



Records of Parasitidae and Laelapidae (Acari: Mesostigmata) from domestic animal manure in Khuzestan province, southwestern Iran with a new record for the Asian fauna

Sara Farahi^{1*}, Parviz Shishehbor¹ & Alireza Nemati²

¹ Department of Plant Protection, Faculty of Agriculture, Shahid Chamran University of Ahvaz, Ahvaz, Iran.

² Department of Plant Protection, Faculty of Agriculture, Shahrekord University, Shahrekord, Iran.

ABSTRACT. Mites of the families Parasitidae and Laelapidae (Acari: Mesostigmata) are among the most common and widely distributed mites of the suborder Gamasina. During 2015-2017, fauna of parasitid and laelapid (Acari: Mesostigmata) mites from domestic animal manure collected and surveyed in Khuzestan Province, southwestern Iran. Totally, four Parasitidae species belonging to three genera and seven Laelapidae species belonging to four genera collected from domestic animal manure in Khuzestan Province. Among them, *Cornigamasus ocliferius* Skorupski & Witaliński, 1997 is a new record for mite fauna of Asia and *Androlaelaps projecta* Furman, 1972 is a new name for mite fauna of Iran. Four species are new to Khuzestan Province fauna as well. We also recorded six manure-associated species which have never been previously reported from manure in Iran. *Parasitus fimetorum* (Berlese, 1904) was the most frequent Parasitidae species among our records. The mites distribution and habitats data in Khuzestan Province are provided for all of the species, together with some taxonomic and bio-ecological notes.

Key words: Mesostigmata, *Cornigamasus ocliferius*, Manure-inhabiting mites, Ahvaz

Received:
05 January, 2020

Accepted:
15 June, 2020

Published:
23 June, 2020

Subject Editor:
Azim Mortazavi

Citation: Farahi, S., Shishehbor, P. & Nemati, A. (2020) Records of Parasitidae and Laelapidae (Acari: Mesostigmata) from domestic animal manure in Khuzestan province, southwestern Iran with a new record for the Asian fauna. *Journal of Insect Biodiversity and Systematics*, 6 (3), 247–260.

Introduction

The Parasitidae Oudemans (Acari: Mesostigmata) are among the most common and widely distributed mites of the suborder Gamasina which comprises two subfamilies, Parasitinae Oudemans and Pergamasinae Juvara-Bals (Beaulieu et al., 2011; Hyatt, 1980). The Parasitidae is a family of important predatory mites found in litter and humus, and certain species are especially abundant in accumulations of organic material such as rotting seaweed, compost, manure and in the subterranean nests of small mammals (Hyatt, 1980; Karg, 1993; Blackman, 1997). Mites of this family mainly predate on soil-inhabiting microarthropods and nematodes and disperse phoretically through their deutonymphal stage on insects (mostly of the orders Coleoptera and Hymenoptera) (Beaulieu et al., 2011).

Corresponding author: Sara Farahi, E-mail: sara.farahi@gmail.com

Copyright © 2020, Farahi et al. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY NC 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

The family Laelapidae Berlese comprises a multitude of genera and species of morphologically and ecologically diverse mites that are free living, parasites and predators (Lindquist et al., 2009). Mites of the family Laelapidae are found commonly in such habitats as manure, litter and soil, and in association with arthropods, mammals and birds. Most species have been found in the soil-litter habitats as free-living predators, but some are found in the nests or on the body of arthropods or rodents (Rosario, 1981; Strong & Halliday, 1994; Beaulieu, 2009; Faraji & Halliday, 2009; Gwiazdowicz et al., 2018; Lindquist et al., 2009; Nemati & Mohseni, 2013). Laelapid mites have a suppressive effect on pest insect populations and adding composting manure to the soil as a means of increasing mite numbers has resulted in promoting the pest's control (Hagen et al., 1999). Members of the genera *Cosmolaelaps* Berlese, *Gaeolaelaps* Evans & Till, *Hypoaspis* Berlese and *Androlaelaps* Berlese have been collected in manure, litter or soil substrates in Iran, while species of these and other genera are routinely or occasionally encountered in the nests of mammals or arthropods or directly associated with insects (Gwiazdowicz et al., 2018; Kazemi & Rajaei, 2013; Nemati et al., 2018).

The early results on manure-inhabiting mites were previously published by Farahi et al. (2018b). Here we aim to report some Parasitidae and Laelapidae records from southwestern Iran which were collected during faunistic surveys on manure-inhabiting mites. A Parasitidae species is presented for the first time from Asia together with taxonomic discussion on the species.

Material and methods

This study was conducted in Ahvaz and its vicinity in Khuzestan Province, southwestern Iran, over a period of two years (April, 2015 to April 2017). Mites were collected and extracted from different manure types of domestic animals and poultry, using Berlese-Tullgren funnels. The specimens were placed in Nesbitt's solution and Lactophenol (1:1) for clearing and then permanently mounted in Hoyer's medium on microscope slides. Specimens were then sorted and identified to species level based on available related literatures. Host and habitats of previously reported species have only been mentioned for those which recorded from Khuzestan Province based on available literature. Collected specimens were deposited in the Insect and Mite Collection of Ahvaz (IMCA), Department of Plant Protection, Shahid Chamran University of Ahvaz, Ahvaz, Iran. In this study the notations of dorsal and ventral chaetotaxy, poroidotaxy/adenotaxy have been used according to Witalinski's work which are based on Lindquist & Evans (1965), Evans & Till (1979) which connects poroids/gland pores with setae, but also by Lindquist & Moraza (1998), whereas poroidotaxy/adenotaxy on Johnson & Moraza (1991) and most recently, on Moraza & Pena (2005), with some necessary adjustments for Parasitidae.

Results

In total, four species belonging to three genera of Parasitidae and seven species belonging to four genera of Laelapidae were collected and identified from domestic animal manure in Khuzestan Province, from which the Parasitidae species *Cornigamasus oculiferius* Skorupski & Witaliński, 1997 is a new species record from Asia.

Family Parasitidae Oudemans, 1901***Cornigamasus* Evans and Till, 1979*****Cornigamasus ocliferius* Skorupski & Witaliński, 1997**

Cornigamasus ocliferius Skorupski & Witaliński, 1997: 148; Witaliński et al., 2005: 146; Witaliński, 2014: 341.

Studied materials and related host/habitat: one female, one male, three deutonymphs, Ahvaz, Gavmish Abad, 31°17'34" N, 48°40'05" E, 15 m, 24.IV.2015 (buffalo manure); five deutonymphs, Bavi, Mollasani, 31°35'31" N, 48°53'10" E, 27 m, 14.V.2015 (cow manure), one female, three deutonymphs, 20.X.2015 (buffalo manure), two deutonymphs, 16.VI.2016 (sheep manure), three females, one male, two deutonymphs, 23.X.2016 (cow manure); four deutonymphs, Shush, Khavar-e Seyyed Khalaf, 31°31'23" N, 48°49'31" E, 25 m, 8.VI.2015 (buffalo manure), one female, two males, 9.X.2016 (cow manure); one female, seven deutonymphs Ahvaz, dairy farm at Shahid Chamran University campus, 32°17'59" N, 48°39'39" E, 15 m, 28.VI.2015 (cow manure), one female, three deutonymphs, 17.XI.2015 (cow manure), three deutonymphs, 29.V.2016 (cow manure); four deutonymphs, Shush, Beyt-e Juhi, 31°57'50" N, 48°17'42" E, 64 m, 13.VII.2015 (cow manure); three deutonymphs, Ahvaz, Jassaniyeh-ye Kuchak, 31°24'10" N, 48°44'58" E, 21 m, 29.IX.2015 (cow manure); three deutonymphs, Ahvaz, 31°23'02" N, 48°38'38" E, 18 m, 30.XI.2015 (horse manure); four deutonymphs, Hamidieh, 31°28'39" N, 48°26'44" E, 29 m, 12. XII.2015 (buffalo manure), three deutonymphs, 22.IV.2016 (buffalo manure); three deutonymphs, Ahvaz, Nabi-ye Akram village, 31°26'15" N, 48°45'11" E, 18 m, 6.IV.2016 (cow manure); four deutonymphs, Ahvaz, Alhaei, 31°39'20" N, 48°35'26" E, 31 m, 29.IV.2016 (cow manure); one female, three deutonymphs, Shush, Abdolkhan, 31°52'29" N, 48°20'30" E, 43 m, 6.V.2016 (cow manure); four deutonymphs, Shushtar, Band-e Qir, 31°39'10" N, 48°53'09" E, 26 m, 13.V.2016 (cow manure); two deutonymphs, Hamidieh, Pich-e Seyyed Jaber, 31°27'34" N, 48°25'26" E, 21 m, 20.X.2016 (buffalo manure); ten females, five males, Hamidieh, Tarrahiye, 31°25'21" N, 48°23'21" E, 18 m, 20.V.2016 (buffalo manure); three deutonymphs, Ahvaz, Daghagheleh, 31°23'31" N, 48°41'28" E, 20 m, 29.V.2016 (cow manure).

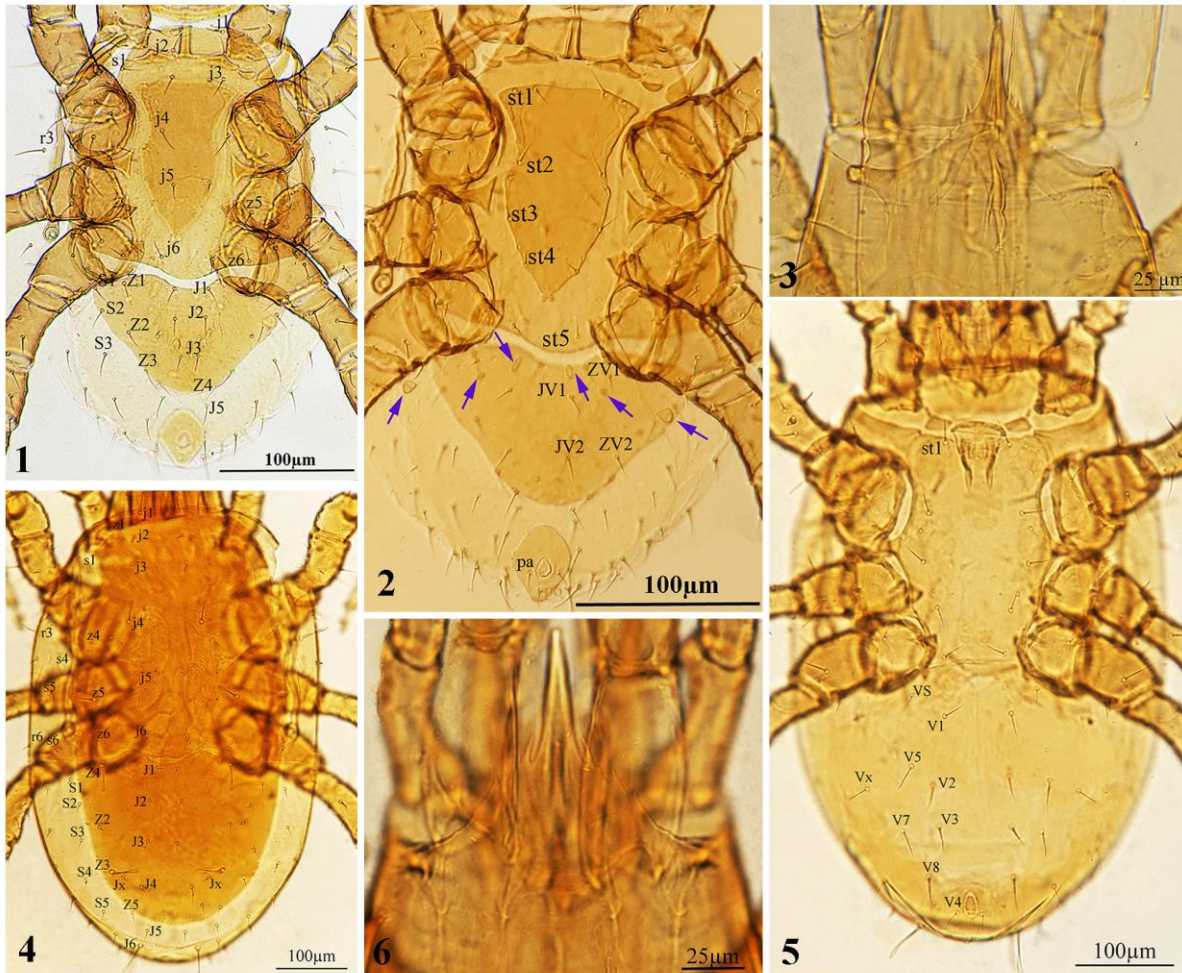
Deutonymph. Idiosoma: length 323-418 µm, width 212 µm. Podonotal shield possesses 18 pairs of setae. Opisthonotal shield triangular with straight posterolateral margins. It has 9 pairs of setae, *J4* missing, *S3* and *J5* are placed outside the shield (Fig. 1). Presternal plates and sternal shield not clearly visible. Two pairs of sclerites situated between *st5*, *JV1* and *ZV1* setae in the poststernal region. A third pair of larger regular sclerites exists laterally (Fig. 2). Central projecting pointed part of epistome has denticulate lateral margins (Fig. 3).

Male. Idiosoma: length 610-666 µm, width 393 µm entirely sclerotized, a transverse suture separated podonotum (372 µm long) and opisthonotum (294 µm). Seta *j3* on podonotum is enlarged and pilose; seta *J4* on opisthonotum is finely pilose, seta *J5* is setose but not stout, and an additional seta *Jx* exists. Therefore, there are five pairs of stout and pilose setae on podonotum: *j1*, *j3*, *r3*, *j4* and *z5*. On opisthonotum there are only three pairs of stout and pilose setae: *J6*, *Z1*, *Z3* (Fig. 4). The tritosternum absent. Anterior margin of sternum has a shallow depression between setae *st1*, and two indentations facing the lateral sides of presternal platelets. The sternal and opisthogastric shields are separated by suture. Platelets are situated on each side of genital opening which their anterior-most parts are fragmented. Orderly embowed anterior boundary of genital lamina is shown in Fig. 5. The epistome has a median large projection (Fig. 6).

Female. Idiosoma: length 723–811 μm , width 415 μm . Podonotal shield has 22 pairs of setae including setae *r2* and *r4* which situated near the shield margin due to flexible cuticle.

Setae *j1*, *j3*, *j4*, *z5* and *r3* are stout (club-shaped) and terminally pilose (*r3* figured distinctly). The opisthotal shield is rather small and possesses 9 pairs of setae which 2 of them (*Z1* and *Z3*) are stout and terminally pilose (Fig. 7). Presternal plates are ellipsoidal and large. The sternal shield is not reticulated, its anterior margin has a shallow incision, whereas the posterior margin is irregularly truncate and medially hollowed (Figs. 8, 9). Sternal setae *st2* are shorter and more robust than setae *st1* and *st3*. The opisthogastric shield is narrowed posteriorly and fused with a small perianal plate by a slender junction of cuticle. It has 6 pairs of setae, the posteriormost pair (*V8*) is stout (Fig. 8). The genital shield is presented in figure 9. Paragynia are not clearly visible. Epigynial plate terminates anteriorly with a narrow and long central prong. Epistome seen as a long smooth median projection with truncated end based on a denticulate basis (Fig. 10).

General Distribution: Poland, wet and rotten haystack on grasslands (Witaliński, 2014); Egypt, cow dung (Negm, 2016). This is the first record for the Asian mite fauna.



Figures 1–6. *Cornigamasus ocliferius* (Skorupski & Witaliński, 1997). 1. Deutonymph, Dorsal idiosoma. 2. Deutonymph, Ventral view of idiosoma. 3. Deutonymph, Epistome. 4. Male, Dorsal view of idiosoma. 5. Male, Ventral view of idiosoma. 6. Male, Epistome.



Figures 7–10. *Cornigamasus ocliferius* (Skorupski & Witaliński, 1997). 7. Female, **a.** Dorsal view of idiosoma, **b.** setae *r2–r4*. 8. Female, Ventral view of idiosoma. 9. Female, sternal and genital shields. 10. Female, Epistome.

Remarks

The close species *Cornigamasus lunaris* (Berlese, 1882) occurs in Mazandaran, Guilan, Khorasan and Kerman Provinces. Since both species are similar in general appearance, *C. ocliferius* may be misidentified as *C. lunaris*. However, the diagnostic features can be summarized as follows:

Female: In *C. ocliferius* tarsi of leg I devoid of ambulacrum, podonotum with five and opisthonotum with two pairs of stout and terminally pilose setae. Endogynium elongated.

While, in *C. lunaris* tarsi I ending in ambulacrum. Podonotum with four and opisthonotum with three pairs of stout and pilose setae. Endogynium subspherical.

Male: There is no ambulacrum on tarsi I in *C. ocliferius*, whereas tarsi I ending with ambulacrum in *C. lunaris*. In *C. ocliferius* femur II with only one small conical main spur, but in the latter species with large curved main spur and small axillary spur; each of genu II and tibia II bear one small spur.

Deutonymph: In *C. ocliferius* opisthonotum with nine pairs of setae and movable digit of chelicera with five teeth; whereas in *C. lunaris* opisthonotum with 12 pairs of setae and movable digit of chelicera with three teeth.

Parasitus Latreille, 1795

Parasitus beta Oudemans & Voigts, 1904

Parasitus beta Oudemans & Voigts, 1904: 652.

Parasitus beta Hyatt, 1980: 260.

Previous record: This is a new record for Khuzestan province fauna.

Studied materials and related host/habitat: one female, four deutonymphs, Ahvaz, Gavmish Abad, 31°17'34" N, 48°40'05" E, 15 m, 24.IV.2015 (buffalo manure), five deutonymphs, 13.XI.2016 (buffalo manure); three deutonymphs, Bavi, Gabir, 31°26'34" N, 48°45'17" E, 20 m, 2.V.2015 (sheep manure); five deutonymphs, Bavi, Shajaraat, 31°30'40" N, 48°54'27" E, 22 m, 8.VI.2015 (buffalo manure); one female, two deutonymphs, Ahvaz, dairy farm at Shahid Chamran University campus, 32°17'59" N, 48°39'39" E, 15 m, 28.VI.2015 (cow manure), five females, two deutonymphs, 22.XI.2015 (buffalo manure); two deutonymphs, Bavi, Mollasani, 31°35'31" N, 48°53'10" E, 27 m, 19.IX.2016 (cow manure), five females, two deutonymphs, 22.XI.2015 (buffalo manure), four deutonymphs, 16.VI.2016 (sheep manure), two deutonymphs, 25.VIII.2016 (buffalo manure); three deutonymphs, Ahvaz, Jassaniyeh-ye Kuchak, 31°24'10" N, 48°44'58" E, 21 m, 29.IX.2015 (cow manure); two deutonymphs, Hamidieh, 31°28'39" N, 48°26'44" E, 29 m, 5.XI.2015 (cow manure), two females, two deutonymphs, 22.IV.2016 (buffalo manure); one male, two deutonymphs, Ahvaz, 31°23'02" N, 48°38'38" E, 18m, 30.XI.2015 (horse manure), two females, two deutonymphs, Ahvaz, Nabi-ye Akram village, 31°26'15" N, 48°45'11" E, 18 m, 30.XI.2015 (cow manure); three deutonymphs, Hamidieh, Tarrahiyeh, 31°25'21" N, 48°23'21" E, 18 m, 10.III.2016 (cow manure); one female, four deutonymphs, Shush, Abdolkhan, 31°52'29" N, 48°20'30" E, 43 m, 6.V.2016 (buffalo manure); four deutonymphs, Shushtar, Arab Hassan, 31°49'44" N, 48°53'55" E, 30 m, 13.V.2016 (cow manure); six deutonymphs, Shush, Beyt-e Juhi, 31°57'50" N, 48°17'42" E, 64 m, 26.V.2016, (cow manure); two deutonymphs, Bavi, Talbumeh, 31°31'37" N, 48°55'27" E, 20 m, 9.X.2016 (cow manure); eight females, three deutonymphs, Susangerd, Abu Hamizeh, 31°31'48" N, 48°13'11" E, 15 m, 20.X.2016 (buffalo manure); two females, two deutonymphs, Bavi, Veys, 31°28'56" N, 48°52'41" E, 24 m, 23.X.2016 (cow manure).

Note: Kamali et al. (2001) and Pakyari et al. (2006) recorded this species as *P. eta* Oudemans & Voigts, 1904, while *P. eta* has been considered as a junior synonym of *P. beta* (Karg, 1993).

Parasitus fimetorum* (Berlese, 1904)Gamasus fimetorum* Berlese, 1904: 238.*Parasitus fimetorum* Hyatt, 1980: 271.

Previous record: This species has been previously recorded from Khuzestan Province from soil (Kazemi & Rajaei, 2013).

Studied materials and related host/habitat: six deutonymphs, Bavi, Mollasani, 31°35'31" N, 48°53'10" E, 27 m, 8.IV.2015 (sheep manure), five deutonymphs, 14.V.2015 (cow manure), four deutonymphs, 30.VIII.2015 (buffalo manure), four females, four deutonymphs, 22.XI.2015 (buffalo manure), four deutonymphs, 25.VIII.2016 (sheep manure), two females, four males, 23.X.2016 (cow manure), six deutonymphs, 12.IV.2017 (sheep manure); one female, three deutonymphs, Ahvaz, Gavmish Abad, 31°17'34" N, 48°40'05" E, 15 m, 24.IV.2015 (buffalo manure); four deutonymphs, Bavi, Gabir, 31°26'34" N, 48°45'17" E, 20 m, 2.V.2015 (sheep manure), four deutonymphs, 3.III.2017 (poultry manure); four deutonymphs, Ahvaz, dairy farm at Shahid Chamran University campus, 32°17'59" N, 48°39'39" E, 15 m, 26.V.2015 (cow manure), one female, four deutonymphs, 28.VI.2015 (cow manure), four deutonymphs, 17.IX.2015 (cow manure), five deutonymphs, 17.XI.2015 (cow manure), five deutonymphs, 29.V.2016 (cow manure); four deutonymphs, Bavi, Shajaraat, 31°30'40" N, 48°54'27" E, 22 m, 8.VI.2015 (buffalo manure); four deutonymphs, Shush, Beyt-e Juhi, 31°57'50" N, 48°17'42" E, 64 m, 13.VII.2015 (poultry manure); one male, three deutonymphs, 13.XII.2015 (cow manure); six deutonymphs, Shushtar, Arab Hassan, 31°49'44" N, 48°53'55" E, 30 m, 2.III.2016 (sheep manure); five deutonymphs, Hamidieh, Tarrahiyeh, 31°25'21" N, 48°23'21" E, 18 m, 10.III.2016 (buffalo manure); eight deutonymphs, Ahvaz, Nabi-ye Akram village, 31°26'15" N, 48°45'11" E, 18 m, 6.IV.2016 (cow manure); five deutonymphs, Ahvaz, Alhaei, 31°39'20" N, 48°35'26" E, 31 m, 29.IV.2016 (cow manure); four deutonymphs, Shush, Abdolkhan, 31°52'29" N, 48°20'30" E, 43 m, 6.V.2016 (buffalo manure); six deutonymphs, Shushtar, Band-e Qir, 31°39'10" N, 48°53'09" E, 26 m, 13.V.2016 (cow manure); one female, three deutonymphs, Shush, Beyt-e Jazayer, 32°00'56" N, 48°17'27" E, 60 m, 26.V.2016 (cow manure); four deutonymphs, Ahvaz, Ebadeh, 31°26'14" N, 48°45'07" E, 20 m, 16.VI.2016 (cow manure); three deutonymphs, Bavi, Talbume, 31°31'37" N, 48°55'27" E, 20 m, 9.X.2016 (cow manure); one male, three deutonymphs, Hamidieh, Pich-e Seyyed Jaber, 31°27'34" N, 48°25'26" E, 21 m, 20.X.2016 (cow manure); four males, six deutonymphs, Susangerd, Abu Hamizeh, 31°31'48" N, 48°13'11" E, 15 m, 20.X.2016 (buffalo manure); one male, four deutonymphs, Ahvaz, Gavmish Abad, 31°17'34" N, 48°40'05" E, 15 m, 13.XI.2016 (buffalo manure); three deutonymphs, Bavi, Naddafieh, 31°36'20" N, 48°52'59" E, 27 m, 13.XI.2016 (sheep manure).

Rhabdocarpais Athias*- Henriot, Claire, 1981**Rhabdocarpais mammillatus* (Berlese, 1904)***Gamasus mammillatus* Berlese, 1904: 166.

Previous record: This is a new record for Khuzestan province fauna.

Studied materials and related host/habitat: one female, three deutonymphs, Bavi, Mollasani, 31°35'31" N, 48°53'10" E, 27 m, 8.IV.2015 (sheep manure), two deutonymphs, 2.IX.2015 (sheep manure), one female, four deutonymphs, 19.IX.2015 (buffalo manure), four deutonymphs, 25.VIII.2016 (sheep manure); three deutonymphs, Ahvaz, Gavmish Abad, 31°17'34" N, 48°40'05" E, 15 m, 24.IX.2015 (buffalo manure); two deutonymphs Ahvaz, dairy farm at Shahid Chamran University campus, 32°17'59" N, 48°39'39" E, 15 m, 26.V.2015 (cow manure), one female, two males, 28.VI.2015 (cow manure), three deutonymphs, 17.IX.2015 (cow manure), two deutonymphs, 27.VI.2016 (cow manure); four deutonymphs, Shush, Khavar-e Seyyed Khalaf, 31°31'23" N, 48°49'31" E, 25 m, 8.VI.2015 (buffalo manure); three

deutonymphs, Shush, Khoyes, 32°01'53" N, 48°16'45" E, 60 m, 13.IX.2016 (buffalo manure); six deutonymphs, Shush, Abdolkhan, 31°52'29" N, 48°20'30" E, 43 m, 6.V.2016 (buffalo manure); five deutonymphs, Shush, Beyt-e Juhi, 31°57'50" N, 48°17'42" E, 64 m, 26.V.2016 (cow manure); four deutonymphs, Ahvaz, Hatam village, 31°51'35" N, 48°21'31" E, 36 m, 11.V.2017 (sheep manure).

Family Laelapidae Berlese, 1892

Androlaelaps Berlese, 1903

Androlaelaps casalis (Berlese, 1887)

Laelaps casalis Berlese, 1887: 8.

Previous records: This species has been previously recorded from Khuzestan Province from different insects of orders Coleoptera (Scarabaeidae, Carabidae), Hymenoptera (Formicidae) and Orthoptera (Kazemi & Rajaei, 2013).

Studied materials and related host/habitat: one female, Bavi, Mollasani, 31°35'31" N, 48°53'10" E, 27 m, 8.IV.2015 (sheep manure); one female, Ahvaz, Gavmish Abad, 31°17'34" N, 48°40' 05" E, 15 m, 24.IV.2015 (buffalo manure); one female, Bavi, Naddafieh, 31°36'20" N, 48°52'59" E, 27 m, 19.XI.2016 (sheep manure).

Note: There is morphological variation in hind margin of sternal shield.

Androlaelaps projecta Furman, 1972

Androlaelaps projecta Furman, 1972: 54.

Previous record: This is a new name for Iran mite fauna.

Studied materials and related host/habitat: two females, Ahvaz, Gavmish Abad, 31°17'34" N, 48°40'05" E, 15 m, 24.IV.2015 (buffalo manure).

Androlaelaps shealsi Costa, 1968

Androlaelaps shealsi Costa, 1968: 21.

Previous record: This is a new record for Khuzestan province fauna.

Studied materials and related host/habitat: four females, Ahvaz, Gavmish Abad, 31°17'34" N, 48°40'05" E, 15 m, 24.IV.2015 (buffalo manure).

Androlaelaps sp.

Previous record: three females, Bavi, Talbume, 31°31'37" N, 48°55'27" E, 20m, 9.X.2016 (cow manure).

Note: This currently undescribed laelapid species was collected from cow manure in rural districts.

Cosmolaelaps Berlese, 1903

Cosmolaelaps brevipedestra (Karg, 1985)

Hypoaspis (*Cosmolaelaps*) *brevipedestra* Karg, 1985: 234.

Hypoaspis (*Cosmolaelaps*) *brevipedestra* Karg, 1988: 516; Faraji et al., 2008: 207.

Cosmolaelaps brevipedestra Farrier & Hennessy, 1993: 68; Kazemi, 2015: 426; Moreira et al., 2014: 319; Moreira, 2014: 204.

Previous record: This species has been previously recorded from Khuzestan Province from nest of ants (Kazemi & Rajaei, 2013; Nemati et al., 2018).

Studied materials and related host/habitat: three females, two males, Bavi, Mollasani, 31°35'31" N, 48°53'10" E, 27 m, 19.XI.2016 (cow manure).

Note: Some differences were observed between the original description and the holotype during studying type materials by the third author. For example, chelicerae are 6 denticulate whereas it was illustrated as 5 denticulate in the original description. Other differences were observed between shield patterns and some sizes with the original description (Nemati and Gwiazdowicz, 2016).

Gaeolaelaps Evans & Till, 1966

Gaeolaelaps khajooii Kazemi, Rajaei & Beaulieu, 2014

Gaeolaelaps khajooii Kazemi, Rajaei & Beaulieu, 2014: 510.

Previous record: This is a new record for Khuzestan province fauna.

Studied materials and related host/habitat: two females, Shush, Khavar-e Seyyed Khalaf, 31°31'23"N, 48°49'31" E, 25 m, 9.X.2016 (cow manure).

Gaeolaelaps minor (Costa, 1968)

Hypoaspis minor Costa, 1968: 9.

Previous record: This species has been previously recorded from Khuzestan province from soil (Nemati et al., 2018).

Studied materials and related host/habitat: two females, Bavi, Mollasani, 31°35'31" N, 48°53'10" E, 27 m, 22.VI.2015 (cow manure).

Hypoaspisella Bernhard, 1971

Hypoaspisella linteyini Samšičák, 1964

Hypoaspis linteyini Samšičák, 1964: 49.

Previous record: This species has been previously recorded from Khuzestan province from soil (Nemati et al., 2018).

Studied materials and related host/habitat: four females, two deutonymphs, Ahvaz, 31°23'02" N, 48°38'38" E, 18 m, 24.IV.2015 (horse manure); one female, 30.XI.2015 (horse manure); one female, Bavi, Mollasani, 31°35'31" N, 48°53'10" E, 27 m, 22.VI.2015 (cow manure), one female, 22.XI.2015 (buffalo manure), two females, 12.XII.2015 (sheep manure); one female, Hamidieh, 31°28'39" N, 48°26'44" E, 29 m, 22.IV.2015 (sheep manure); two females, Ahvaz, Alhaei, 31°39'20" N, 48°35'26" E, 31 m, 29.IV.2016 (sheep manure); one female, Shush, Seyyed Abbas, 31°49'49" N, 48°23'21" E, 40 m, 6.V.2016 (buffalo manure); two females, Bavi, Talbume, 31°31'37" N, 48°55'27" E, 20 m, 9.X.2016 (cow manure); four females, Bavi, Naddafieh, 31°36'20" N, 48°52'59" E, 27 m, 19.XI.2016 (sheep manure).

Discussion

The current findings were the continuation of a study conducted on the mesostigmatid mites associated with manure from Khuzestan Province, southwestern Iran by Farahi et al. (2018a, 2018b, 2019). According to our results, *Cornigamasus ocliferius* is new to the Asian mite fauna from Iran. *Androlaelaps projecta* Furman, 1972 is a new name for Iran mite fauna. This species has previously recorded as *Androlaelaps kifli* Metwali & Ibrahim, 1985 and

Androlaelaps aegypticus Hafez, Elbadry & Naser, 1982 from Iran (Kazemi & Rajaei, 2013; Nemati et al., 2018). However, According to personal communication (the third author of present paper, A. N., with Dr. Nasr from Egypt) and taxonomic examination of characters in related species, these two mentioned species could be considered as junior synonyms of *A. projecta*. Four species were also new to Khuzestan Province fauna. Previously, 129 manure-inhabiting Mesostigmata from different Provinces of Iran were collected from animal manures (Kazemi & Rajaei, 2013; Nemati et al., 2018; Farahi et al., 2018a, 2018b, 2019). Here, we recorded six manure-associated species which were not previously reported from manure in Iran (*R. mammillatus*, *A. projecta*, *A. shealsi*, *C. brevipedestra*, *G. khajooii*, *H. linteyini*). We do expect to have a longer list of manure-inhabiting mesostigmatic mites in Iran through future studies. Parasitidae species were more abundant than Laelapidae among our records. The most widespread and the most frequent laelapid species in manures was *H. linteyini*. It has not been previously recorded from manure in Iran. *P. fimetorum* was also the most frequent Parasitidae species among our records.

Biology and environmental preferences of *Cornigamasus* have not studied yet. According to Witaliński (2014) and Witaliński et al. (2005), *C. ocliferius* is a rare species in haystacks habitats in Poland due to a strictly nidicolous existence in rodent nests from which it is only occasionally transported on the fur of rodents to vole-visited haystacks and similar places. However, in other localities we can find numerous specimens in other microhabitat such as compost and similar types of decomposed plant matter, like in the Iran (Witaliński, pers. comm.).

Animal manures possess a rich fauna of arthropods including significant percentage of mites. Hundreds of mite species occur as predators, fungivores, detritivores, and bacteriophages in dung substrates. Six mite families of Mesostigmata encountered in dung including Parasitidae and Laelapidae are predators. Some of their species prey on the eggs or early instar larvae of coprophagous flies, and may be effective on the population of pest flies (Krantz, 1983). According to Karg (1971), Koehler (1997) and Lindquist et al. (2009), preferred habitats of Parasitidae and Laelapidae are organic and forest soils, animal dropping and nests of birds and rodents. Their preferred food are small arthropods and nematodes. Moreover, Laelapidae can be found in stored products and has been recorded as ectoparasit of mammals, birds and insects. Our results imply such recorded habitats/food. The species of Macrochelidae prey on the eggs or early instar larvae of coprophagous flies, and are effective fly egg and larval predators (Krantz, 1983; Farahi et al., 2018a). The feeding of Parasitidae and Laelapidae species on fly eggs has been observed too. However, their efficiency has not been accurately assessed (Krantz, 1983).

Gaeolaelaps aculeifer (Canestrini, 1884) and *A. casalis* are two common laelapid species which have an important role in controlling the poultry red mite *Dermanyssus gallinae* De Geer, 1778 (Lesna et al., 2009). We recorded *A. casalis* in Ahvaz and Mollasani areas in this study. Some specimens of the poultry red mite were collected from poultry manures in Mollasani where the laelapid predatory species *A. casalis* was also obtained from dung samples. Same findings have reported by Arjomandi et al. (2013) in Kerman County.

Acknowledgments

We express our appreciation to people in the rural districts for accompaniment in sampling programs. We also sincerely thank Dr. Wojciech Witaliński for his kind help in identification of Parasitidae specimens. This study was financially supported by the Shahid Chamran University of Ahvaz which is deeply appreciated.

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

- Arjomandi, E., Kazemi, Sh. & Afshari, A. (2013) Fauna and diversity of the manure-inhabiting Mesostigmata (Acari) in Kerman county, south eastern Iran. *Persian Journal of Acarology*, 2 (2), 253–263. <http://dx.doi.org/10.22073/pja.v2i2.9958>
- Beaulieu, F. (2009) Review of the mite genus *Gaeolaelaps* Evans & Till (Acari: Laelapidae), and description of a new species from North America, *G. gillespiei* n. sp. *Zootaxa*, 2158, 33–49. <https://doi.org/10.11646/zootaxa.2158.1.3>
- Beaulieu, F., Dowling, A.P.G., Klompen, H., Moraes, G.J. & Walter, D. (2011) Superorder Parasitiformes Reuter, 1909. In: Zhang, Z-Q (ed.) Animal biodiversity: an outline of higher-level classification and survey of taxonomic richness. *Zootaxa*, 3703, 123–128.
- Berlese, A. (1887) Acari, Miriapoda, et Scorpiones hucusque in Italia reperta [38]. *Padova*, 38, 8. <https://doi.org/10.5962/bhl.title.69269>
- Berlese, A. (1904) Acari nuovi. Manipulus I. *Redia*, 1 (2), 238.
- Blackman, S.W. (1997) Experimental evidence that the mite *Poecilochirus davydovae* (Mesostigmata: Parasitidae) eats the eggs of its beetle host. *Journal of Zoological Society of London*, 242, 63–67. <https://doi.org/10.1111/j.1469-7998.1997.tb02929.x>
- Costa, M. (1968) Little known and new litter-inhabiting Laelapine mites (Acari, Mesostigmata) from Israel. *Israel Journal of Zoology*, 17, 21. <https://doi.org/10.1080/00212210.1968.10688258>
- Evans, G.O. & Till, W.M. (1979) Mesostigmatic mites of Britain and Ireland (Chelicerata: Acari-Parasitiformes) An introduction to their external morphology and classification. *Transactions of the Zoological Society of London*, 35, 139–270. <https://doi.org/10.1111/j.1096-3642.1979.tb00059.x>
- Farahi, S. Shishehbor, P. & Nemati, A. (2018a) Bisexual and oedipal reproduction of *Macrocheles muscaedomesticae* (Acari, Macrochelidae) feeding on *Musca domestica* (Diptera, Muscidae) eggs. *Acarologia*, 58 (2), 430–441. <http://dx.doi.org/10.24349/acarologia/20184251>
- Farahi, S. Shishehbor, P. & Nemati, A. (2018b) Some mesostigmatic mites (Acari: Parasitiformes) of Khuzestan Province, southwestern Iran. *Persian Journal of Acarology*, 7 (4), 323–344. <http://dx.doi.org/10.22073/pja.v7i4.38663>
- Farahi, S. Shishehbor, P. Nemati, A. & Witaliński, W. (2019) *Trachygamasus karuni* sp. nov., a new mite species from Iran (Parasitiformes: Parasitidae). *Zootaxa*, 4706 (3), 439–450. <http://dx.doi.org/10.11646/zootaxa.4706.3.4>
- Faraji, F., Abedi, L., Ostovan, H. (2008) A new species of *Hypoaspis Canestrini* from Iran with a key to the Iranian species of *Hypoaspis* (Acari, Gamasina, Hypoaspididae). *Zoosystematics and Evolution*, 84, 205–209. <https://doi.org/10.1002/zoos.200800005>
- Faraji, F. & Halliday, B. (2009) Five new species of mite (Acari: Laelapidae) associated with large Australian cockroaches (Blattodea: Blaberidae). *International journal of acarology*, 35 (3), 245– 264. <https://doi.org/10.1080/01647950903059445>
- Farrier, M.H. & Hennessey, M.K. (1993) Soil-inhabiting and free-living Mesostigmata (Acari-Parasitiformes) from North America. An annotated checklist with bibliography and index. *North Carolina Agricultural Research Service Technical Bulletin*, 302, 1–408.
- Gwiazdowicz, D.J., Nemati, A. & Riahi, E. (2018) Mesostigmatic mites associated with birds and mammals in Iran. A review. *Biologia*, 73, 485–491. <https://doi.org/10.2478/s11756-018-0055-0>
- Furman, D.P. (1972) Laelapid mites (Laelapidae: Laelapinae) of Venezuela. *Brigham Young University Science Bulletin (Biological Series)*, 17 (3), 54.

- Hagen, K.S., Mills, N.J., Gordh, G. & McMurtry, C. (1999) Terrestrial arthropod predators of insect and mite pests. In: Bellows, T.S. & Fisher, T.W. (eds.) *Handbook of Biological Control*. Academic Press, San Diego, pp. 383–503. <https://doi.org/10.1016/B978-012257305-7/50063-1>
- Hyatt, K.H. (1980) Mites of the subfamily Parasitinae (Mesostigmata: Parasitidae) in the British Isles. *Bulletin of the British Museum (Natural History) Zoology*, 38 (5), 237–378.
- Johnston, D.E. & Moraza, M.L. (1991) The idiosomal adenotaxy and poroidotaxy of Zerconidae (Mesostigmata: Zerconina). *Modern Acarology*, 2, 349–356.
- Kamali, K., Ostovan, H. & Atamehr, A. (2001) *A catalog of mites & ticks (Acari) of Iran*. Islamic Azad University Scientific Publication Center, Tehran. 192 pp.
- Karg, W. (1971) Acari (Acarina), Milben, Unterordnung Anactinochaeta (Parasitiformes). Die freilebenden Gamasina (Gamasides), Raubmilben. *Die Tierwelt Deutschlands*, 59, 1–475.
- Karg, W. (1988) Die Arten der Raubmilbenuntergattung *Cosmolaelaps* Berlese, 1903 (gattung *Hypoaspis* Canestrini, 1884, Acarina, Parasitiformes). *Zoologische Jahrbücher Abteilung für Systematik, Ökologie und Geographie der Tiere*, 115, 509–526.
- Karg, W. (1985) Zwei neue Raubmilbenarten der Untergattung *Cosmolaelaps* Berlese, 1903 (Gattung *Hypoaspis* Can. 1884) aus Termitennestern (Acarina, Parsitiformese). *Deutsche entomologische Zeitschrift*, 32 (4–5), 234. <https://doi.org/10.1002/mmnz.19810570203>
- Karg, W. (1993) Acari (Acarina), milben Parasitiformes (Anactinochaeta) cochors Gamasina Leach: Raubmilben. In: Zoologisches Museum Berlin (Hrsg.), Dahl F. (Begr.), *Die Tierwelt Deutschlands und der angrenzenden Meeressteile*. 59. Teil. Gustav Fischer Verlag, Jena, 523 pp.
- Kazemi, Sh. & Rajaei, A. (2013) An annotated checklist of Iranian Mesostigmata (Acari), excluding the family Phytoseiidae. *Persian Journal of Acarology*, 2 (1), 63–158. <http://dx.doi.org/10.22073/pja.v2i1.9950>
- Kazemi, Sh., Rajaei, A. & Beaulieu, F. (2014) Two new species of *Gaeolaelaps* (Acari: Mesostigmata: Laelapidae) from Iran, with a revised generic concept and notes on significant morphological characters in the genus. *Zootaxa*, 3861 (6), 501–530. <http://dx.doi.org/10.11646/zootaxa.3861.6.1>
- Kazemi, Sh. (2015) A new species of *Laelaspis* Berlese (Acari: Mesostigmata: Laelapidae) from Iran, with a revised generic concept and notes on significant morphological attributes in the genus. *Zootaxa*, 4044 (3), 411–428. <http://dx.doi.org/10.11646/zootaxa.4044.3.5>
- Koehler, H.H. (1997) Mesostigmata (Gamasina, Uropodina), efficient predators in agroecosystems. *Agriculture, Ecosystem and Environment*, 62, 105–117. [https://doi.org/10.1016/S0167-8809\(96\)01141-3](https://doi.org/10.1016/S0167-8809(96)01141-3)
- Krantz, G.W. (1983) Mite as biological control agents of dung- breeding flies, with special reference to the Macrochelidae. In: Hoy, M.A., Cunningham, G.L. & Knutson, L. (eds.) *Biological control of pests by mites*. University of California Press, Berkeley, pp. 91–98.
- Lesna, I., Wolfs, P., Faraji, F., Roy, L., Komdeur, J. & Sabelis, M.W. (2009) Candidate predators for biological control of the poultry red mite *Dermanyssus gallinae*. *Experimental and Applied Acarology, Amsterdam*, 48 (1–2), 63–80. <https://doi.org/10.1007/s10493-009-9239-1>
- Lindquist, E.E. & Evans, G.O. (1965) Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). *Memoirs of the Entomological Society of Canada*, 47, 1–64. <https://doi.org/10.4039/entm9747fv>
- Lindquist, E.E. & Moraza, M.L. (1998) Observations on homologies of idiosomal setae in Zerconidae (Acari: Mesostigmata), with modified notation for some posterior body setae. *Acarologia*, 39 (3), 203–226.
- Lindquist, E.E., Krantz, G.W. & Walter, D.E. (2009) Order Mesostigmata. In: Krantz, G.W. & Walter, D.E. (eds.) *A Manual of Acarology*. 3rd ed, Texas tech University Press, pp. 124–232.

- Moraza, M.L. & Pena, M.A. (2005) The family Pachylaelapidae Vitzthum, 1931 on Tenerife Island (Canary Islands) with description of a seven new species of the genus Pachylaelaps (Acari, Mesostigmata: Pachylaelapidae). *Acarologia*, 45 (2–3), 103–129.
- Moreira, G.F. (2014) *Taxonomic Studies of Laelapid Mites (Acari: Mesostigmata: Laelapidae) and Their Use in Combination with Entomopathogenic Nematodes (Rhabditida: Steinernematidae, Heterorhabditidae) to Control Frankliniella occidentalis (Thysanoptera: Thripidae)* (Unpublished PhD Dissertation), Universidade Estadual Paulista.
- Moreira, G.F., Klompen, H. & Moraes, G.J. (2014) Redefinition of *Cosmolaelaps* Berlese (Acari: Laelapidae) and description of five new species from Brazil. *Zootaxa*, 3764 (3), 317–346. <http://dx.doi.org/10.11646/zootaxa.3764.3.4>
- Negm, M.W. (2016) Predatory mites of the family Parasitidae Oudemans (Acari: Mesostigmata) from Egypt: redescrptions, new record and a key to species. *African Entomology*, 24 (2), 460–475. <https://doi.org/10.4001/003.024.0460>
- Nemati, A. & Mohseni, M. (2013) Two new species of *Gaeolaelaps* (Acari: Laelapidae) from Iran. *Zootaxa*, 3750 (1), 071–082. <https://doi.org/10.4001/003.024.0460>
- Nemati, A. & Gwiazdowicz, D. J. (2016) Description of a new species of *Cosmolaelaps* Berlese and the male of *C. brevipedestra* (Karg) from Iran, with notes on some other species of *Cosmolaelaps* Berlese (Acari: Laelapidae). *Zootaxa*, 4066 (5), 535–551. <http://dx.doi.org/10.11646/zootaxa.4066.5.2>
- Nemati, A., Riahi, E., Khalili-Moghadam, A. & Gwiazdowicz, D.J. (2018) A catalogue of the Iranian Mesostigmata (Acari): additions and updates of the previous catalogue. *Persian Journal of Acarology*, 7 (2), 115–191. <http://dx.doi.org/10.22073/pja.v7i2.36985>
- Nemati, A.R, Kamali, K & Mossadegh, M.S. (2000) A faunistic survey of Laelapidae (Acari: Mesostigmata) mites in the soil of Ahwaz region, Khuzestan Province. *Proceedings of 14th Iranian Plant Protection Congress, 2000, 5–8 September, Isfahn, Iran*. Isfahan University of Technology, p. 333.
- Pakyari, H., Ostovan, H. & Kamali, K. (2006) Specific diversity of family Parasitidae collected from Sorkheh Hesar Park of Tehran and new records of two species from Iran. In: Manzari Sh. (ed) *Proceedings of the 17th Iranian Plant Protection Congress, 2006, 2–5 September, Karaj, Iran*. Campus of Agriculture and Natural Resources, University of Tehran, p. 193.
- Rosario, R.M.T. (1981) Philippine Hypoaspidae (Acarina: Mesostigmata: Laelapidae). *Philippine entomologist*, 5, 23–82.
- Samširák, K. (1964) Termitophile Milben aus der VR China. I. Mesostigmata. *Entomologische Abhandlungen aus dem Museum für Tierkunde Dresden*, 32 (3), 49.
- Skorupski, M. & Witaliński, W. (1997) *Cornigamasus ocliferius* sp. n. a new gamasid mite from Poland (Acari: Parasitidae). *Genus*, 8, 145–152.
- Strong, K.L. & Halliday, R.B. (1994) Three new species of *Hypoaspis Canestrini* (Acarina: Laelapidae) associated with large Australian cockroaches. *Journal of the Australian Entomological Society*, 33, 87–96. <https://doi.org/10.1111/j.1440-6055.1994.tb00927.x>
- Voigts, H. (1904) Neue Milben aus der Umgegend von Bremen. *Zoologischer anzeiger leipziger*, 27 (20/21), 652.
- Witaliński, W. (2014) Description of the female of *Cornigamasus ocliferius* Skorupski et Witaliński, 1997 with a key to *Cornigamasus* species (Parasitiformes: Mesostigmata: Gamasida: Parasitidae). *Genus*, 25 (3), 341–350.
- Witaliński, W., Skorupski, M. & Juvara-Bals, I. (2005) Deutonymph of *Cornigamasus ocliferius* Skorupski et Witaliński, 1997 (Acari: Gamasida: Parasitidae). *Genus*, 16, 145–153.

گزارشی از کنه‌های خانواده‌های Parasitidae و Laelapidae (Acari: Mesostigmata) در کود دامی از استان خوزستان، جنوب غربی ایران و معرفی یک گزارش جدید برای فون آسیا

سارا فرحی^{۱*}، پرویز شیشه بر^۱ و علیرضا نعمتی^۲

۱ گروه گیاهپزشکی، دانشکده کشاورزی، دانشگاه شهید چمران اهواز، اهواز، ایران.

۲ گروه گیاهپزشکی، دانشکده کشاورزی، دانشگاه شهرکرد، شهرکرد، ایران.

* پست الکترونیکی نویسنده مسئول مکاتبه: sara.farahi@gmail.com

| تاریخ دریافت: ۱۵ دی ۱۳۹۸ | تاریخ پذیرش: ۲۶ خرداد ۱۳۹۹ | تاریخ انتشار: ۰۳ تیر ۱۳۹۹ |

چکیده: کنه‌های خانواده Parasitidae و Laelapidae از رایج‌ترین و گسترده‌ترین کنه‌های زیر راسته Gamasina می‌باشند. در سال‌های ۱۳۹۴-۱۳۹۶ فون کنه‌های کودزی Parasitidae و Laelapidae از راسته Mesostigmata در استان خوزستان واقع در جنوب غربی ایران جمع‌آوری و مطالعه شد. در مجموع، چهار گونه متعلق به سه جنس از خانواده Parasitidae و هفت گونه متعلق به چهار جنس از خانواده Laelapidae از کودهای دامی در استان خوزستان جمع‌آوری شدند که از میان آنها گونه *Cornigamasus ocliferius* (Skorupski & Witaliński, 1997) می‌باشد. گونه *Androlaelaps projecta* Furman, 1972 یک نام جدید برای فون کنه‌های ایران است. چهار گزارش گونه برای فون کنه‌های استان خوزستان جدید هستند و شش گونه نیز برای اولین بار از کود در ایران گزارش می‌شوند. کنه *Parasitus fimetorum* (Berlese, 1904) بیشترین تعداد افراد را در خانواده Parasitidae داشت. اطلاعات مربوط به انتشار و زیستگاه تمامی گونه‌ها در استان خوزستان، همراه با یادداشت‌هایی در مورد تاکسونومی و بیواکولوژی ارائه شد.

واژگان کلیدی: میان استیگمایان، *Cornigamasus ocliferius*، کنه‌های کودزی، اهواز