



Raphignathoid mites (Acariformes: Raphignathoidea) in parts of the Azerbaijan provinces of Iran

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ABSTRACT: While performing a faunistic study on the superfamily Raphignathoidea of northwestern Iran, north parts of east Azerbaijan and southwest parts of west Azerbaijan provinces during 2016-2018, a total number of 40 species in 13 genera belonging to the superfamily were collected and identified. Among them, four species: *Stigmaeus luxtoni* Wood, 1981; *Ledermuelleriopsis sezeki* Doğan, 2004; *Eustigmaeus gulingensis* Hu and Chen, 1996 and *Molothrognathus kamili* Doğan, 2003 have been recorded for the first time from Iran.

Keywords: Acari, fauna, predatory, new record, Azerbaijan, northwestern Iran.

Zoobank: <http://zoobank.org/57B66053-9AD1-4C78-ADA6-83AC029A284A>

INTRODUCTION

The predatory mites of the superfamily Raphignathoidea Kramer, 1877 (Acari: Trombidiformes: Prostigmata) are mostly known as biological control agents of small invertebrates such as eriophyid, spider and false spider mites and some small insects. Also, some species of these mites are probably the second most important species of plant mite predators after Phytoseiidae especially when the densities of phytoseiid mites are low (Gerson et al., 2003; Fan and Zhang, 2005; Fan and Flechtmann, 2015).

Currently, raphignathoid mites include about 1087 species of 69 genera in 12 families (Beron, 2020). Until now, seven families, 23 genera and 222 species of this group of mites have been described and reported from Iran, namely: Barbutiidae Robaux (one genus, four species); Caligonellidae Grandjean (five genera, 26 species); Camerobiidae Southcott (two genera, 23 species); Cryptognathidae Oudemans (two genera, 19 species); Eupalopsellidae Willmann (one genus, seven species); Raphignathidae Kramer (one genus, 29 species); Stigmaeidae Oudemans (11 genera, 114 species) (Bagheri and Mohammad-Doustaresharaf, 2020; Mohammad-Doustaresharaf and Bagheri, 2021; Pishahvar and Khanjani, 2021; Rostami and Mohammad-Doustaresharaf, 2021).

In this study, a total number of 40 species in 13 genera within the superfamily Raphignathoidea have been collected; four of them: *Stigmaeus luxtoni* Wood, 1981; *Ledermuelleriopsis sezeki* Doğan, 2004; *Eustigmaeus gulingensis* Hu and Chen, 1996 and *Molothrognathus kamili* Doğan, 2003 are new records for the Iranian fauna.

MATERIALS AND METHODS

Sampling procedure

Many samples collected during 2016-2018, from various habitats such as soil and litter, rotten wood, the aerial

parts of the crops, orchards and weeds of different regions of studied area. Mite specimens were extracted using Berlese-Tullgren funnel, preserved in 70% ethanol, cleared in Nesbitt's fluid/lactophenol solution, mounted in Hoyer's medium and studied using BX41 light microscope with phase-contrast device. All examined materials are deposited in the Acarology Laboratory, Plant Protection Department, Agricultural Faculty, University of Maragheh, Iran (UMI).

Study area

The study area is located in north-western Iran and including two provinces: East Azerbaijan and West Azerbaijan. Sampling were taken from different localities in two counties of north parts of East Azerbaijan namely Jolfa and Khoda Afarin and five counties of southwestern parts of West Azerbaijan namely Urmia, Sardasht, Piranshahr, Mahabad, Oshnaviyeh. The locations of the sampled cities are shown in Figure 1.

RESULTS and DISCUSSION

Superfamily Raphignathoidea
Family Caligonellidae Grandjean, 1944
Genus *Caligonella* Berlese, 1910

Caligonella haddadi Bagheri and Maleki, 2013

This species was originally described from leaf litter under walnut (*Juglans* sp.) from Iran (Bagheri et al., 2013b). It was also recorded from Turkey (Yamaç, 2019; Doğan and Doğan, 2020c).

Material examined: Two females, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; four females, soil and litter, Khoda Afarin (Abbas Abad) (37° 55' 46" N, 46° 47' 88" E, 1310 m), 4 July 2017; two females, soil, Urmia (Qare Aqaj) (37° 27' 53" N, 45° 09' 19" E, 1302 m), 24 July 2018; coll. M. Mohammad-Doustaresharaf.

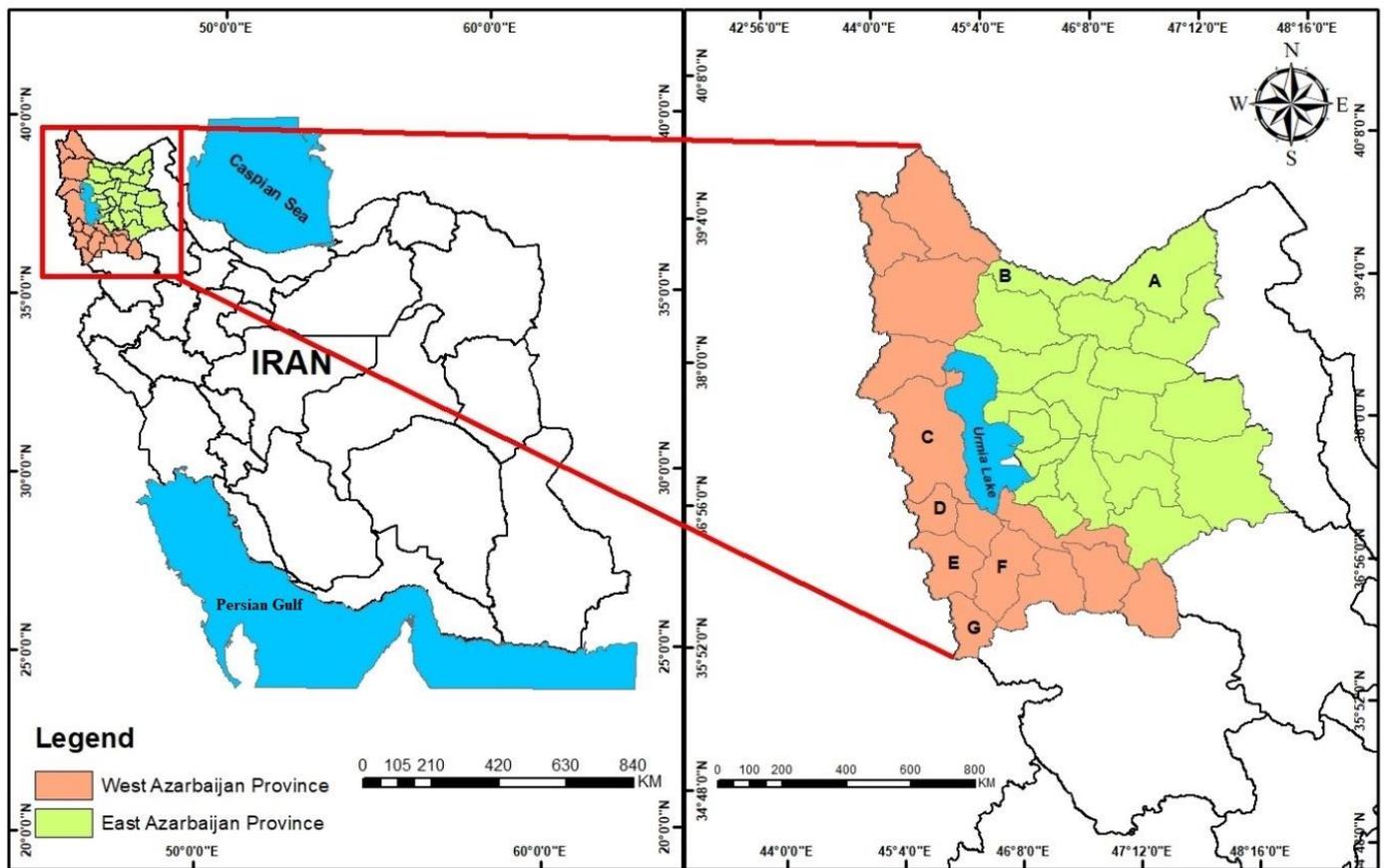


Figure 1. The location of the sampled cities. A: Jolfa, B: Khoda Afarin, C: Urmia, D: Oshnaviyeh, E: Piranshahr, F: Mahabad, G: Sardasht.

Caligonella humilis (Koch, 1838)

This species is widely distributed in 14 countries and originally described from Germany (Beron, 2020). It was also previously recorded from different part of Iran (Beyzavi et al., 2013).

Material examined: Two females, soil and litter under pear tree (*Pyrus* sp.), Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; six females, soil under apple trees (*Malus* sp.), Urmia (Balanej) (37° 24' 35" N, 45° 09' 11" E, 1312 m), 17 September 2018; four females, soil under oak tree (*Quercus* sp.), Mahabad (Kavelan) (36° 23' 34" N, 45° 39' 59" E, 1631 m), 19 September 2017; coll. M. Mohammad-Doustaresharaf.

Genus *Molothrognathus* Summers and Schlinger, 1955

Molothrognathus bahariensis Ueckermann and Khanjani, 2003

This species was originally described from Iran where it was found from different habitats (Ueckermann and Khanjani, 2003). Recently it was also recorded from Turkey (Doğan and Doğan, 2020a).

Material examined: Two females, soil, Jolfa (Asiyab Kharabeh) (38° 51' 25" N, 45° 51' 21" E, 1743 m), 17 July 2018; four females, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; one female, soil under apple trees (*Malus* sp.), Urmia (Balanej) (37° 24' 35" N, 45° 09' 11" E, 1312 m), 17 Septem-

ber 2018; five females, soil, Urmia (Ali Beygloo) (37° 74' 09" N, 45° 07' 90" E, 1324 m), 11 August 2017; coll. M. Mohammad-Doustaresharaf.

Molothrognathus kamili Doğan, 2003

This species was originally described from soil under *Astragalus* sp. from Turkey (Doğan, 2003b).

This is a new record for the Iranian fauna.

Material examined: Four females, soil, Urmia (Shalmakan) (37° 27' 34" N, 44° 59' 59" E, 1800 m), 16 August 2018; two females, soil, Urmia (Dalamper) (37° 10' 41" N, 44° 53' 37" E, 1890 m), 4 August 2016; coll. M. Mohammad-Doustaresharaf.

Molothrognathus mehrnejadi Liang and Zhang, 1997

This species is currently known only from Iran where it was found in pistachio (*Pistacia* sp.) collar soil and bark stem (Liang and Zhang, 1997).

Material examined: Seven females, soil and litter, Khoda Afarin (Abbas Abad) (37° 55' 46" N, 46° 47' 88" E, 1310 m), 4 July 2017; two females, soil under oak tree (*Quercus* sp.), Sardasht (Alvatan) (36° 24' 22" N, 45° 21' 23" E, 1526 m), 30 September 2016; five females, soil under oak tree (*Quercus* sp.), Piranshahr (Mirabad) (36° 26' 08" N, 45° 21' 07" E, 1294 m), 1 October 2016; coll. M. Mohammad-Doustaresharaf.

Genus *Neognathus* Willmann, 1952

Neognathus terrestris (Summers and Schlinger, 1955)

This species was described from California, USA (Summers and Schlinger, 1955). It was also recorded from Canada, Crimea, Hungary, Turkey and Iran (Beron, 2020).

Material examined: Four females, soil, Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; one female, soil, Urmia (Dalamper) (37° 10' 41" N, 44° 53' 37" E, 1890 m), 4 August 2016; two females, soil, Urmia (Dolama) (37° 21' 23" N, 45° 14' 51" E, 1293 m), 16 August 2018; coll. M. Mohammad-Doustaresharaf.

Neognathus ueckermanni Bagheri, Doğan and Haddad, 2010

This species was originally described from soil under *Medicago sativa* L. from Iran (Bagheri et al., 2010a). Recently it was recorded from Turkey (Doğan, 2019).

Material examined: Two females, soil under azarole tree (*Crataegus azarolus*), Piranshahr (Mirabad) (36° 26' 08" N, 45° 21' 07" E, 1294 m), 1 October 2016; three females, soil and litter under pear tree (*Pyrus* sp.), Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; four females, soil under oak tree (*Quercus* sp.), Oshnaviyeh (Miraveh) (36° 58' 48" N, 45° 01' 30" E, 1694 m), 1 July 2017; coll. M. Mohammad-Doustaresharaf.

Family Cryptognathidae Oudemans, 1902

Genus *Cryptognathus* Kramer, 1879

Cryptognathus lagena Kramer, 1879

This species is widely distributed and originally described from Germany (Beron, 2020). It was also previously recorded from Iran (Khanjani et al., 2014).

Material examined: Six females, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; one female, soil, Khoda Afarin (Aynaloo) (38° 53' 03" N, 46° 47' 38" E, 1700 m), 18 July 2018; two females, soil, Khoda Afarin (Garmanab) (38° 54' 26" N, 46° 47' 19" E, 1520 m), 4 October 2017; coll. M. Mohammad-Doustaresharaf.

Genus *Favognathus* Luxton, 1973

Favognathus kamili Dönel and Doğan, 2011

This species was originally described from Turkey (Dönel and Doğan, 2011; Doğan, 2019) and it was also recorded from Iran (Bagheri et al., 2015; Doğan and Doğan, 2020b).

Material examined: Two females, soil under oak tree (*Quercus* sp.), Sardasht (Alvatan) (36° 24' 22" N, 45° 21' 23" E, 1526 m), 30 September 2016; two females, soil, Jolfa (Asiyab Kharabeh) (38° 51' 25" N, 45° 51' 21" E, 1743 m), 17 July 2018; two females, soil under apple trees (*Malus* sp.), Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; coll. M. Mohammad-Doustaresharaf.

Favognathus mirazii Khanjani and Ueckermann, 2008

This species is currently known only from Iran where it was found from soil under pear tree (*Pyrus* sp.) (Khanjani and Ueckermann, 2008b).

Material examined: One female, soil under apple trees (*Malus* sp.), Urmia (Gasemloo valley) (37° 17' 58" N, 45° 07' 16" E, 1750 m), 5 July 2017; three females, soil, Urmia (Qare Aqaj) (37° 27' 53" N, 45° 09' 19" E, 1302 m), 24 July 2018; two females, soil, Urmia (Qare Aqaj) (37° 27' 53" N, 45° 09' 19" E, 1302 m), 25 July 2018; coll. M. Mohammad-Doustaresharaf.

Family Eupalopsellidae Willmann, 1952

Genus *Eupalopsellus* Sellnick, 1949

Eupalopsellus deformatus Fan, 2004

This species was originally described from leaves of an unidentified grass, China (Fan, 2004). It was also recorded from Turkey and Iran (Bagheri et al., 2014; Doğan, 2019).

Material examined: One female, soil, Urmia (Qare Aqaj) (37° 27' 53" N, 45° 09' 19" E, 1302 m), 24 July 2018; coll. M. Mohammad-Doustaresharaf.

Eupalopsellus prasadi Bagheri and Khanjani, 2009

This species was described from soil under apple trees (*Malus* sp.) from Iran (Bagheri and Khanjani, 2009). It was also recorded from Turkey (Kasap et al., 2013).

Material examined: Two deutonymphs, Hornbeam tree foliage, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 18 July 2017; one female, raspberry foliage (*Rubus* sp.), Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 2 September 2017; one female, rose hip foliage (*Rosa* sp.), Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; coll. M. Mohammad-Doustaresharaf.

Family Raphignathidae Kramer, 1877

Genus *Raphignathus* Dugés, 1834

Raphignathus azarshahriensis Ahaniazad and Bagheri, 2012

This species is currently known only from Iran where it was found from soil of black cherry (*Prunus* sp.), walnut (*Juglans* sp.) and almond orchards (Ahaniazad et al., 2012).

Material examined: Three females, soil under *Astragalus* sp., Urmia (Dalamper) (37° 10' 41" N, 44° 53' 37" E, 1890 m), 8 July 2018; seven females, soil under pear tree (*Pyrus* sp.), Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; coll. M. Mohammad-Doustaresharaf.

***Raphignathus giselae* Meyer and Ueckermann, 1989**

This species was originally described from Zimbabwe (Meyer and Ueckermann, 1989). It was also recorded from South Africa, Turkey, Yemen and Iran (Beron, 2020).

Material examined: Twelve females, soil under oak tree (*Quercus* sp.), Sardasht (Alvatan) (36° 24' 22" N, 45° 21' 23" E, 1526 m), 30 September 2016; three females, soil under azarole tree (*Crataegus azarolus*), Piranshahr (Mirabad) (36° 26' 08" N, 45° 21' 07" E, 1294 m), 1 October 2016; coll. M. Mohammad-Doustaresharaf.

***Raphignathus gracilis* (Rack, 1962)**

This species is widely distributed in 17 countries and originally described from Germany (Rack, 1962; Beron, 2020). It was also previously recorded from different part of Iran (Beyzavi et al., 2013; Mohammad-Doustaresharaf and Bagheri, 2018).

Material examined: Three females, soil, Khoda Afarin (Vaygan) (38° 55' 07" N, 46° 46' 58" E, 1350 m), 14 July 2016; four females, soil under oak tree (*Quercus* sp.), Oshnaviyeh (Miraveh) (36° 58' 48" N, 45° 01' 30" E, 1694 m), 1 July 2017; coll. M. Mohammad-Doustaresharaf.

***Raphignathus hecmatanaensis* Khanjani and Ueckermann, 2003**

This species originally was described from grass from Iran (Khanjani and Ueckermann, 2003). It was also recorded from different part of Turkey (Doğan, 2019).

Material examined: Five females, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; five females, soil, Khoda Afarin (Aynaloo) (38° 53' 03" N, 46° 47' 38" E, 1700 m), 18 July 2018; four females, soil, Khoda Afarin (Garmanab) (38° 54' 26" N, 46° 47' 19" E, 1520 m), 4 October 2017; coll. M. Mohammad-Doustaresharaf.

***Raphignathus khorrabadensis* Bagheri, 2013**

This species was originally described from soil from Iran (Bagheri et al., 2013a). It was also recorded from Turkey (Uluçay et al., 2016).

Material examined: Four females, soil, Khoda Afarin (Garmanab) (38° 54' 26" N, 46° 47' 19" E, 1520 m), 4 October 2017; 12 females, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; four females, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 4 August 2018; coll. M. Mohammad-Doustaresharaf.

***Raphignathus orientalis* Fan and Li, 1993**

This species was originally described from China (Fan and Li, 1993). It was also recorded from Iran (Mohammad-Doustaresharaf and Bagheri, 2018).

Material examined: Two females, soil, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; coll. M. Mohammad-Doustaresharaf.

***Raphignathus zhaoi* Hu, Jing and Liang, 1995**

This species originally was described from China (Hu et al., 1995). It was also recorded from different part of Turkey and Iran (Beyzavi et al., 2013; Doğan, 2019).

Material examined: Three females, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; two females, soil, Urmia (Ali Beygloo) (37° 74' 09" N, 45° 07' 90" E, 1324 m), 11 August 2017; one female, soil, Urmia (Dolama) (37° 21' 23" N, 45° 14' 51" E, 1293 m), 16 August 2018; coll. M. Mohammad-Doustaresharaf.

Family Stigmaeidae Oudemans, 1931

Genus *Eustigmaeus* Berlese, 1910

***Eustigmaeus anauniensis* (Canestrini, 1889)**

This species is widely distributed in 20 countries and originally described from Italy (Fan et al., 2016; Beron, 2020). It was also previously recorded from different part of Iran (Beyzavi et al., 2013).

Material examined: Five females, soil and litter, Khoda Afarin (Abbas Abad) (37° 55' 46" N, 46° 47' 88" E, 1310 m), 4 July 2017; three females, soil, Khoda Afarin (Vaygan) (38° 55' 07" N, 46° 46' 58" E, 1350 m), 14 July 2016; two females and one male, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; four females, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 29 August 2018; coll. M. Mohammad-Doustaresharaf.

***Eustigmaeus gulingensis* Hu and Chen, 1996**

This species is currently known only from China where it was found from soil (Hu et al., 1996).

This is a new record for the fauna of Iran.

Material examined: Two females and one deutonymph, soil under *Astragalus* sp., Urmia (Dalamper) (37° 10' 41" N, 44° 53' 37" E, 1890 m), 8 July 2018; One female, soil, Urmia (Dalamper) (37° 10' 41" N, 44° 53' 37" E, 1890 m), 4 August 2018; coll. M. Mohammad-Doustaresharaf.

***Eustigmaeus pinnatus* (Kuznetsov, 1977)**

This species was originally described from soil from Russia (Kuznetsov, 1977). It was also recorded from Crimea, Greece, Hungary, Moldavia, Russia, Poland, Slovakia, Turkey, Ukraine and Iran (Fan et al., 2016; Beron, 2020).

Material examined: One female, soil, Khoda Afarin (Vaygan) (38° 55' 07" N, 46° 46' 58" E, 1350 m), 14 July 2016; two females, soil, Urmia (Qare Aqaj) (37° 27' 53" N, 45° 09' 19" E, 1302 m), 24 July 2018; one female, soil under azarole tree (*Crataegus azarolus*), Oshnaviyeh (Miraveh) (36° 58' 48" N, 45° 01' 30" E, 1694 m), 1 July 2017; two females, soil under apple trees (*Malus* sp.), Urmia (Balanej) (37° 24' 35" N, 45° 09' 11" E, 1312 m), 17 September 2018; coll. M. Mohammad-Doustaresharaf.

***Eustigmaeus plumifer* (Halbert, 1923)**

This species was originally described from Ireland under a stone (Halbert, 1923). It was also recorded from Austria, Denmark, Greece, Ireland, Russia, Slovakia, Spain, USA and Iran (Fan et al., 2016; Beron, 2020).

Material examined: Four females, soil, Urmia (Dalamper) (37° 10' 41" N, 44° 53' 37" E, 1890 m), 4 August 2018; four females, rotten woods, Sardasht (Alvatan) (36° 24' 22" N, 45° 21' 23" E, 1526 m), 30 September 2016; two females, soil, Urmia (Shalmakan) (37° 27' 34" N, 44° 59' 59" E, 1800 m), 16 August 2018; coll. M. Mohammad-Doustaresharaf.

***Eustigmaeus segnis* (Koch, 1836)**

Cosmopolitan species. This species is widely distributed in 21 countries and originally described from moss from Germany (Fan et al., 2016; Beron, 2020).

Material examined: 15 females, four deutonymphs and two males soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; three females, soil, Khoda Afarin (Aynaloo) (38° 53' 03" N, 46° 47' 38" E, 1700 m), 18 July 2018; 12 females and two deutonymphs, soil, Khoda Afarin (Garmanab) (38° 54' 26" N, 46° 47' 19" E, 1520 m), 4 October 2017; six females, soil and litter, Khoda Afarin (Abbas Abad) (37° 55' 46" N, 46° 47' 88" E, 1310 m), 4 July 2017; four females, soil, Urmia (Qare Aqaj) (37° 27' 53" N, 45° 09' 19" E, 1302 m), 24 July 2018; one female, soil under oak tree (*Quercus* sp.), Sardasht (Alvatan) (36° 24' 22" N, 45° 21' 23" E, 1526 m), 30 September 2016; one female, soil under azarole tree (*Crataegus azarolus*), Piranshahr (Mirabad) (36° 26' 08" N, 45° 21' 07" E, 1294 m), 1 October 2016; two females, soil and litter under pear tree (*Pyrus* sp.), Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; two females, soil under oak tree (*Quercus* sp.), Oshnaviyeh (Miraveh) (36° 58' 48" N, 45° 01' 30" E, 1694 m), 1 July 2017; five females, three deutonymphs and one larva, soil under *Astragalus* sp., Urmia (Dalamper) (37° 10' 41" N, 44° 53' 37" E, 1890 m), 8 July 2018; two females, soil, Jolfa (Asiyab Kharabeh) (38° 51' 25" N, 45° 51' 21" E, 1743 m), 17 July 2018; coll. M. Mohammad-Doustaresharaf.

***Eustigmaeus setiferus* Bagheri, Saber, Ueckermann, Ghorbani and Navaei-Bonab, 2011**

This species is currently known only from Iran where it was found from soil in apple trees (*Malus* sp.) orchard (Bagheri et al., 2011b).

Material examined: One female, litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; four females, soil under oak tree (*Quercus* sp.), Oshnaviyeh (Miraveh) (36° 58' 48" N, 45° 01' 30" E, 1694 m), 1 July 2017; six females, soil under apple trees (*Malus* sp.), Urmia (Balanej) (37° 24' 35" N, 45° 09' 11" E, 1312 m), 17 September 2018; one female, soil under *Astragalus* sp., Urmia (Soladokal) (37° 10' 27" N, 44° 51' 51" E, 2035 m), 5 August 2018; coll. M. Mohammad-Doustaresharaf.

***Eustigmaeus ueckermanni* Bagheri and Beyzavi, 2013**

This species is currently known only from Iran where it was found from humus under oak trees (*Quercus brantii*) (Bagheri and Beyzavi, 2013).

Material examined: Four females, soil and litter under oak tree (*Quercus* sp.), Mahabad (Kavelan) (36° 23' 34" N, 45° 39' 59" E, 1631 m), 19 September 2017; one female, rotten wood, Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; coll. M. Mohammad-Doustaresharaf.

Genus *Ledermuelleriopsis* Willmann, 1953

***Ledermuelleriopsis sezeki* Doğan, 2004**

This species is currently known only from Turkey where it was found from decayed stump and ant (Formicidae) nest (Doğan, 2004).

This is a new record for the Iranian fauna.

Material examined: Two females, soil under oak tree (*Quercus* sp.), Oshnaviyeh (Miraveh) (36° 58' 48" N, 45° 01' 30" E, 1694 m), 1 July 2017; coll. M. Mohammad-Doustaresharaf.

***Ledermuelleriopsis zahiri* Khanjani and Ueckermann, 2002**

This species was originally described from soil under *Pyrus communis* from Iran and currently known only from different part of Iran (Khanjani and Ueckermann, 2002; Fan et al., 2016).

Material examined: Three females, soil, Khoda Afarin (Garmanab) (38° 54' 26" N, 46° 47' 19" E, 1520 m), 4 October 2017; 11 females, soil and litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; seven females and two deutonymphs, soil and litter, Khoda Afarin (Abbas Abad) (37° 55' 46" N, 46° 47' 88" E, 1310 m), 4 July 2017; four females, soil, Urmia (Qare Aqaj) (37° 27' 53" N, 45° 09' 19" E, 1302 m), 24 July 2018; two females, soil and litter under oak tree (*Quercus* sp.), Piranshahr (KhidirAabad) (36° 26' 08" N, 45° 21' 07" E, 1294 m), 31 July 2017; three females and two males, soil under azarole tree (*Crataegus azarolus*), Piranshahr (Mirabad) (36° 26' 08" N, 45° 21' 07" E, 1294 m), 1 October 2016; five females, soil under pear tree (*Pyrus* sp.), Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; two females and one deutonymph, soil, Jolfa (Asiyab Kharabeh) (38° 51' 25" N, 45° 51' 21" E, 1743 m), 17 July 2018; coll. M. Mohammad-Doustaresharaf.

Genus *Prostigmaeus* Kuznetsov, 1984

***Prostigmaeus khanjanii* Bagheri and Ghorbani, 2010**

This species was originally described from soil from Iran (Bagheri et al., 2010b). Recently it was also recorded from Turkey (Akyol, 2021).

Material examined: Two females and one male, soil and litter, Khoda Afarin (Abbas Abad) (37° 55' 46" N, 46° 47' 88" E, 1310 m), 4 July 2017; three females, soil, Khoda Afarin (Vaygan) (38° 55' 07" N, 46° 46' 58" E, 1350 m), 14 July 2016; coll. M. Mohammad-Doustaresharaf.

Genus *Stigmaeus* Koch, 1836

***Stigmaeus angustus* Dönel and Doğan, 2011**

This species was described from grassy soil from Turkey (Dönel and Doğan, 2011). It was also recorded from Iran (Bagheri and Mohammad-Doustaresharaf, 2020).

Material examined: Five females and three deutonymphs, soil, Urmia (Qare Aqaj) (37° 27' 53" N, 45° 09' 19" E, 1302 m), 24 July 2018; seven females and two males, soil, Urmia (Qare Aqaj) (37° 27' 53" N, 45° 09' 19" E, 1302 m), 12 September 2017; six females, soil, Urmia (Balanej) (37° 24' 35" N, 45° 09' 11" E, 1312 m), 17 September 2018; one female, and one deutonymph soil, Urmia (Dolama) (37° 21' 23" N, 45° 14' 51" E, 1293 m), 16 August 2018; two females, soil and litter under pear tree (*Pyrus* sp.), Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; coll. M. Mohammad-Doustaresharaf.

***Stigmaeus cariae* Khanjani, Pishehvar, Mirmoayedi and Khanjani, 2012**

This species is currently known only from Iran where it was found in soil under walnut trees *Juglans* sp. (Khanjani et al., 2012).

Material examined: Two females, soil under apricot tree (*Prunus armeniaca*), Urmia (Gasemloo valley) (37° 17' 58" N, 45° 07' 16" E, 1750 m), 5 July 2017; three females, soil, Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; coll. M. Mohammad-Doustaresharaf.

***Stigmaeus elongatus* Berlese, 1886**

This species is widely distributed in 11 countries and originally described from Italy (Fan et al., 2016; Beron, 2020). It was also previously recorded from different part of Iran (Beyzavi et al., 2013).

Material examined: Three females and one male, soil under oak tree (*Quercus* sp.), Oshnaviyeh (Miraveh) (36° 58' 48" N, 45° 01' 30" E, 1694 m), 1 July 2017; five females, soil, Urmia (Balanej) (37° 24' 35" N, 45° 09' 11" E, 1312 m), 17 September 2018; two females and two deutonymphs, soil and litter, Khoda Afarin (Aynaloo) (38° 53' 03" N, 46° 47' 38" E, 1700 m), 18 July 2018; coll. M. Mohammad-Doustaresharaf.

***Stigmaeus glypticus* Summers, 1962**

This species was originally described from stump from USA (Summers, 1962). It was also recorded from Canada, Crimea, Ukraine and Iran (Fan et al., 2016; Mohammad-Doustaresharaf and Bagheri, 2018; Beron, 2020).

Material examined: Twelve females and two males, moss, Khoda Afarin (Garmanab) (38° 54' 26" N, 46° 47' 19" E,

1520 m), 4 October 2017; five females and three deutonymphs, rotten wood, Khoda Afarin (Garmanab) (38° 54' 26" N, 46° 47' 19" E, 1520 m), 11 September 2017; four females, one male and two deutonymphs, litter, Khoda Afarin (Garmanab) (38° 54' 26" N, 46° 47' 19" E, 1520 m), 17 September 2017; coll. M. Mohammad-Doustaresharaf.

***Stigmaeus luxtoni* Wood, 1981**

This species was originally described from New Zealand by Wood (1981) and later given from Turkey as *Stigmaeus turcica* by Doğan (2003a), synonymized by Faraji and Ueckermann (2006).

This is a new record for the fauna of Iran.

Material examined: Two females and one deutonymph, soil under *Carpinus* sp., Khoda Afarin (Garmanab) (38° 56' 42" N, 46° 45' 43" E, 1302 m), 27 August 2018; coll. M. Mohammad-Doustaresharaf.

***Stigmaeus miandoabiensis* Bagheri and Zarei, 2012**

This species was described from soil in apple trees (*Malus* sp.) from Iran (Bagheri and Zarei, 2012). It was also recorded from Turkey (Bingül et al., 2017).

Material examined: Three females, soil, Urmia (Qarah Hasanlu) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 23 August 2016; four females, soil, Urmia (Ali Beygloo) (37° 74' 09" N, 45° 07' 90" E, 1324 m), 11 August 2017; one female, soil under apricot tree (*Prunus armeniaca*), Urmia (Gasemloo valley) (37° 17' 58" N, 45° 07' 16" E, 1750 m), 5 July 2017; one females, soil under apple trees (*Malus* sp.), Urmia (Balanej) (37° 24' 35" N, 45° 09' 11" E, 1312 m), 17 September 2018; coll. M. Mohammad-Doustaresharaf.

***Stigmaeus pilatus* Kuznetsov, 1978**

This species was described from soil from Crimea (Kuznetsov, 1977). It was also recorded from Azerbaijan, Greece, Latvia, Poland, Slovakia, Spain, Turkey, Ukraine, Asian Russia and Iran (Stathakis et al., 2019; Khaustov, 2020).

Material examined: Four females, soil and litter under oak tree (*Quercus* sp.), Piranshahr (KhidirAabad) (36° 26' 08" N, 45° 21' 07" E, 1294 m), 31 July 2017; three females, soil and litter under pear tree (*Pyrus* sp.), Urmia (Marmisho) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 7 September 2017; four females, soil under oak tree (*Quercus* sp.), Oshnaviyeh (Miraveh) (36° 58' 48" N, 45° 01' 30" E, 1694 m), 1 July 2017; coll. M. Mohammad-Doustaresharaf.

Genus *Storchia* Oudemans, 1923

***Storchia robusta* (Berlese, 1885)**

Cosmopolitan species. Recorded from Eurasia, North America, Africa, New Zealand (Dönel and Doğan, 2011; Khaustov and Sergeyenko, 2014; Fan et al., 2016).

Material examined: Five females and two males, soil under oak tree (*Quercus* sp.), Mahabad (Kavelan) (36° 23' 34" N, 45° 39' 59" E, 1631 m), 19 September 2017; two females and two deutonymphs, soil and litter, Khoda Afarin (Aynaloo) (38° 53' 03" N, 46° 47' 38" E, 1700 m), 18 July 2018; one female, soil under oak tree (*Quercus* sp.), Sardasht (Alvatan) (36° 24' 22" N, 45° 21' 23" E, 1526 m), 30 September 2016; one female, soil, Jolfa (Asiyab Kharabeh) (38° 51' 25" N, 45° 51' 21" E, 1743 m), 17 July 2018; two females and one male, soil, Urmia (Dallamper) (37° 10' 41" N, 44° 53' 37" E, 1890 m), 4 August 2016; one female, soil, Khoda Afarin (Tatar) (39° 03' 10" N, 46° 46' 34" E, 308 m), 27 August 2018; one female, soil under *Astragalus* sp., Urmia (Soladokal) (37° 10' 27" N, 44° 51' 51" E, 2035 m), 5 August 2018; three females, soil, Urmia (Qarah Hasanlu) (37° 59' 97" N, 45° 04' 67" E, 1297 m), 23 August 2016; coll. M. Mohammad-Doustaresharaf.

***Storchia yazdani* Bagheri, 2011**

This species is currently known only from Iran where it was found on the soil and moss (Bagheri et al., 2011a).

Material examined: Six females, soil and litter, Khoda Afarin (Abbas Abad) (37° 55' 46" N, 46° 47' 88" E, 1310 m), 5 September 2017; five females, litter, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; one female, soil, Khoda Afarin (Tatar) (39° 03' 10" N, 46° 46' 34" E, 308 m), 27 August 2018; coll. M. Mohammad-Doustaresharaf.

Genus *Zetzellia* Oudemans, 1927

***Zetzellia mali* (Ewing, 1917)**

Cosmopolitan species. This species is widely distributed in 28 countries and originally described from Hillsboro, Oregon, USA (Fan et al., 2016; Beron, 2020). It was also previously recorded from different part of Iran (Beyzavi et al., 2013; Bagheri and Mohammad-Doustaresharaf, 2020).

Material examined: Two females and two deutonymphs, *Carpinus* sp., foliage, Khoda Afarin (Aynaloo) (38° 53' 03" N, 46° 47' 38" E, 1700 m), 18 July 2018; one female, *Carpinus* sp., foliage, Khoda Afarin (Kalaleh) (38° 56' 42" N, 46° 45' 43" E, 1380 m), 27 August 2018; coll. M. Mohammad-Doustaresharaf.

***Zetzellia pourmirzai* Khanjani and Ueckermann, 2008**

This species is currently known only from Iran where it was found on the plum leaves with *Eutetranychus orientalis* (Khanjani and Ueckermann, 2008a).

Material examined: Five females and one deutonymph, *Carpinus* sp., foliage, Khoda Afarin (Aynaloo) (38° 53' 03" N, 46° 47' 38" E, 1700 m), 18 July 2018; two females and one deutonymph, azarole foliage (*Crataegus azarolus*), Urmia (Dallamper) (37° 10' 41" N, 44° 53' 37" E, 1890 m), 4 August 2016; coll. M. Mohammad-Doustaresharaf.

Authors' contributions

Mojtaba Mohammad-Doustaresharaf: Investigation, resources, collection of the samples, assemble data, writing the original manuscript and identification of specimens. **Mohammad Bagheri:** Supervision, validation, editing, modify and revise.

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Conflict of interest

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