). This is the second record from Iran and new to Khuzestan province fauna.

Material examined – Three deutonymphs, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 8 April 2015 (buffalo manure), three females, two males, 22 November 2015 (buffalo manure); two deutonymphs, Ahvaz, dairy farm at the Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 26 May 2015 (cow manure), two deutonymphs, 17 November 2015 (cow manure); two deutonymphs, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 24 October 2016 (buffalo manure); three females, one male, Shush, Abdolkhan, 31° 52' 29" N, 48° 20' 30" E, 43 m a.s.l., 6 May 2016 (cow manure); two deutonymphs, Shushtar, Arab Hassan, 31° 49' 44" N, 48° 53' 55" E, 30 m a.s.l., 13 May 2016 (cow manure); two deutonymphs, Shushtar, Band-e Qir, 31° 39' 10" N, 48° 53' 09" E, 26 m, 13 May 2016 (cow manure); two deutonymphs, Shush, Khoyes, 32° 01' 53" N, 48° 16' 45" E, 60 m a.s.l., 26 May 2016 (cow manure); two deutonymphs, Hamidieh, Tarrahiye, 31° 25' 21" N, 48° 23' 21" E, 18 m a.s.l., 20 October 2016 (cow manure); three deutonymphs, Hamidieh, Pich-e Seyyed Jaber, 31° 27' 34" N, 48° 25' 26" E, 21 m a.s.l., 20 October 2016 (buffalo manure).

Note – Characters of the Iranian specimens agreed with data presented in Hirschmann and Wiśniewski (1982).

Dendrolaelaps presepum Berlese, 1918

Gamasellus (*Digamasellus*) *presepum* – Berlese (1918): 136.

Dendrolaelaps presepum – Hirschmann and Wiśniewski (1982): 9.

Distribution and habitats in Iran – Fars (soil) (Kazemi and Rajaei 2013), Chaharmahal va Bakhtiari and Khuzestan Provinces (soil) (Nemati *et al.* 2018).

Material examined – One female, one deutonymph, Dasht-e Azadegan, Susangerd, 31° 32' 58" N, 48° 11' 57" E, 14 m a.s.l., 12 December 2015 (buffalo manure); one female, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 22 April 2016 (buffalo manure); one female, two deutonymphs, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m, 29 April 2016 (sheep manure).

Note – Characters of the Iranian specimens agreed with data presented in Hirschmann and Wiśniewski (1982).

Diplogyniidae Trägårdh, 1941
***Lobogynium* Trägårdh, 1950**

***Lobogynium sudhiri* (Datta, 1985)**

Ophiocelaeno sudhiri – Datta (1985): 44.

Lobogynium sudhiri – Plumari and Kazemi (2012): 5.

Distribution and habitats in Iran – Tehran (*Atholus scutellaris* (Erichson)), Fars (dried cow dung and decaying plant material), Golestan (*Geotrupes spiniger* (Marshall)), Khorasan-e Razavi (*Atholus scutellaris* (Erichson)) and Khorasan-e Shomali (sheep and cow dung) Provinces (Kazemi and Rajaei 2013). This is a new record for Khuzestan province fauna.

Material examined – Three females, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 14 May 2015 (cow manure), two females, three deutonymphs, 25 May 2015 (sheep manure), four deutonymphs, 2 September 2015 (sheep manure), two females, 23 October 2016 (cow manure), six females, two deutonymphs, 12 April 2017 (sheep manure), two females, one male, 22 November 2015 (buffalo manure); two females, three males, Ahvaz, Jassaniyeh-ye Kuchak, 31° 24' 10" N, 48° 44' 58" E, 21 m a.s.l., 29 September 2015 (cow manure); four females, Ahvaz, dairy farm at the Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 17 November 2015 (cow manure); three females, Ahvaz, Nabi-ye Akram village, 31° 26' 15" N, 48° 45' 11" E, 18 m a.s.l., 30 November 2015 (cow manure); two females, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 29 April 2016 (sheep manure); three females, one deutonymph, Shush, Beyt-e Juhi, 31° 57' 50" N, 48° 17' 42" E, 64 m a.s.l., 26 May 2016 (cow manure); three females, Bavi, Shajaraat, 31° 30' 40" N, 48° 54' 27" E, 22 m a.s.l., 9 October 2016 (cow manure); three females, Bavi, Naddafieh, 31° 36' 20" N, 48° 52' 59" E, 27 m a.s.l., 19 November 2016 (sheep manure); three females, Ahvaz, Haatam village, 31° 51' 35" N, 48° 21' 31.05" E, 36 m a.s.l., 11 May 2017 (sheep manure).

Note – Characters of our specimens agree with data presented in Plumari and Kazemi (2012), who designated a neotype for this species and transferred it to the redefined genus *Lobogynium*.

Family Halolaelapidae Karg, 1965
***Halolaelaps* Berlese & Trouessart, 1889**

***Halolaelaps sexclavatus* (Oudemans, 1902)**

Parasitus sexclavatus – Oudemans (1902): 17.

Halolaelaps sexclavatus – Karg (1962): 74.

Distribution and habitats in Iran – Provinces of Fars (soil of orchards, foliage, soil, leaf-litter, weeds and soil of apple trees) Golestan (*Herpalus* sp.), Isfahan (soil), Khorasan-e Shomali (soil of farms, gardens and manures) (Kazemi and Rajaei 2013), Kerman (cow manure and sheep manure, soil and leaf litter) and Zanjan (soil) (Nemati *et al.* 2018). This is new to the Khuzestan province fauna.

Material examined – Sixteen deutonymphs, Ahvaz, 31° 23' 02" N, 48° 38' 38" E, 18 m a.s.l., 24

April 2015 (horse manure), four deutonymphs, 30 November 2015 (horse manure); two deutonymphs, Ahvaz, dairy farm at Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 17 November 2015 (cow manure); two deutonymphs, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 22 November 2015 (buffalo manure); two deutonymphs, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 29 April 2016 (cow manure); three deutonymphs, Shush, Abdolkhan, 31° 52' 29" N, 48° 20' 30" E, 43 m a.s.l., 6 May 2016 (cow manure); two deutonymphs, Shush, Seyyed Abbas, 31° 49' 49" N, 48° 23' 21" E, 40 m a.s.l., 6 May 2016 (buffalo manure); four deutonymphs, Shushtar, Band-e Qir, 31° 39' 10" N, 48° 53' 09" E, 26 m a.s.l., 13 October 2016 (cow manure); two deutonymphs, Shushtar, Arab Hassan, 31° 49' 44" N, 48° 53' 55" E, 30 m a.s.l., 13 May 2016 (cow manure); one deutonymph, Bavi, Naddafieh, 31° 36' 20" N, 48° 52' 59" E, 27 m a.s.l., 16 November 2016 (cow manure).

Note – Characters of the Iranian specimens agreed with data presented in Karg (1962).

Leitneria Evans, 1957

Diagnosis

Leitneria genus bears small and fragmented platelets adjacent to the lateral margins of sternal shield alongside of anterior and posterior of coxae II (Figs. 1, 2b). There is a depression at the posterior part of opisthogastric area (below anus) with ornamented decoration (Fig. 1). There are additional Zx setae between Z1 and Z2 on dorsal idiosoma (Fig. 2a). Peritreme is wider at the beginning compared to its anterior part in *Leitneria* (Fig. 2c), whereas in the genus *Halolaelaps* there are large and triangular plates on posterolateral of sternal shield, lacking extra Zx setae and peritreme becomes wider at anterior part.

Leitneria pugio (Karg, 1961)

Saprolaelaps pugio – Karg (1961): 132.

Leitneria pugio – Karg (1962): 75.

Diagnosis

Dorsal shield is reticulated and consisting podonotal and opisthonotal shields whereas the only congeneric species *L. granulatus* (Halbert, 1923) has no reticulated dorsal shield. Evans (1957) mentioned “ventrianal shield considerably wider than long” as a character of the genus according to the only known species at that time (*L. granulatus*). However, ventrianal shield of *L. pugio* is not as Evans' description and has an approximately equal length and width, although its posterior margin is a bit wider than its anterior margin (Fig. 1). Epistome is denticulate with a long and acute projection in the middle. However, in *L. granulatus* epistome is finely dentate and considerably projected in the middle.

Note – This species has been recorded in Europe (Karg 1993), Poland (Gwiazdowicz and Kmita 2004, litter), Spain (Moraza 2010, soil litter and humus), Austria (Wissuwa *et al.* 2012: soil) and Crimea (Kaczmarek and Marquardt 2008: soil). Both of the genus and species are new records for Asia. There are only two species of *L. pugio* and *L. granulatus* in the genus *Leitneria*. *Leitneria granulatus* was first described in *Halolaelaps*. The species *pugio* was also first described in *Saprolaelaps* but subsequently transferred to *Leitneria* together with *granulatus* (Karg 1993). Characters of Our specimen agree with data presented in Karg (1962).

Distribution and habitats in Iran – This is the first record for Iran mite fauna.

Material examined – One female, Ahvaz, 31° 23' 02" N, 48° 38' 38" E, 18 m a.s.l., 24 April 2015 (horse manure).

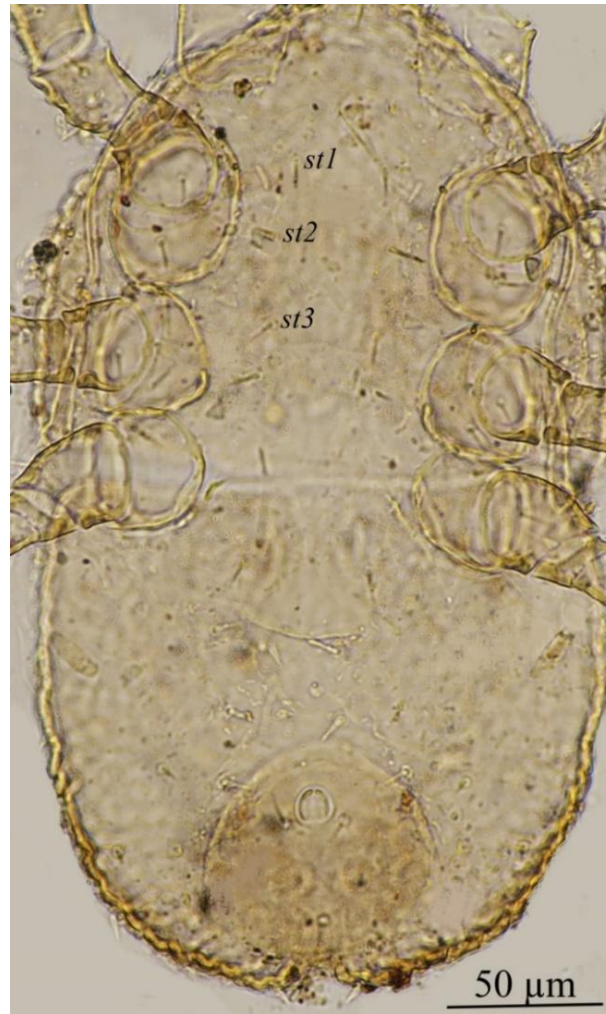


Figure 1. Female of *Leitneria pugio* (Karg, 1961) – Ventral view of idiosoma.

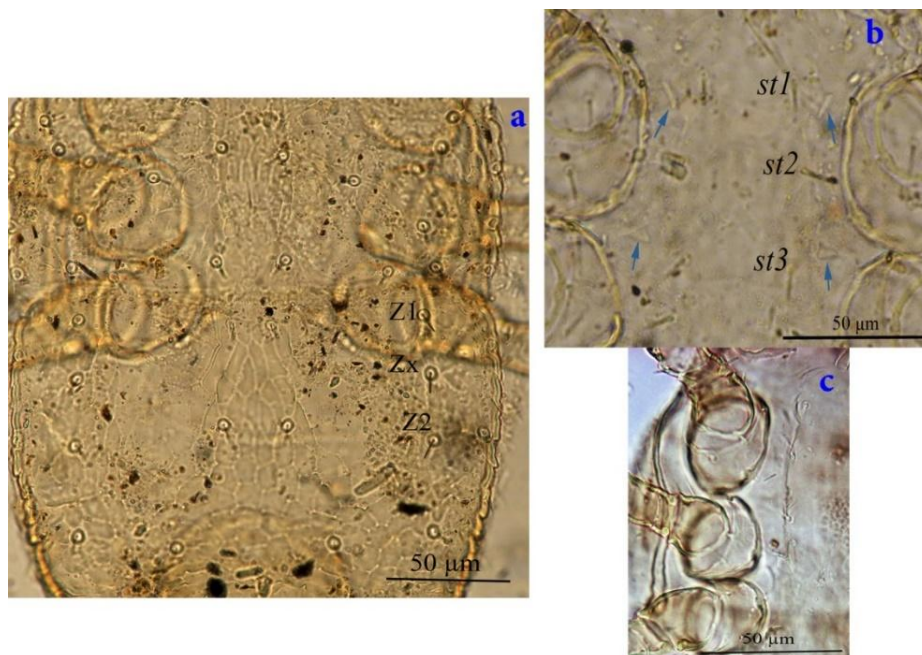


Figure 2. Female of *Leitneria pugio* (Karg, 1961) – a. dorsal idiosoma: *Zx* seta between *Z1* and *Z2* setae; b. Sternal shield, c. Peritreme.

Family Macrochelidae Vitzthum, 1930
***Glyphtholaspis* Filipponi & Pegazzano, 1960**

***Glyphtholaspis confusa* (Foà, 1900)**

Holostaspis confusa – Foà (1900): 137.

Glyphtholaspis confuse – Hyatt and Emberson (1988): 116.

Distribution and habitats in Iran – Provinces of Fars (putrid onion, manure, soil and leaf-litter), Tehran (soil, leaf-litter, decomposing organic matter, manure, unknown scarab beetles), Mazandaran (soil), Chaharmahal va Bakhtiari (dung), Golestan (*Euonthophagus gibbosus* (Scriba), soil, cow and sheep manure), Khorasan-e Shomali (manures, soil of farms and gardens), Golestan (*Polyphylla olivieri* Laporte de Castelnau) (Kazemi and Rajaei 2013) and Qom (soil, dung, compost and plant litters of crops, lawns, shrubs and trees in farms, forests, orchards and parks) (Nemati *et al.* 2018). This is new to the Khuzestan province fauna.

Material examined – Four females, two males, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 14 May 2015 (cow manure), six females, 21 July 2015 (cow manure), eight females, three males, 19 September 2015 (buffalo manure), five females, 12 April 2017 (sheep manure); nine females, one males, Ahvaz, dairy farm at Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 26 May 2015 (cow manure); eight females, Bavi, Shajaraat, 31° 30' 40" N, 48° 54' 27" E, 22 m a.s.l., 8 June 2015 (buffalo manure); eight females, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 5 November 2015 (poultry manure); eight females, Hamidieh, Gambue, 31° 23' 59" N, 48° 31' 21" E, 16 m a.s.l., 30 November 2015 (cow manure); two females, Hamidieh, Gambue, 31° 23' 59" N, 48° 31' 21" E, 16 m a.s.l., 12 December 2015 (sheep manure); four females, three males, Hamidieh, Pich-e Seyyed Jaber, 31° 27' 34" N, 48° 25' 26" E, 21 m a.s.l., 10 March 2016 (cow manure); six females, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 29 April 2016 (cow manure); six females, four males, Shush, Seyyed Abbas, 31° 49' 49" N, 48° 23' 21" E, 40 m a.s.l., 6 May 2016 (buffalo manure); six females, Bavi, Naddafieh, 31° 36' 20" N, 48° 52' 59" E, 27m, 19 November 2016 (cow manure), seven females, 2 June 2017 (sheep manure); eleven females, two males, Ahvaz, Nabi-ye Akram village, 31° 26' 15" N, 48° 45' 11" E, 18 m a.s.l., 3 March 2017 (cow manure); five females, three males, Bavi, Veys, 31° 28' 56" N, 48° 52' 41" E, 24 m a.s.l., 28 April 2017 (cow manure); ten females, two males, Ahvaz, Haatam village, 31° 51' 35" N, 48° 21' 31.05" E, 36m, 11 May 2017 (sheep manure).

Note– Characters of the Iranian specimens agreed with data presented in Hyatt and Emberson (1988).

***Macrocheles* Latreille, 1829**

***Macrocheles glaber* (Müller, 1860)**

Holostaspis glabra – Müller (1860): 178.

Macrocheles glaber – Hyatt and Emberson (1988): 107.

Distribution and habitats in Iran – Provinces of Hamedan (clover (*Trifolium* sp.) farms), Azerbaijan-e Sharghi (soil of orchards), Azerbaijan-e Gharbi (house dust), Tehran (soil, leaf-litter, decomposing organic matter, manure, unidentified scarab beetles), Markazi (soil), Isfahan (soil of fruit orchards), Khuzestan (soil), Alborz (compost), Guilan (soil), Mazandaran (soil), Kerman (soil, cow and poultry manure), Chaharmahal va Bakhtiari (dung), Fars (manure, soil and leaf-litter), Golestan (soil, *E. gibbosus*, *Oxythrea cinctella* (Schaum) and an unidentified cerambycid, camel and cow manure), Khorasan-e Shomali (manures, soil) an unknown region (honey bee hives) (Kazemi

and Rajaei 2013), Azerbaijan-e Sharghi (soil and plant debris), Chaharmahal va Bakhtiari (soil) and Khorasan-e Razavi (soil) (Nemati *et al.* 2018).

Material examined – Two females, one male, Ahvaz, Gavmish Abad, 31° 17' 34.77" N, 48° 40' 05.05" E, 15 m a.s.l., 24 April 2015 (buffalo manure); two females, Ahvaz, dairy farm at Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 26 May 2015 (cow manure), two females, 29 May 2016 (cow manure); three females, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 19 September 2015 (buffalo manure), three females, one male, 25 August 2016 (sheep manure), four females, 5 March 2017 (poultry manure); four females, Ahvaz, Nabi-ye Akram village, 31° 26' 15" N, 48° 45' 11" E, 18 m a.s.l., 30 November 2015 (cow manure); four females, Susangerd, Abu Hamizeh, 31° 31' 48" N, 48° 13' 11" E, 15 m a.s.l., 20 October 2016 (buffalo manure); three females, Shush, Khoyes, 32° 01' 53" N, 48° 16' 45" E, 60 m a.s.l., 7 April 2017 (cow manure); seven females, Bavi, Talbume, 31° 31' 37" N, 48° 55' 27" E, 20 m a.s.l., 26 April 2017 (cow manure); two females, two males, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 24 May 2017 (cow manure).

Note – Characters of the Iranian specimens agreed with data presented in Hyatt and Emberson (1988).

Macrocheles merdarius (Berlese, 1889)

Holostaspis merdarius – Berlese (1889): 1.

Macrocheles merdarius – Hyatt and Emberson (1988): 113.

Distribution and habitats in Iran – Provinces of Azerbaijan-e Sharghi (soil of orchards), Fars (stored onion, soil of citrus orchards, manure, soil and leaf-litter, soil and decayed plants associated with conifers, foliage, soil, leaf-litter, weeds and soil of apple trees), Tehran (soil, leaf-litter, decomposing organic matter, manure, unidentified scarab beetles), Markazi (soil), Isfahan (soil of fruit orchards), Sistan va Baluchestan (soil), Alborz (compost), Guilan (stored rice, rice dust and debris, soil), Mazandaran (soil), Chaharmahal va Bakhtiari (dung), Golestan (soil, *E. gibbosus*, *P. olivieri*, *O. cinctella*, cow and sheep manure), Zanjan (soil) Kerman (soil, cow, sheep and poultry manure) Azerbaijan-e Gharbi (soil of sunflower fields, soil and plant debris of apple orchards), Khorasan-e Shomali (soil of farms, gardens and manures) Golestan (*P. olivieri*) Khorasan-e Razavi (*O. cinctella*) (Kazemi and Rajaei 2013), Khorasan-e Razavi (stored food products), Lorestan (orchard, oak forest, ant nest and manure), Khorasan-e Shomali (associated with *Onthophagus* sp. and *Xylocopa* sp.), Chaharmahal va Bakhtiari (soil), Isfahan (empty pastures and vineyards), Qom (soil, dung, compost and plant-litters of crops, lawns, shrubs and trees in farms, forests, orchards and parks) and North East of Iran (stored food products) (Nemati *et al.* 2018). This is new to the Khuzestan province fauna.

Material examined – Seven females, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 8 April 2015 (sheep manure), eight females, 16 September 2015 (cow manure), eleven females, 22 November 2015 (buffalo manure); seven females, three males, Ahvaz, dairy farm at Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 24 April 2015 (buffalo manure), six females, four males, 27 October 2015 (cow manure), nine females, 29 May 2016 (cow manure); six females, Ahvaz, Gavmish Abad, 31° 17' 34.77" N, 48° 40' 05.05" E, 15 m a.s.l., 26 May 2015 (cow manure); four females, four males, Ahvaz, Daghadheleh, 31° 23' 31" N, 48° 41' 28" E, 20 m, 30 November 2015 (cow manure); five females, two males, Ahvaz, Jassaniyeh-ye Bozorg, 31°25'55" N, 48° 44' 41" E, 22 m a.s.l., 30 November 2015 (cow manure); six female, Hamidieh, Gambue, 31° 23' 59" N, 48° 31' 21" E, 16 m a.s.l., 11 December 2015 (cow manure); 12 females, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 12 December 2015 (sheep manure), four females, 22 April 2016 (buffalo manure); seven females, Shushtar, Arab Hassan, 31° 49' 44" N, 48° 53' 55" E, 30 m a.s.l., 2

March 2016 (cow manure); six females, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 29 April 2016 (cow manure); four females, three males, Shush, Seyyed Abbas, 31° 49' 49" N, 48° 23' 21" E, 40 m a.s.l., 2 May 2016 (cow manure), six females, 25 May 2017 (cow manure); 8 females, Shush, Abdolkhan, 31° 52' 29" N, 48° 20' 30" E, 43 m a.s.l., 6 May 2016 (cow manure); nine females, Shushtar, Band-e Qir, 31° 39' 10" N, 48° 53' 09" E, 26 m a.s.l., 13 May 2016 (cow manure); ten females, Ahvaz, Ebadeh, 31° 26' 14" N, 48° 45' 07" E, 20 m a.s.l., 16 June 2016 (sheep manure); four females, three males, Hamidieh, Pich-e Seyyed Jaber, 31° 27' 34" N, 48° 25' 26" E, 21 m a.s.l., 20 October 2016 (buffalo manure); six females, four males, Hamidieh, Tarrahiyeh, 31° 25' 21" N, 48° 23' 21" E, 18 m a.s.l., 20 October 2016 (buffalo manure); eleven females, Bavi, Veys, 31° 28' 56" N, 48° 52' 41" E, 24 m a.s.l., 23 October 2016 (cow manure), six females, 28 April 2017 (cow manure); ten females, four males, Ahvaz, Gavmish Abad, 31° 17' 34.77" N, 48° 40' 05.05" E, 15 m a.s.l., 13 November 2016 (buffalo manure); five females, Bavi, Gabir, 31° 26' 34" N, 48° 45' 17" E, 20 m a.s.l., 27 October 2016 (cow manure); eight females, Ahvaz, Nabi-ye Akram village, 31° 26' 15" N, 48° 45' 11" E, 18 m a.s.l., 3 March 2017 (poultry manure); eight females, Bavi, Shajaraat, 31° 30' 40" N, 48° 54' 27" E, 22 m a.s.l., 13 May 2017 (cow manure); six females, four males, Bavi, Naddafieh, 31° 36' 20" N, 48° 52' 59" E, 27 m a.s.l., 2 June 2017 (sheep manure).

Note – Characters of the Iranian specimens agreed with data presented in Hyatt and Emberson (1988).

Macrocheles muscaedomesticae (Scopoli, 1772)

Acarus muscaedomesticae – Scopoli (1772): 125

Macrocheles muscaedomesticae – Hyatt and Emberson (1988): 80.

Distribution and habitats in Iran – Provinces of Tehran (honey bee hives, soil, leaf-litter, decomposing organic matter, manure, unidentified scarab beetles), Azerbaijan-e Sharghi (soil), Khuzestan (soil, nests of insects or body of fresh and pinned museum specimens), Guilan (soil), Chaharmahal va Bakhtiari (nests of insects or body of fresh and pinned museum specimens, dung), Bushehr (nests of insects or body of fresh and pinned museum specimens), Mazandaran (soil), Kerman (cow manure, soil), Golestan (*Pentodon* sp., *Melolontha melolontha* (L.), *Geotrupes* sp., manure), Fars (manure, soil and leaf-litter, potato, zucchini, flour and the floor of insectariums, soil), Khorasan-e Shomali (soil of farms, gardens and manures) (Kazemi and Rajaei 2013), Kerman (cow and poultry manure, soil), Khorasan-e Razavi (stored food products), Chaharmahal va Bakhtiari (soil), Isfahan (empty pastures and tomato patches) and North East of Iran (associated with stored food products) (Nemati *et al.* 2018).

Material examined – Five females, three males, Ahvaz, dairy farm at Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 11 March 2015 (cow manure), five females, 26 May 2015 (cow manure), 5 females, 21 July 2015 (cow manure), five female, two male, 17 September 2015 (cow manure), six females, 17 November 2015 (cow manure); four females, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 8 April 2015 (poultry manure), three females, two males, 24 April 2015 (cow manure), five female, 14 May 2015 (poultry manure), two females, 24 June 2015 (poultry manure), five females, 29 August 2015 (buffalo manure), five females, five males, 27 October 2015 (cow manure), four females, 22 November 2015 (sheep manure), eight females, seven males, 25 August 2016 (cow manure), seven females, four males, 5 March 2017 (cow manure), eight females, two males, 21 April 2017 (cow manure); seven females, three males, Ahvaz, 31° 23' 02" N, 48° 38' 38" E, 18 m a.s.l., 8 April 2015 (horse manure), three females, two males, Ahvaz, Gavmish Abad, 31° 17' 34.77" N, 48° 40' 05.05" E, 15 m a.s.l., 8 April 2015 (buffalo manure), seven female, 26 May 2015 (buffalo manure); three females, Shush, Khavar-e Seyyed Khalaf, 31° 31' 23" N, 48° 49' 31" E, 25 m a.s.l., 8 June 2015 (cow manure), four females, 9 October 2016 (cow manure); three females, Bavi, Shajaraat, 31° 30' 40" N, 48° 54' 27" E, 22 m a.s.l., 8 June 2015 (buffalo manure), two

females, four males, Ahvaz, Ebadeh, 31° 26' 14" N, 48° 45' 07" E, 20 m a.s.l., 2 May 2015 (cow manure); three females, 29 October 2016 (cow manure); three females, one male, Bavi, Gabir, 31° 26' 34" N, 48° 45' 17" E, 20 m a.s.l., 2 May 2015 (sheep manure), three females, 29 October 2016 (cow manure); four females, Shush, Beyt-e Juhi, 31° 57' 50" N, 48° 17' 42" E, 64 m, 13 July 2015 (cow manure), Twelve females, two males, 26 May 2016 (cow manure); nine females, Ahvaz, Jassaniyeh-ye Kuchak, 31° 24' 10" N, 48° 44' 58" E, 21 m a.s.l., 29 September 2015 (cow manure); six females, two males, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 5 November 2015 (cow manure), four females, one male, 22 April 2016 (buffalo manure); three females, Ahvaz, Jassaniyeh-ye Bozorg, 31° 25' 55" N, 48° 44' 41" E, 22 m a.s.l., 30 November 2015 (cow manure); two females, Ahvaz, Daghadheleh, 31° 23' 31" N, 48° 41' 28" E, 20 m a.s.l., 30 November 2015 (cow manure); one female, two males, Hamidieh, Gambue, 31° 23' 59" N, 48° 31' 21" E, 16 m a.s.l., 11 December 2015 (cow manure); two females, Dasht-e Azadegan, Susangerd, 31° 32' 58" N, 48° 11' 57" E, 14 m a.s.l., 12 December 2015 (sheep manure), four females, one male, 22 April 2016 (cow manure); eight females, Shushtar, Arab Hassan, 31° 49' 44" N, 48° 53' 55" E, 30 m a.s.l., 2 March 2016 (sheep manure); four females, two males, Hamidieh, Tarrahiyeh, 31° 25' 21" N, 48° 23' 21" E, 18 m a.s.l., 10 March 2016 (cow manure), four females, two males, 20 October 2016 (cow manure); four females, two males, Hamidieh, Pich-e Seyyed Jaber, 31° 27' 34" N, 48° 25' 26" E, 21 m a.s.l., 10 March 2016 (cow manure); six females, two males, 4 June 2016 (cow manure); nine females, Shush, Khoyes, 32° 01' 53" N, 48° 16' 45" E, 60 m a.s.l., 13 April 2016 (buffalo manure), ten females, three males, 4 July 2017 (cow manure); six females, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 29 April 2016 (cow manure); eight females, Shush, Seyyed Abbas, 31° 49' 49" N, 48° 23' 21" E, 40 m a.s.l., 5 June 2016 (buffalo manure), eight females, four males, 25 May 2016 (cow manure); ten females, Shushtar, Band-e Qir, 31° 39' 10" N, 48° 53' 09" E, 26 m a.s.l., 13 October 2016 (cow manure), three females, 19 June 2016 (sheep manure); four females, Bavi, Talbumeleh, 31° 31' 37" N, 48° 55' 27" E, 20 m a.s.l., 9 October 2016 (cow manure); four females, two males, Susangerd, Abu Hamizeh, 31° 31' 48" N, 48° 13' 11" E, 15 m a.s.l., 20 October 2016 (cow manure); nine females, Bavi, Veys, 31° 28' 56" N, 48° 52' 41" E, 24 m a.s.l., 23 October 2016 (cow manure); three females, Bavi, Naddafieh, 31° 36' 20" N, 48° 52' 59" E, 27 m a.s.l., 19 November 2016 (sheep manure).

Note – Characters of the Iranian specimens agreed with data presented in Hyatt and Emberson (1988).

Macrocheles scutatus (Berlese, 1904)

Holostaspis subbadius var. *scutatus* – Berlese (1904): 264.

Macrocheles scutatus – Hyatt and Emberson (1988): 110.

Distribution and habitats in Iran – Provinces of Tehran (soil, leaf-litter, decomposing organic matter, manure, unidentified scarab beetles), Fars (soil of citrus orchards), Markazi (soil), Isfahan (soil of fruit orchards), Chaharmahal va Bakhtiari (dung), Khorasan-e Shomali (soil of farms, gardens and manures), Mazandaran (soil), Golestan (*Geotrupes* sp.) (Kazemi and Rajaei 2013) and Lorestan (oak forest, field and manure) (Nemati *et al.* 2018). This is new to the Khuzestan Province fauna.

Material examined – Two females, Ahvaz, Gavmish Abad, 31° 17' 34.77" N, 48° 40' 05.05" E, 15 m a.s.l., 26 May 2015 (buffalo manure); two females, Bavi, Shajaraat, 31° 30' 40" N, 48° 54' 27" E, 22 m a.s.l., 8 June 2015 (cow manure); three females, one male, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 8 April 2015 (buffalo manure), two females, 22 November 2015 (cow manure); two females, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 5 November 2015 (cow manure), two females, 22 April 2016 (buffalo manure); two females, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 29 April 2016 (cow manure); one female, Shush, Seyyed Abbas, 31° 49' 49" N, 48° 23' 21" E, 40 m a.s.l., 5 June 2016 (buffalo manure); one female, two males, Shush, Khoyes, 32° 01' 53" N, 48° 16' 45" E, 60 m a.s.l., 26 May 2016 (sheep manure); two females, Bavi, Talbumeh, 31° 31'

37° N, 48° 55' 27" E, 20 m a.s.l., 9 October 2016 (cow manure); one female, Hamidieh, Pich-e Seyyed Jaber, 31° 27' 34" N, 48° 25' 26" E, 21 m a.s.l., 20 October 2016 (cow manure); one female, Hamidieh, Tarrahiyeh, 31° 25' 21" N, 48° 23' 21" E, 18 m, 20 October 2016 (buffalo manure); two females, Bavi, Veys, 31° 28' 56" N, 48° 52' 41" E, 24 m a.s.l., 23 October 2016 (cow manure); two females, one male, Bavi, Naddafieh, 31° 36' 20" N, 48° 52' 59" E, 27 m a.s.l., 2 June 2017 (sheep manure).

Note – Characters of the Iranian specimens agreed with data presented in Hyatt and Emberson (1988).

Macrocheles subbadius (Berlese, 1904)

Holostaspis subbadius– Berlese (1904): 264.

Macrocheles subbadius – Hyatt and Emberson (1988): 111.

Distribution and habitats in Iran – Provinces of Fars (putrid onion, soil and decayed plants associated with conifers, manure, soil and leaf-litter), Alborz (compost), Chaharmahal va Bakhtiari (dung), Golestan (*Geotrupes* sp., cow and sheep manure), Kerman (soil) (Kazemi and Rajaei 2013), Gulian (soil of hazelnut orchard), Markazi (soil) and Chaharmahal va Bakhtiari (soil) (Nemati *et al.* 2018). This is new to the Khuzestan Province fauna.

Material examined – Two females, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 8 April 2015 (sheep manure), one female, 14 May 2015 (cow manure); one female, Ahvaz, dairy farm at Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 6 April 2016 (cow manure); one female, Shush, Seyyed Abbas, 31° 49' 49" N, 48° 23' 21" E, 40 m a.s.l., 6 May 2016 (buffalo manure).

Note – Characters of the Iranian specimens agreed with data presented in Hyatt and Emberson (1988).

Macrocheles sumbaensis Hartini & Takaku, 2005

Macrocheles sumbaensis – Hartini and Takaku (2005): 206.

Distribution and habitats in Iran – Chaharmahal va Bakhtiari Province (dung) (Babaeian *et al.* 2011, Kazemi and Rajaei 2013). This is the second record from Iran and new to the Khuzestan Province fauna.

Material examined – Five females, Ahvaz, 31° 23' 02" N, 48° 38' 38" E, 18 m a.s.l., 24 April 2015 (horse manure), four females, one male, 30 November 2015 (horse manure), five females, 13 November 2016 (horse manure); two females, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 14 May 2015 (poultry manure), three females, 27 October 2015 (poultry manure), two females, 23 October 2016 (cow manure); two females, one male, Ahvaz, dairy farm at Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 26 May 2015 (cow manure), three females, 17 November 2015 (cow manure), two females, 29 May 2016 (cow manure), three females, one male, 16 November 2016 (cow manure); two females, one male, Ahvaz, Jassaniyeh-ye Bozorg, 31° 25' 55" N, 48° 44' 41" E, 22 m a.s.l., 30 November 2015 (cow manure); four females, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 22 April 2016 (buffalo manure); three females, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 29 April 2016 (sheep manure); two females, Shushtar, Band-e Qir, 31° 39' 10" N, 48° 53' 09" E, 26 m a.s.l., 13 May 2016 (cow manure); three females, Shushtar, Arab Hassan, 31° 49' 44" N, 48° 53' 55" E, 30 m a.s.l., 13 May 2016 (cow manure); two females, Bavi, Talbume, 31° 31' 37" N, 48° 55' 27" E, 20 m a.s.l., 9 October 2016 (cow manure); two females, Bavi, Naddafieh, 31° 36' 20" N, 48° 52' 59" E, 27 m a.s.l., 19 November 2016 (sheep

manure); three females, Shush, Khoyes, 32° 01' 53" N, 48° 16' 45" E, 60 m a.s.l., 10 December 2016 (sheep manure).

Note – Characters of the Iranian specimens agreed with data presented in Hartini and Takaku (2005).

Oplitidae Hirschmann & Zirngiebl-Nicol, 1964
***Oplitis* Berlese, 1884**

***Oplitis paradoxa* (Canestrini & Berlese, 1884)**

Uropoda paradoxa – Canestrini & Berlese (1884): 175.

Oplitis paradoxa – Karg (1989): 163.

Distribution and habitats in Iran – Fars (soil of citrus orchards), Yazd (soil of wheat fields) and Kerman (soil) (Kazemi and Rajaei 2013) Provinces. This is a new record for Khuzestan province fauna.

Material examined – One female, Shush, Beyt-e Jazayer, 32° 00' 56" N, 48° 17' 27" E, 60 m a.s.l., 26 May 2016 (cow manure); one female, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 12 April 2017 (sheep manure).

Note – Characters of the Iranian specimens agreed with data presented in Karg (1989). The genus was also considered as a member of the family Uropodidae (e.g. Hirschmann 1991) or Trachyuropodidae (e.g. Kontschán 2013). However, we place it in Oplitidae following Pereira *et al.* (2016).

Sejidae Berlese, 1885
***Sejus* C.L. Koch, 1836**

***Sejus australis* Hirschmann & Kaczmarek, 1991**

Sejus australis – Hirschmann and Kaczmarek (1991): 163.

Distribution and habitats in Iran – Isfahan and Chaharmahal va Bakhtiari (soil) provinces (Kazemi and Rajaei 2013). This is a new record for Khuzestan province fauna.

Material examined – Two females, three deutonymphs, Ahvaz, dairy farm at the Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 26 May 2015 (cow manure); four females, Ahvaz, Nabi-ye Akram village, 31° 26' 15" N, 48° 45' 11" E, 18 m a.s.l., 18 November 2016 (cow manure).

Note – Characters of the Iranian specimens agreed with data presented in Hirschmann and Kaczmarek (1991).

Urodynychidae Berlese, 1917
***Uroobovella* Berlese, 1903**

***Uroobovella difoveolata* Hirschmann & Zirngiebl-Nicol, 1962**

Uroobovella difoveolata – Hirschmann and Zirngiebl-Nicol (1962): 59.

Uroobovella difoveolata – Karg (1989): 137.

Distribution and habitats in Iran – Khorasan-e Razavi (*Copris hispanus* L.), Mazandaran (*Euonthophagus pallens* (Olivier)) (Kazemi and Rajaei 2013), Kerman (cow and sheep manure), Lorestan (soil of walnut trees and vine orchards) and Fars (soil and debris) Provinces (Nemati *et al.* 2018). This is a new record for Khuzestan Province fauna.

Material examined – Four females, Ahvaz, dairy farm at the Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 26 May 2015 (cow manure); three females, Bavi, Shajaraat, 31° 30' 40" N, 48° 54' 27" E, 22 m a.s.l., 6 August 2015 (buffalo manure); three females, one deutonymph, Shush, Beyt-e Juhi, 31° 57' 50" N, 48° 17' 42" E, 64 m a.s.l., 26 July 2015, (cow manure); two females, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 12 November 2017 (sheep manure), three females, 23 October 2015 (cow manure), two females, 23 October 2016 (cow manure), three females, two males, 5 March 2017 (sheep manure); two females, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 5 November 2015 (cow manure); four females, two males, Ahvaz, Nabi-ye Akram village, 31° 26' 15" N, 48° 45' 11" E, 18 m a.s.l., 30 November 2015 (cow manure). Three females, Hamidieh, Tarrahiyeh, 31° 25' 21" N, 48° 23' 21" E, 18 m a.s.l., 10 March 2016 (cow manure); four females, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 22 April 2016 (sheep manure); five females, two males, Ahvaz, Gavmish Abad, 31° 17' 34.77" N, 48° 40' 05.05" E, 15 m a.s.l., 23 April 2016 (buffalo manure); four females, two males, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 29 April 2016 (sheep manure); four females, one male, Shush, Abdolkhan, 31° 52' 29" N, 48° 20' 30" E, 43 m a.s.l., 5 June 2016 (cow manure); six females, Shushtar, Arab Hassan, 31° 49' 44" N, 48° 53' 55" E, 30 m a.s.l., 13 May 2016 (cow manure); four females, Shush, Khoyes, 32° 01' 53" N, 48° 16' 45" E, 60 m a.s.l., 26 May 2016 (cow manure); three females, one male, Bavi, Talbume, 31° 31' 37" N, 48° 55' 27" E, 20 m a.s.l., 9 October 2016 (cow manure); four females, Ahvaz, Daghagheleh, 31° 23' 31" N, 48° 41' 28" E, 20 m a.s.l., 29 October 2016 (cow manure); three females, Shushtar, Band-e Qir, 31° 39' 10" N, 48° 53' 09" E, 26 m a.s.l., 19 November 2016 (cow manure); four females, Shush, Seyyed Abbas, 31° 49' 49" N, 48° 23' 21" E, 40 m a.s.l., 25 May 2017 (cow manure).

Note – Characters of the Iranian specimens agreed with data presented in Karg (1989).

Uroobovella fimicola (Berlese, 1903)

Dinychus fimicolus – Berlese (1903): 248

Uroobovella fimicola – Karg (1989): 134.

Distribution and habitats in Iran – Provinces of Fars (birdseed and poultry bed and soil of fields), Tehran (humus rich areas of orchards, parks and lawns of the region, soil), Alborz (compost and mushroom), Khorasan-e Razavi and Mazandaran (unidentified scarabaeid beetles), Golestan (*E. gibbosus*), Azerbaijan-e Gharbi (soil of sunflower fields, soil and plant debris of apple orchards), Khorasan-e Shomali (soil of farms, gardens and manures) and Mazandaran (soil, litter, humus, cow and sheep dung) (Kazemi and Rajaei 2013). This is a new record for Khuzestan province fauna.

Material examined – Five females, Ahvaz, Gavmish Abad, 31° 17' 34.77" N, 48° 40' 05.05" E, 15 m a.s.l., 24 April 2015 (buffalo manure); two females, Shush, Seyyed Abbas, 31° 49' 49" N, 48° 23' 21" E, 40 m a.s.l., 7 May 2015 (buffalo manure); four females, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 25 May 2015 (sheep manure), three females, 30 August 2015 (buffalo manure), one female, three males, 23 October 2015 (sheep manure), five females, 23 October 2016 (cow manure); five females, Ahvaz, dairy farm at the Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 26 May 2015 (cow manure), four females, one male, 30 November 2015

(cow manure); four females, two males, Shush, Beyt-e Juhi, 31° 57' 50" N, 48° 17' 42" E, 64 m a.s.l., 13 July 2015 (poultry manure); two females, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 5 November 2015 (cow manure), five females, 22 April 2016 (sheep manure); four females, Dasht-e Azadegan, Susangerd, 31° 32' 58" N, 48° 11' 57" E, 14 m a.s.l., 12 December 2015 (buffalo manure); three females, Band-e Qir, 31° 39' 10" N, 48° 53' 09" E, 26 m a.s.l., 13 October 2016 (cow manure), two females, 19 November 2016 (cow manure); three females, Ahvaz, Jassaniyeh-ye Kuchak, 31° 24' 10" N, 48° 44' 58" E, 21 m a.s.l., 27 May 2016 (cow manure); three females, two males, Shush, Khavar-e Seyyed Khalaf, 31° 31' 23" N, 48° 49' 31" E, 25 m a.s.l., 9 October 2016 (cow manure).

Note – Characters of the Iranian specimens agreed with data presented in Karg (1989).

***Uroobovella marginata* (C.L. Koch, 1839)**

Notaspis marginatus – C.L. Koch (1839): 22.

Uroobovella marginata – Karg (1989): 137.

Distribution and habitats in Iran – Provinces of Tehran (humus rich areas of orchards, parks and lawns of the region, soil), Kerman (soil, cow and poultry manure), Isfahan (soil of fruit trees orchards), Khorasan-e Razavi and Mazandaran (unidentified scarabaeid beetles, soil, litter, humus, cow and sheep dung), Khorasan-e Razavi (soil and leaf litter), Guilan (stored rice, rice dust and debris), Golestan (*E. gibbosus*), Khorasan-e Shomali (soil of farms, gardens and manures), Azerbaijan-e Gharbi (soil and plant debris of apple orchards) (Kazemi and Rajaei 2013) and Sistan va Baluchestan (*Rhynchophorus ferrugineus* Olivier) (Nemati *et al.* 2018). This is a new record for Khuzestan Province fauna.

Material examined – Four females, Ahvaz, Gavmish Abad, 31° 17' 34.77" N, 48° 40' 05.05" E, 15 m a.s.l., 26 November 2015 (buffalo manure); five females, one male, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 30 April 2015 (sheep manure), four females, 29 April 2016 (cow manure); nine females, three males, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 14 May 2015 (cow manure), five females, 25 May 2015 (sheep manure), four females, 24 June 2015 (poultry manure), four females, 2 September 2015 (sheep manure), seven females, one male, 27 October 2015 (buffalo manure), three females, 23 November 2015 (sheep manure), six females, 25 August 2016 (sheep manure); six females, Ahvaz, dairy farm at the Shahid Chamran University campus, 32° 17' 59" N, 48° 39' 39" E, 15 m a.s.l., 26 May 2015 (cow manure), five females, 17 September 2015 (cow manure), two females, 17 November 2015 (cow manure), eight females, two males, 29 May 2016 (cow manure); six females, Bavi, Shajaraat, 31° 30' 40" N, 48° 54' 27" E, 22 m a.s.l., 8 June 2015 (cow manure); five females, three males, Shush, Beyt-e Juhi, 31° 57' 50" N, 48° 17' 42" E, 64 m a.s.l., 13 July 2015 (poultry manure); five females, Ahvaz, Jassaniyeh-ye Kuchak, 31° 24' 10" N, 48° 44' 58" E, 21 m a.s.l., 29 September 2015 (cow manure); three females, Hamidieh, 31° 28' 39" N, 48° 26' 44" E, 29 m a.s.l., 5 November 2015 (cow manure); six females, two males, Ahvaz, Nabi-ye Akram village, 31° 26' 15" N, 48° 45' 11" E, 18 m a.s.l., 30 November 2015 (cow manure); four females, Hamidieh, Gambue, 31° 23' 59" N, 48° 31' 21" E, 16 m a.s.l., 11 December 2015 (cow manure); six females, Shushtar, Arab Hassan, 31° 49' 44" N, 48° 53' 55" E, 30 m a.s.l., 2 March 2016 (sheep manure); two females, Hamidieh, Tarrahiye, 31° 25' 21" N, 48° 23' 21" E, 18 m a.s.l., 22 April 2016 (buffalo manure); five females, one male, Shush, Abdolkhan, 31° 52' 29" N, 48° 20' 30" E, 43 m a.s.l., 6 May 2016 (buffalo manure); seven females, Shushtar, Arab Hassan, 31° 49' 44" N, 48° 53' 55" E, 30 m a.s.l., 13 May 2016 (cow manure); five females, Bavi, Talbume, 31° 31' 37" N, 48° 55' 27" E, 20 m a.s.l., 9 October 2016 (cow manure); two females, Hamidieh, Pich-e Seyyed Jaber, 31° 27' 34" N, 48° 25' 26" E, 21 m a.s.l., 20 October 2016 (cow manure); four females, Ahvaz, Ebadeh, 31° 26' 14" N, 48° 45' 07" E, 20 m a.s.l., 29 October 2016 (cow manure); five females, Shushtar, Band-e Qir, 31° 39' 10" N, 48° 53' 09" E, 26 m a.s.l., 19 November 2016 (sheep manure); four females, Ahvaz,

Haatam village, 31° 51' 35" N, 48° 21' 31.05" E, 36 m a.s.l., 11 May 2017 (sheep manure); five females, two males, Bavi, Naddafieh, 31° 36' 20" N, 48° 52' 59" E, 27 m a.s.l., 2 June 2017 (sheep manure).

Note – Characters of the Iranian specimens agreed with data presented in Karg (1989).

***Uroobovella varians* Hirschmann & Zirngiebl-Nicol, 1962**

Uroobovella varians – Hirschmann and Zirngiebl-Nicol (1962): 59.

Uroobovella varians – Karg (1989): 136.

Distribution and habitats in Iran – This is the first record for Iran mite fauna.

Material examined – One deutonymph, Shushtar, Band-e Qir, 31°39'10" N, 48°53'09" E, 26m, 13 october 2016 (cow manure).

Identification – Deutonymph: Length of idiosoma 467 µm, width 352 µm, colour yellow-brown. Shape of idiosoma oval, posterior margin rounded. Dorsal and marginal shields fused anteriorly (Fig. 3a). Dorsal and marginal shields without sculptural pattern and bearing short and smooth acicular setae. Surface of sternal shield smooth, with 9 pairs of setae and small pimple pits. Sternal setae *St1*, *St2* and *St3* situated near coxae II. *St4* – *St7* placed near coxae III. *St8* and *St9* situated near coxae IV (Fig. 3b). Posterior part of sternal shield wider than 1/2 width of the ventrianal shield. Surface of ventrianal shield smooth. Marginal setae of the ventrianal shield not elongated. Anal shield as in Fig. 3c. Peritremes with several S-shaped coils (Fig. 3d). Corniculi horn-like, internal malae smooth and longer than corniculi. Chelicerae with long apical process on fixed digit.

Note – This species has a Palearctic distribution and was recorded from Europe and Korean Peninsula (Kontschán *et al.* 2012). It has not yet been recorded from other parts of Asia. It may be due to the poor investigation of Uropodina fauna in Asia. The report of this species by Mesbah *et al.* (2008) from Egypt could be misidentification (Dilipkumar *et al.* 2015). However, it was again recorded from Egypt by Elmoghazy and Shower (2013). This mite has previously been recorded from horse dung (Schelvis 1991; Skorupski and Gwiazdowicz 1998), strongly decayed, moist litter (Kontschán *et al.* 2012) and soil (Elmoghazy and Shower 2013). Characters of Our specimen agree with data presented in Karg (1989).

Uropodidae Kramer, 1881

***Uropoda* Latreille, 1806**

***Uropoda orbicularis* (Müller, 1776)**

Acarus orbicularis – Müller (1776): 187.

Uropoda orbicularis – Karg (1989): 171.

Distribution and habitats in Iran – Provinces of Azerbaijan-e Sharghi (soil of orchards, soil and foliage of poplar and elm trees), Hamedan (clover fields), Fars (decaying onion, soil of citrus orchards, foliage, soil, leaf-litter, weeds and soil of apple trees, oak forests, soil and leaf litter, soil and debris), Tehran (humus rich areas of orchards, parks and lawns of the region, soil, honey bee hives), Azerbaijan-e Gharbi (aerial plants part and soil of potato fields, soil and plant debris of apple orchards, soil of sunflower fields), Khuzestan (soil), Khorasan-e Shomali (*Caccobius schreberi* (L.)

and *Onthophagus* sp., soils of farm, gardens and manures), Golestan (soil), Kerman (soil), Mazandaran (soil, litter, humus, cow and sheep dung, dead wood, leaf-litter, *Lucanus* sp.), Lorestan (soil of apple orchard) and Khorasan-e Razavi (soil) (Kazemi and Rajaei 2013; Nemati *et al.* 2018).

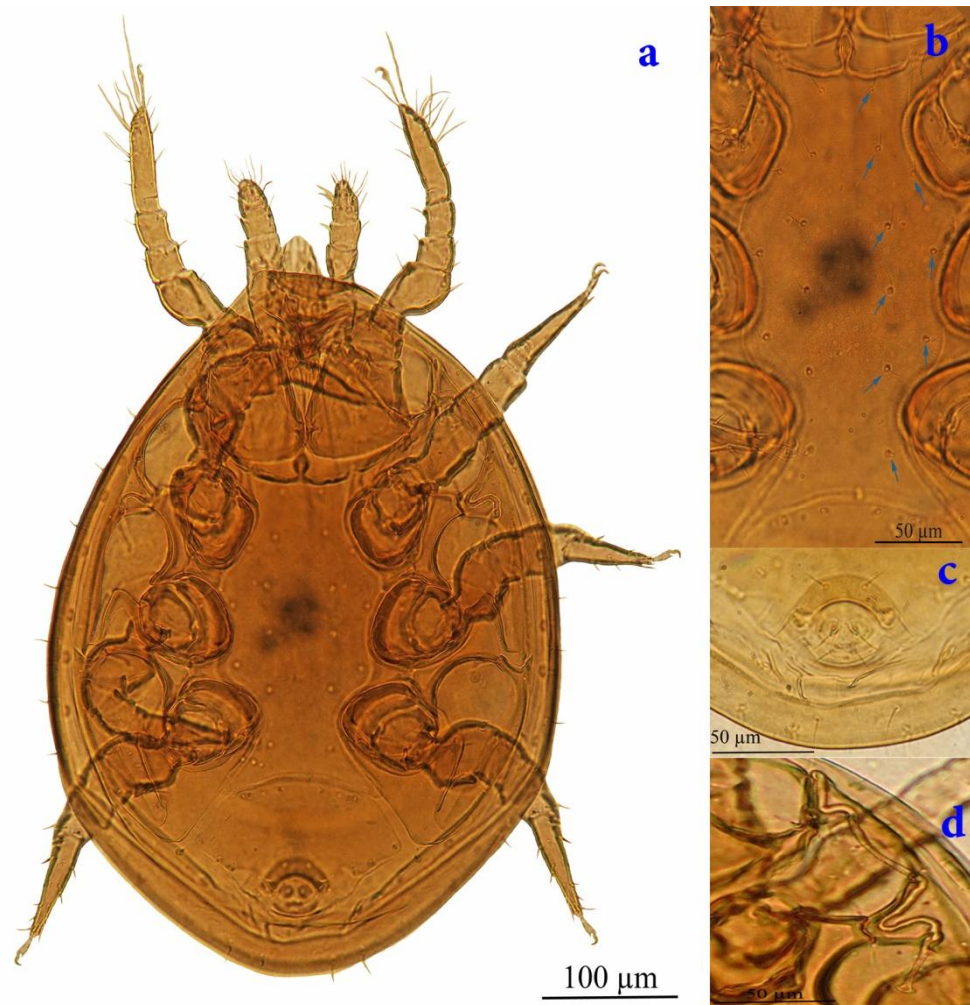


Figure 3. Deutonymph of *Uroobovella varians* Hirschmann & Zirngiebl-Nicol, 1962 – a. Ventral view; b. Sternal shield; c. Anal shield, d. Peritreme.

Material examined – One deutonymph, Shush, Abdolkhan, 31° 52' 29" N, 48° 20' 30" E, 43 m a.s.l., 6 May 2016 (cow manure); one deutonymph, Bavi, Mollasani, 31° 35' 31" N, 48° 53' 10" E, 27 m a.s.l., 12 April 2017 (cow manure); one deutonymph, Ahvaz, Haatam village, 31° 51' 35" N, 48° 21' 31.05" E, 36 m a.s.l., 11 May 2017 (sheep manure); one deutonymph, Ahvaz, Alhaei, 31° 39' 20" N, 48° 35' 26" E, 31 m a.s.l., 24 May 2017 (cow manure).

Note – Characters of the Iranian specimens agreed with data presented in Karg (1989).

DISCUSSION

According to our results, the genus and species of *Leitneria pugio* (Karg, 1961) are present in Iran which is the first record of their presence in Asia. *Uroobovella varians* Hirschmann & Zirngiebl-Nicol, 1962 is also a new record for west Asia from Iran. Three of the found species in our study are second records for Iran and 14 species out of 20 were new to Khuzestan province fauna. Khuzestan province has an area of 67,000 km², consisting of mountainous and plain parts. Our study was

conducted in plain parts of Khuzestan which are semi-desert lowlands and excessively hot and dry in summer. It seems that exploring more locations and different host/habitats in this province would increase the number of recorded mite species not only in Khuzestan, but also in Iran.

Kazemi and Rajaei (2013) reported 72 manure-inhabiting Mesostigmata from different Iranian provinces which were collected from cow, sheep, chicken, poultry and camel manures. According to Nemati *et al.* (2018), 50 more Mesostigmata mites (excluding Phytoseiidae) were collected from manure in Iran, after Kazemi and Rajaei (2013) checklist. Here, we found 4 manure-associated species (excluding *L. pugio* and *U. varians*) which were not previously recorded from manure in Iran. We do expect to find new manure-associated mesostigmatic mites through further studies in Iran.

Some of manure-associated mite species prey on the eggs or early instar larvae of coprophagous flies, and could be effective fly egg and larval predators (Krantz 1983; Farahi *et al.* 2018). Our results revealed that the species of Macrochelidae, a cosmopolitan family of predatory mesostigmatic mites, were more abundant and widespread among our recorded taxa. It indicates the importance of studying the biology and predation capacity of such mite species, especially in the less explored areas of Iran. On the other hand, the potential of urodinychid species (which had a considerable abundance among our records) for controlling flies seems to be limited due to its low reproduction rate, patchy distribution and slow movement in dung substrates, according to Krantz (1983). A provisional key for known Iranian species of the genus *Uroobovella* is as follows:

Provisional key to the known species of the genus *Uroobovella* in Iran, modified from Karg 1989

1. Female, with a genital shield between coxa II–IV 2
 - Deutonymph, without a genital shield..... 8
2. Dorsal shield with structural pits..... 3
 - Dorsal shield without structural pits..... 4
3. Marginal shields united posteriorly, genital shield pointed anteriorly, dorsal setae pilose *Uroobovella pulchella* (Berlese)
 - Marginal shields not united posteriorly, genital shield rounded anteriorly, dorsal setae not pilose *Uroobovella fimicola* (Berlese)
4. Peritreme extremely broad and short..... *Uroobovella fracta* (Berlese)
 - Peritreme narrow and long 5
5. Marginal setae as long as dorsal setae..... 6
 - Marginal setae longer than dorsal setae, genital shield scutiform with blunt anterior area, dorsal setae needle-like *Uroobovella obovata* (G. Canestrini & Berlese)
6. All dorsal setae needle-like with equal length, six to seven pairs of sternal setae alongside genital shield, genital shield anteriorly rounded with knobs near anterior and V shape ornamentation near posterior..... *Uroobovella vinicolora* (Vitzthum)
 - Two to four caudal pairs of dorsal setae pilose 7
7. Posterior part of marginal shield divided, genital shield with a bifid anterior spike *Uroobovella marginata* (C.L. Koch)
 - Posterior part of marginal shield complete and not divided, genital shield slightly sharpened anteriorly *Uroobovella difoveolata* Hirschmann & Zirngiebl-Nicol
8. Sternum narrow, not touching the coxal margins and with 8 pairs of setae, peritreme not coiled *Uroobovella flagelliger* (Berlese)
 - Sternum wider, touching the coxal margins and with 9 pairs of setae, peritreme with several S-shaped coils *Uroobovella varians* Hirschmann & Zirngiebl-Nicol

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برخی از کنه‌های میان استیگمای (Acari: Parasitiformes) استان خوزستان، جنوب غربی ایران

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چکیده

مدفوع حیوانات، زیستگاه موقتی است که در آن جوامع بی‌مهرگان تخصص یافته، شامل جمعیت بسیاری از کنه‌ها، در کنار یکدیگر زندگی می‌کنند. به منظور مطالعه کنه‌های میان استیگمای کودزی، نمونه‌هایی از کودهای مختلف حیوانات اهلی و طیور در اهواز و حومه آن در استان خوزستان، جنوب غربی ایران، در مدت دو سال (۱۳۹۴-۱۳۹۶) جمع‌آوری شد. در مجموع، ۲۰ گونه متعلق به هشت خانواده از میان استیگمایان گزارش شد، که ۱۴ گونه از آنها نخستین گزارش برای فون استان خوزستان‌اند. جنس و گونه *Leitneria pugio* (Karg, 1961) گزارش جدید برای فون کنه‌های ایران است. این جنس و گونه پیشتر تنها از اروپا گزارش شده است. گونه *Uroobovella varians* Hirschmann & Zirngiebl- Nicol, 1962 نیز که بر اساس مرحله پوره سن دوم بود برای نخستین بار از ایران گزارش می‌شود. همچنین اطلاعات جمع‌آوری مربوط به هر گونه همراه با کلیدی برای شناسایی گونه‌های تاکنون شناخته شده جنس *Uroobovella* در ایران ارائه شده است.

واژگان کلیدی: میان استیگمایان؛ کنه‌های کودزی؛ *Uroobovella*؛ اهواز؛ ایران.

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