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Article

Stigmaeid and pseudocheylid mite fauna (Acari: Prostigmata) in three northwestern provinces of Iran with description of male and re-description of female of *Mediolata belfieldi* Momen

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Abstract

A study on the stigmaeid and pseudocheylid mite fauna in northwestern provinces of Iran was carried out during 2012–2014. In this survey, 24 and 4 species of Stigmaeidae (belonging to 7 genera) and Pseudocheylidae (belonging to 1 genus) were collected and identified, respectively. In this paper, the male of *Mediolata belfieldi* Momen, 1987 is described and the female is re-described.

Key words: Anystoidea; *Mediolata*; Pseudocheylidae; Raphignathoidea; Stigmaeidae; Trombidiformes.

Introduction

The family Stigmaeidae (Acari: Trombidiformes) is a large cosmopolitan group in the superfamily Raphignathoidea (Acari: Prostigmata) found in soil, litter, plant foliages, vegetation, grass, leaf, mulch, lichen, bark, rock and even occur as parasitic on sand flies and phlebotomine flies (Martinez-Ortega *et al*. 1983; Koç and Ayyıldız 1997). Stigmaeid mites are mainly predators and feed on spider mites, scale insects, especially their eggs, and small arthropods (Summers 1966; Ueckermann and Meyer 1987; Walter *et al*. 2009). This family is the second most frequent predatory mite family found on plants after the Phytoseiidae (Santos and Laing 1985; Khanjani and Ueckermann 2002; Hernandes and Feres 2005). This family can be defined as follows: dorsal shields absent or dorsum completely covered by 2–4 shields or partly covered by 3 or more shields; 12–14 pairs of dorsal body setae; chelicerae usually free but partially fused in some genera; palp with thumb-claw complex with a seta or claw-like accessory claw at base

of tibial claw; and terminal sensillum on palptarsus varies from a simple bidentate to tridentate spine or four eupathidia. The family Stigmaeidae contains 32 genera (Fan and Zhang 2005; Doğan, *et al*. 2011; Khanjani *et al.* 2012), of which 11 genera are recorded from Iran namely: *Agistemus* Summers, 1960, *Cheylostigmaeus* Willmann, 1951, *Eustigmaeus* Berlese, 1910, *Ledermuelleriopsis* Willmann, 1953, *Parastigmaeus* Kuznetzov, 1984, *Prostigmaeus* Kuznetzov, 1984, *Stigmaeus* Koch, 1836, *Storchia* Oudemans, 1923, *Mediolata* Canestrini, 1889, *Zetzellia* Oudemans, 1927 and *Eryngiopus* Summers, 1964. To date 39, 25 and 6 species of stigmaeid mites were reported from East Azerbaijan, West Azerbaijan and Ardabil, repectively. 18 species are reported here for the first time for the mite fauna of these provinces (Table 1). Because a little information is given in the original description of *Mediolata belfield*, we decided to re-describe it's female and present new data for the male.

Pseudocheylid mites are found under tree bark, in litter and nests, and on moss (Walter *et al*. 2009) and in soil (Van Dis and Ueckermann 1991). Knowledge of the biology of pseucheylids is poor. The predatory mite family Pseudocheylidae (Acari: Anystoidea) includes three valid genera: *Pseudocheylus* Berlese, *Neocheylus* Trägårdh and *Anoplocheylus* Berlese (Ueckermann and Khanjani 2004; Navaei-Bonab *et al*. 2011a; Zhang *et al*. 2011; Bagheri *et al*. 2013a). The family Pseudocheylidae is distinguished by: lacking genital papillae; legs having pad-like tarsal apoteles that are produced into elongated annulate stalks and bear paired, minute claws; a reduced palp-tarsus; widely separated coxal fields I–II and III–IV; and anapomorphic additions of adanal and anal setae during ontogeny (Walter *et al*. 2009). The members of Pseudocheylidae have been recorded from South Africa, Brazil and Paraguay, USA, Canada, Italy, Australia, Egypt, Ukraine, Uganda and Iran (Ueckermann and Khanjani 2004; Khaustov and Tolstikov 2015).

Material and methods

Samples were collected from field and orchards of different regions of East Azerbaijan, West Azerbaijan and Ardabil provinces (Northwestern Iran). Mites were extracted using a Berlese-Tulgeren funnel; specimens were cleared in Nesbitt's fluid, mounted in Hoyer's medium (Walter and Krantz 2009) and examined under an Olympus BX40 phase contrast microscope equipped with a drawing tube at 1000× magnification. The length of the idiosoma was measured from the base of the chelicerae to the posterior margin of the body; the width of the idiosoma was measured at the broadest part. Setae were measured from their insertions to their tips; distances between setae were measured between their insertions. The terminology and abbreviations are based on Kethley (1990). All measurements are given in micrometers (μm).

Results

Family Stigmaeidae Oudemans, 1931
Genus *Stigmaeus* Koch, 1836

The genus *Stigmaeus* Koch with more than 135 species (described from Australia, China, Egypt, Iran, Ireland, Island, Italy, New Zealand, Russia, South Africa, Spain, Syria, Turkey, USA and Yemen) is the largest and most important genus of this family and members of this genus are found in various habitats such as aerial part of plants and soil. They are usually predators and feeding on a variety of arthropods (Swift 1987;

Akyol & Koç 2007; Bagheri *et al*. 2013b). To date 39 species of this genus have been described or reported from Iran, namely: *S. alvandicus* Khanjani and Ueckermann, 2002; *S. unicus* Kuznetzov, 1977 [by Khanjani and Ueckermann (2002)]; *S. elongatus* Berlese, 1886; *S. candidus* Fan and Li, 1993 (*S. mazandaranicus* Faraji and Ueckermann, 2006); *S. malekii* Haddad Irani-Nejad *et al*., 2006; *S. pilatus* Kuznetzov, 1978 [by Khanjani *et al*. (2010)]; *S. shabestariensis* Haddad Irani-Nejad *et al*., 2010b; *S. shendabadiensis* Haddad Irani-Nejad *et al*., 2010a; *S. boshroyehensis* Khanjani *et al*., 2010; *S. marandiensis* Bagheri *et al*., 2011; *S. ueckermanni* Pahlavan Yali *et al*., 2011; *S. longipilis* Canestrini, 1889 [by Pahlevan Yali *et al*. (2011)]; *S. maraghehiensis* Bagheri *et al*., 2012; *S. cariae* Khanjani *et al*., 2012; *S. kermanshahiensis* Khanjani *et al*., 2012; *S. makouiensis* Bagheri and Maleki, 2013; *S. saboorii* Bagheri and Paktinat-Saeej 2013; *S. echinopus* Summers, 1962 [by Ahaniazad *et al*. (2013)]; *S. glypticus* Summers, 1962 [by Hajizadeh *et al*. (2013)]; *S. petrophilus* Kuznetsov and Petrova, 1979 [by Hajizadeh *et al*. (2013)]; *S. fissicomus* Ueckermann and Meyer 1987 [by Kamali *et al*. (2001)]; *S. haddadi* Zarei and Bagheri (2012); *S. iranensis* Bagheri *et al*., 2012; *S. kermaniensis* Changizi and Bagheri, 2012; *S. ladanae* Nazari *et al*., 2012; *S. miandoabiensis* Bagheri and Zarei, 2012; *S. nasrinae* Nazari *et al*., 2012; *S. pulchellus* Kuznetzov, 1978 [by Zarei and Bagheri (2012)]; *S. siculus* (Berlese, 1883) [by Bagheri and Zarei (2012)]; *S. Sphagneti* (Hull, 1918) [by Akbari *et al*., 2010]; *S. sariensis* Bagheri, 2014; *S. corticeus* Kuznetzov and Wainstein, 1977 [by Faraji *et al*. (2014)]; *S. Kamili* Doğan and Ayyıldız, 2003 [by Ahaniazad *et al*. (2014)]; *S. hashtrudiensis* Bagheri and Maleki, 2014; *S. isfahaniensis* Bagheri *et al*. (2014); *S. planus* Kuznetzov, 1978 [by Doğan *et al.* (2012)]; *S. delaramae* Khanjani *et al*., 2014; *S. kurdistaniensis* Kanjani *et al*., 2015; *S. jalili* Fakhari, Khanjani and Rahmani, 2015.

***S. elongatus* Berlese, 1886**

Stigmaeus luteus Summers, 1962 [Synonymized by Wood (1973)].

Material examined

Two females from soil in pear orchards, July 2014, Shabestar, East Azerbaijan; six females from soil in sunflower fields, October 2013, Marand, East Azerbaijan; two females from soil in alfalfa fields, August 2012, Khoy, West Azerbaijan; Two females from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil; three females from soil in sunflower fields, July 2013, Meshkin shahr, Ardabil; two females from soil in alfafa orchards, 2013, Lahrud, Ardabil.

Previous provincial records from Iran

Fars (Sahraeian *et al.* 2006; Khademi *et al.* 2006; Daneshnia and Akrami 2013), Guilan (Noei *et al.* 2007), East Azerbaijan (Bagheri *et al.* 2006, 2011a; Akbari *et al.* 2010; Lotfollahi *et al.* 2010; Gheblealivand *et al.* 2011a, b; Navaei-Bonab *et al.* 2012; Navaei-Bonab and Parsaeyan 2013; Abaci *et al*. 2014; Ahaniazad *et al*. 2014; Faraji *et al*. 2014; Seilsepur *et al*. 2014), Hamedan (Khanjani and Ueckermann 2002; Rostami *et al.* 2010a, b; 2012; Mohammadi *et al*. 2013), West Azerbaijan (Bagheri *et al.* 2011b; Zarei *et al.* 2011; Yousefi *et al*. 2014), Kerman (Izadi *et al.* 2010; Changizi *et al.* 2011a), Zanjan (Rahmani *et al.* 2011; Fakhari *et al*. 2014), Razavi Khorasan (Paktinat-Saeej *et al.* 2012a, b; Rahmdeli *et al*. 2013), Mazandaran (Paktinat Saeej *et al*. 2014) and Lorestan (Rahmati *et al*. 2015).

S. shabestariensis Haddad, Lotfollahi and Akbari, 2010

Material examined

Three females from soil in alfalfa fields, August 2014, Shabestar, East Azerbaijan; one female from soil in apple orchards, October 2013, Marand, East Azerbaijan; two females from soil in apple orchards, August 2012, Khoy, West Azerbaijan; two females from soil in wheat fields, July 2013, Meshkin shahr, Ardabil.

Previous provincial records from Iran

East Azerbaijan (Haddad Irani-Nejad *et al.* 2010; Navaei-Bonab *et al.* 2012; Navaei-Bonab and Parsaeyan 2013; Abaci *et al*. 2014; Ahaniazad *et al*. 2014; Faraji *et al*. 2014), West Azerbaijan (Bagheri *et al.* 2011b; Zarei *et al.* 2011; Abaci *et al*. 2014; Yousefi *et al*. 2014) and Zanjan (Fakhari *et al*. 2014).

S. pilatus Kuznetzov, 1978

Material examined

Four females from soil under apple orchards, August 2013, Shabestar and Marand, East Azerbaijan; three females from soil in apple orchards, July 2012, Urmia, West Azerbaijan; one female from soil in wheat fields, July 2013, Meshkin shahr, Ardabil.

Previous provincial records from Iran

Hamedan (Rostami *et al.* 2010a, b, 2012; Khanjani *et al.* 2010, 2012; Mohammadi *et al*. 2013; Nazari *et al*. 2013), Kerman (Changizi *et al.* 2011b), East Azerbaijan (Bagheri *et al.* 2011a; Navaei-Bonab *et al.* 2012; Navaei-Bonab and Parsaeyan 2013; Ahaniazad *et al*. 2014; Abaci *et al*. 2014; Seilsepur *et al*. 2014), Esfahan (Rafeian Najaf-Abadi *et al*. 2014), Mazandaran (Paktinat-Saeej *et al*. 2014), West Azerbaijan (Yousefi *et al*. 2014), Zanjan (Fakhari *et al*. 2014), Guilan (Zarei *et al*. 2015).

S. iranensis Bagheri and Gheblealivand, 2012

Material examined

Two females from soil in apple orchards, August 2012, Urmia, West Azerbaijan; two females from soil in apple orchards, August 2014, Shabestar, East Azerbaijan.

Previous provincial records from Iran

East Azerbaijan (Bagheri *et al.* 2012).

S. miandoabiensis Bagheri and Zarei, 2012

Material examined

One female from soil in apple orchards, August 2012, Khoy, West Azerbaijan; two females from soil in apple orchards, August 2014, Marand, East Azerbaijan.

Previous provincial records from Iran

West Azerbaijan (Bagheri and Zarei 2012), East Azerbaijan (Bagheri and Zarei 2012), Lorestan (Rahmati *et al*. 2015).

S. marandiensis Bagheri and Ueckermann, 2011

Material examined

Three females from soil in apple orchards, June 2014, Shabestar, East Azerbaijan; three females from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Previous provincial records from Iran

East Azerbaijan (Bagheri *et al.* 2011c; Navaei-Bonab *et al*. 2012; Abaci *et al*. 2014; Ahaniazad *et al*. 2014), West Azerbaijan (Abaci *et al*. 2014).

S. boshroyehensis Khanjani, Izadi, Asali-Fayaz, Raisi, Rostami and Doğan, 2010

Material examined

One female from soil in apple orchards, April 2013, Varzeghan, East Azerbaijan; one female from soil in apple orchards, August 2014, Marand, East Azerbaijan.

Previous provincial records from Iran

South Khorasan (Khanjani *et al*. 2010), Kerman (Changizi *et al*. 2011a), East Azerbaijan (Gheblealivand *et al.* 2011a), Esfahan (Rafeian Najaf-Abadi *et al*. 2014; Navaei-Bonab and Parsaeyan, 2013), Hamedan (Nazari *et al*. 2013; Mohammadi*et al*. 2013), Zanjan (Fakhari *et al*. 2014), Guilan (Zarei *et al*. 2015), Lorestan (Rahmati *et al*. 2015).

S. haddadi Bagheri and Zarei, 2012

Material examined

One female from soil in apple orchards, July 2012, Marand, East Azerbaijan.

Previous provincial records from Iran

West Azerbaijan (Zarei and Bagheri 2012), Mazandaran (Paktinat-Saeej *et al*. 2014), Zanjan (Fakhari *et al*. 2014, 2015).

S. ueckermanni Pahlavan-Yali, Khanjani and Razmjou, 2011

Material examined

One female from soil in alfalfa fields, June 2014, Shabestar, East Azerbaijan; two females from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil; one female from soil in wheat fields, July 2013, Meshkin shahr, Ardabil; one female from soil in alfalfa fields, July 2013, Lahrud, Ardabil.

Previous provincial records from Iran

Ardabil (Pahlavan-Yali *et al.*2011), Hamedan (Nazari *et al*. 2013).

Mediolata Canestrini, 1889

Type species: *Stigmaeus longirostris* Berlese, 1887 (type lost), by original designation.

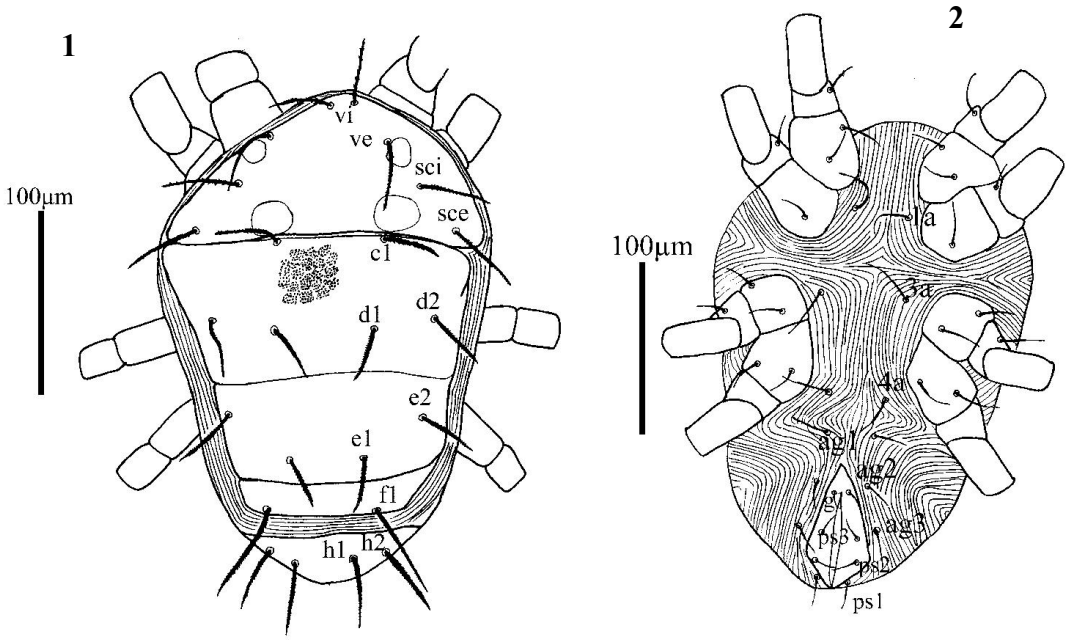
The members of the genus *Mediolata* are predators of spider mites and scale insects (Walter, and Proctor 1999). Until now only one species, *Mediolata belfieldi* Momen, 1987, was reported from Iran (Bagheri *et al*. 2011b).

Mediolata belfieldi Momen, 1987 (Figs. 1–14)

Re-description

Female (Figs. 1–6) – Idiosoma oval in dorsoventral view; length of body (Including gnathosoma) 450, (excluding gnathosoma) 258, width 175.

Gnathosoma – Chelicerae fused basally; subcapitulum with 1 pair of subcapitular setae *n* (29) and 2 pairs of adoral setae (*or1* 9, *or2* 11); palpal chaetotaxy: tarsus with 1 terminal tridentate eupathidium + 1 solenidion + 1 subterminal spine-like eupathidium + 4 setae; tibia with 2 setae + 1 claw + 1 accessory claw; genu with2 setae; femur with 2 setae; trochanter without setae.

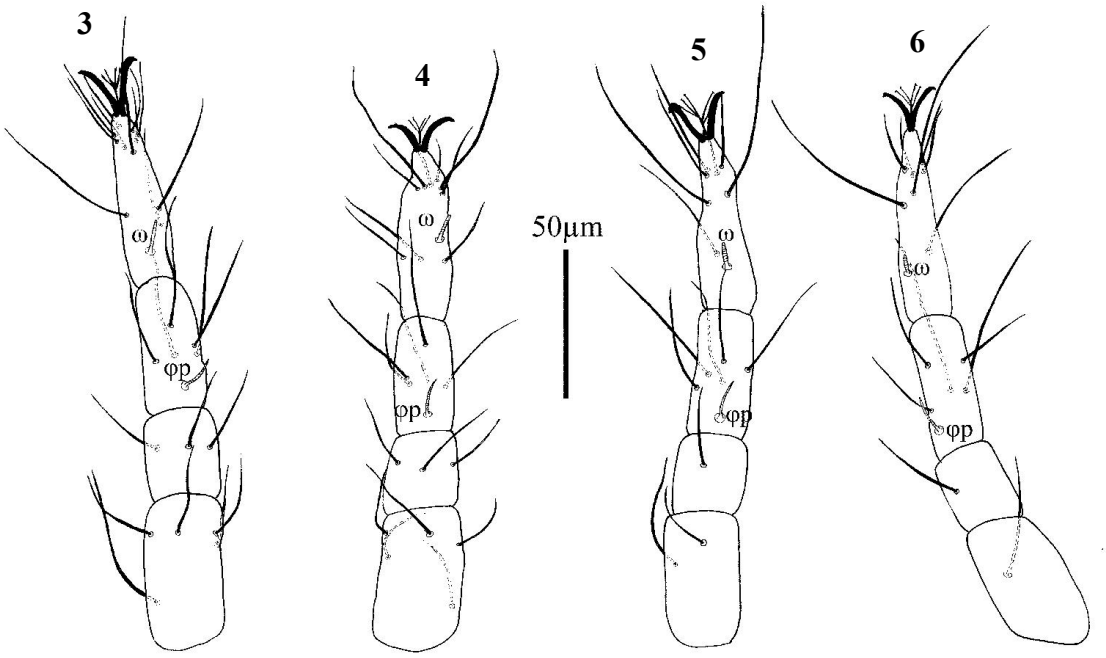


Figures 1–2. *Mediolata belfieldi* (female) – 1. Dorsal view of idiosoma; 2. Ventral view of idiosoma

Dorsum (Fig. 1) – Prodorsum covered with a large shield bearing 4 pairs of setae (*vi*, *ve*, *sci*, *sce*); eyes and post ocular bodies present; hysterosoma covered with 3 transversely divided shields and 6 pairs of setae (*c1*, *d1*, *d2*, *e1*, *e2*, *f1*); humeral shields and setae *c2* absent; suranal shield entire and with 2 pairs of setae (*h1* and *h2*); all dorsal setae similar in form, strong and serrated; dorsal shields bearing dimples; dimensions of dorsal setae as follows:*vi* 22; *ve* 42; *sci* 35; *sce* 40; *c1* 30; *d1* 29; *d2* 28; *e1* 40; *e2 38*; *f1* 45; *h1* 42; *h2* 35; distances between dorsal setae: *vi–vi* 25; *ve–ve* 60; *vi–ve* 30; *ve–sci* 30; *vi–sci* 60; *sci–sci* 95; *sci–sce* 33; *sce–sce* 142; *c1–c1* 54; *c1–d1* 50; *c1–d2* 55; *d1–d1* 50; *d1–d2* 35; *d2–d2* 115; *d1–e1* 70; *d1–e2* 50; *e1–e1* 40; *e1–e2* 40; *e1–f1* 30; *e1–e 2* 40; *e2–f1* 56; *f1–f1* 60; *f1–h1* 28; *f1– h2* 20; *h1–h1* 25; *h1–h2* 22; *h2–h2* 65.

Venter (Fig. 2) – Covered with striae; endopodal shields I-II and III-IV absent, with 3 pairs of ventral setae (*1a*, *3a*, *4a*); measurements of setae: *1a* 30, *3a* 40, *4a* 41; 3 pairs of aggenital setae (*ag1-ag3*) on striae; length of aggenital setae: *ag1* 20, *ag2* 20, *ag3* 26;

anogenital shields with 1 pair of genital setae (*g1*) and 3 pairs of pseudanal setae (*ps1-ps3*); length of anogenital setae: *g1* 17, *ps1* 18, *ps2* 20, *ps3* 15.



Figures 3-6. *Mediolata belfieldi* (female) – 3. Leg I; 4. Leg II; 5. Leg III; 6. Leg IV.

Legs (Figs. 3–6): length of leg I-IV: leg I 225, leg II 205, leg III 183, leg IV 200; setal formulae of legs I-IV (solenidia included): coxae 2- 1- 2- 2; trochanters 1- 1- 1- 0; femora 5- 5- 2- 1; genua 3- 3- 1-1; tibiae 6(φp)- 6(φp)- 6(φp)- 6(φp); tarsi 12(ω)- 10(ω)- 8(ω)- 8(ω).

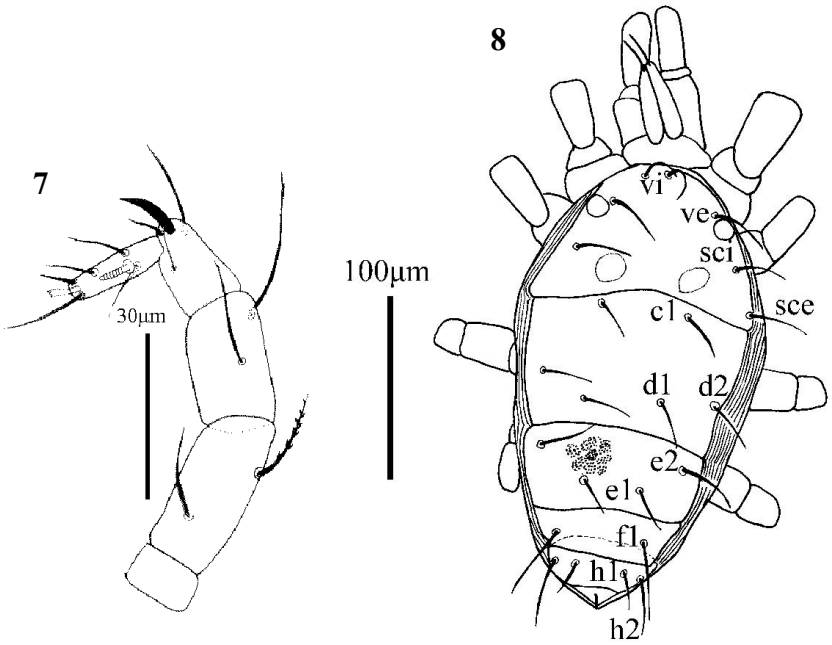
Description

Male (Figs. 7−14) – Idiosoma oval; length of body (including gnathosoma) 363, (excluding gnathosoma) 238, width 130.

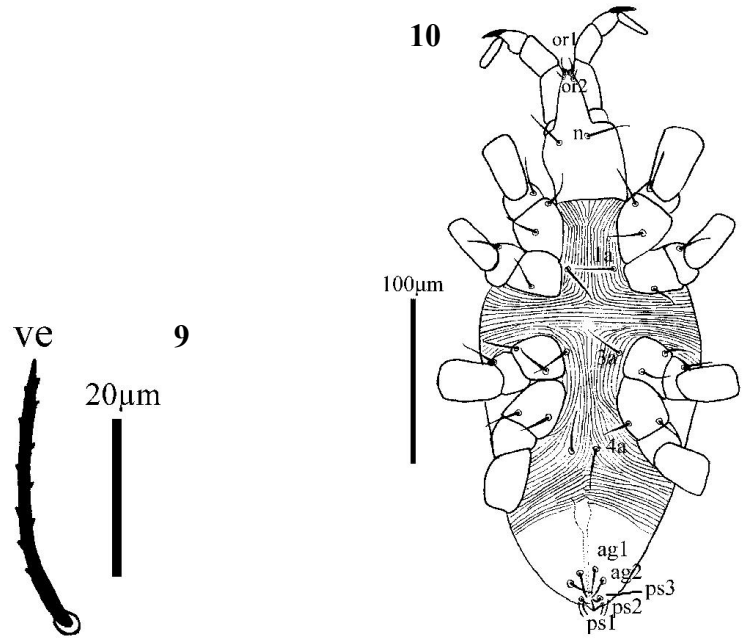
Gnathosoma – Chelicerae fused basally, rarely separate; subcapitulum with 1 pair of subcapitular setae (*n* = 30), and 2 pairs of adoral setae (*or1* = 10, *or2* = 12); palpal chaetotaxy: tarsus with 1 terminal tridentate eupathidium + 1 solenidion + 1 subterminal spine-like eupathidium + 4 setae; tibia with 2 setae + 1 claw + 1 accessory claw; genu with 2 setae; femur with 2 setae; trochanter without setae (Fig. 7).

Dorsum (Fig. 8) – prodorsum covered with a large shield and with 4 pairs of setae (*vi*, *ve*, *sci*, *sce*); eyes and post ocular bodies present; hysterosoma with 3 transversely divided shields and 6 pairs of setae (*c1*, *d1*, *d2*, *e1*, *e2*, *f1*); humeral shields and setae *c2* absent; suranal shield entire bearing 2 pairs of setae (*h1* and *h2*); all dorsal setae similar in form, strong and serrated (Fig. 9); dorsal shields bearing dimples without reticulum; dimensions of dorsal setae as follows: *vi* 18; *ve* 37; *sci* 30; *sce* 35; *c1* 25; *d1* 25; *d2* 25; *e1* 21; *e2* 33; *f1* 43; *h1* 20; *h2* 32; distances between dorsal setae: *vi–vi* 25; *ve–ve* 55; *vi–*

ve 26; *ve–sci* 30; *vi–sci* 55; *sci–sci* 84; *sci–sce* 25; *sce–sce* 112; *c1–c1* 46; *c1–d1* 47; *c1–d2* 45; *d1–d1* 40; *d1–d2* 25; *d2–d2* 92; *d1–e1* 45; *d1–e2* 37; *e1–e1* 30; *e1–e2* 28; *e1–f1* 30; *e1–e2* 28; *e2–f1* 30; *f1–f1*45; *f1–h1* 20; *f1–h2* 17; *h1–h1* 23; *h1–h2* 15; *h2–h2* 50; ratios: *vi*/ *vi–vi* 0.72; *c1*/ *c1–c1* 0.54; *d1*/ *d1–d1* 0.62; *e1*/ *e1–e1* 0.7; *f1*/ *f1–f1* 0.95; *h1*/ *h1–h1* 0.86.

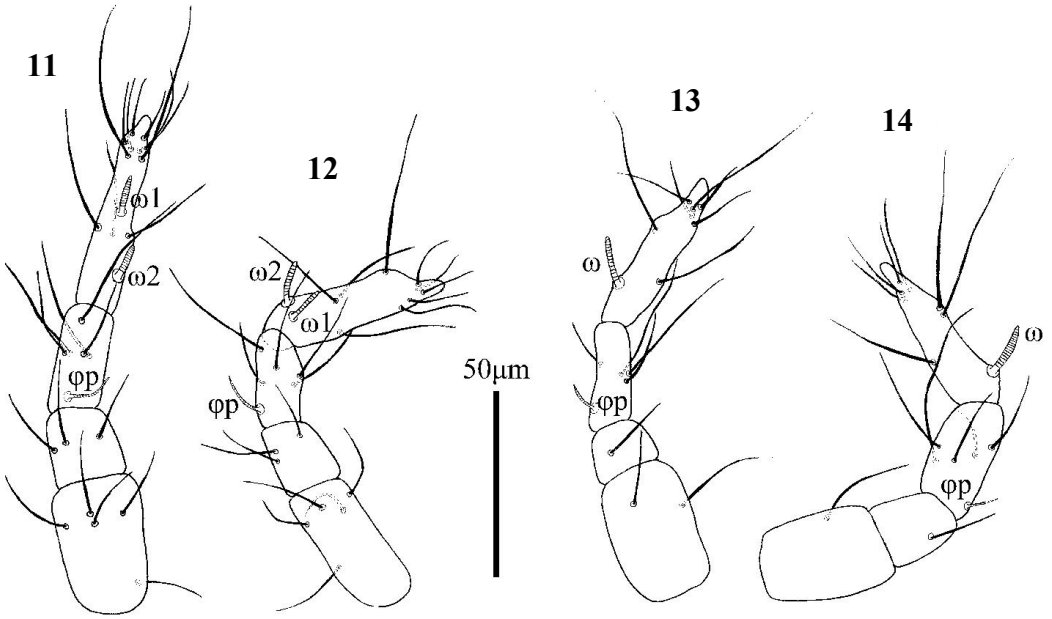


Figures 7–8. *Mediolata belfieldi* (male) – 7. Palp; 8. Dorsal view of idiosoma.



Figures 9–10. *Mediolata belfieldi* (male) – 9. Setae *ve*; 10. Ventral view of idiosoma.

Venter (Fig. 10) – Covered with striae; endopodal shields I-II and III-IV absent and with 3 pairs of ventral setae (*1a*, *3a*, *4a*); measurement of setae: *1a* 35, *3a* 30, *4a* 25; aggenital area with 2 pairs of aggenital setae (*ag1*, *ag2*); measurements of aggenital setae: *ag1* 20, *ag2* 22; anogenital shields with 3 pairs of pseudanal setae (*ps1-ps3*); length of anogenital setae: *ps1* 7, *ps2* 10, *ps3* 5.



Figures 11–14. *Mediolata belfieldi* (male) – 11. Leg I; 12. Leg II; 13. Leg III; 14. Leg IV.

Legs (Figs. 11–14) – Length of leg I-IV: leg I 195, leg II 170, leg III 160, leg IV 178; number of setae on legs I-IV (solenidia included): coxae 2-1-2-2; trochanters 1-1-1-0; femora 5-5-2-1; genua 3-3-1-1; tibia 6(φp)- 6(φp)-6(φp)-6(φp); tarsi 13(ω1, ω2)-11(ω1, ω2)-8(ω)-8(ω).

Material examined

One female and one male collected from nest of bird, Iran: West Azerbaijan province, coll. R. Navaei-Bonab and E. Zarei. The male is deposited as slide-mounted specimen in the Collection of the Acarology Laboratory, University of Maragheh, Maragheh, Iran.

Immature stages – Unknown.

Remarks – This species was first described from the female only (Momen 1987), and our collection represents the first description of the male. Male exhibit all features of the female, except that the male tarsi I-II has two solenidia instead of one solenidion as in female. The females of the Iranian specimens differ from the original description in the length of the dorsal setae. In Iranian specimens the length of the dorsal setae are: *vi* 22, *ve* 42, *c1* 30, *d1* 29, *d2* 28 and *f1* 45 vs. *vi* 37, *ve* 52, *c1* 44, *d1* 41, *d2* 44 and *f1* 55 in original description. Despite these differences, the rest of the features match the original description in all other respects, and is therefore considered the same.

Genus *Eustigmaeus* Berlese, 1910

Type species: *Stigmaeus kermesinus* Koch, 1841

The genus *Eustigmaeus* is one of the largest genera in the Stigmaeidae and contains more than 100 species worldwide (Fan and Zhang 2005; Cheng and Fan 2008; Doğan *et al.* 2011; Bagheri and Beyzavi 2013). The members of this genus generally are free-living on mosses, lichens, grass and various litters, and a few are parasitic on sandflies and can be recognized by having a globular body; 3 unpaired dorsal shields including propodosomal, hysterosomal, and suranal shields which may be smooth, punctate or reticulate; humeral shields bear setae *c*2 ventrolaterally; aggenital shield with 1–3 pairs of setae; anogenital covers with 3 or 4 pairs of setae; eyes and humeral callosity absent or present; palp tarsus with a tridentate, terminal eupathidium. Free living, parasitoid or phytophagous mite (Doğan *et al*. 2011). To date, 19 species of the genus *Eustigmaeus* have been reported from Iran, namely: *Eustigmaeus anauniensis* (Canestrini, 1889) [by Doğan *et al*. (2012)]; *E. azerbaijanensis* Haddad Irani-Nejad *et al.*, 2011; *E. dogani* Khanjani *et al*., 2011; *E. ioaniensis* Kapaxidi and Papadoulis, 1999 [by Navaei–Bonab *et al*. (2012)]; *E. johnstoni* Zhang and Gerson1995 [by Badakhshan *et al*. (2011)]; *E. jiangxiensis* Hu, Chen and Huang 1996 [by Kheradmand *et al*. (2007)]; *E. nahidae* Gheblealivand *et al*., 2012; *E. nasrinae* Khanjani and Ueckermann, 2002; *E. ornatus* Ueckermann and Smith-Meyer, 1987 [by Kamali *et al*. (2006)]; *E. plumifer* (Halbert, 1923)[by Bagheri *et al*. (2011b)]; *E. rhodomela* (Koch, 1841) [by Khanjani *et al*. (2013)]; *E. seemani* Khanjani *et al*., 2013; *E. segnis* (Koch, 1836) [by Khanjani and Ueckermann (2002)]; *E. setiferus* Bagheri *et al*., 2011; *E. spathatus* Ueckermann and Meyer, 1987 [by Darvishzadeh and Kamali (2009)]; *E. sculptus* Doğan *et al*., 2003 [by Lotfollahi *et al*. (2010)]; *E. ueckermanni* Bagheri and Beyzavi (2013); *E. isfahaniensis* Khanjani *et al*. (2014); *E. caspianensis* Bagheri and Paktinat-Saeej (2014).

Eustigmaeus segnis (Koch, 1836)

Material examined

Six females from soil in wheat and alfalfa fields, June 2013, Marand and Shabestar; East Azerbaijan; four females from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil; five females from soil in barely fields, August 2012, Khoy, West Azerbaijan.

Previous provincial records from Iran

East Azerbaijan (Bagheri *et al.* 2006; Akbari *et al.* 2010; Gheblealivand *et al.* 2011a, b; Navaei-Bonab *et al.* 2012; Navaei-Bonab and Parsaeyan 2013; Ahaniazad *et al*. 2014; Navaei-Bonab, 2014), Hamedan (Khanjani and Ueckermann 2002), West Azerbaijan (Bagheri *et al.* 2011b; Zarei *et al.* 2011; Seilsepur *et al*. 2014), Zanjan (Rahmani *et al.* 2011; Fakhari *et al*. 2014), Kerman (Izadi *et al.* 2010), Kermanshah (Darb-Emamieh *et al.* 2008), Golestan (Shirinbeik-Mohajer *et al.* 2012), Fars (Beyzavi and Ostovan 2012), Mazandaran (Ranjbar Varandi, *et al*. 2014; Paktinat-Saeej *et al*. 2014),Tehran (Cheraghali *et al*. 2013); Guilan (Zarei *et al*. 2015), Lorestan (Rahmati *et al*. 2015).

E. dogani Khanjani, Asali-Fayaz, Mirmoayedi and Ghaedi, 2011

Material examined

Two females from soil in apple orchards, Jun 2014, Shabestar and Marand, East Azerbaijan**.**

Previous provincial records from Iran:

Kurdistan (Khanjani *et al*. 2011; Nazari *et al*. 2013), Kermanshah (Khanjani *et al*. 2011; Nazari *et al*. 2013), Hamedan (Mohammadi *et al*. 2013; Nazari *et al*. 2013), Zanjan (Fakhari *et al*. 2014).

E. nahidae Gheblealivand and Bagheri, 2012

Material examined

Two females from soil in apple orchards, June 2013, Shabestar, East Azerbaijan; one female from soil in alfalfa fields, August 2014, Marand, East Azerbaijan.

Previous provincial records from Iran

East Azerbaijan (Gheblealivand *et al*. 2012).

E. ioaniensis Kapaxidi and Papadoulis, 1999

Material examined

Two females from soil in apple orchards, June 2014, Marand and Shabestar, East Azerbaijan; one female from soil in apple orchards, August 2012, Urmia, West Azerbaijan; one female from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Previous provincial records from Iran

East Azerbaijan (Navaei-Bonab *et al.* 2012), West Azerbaijan (Abaci *et al*. 2014).

E. azerbaijanensis Haddad Irani-Nejad, Lotfollahi and Akbari, 2011

Material examined

One female from soil in apple orchards, June 2013, Shabestar; East Azerbaijan; one female from soil in wheat fields, August 2012, Khoy, West Azerbaijan.

Previous provincial records from Iran

East Azerbaijan (Haddad Irani-Nejad *et al.* 2011; Gheblealivand *et al.* 2011a, b; Navaei-Bonab 2014; Ahaniazad *et al*. 2014), West Azerbaijan (Abaci *et al*. 2014).

E. plumifer (Halbert, 1923)

Material examined

Three females from soil in apple orchards, June 2013, Shabestar, East Azerbaijan.

Previous provincial records from Iran

East Azerbaijan (Bagheri *et al*. 2011a; Faraji *et al*. 2014; Ahaniazad *et al*. 2014).

E. anauniensis (Canestrini, 1889)

Material examined

Two females were collected from soil in apple orchards, June 2013, Marand, East Azerbaijan; one female was collected from soil in alfalfa fields, September 2013, Bonab Jadeid, East Azerbaijan; one female was collected from soil in apple orachards, August 2014, Urmia, West Azerbaijan.

Previous provincial records from Iran

Razavi Khorasan (Doğan *et al.* 2012; Paktinat-Saeej *et al.* 2012a, b; Rahmdeli *et al*. 2013); Guilan (Zarei *et al*. 2015).

Cheylostigmaeus Wilmann, 1951

Up to now 9 species were recorded from Iran namely: *Cheylostigmaeus iranensis* Khanjani and Ueckermann, 2002, *C. ferdowsii* Khanjani *et al.*, 2010; *C. hassanpouri* Bagheri *et al.*, 2011; *C. gharakhanii* Navai-Bonab *et al.*, 2011; *C. unicus* Wainstein [by Rostami *et al*. (2012)]; *C. mahvashae* Khanjani *et al*., 2013; *C. guilaniensis* Hajizadeh *et al*., 2013; *C. tarae* Khanjani *et al*., 2014; *C. sepasgosariani* Bagheri *et al*., 2014.

Cheylostigmaeus iranensis Khanjani and Ueckermann, 2002

Material examined

Two females from soil in apple orchards, June 2014, Marand and Shabestar, East Azerbaijan; one female and one male from soil in apple orchards, August 2012, Urmia, West Azerbaijan.

Previous provincial records from Iran

Isfahan (Jalaeian *et al.* 2005), Hamedan (Khanjani and Ueckermann 2002), East Azerbaijan (Lotfollahi *et al.* 2010; Navaei-Bonab *et al.* 2012; Navaei Bonab 2014).

C. gharakhanii Navaei-Bonab and Bagheri, 2011

Material examined

One male and two females from soil in apple orchards, June 2014, Marand and Shabestar, East Azerbaijan; one female from soil in apple orchards, August 2012, Khoy, West Azerbaijan; One female from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Previous provincial records from Iran

West Azerbaijan (Bagheri *et al.* 2011b; Abaci *et al*. 2014; Yousefi *et al*. 2014), East Azerbaijan (Gheblealivand *et al.* 2011a; Navaei-Bonab *et al.* 2011b; Navaei-Bonab and Parsaeyan 2013; Abaci *et al*. 2014; Navaei-Bonab 2014; Seilsepur *et al*. 2014), Mazandaran (Paktinat-Saeej *et al*. 2014), Lorestan (Rahmati *et al*. 2015).

C. hassanpouri Bagheri, 2011

Material examined

Two male and three females from soil in apple orchards, June 2013, Marand and

Shabestar, East Azerbaijan; one female and two males from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Previous provincial records from Iran

East Azerbaijan (Bagheri *et al.* 2011d; Abaci *et al*. 2014; Navaei-Bonab and Parsaeyan 2013; Navaei Bonab, 2014), West Azerbaijan (Abaci *et al*. 2014)

Genus *Storchia* Oudemans, 1923

The genus *Storchia* Oudemans is one of the smallest genera of Stigmaeidae and can be distinguished from the other genera by its elongate idiosoma, longitudinal prodorsal shield, lack of eyes, short legs and separated chelicerae. The members of this genus live in soil, litter, moss, tree bark, house dust and stored products (Fan and Yan 1997; Miranda *et. al*. 2002; Doğan and Ayyıldız 2003; Noei *et al*. 2007; Palyvos *et al*. 2008; Safasadti and Khanjani 2010). Up to now six species were collected from Iran, namely: *Storchia robusta* (Berlese, 1885); *S. pacifica* (Summers, 1964) [by Noei *et al*. (2007)]; *S. mehrvari* Bagheri *et al*., 2012; *S. ardabiliensis* Safasadati *et al*., 2010; *S. yazdaniani* Bagheri *et al*., 2011; *S. elhamae* Hasanzadeh *et al*., 2013.

Storchia robusta (Berlese, 1885)

Material examined

Five females from soil in apple orchards, June 2013, Marand and Shabestar, East Azerbaijan; three female from soil in potato fields, July 2013, Nir, Ardabil.

Provincial records from Iran

East Azerbaijan (Akbari *et al.* 2010; Gheblealivand *et al.* 2011a, b; Bagheri *et al.* 2011a; Navaei-Bonab *et al.* 2012; Navaei-Bonab and Parsaeyan 2013; Abaci *et al*. 2014; Ahaniazad *et al*. 2014; Seilsepur *et al*. 2014), Hamedan (Khanjani and Ueckermann 2002), Guilan (Noei *et al.* 2007), West Azerbaijan (Bagheri *et al.* 2011b; Zarei *et al.* 2011; Abaci *et al*. 2014; Yousefi *et al*. 2014); Kerman (Izadi *et al.* 2010; Changizi *et al.* 2011a, b), Ardabil (Haddad Irani-Nejad *et al.* 1999); Mazandaran (Paktinat-Saeeij *et al*. 2014), Lorestan (Rahmati *et al*. 2015).

Genus *Ledermuelleriopsis* Wilmann, 1953

The species of the genus *Ledermuelleriopsis* Willmann have been reported from lichen, soil, moss, litter, decayed stump, bark trees, old dune sand and meadow (Khanjani *et al*. 2012). To date, 10 species of genus *Ledermuelleriopsis* have been reported from Iran, namely: *Ledermuelleriopsis plumosa* Willmann, 1951 [by Khanjani and Ueckermann (2002)]; *L. zahiri* Khanjani and Ueckermann, 2002; *L. medicae* Khanjani and Ueckermann, 2002; *L. dogani* Khanjani *et al*. 2012; *L. ariyai* Khanjani *et al*. 2012; *L. punicae* Khanjani *et al*. 2012; *L. spinosa* Wood [by Hajizadeh *et al*. (2013)]; *L. tamariski* Maleki and Bagheri, 2013; *L. ayhani* Maleki and Bagheri, 2013; *L. terrulentus* Ueckermann and Meyer, 1987 [by Kamali *et al*. (2001)].

Ledermuelleriopsis zahiri Khanjani and Ueckermann, 2002

Material examined

Six females from soil in wheat and alfalfa fields and apple orchards, June 2014,

Marand and Shabestar, East Azerbaijan; three females from soil in pear orchards, April 2013, Varzeghan, East Azerbaijan; four females from soil in apple orchards, August 2012, Urmia and Khoy, West Azerbaijan; five females from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Previous provincial records from Iran

Kermanshah (Babakfard *et al.* 2008), East Azerbaijan (Bagheri *et al.* 2006, 2011a; Akbari *et al.* 2010; Lotfollahi *et al.* 2010; Gheblealivand *et al.* 2011a, b; Navaei-Bonab *et al.* 2012; Hashemi-Khabir *et al*. 2013; Navaei-Bonab and Parsaeyan 2013; Abaci *et al*. 2014; Faraji *et al*. 2014; Seilsepur *et al*. 2014), Hamedan (Khanjani and Ueckermann 2002; Rostami *et al.* 2010a, b, 2012; Nazari *et al*. 2013) Fars (Khademi *et al.* 2006), West Azerbaijan (Bagheri *et al.* 2011b; Zarei *et al.* 2011; Abaci *et al*. 2014; Yousefi *et al*. 2014), Razavi Khorasan (Paktinat-Saeej *et al.* 2012a; Rahmdeli *et al*. 2013), Mazandaran (Ranjbar-Varandi *et al*. 2014), Tehran (Cheraghali *et al*. 2013), Zanjan (Fakhari *et al*. 2014), Lorestan (Rahmati *et al*. 2015).

L. plumosa Willmann, 1950

Material examined

Three females from soil in apple orchards, June 2014, Marand and Shabestar, EastAzerbaijan; three females from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Previous provincial records from Iran

Hamedan (Khanjani and Ueckermann 2002), West Azerbaijan (Bagheri *et al.* 2011b; Zarei *et al.* 2011; Abaci *et al*. 2014), Kerman (Changizi *et al.* 2011a, b), East Azerbaijan (Bagheri *et al.* 2006, 2011a; Lotfollahi *et al.* 2010; Gheblealivand *et al.* 2011a, b; Navaei-Bonab *et al.* 2012; Navaei-Bonab and Parsaeyan 2013; Abaci *et al*. 2014; Ahaniazad *et al*. 2014; Faraji *et al*. 2014), Kermanshah (Darb-Emamieh *et al.* 2008b), Mazandaran (Paktinat-Saeeij *et al*. 2014), Lorestan (Rahmati *et al*. 2015).

Genus *Zetzellia* Oudemans, 1927

Members of the genus *Zetzellia* Oudemans contain well known predators of spider mites as well as of a variety of arthropods. They are found mostly in the soil and on plants (Khanjani and Ueckermann, 2002; Kheradmand *et al.* 2007). To date only *Zetzellia mali* (Ewing) [by Kamali *et al*. (2001)]; *Z. kamalii* Kheradmand and Ueckermann, 2007 and *Z. pourmirzai* Khanjani and Ueckermann, 2008 were described and recorded from Iran.

Zetzellia mali (Ewing, 1917)

Material examined

Six females and two males from leaves of apple trees, June 2014, Marand and Shabestar, East Azerbaijan; three males from leaves in pear trees, April 2013, Varzeghan, East Azerbaijan; four females from leaves of apple trees, August 2012, Urmia and Khoy, West Azerbaijan; five females and two males from leaves in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Previous provincial records from Iran

This species was reported from different regions of Iran (Kamali *et al*. 2001).

Pseudocheylidae Oudemans, 1909
Genus *Anoplocheylus* Berlese, 1910

The genus *Anoplocheylus* - the largest in the family - was revised by Ueckermann and Khanjani (2004) and showed that the number of setae on the palp femur, presence or absence of a genital aperture and genital setae, and the number of setae on the prodorsal shield are important characters distinguishing different life stages. Up to now, six species of pseudocheylid mite were described and recorded from Iran, namely: *A. malayeriensis* Ueckermann and Khanjani ,2004; *A. tauricus* Livshitz and Mitrofanov, 1973 [by Ueckermann and Khanjani (2004)]; *A. bonabjadidiensis* Navaei-Bonab, 2011; *A. sinai* Bagheri, 2013; *A. kazemii* Bagheri, 2013; *A. marivaniensis* Khanjani *et al*. 2014 and *A. qorvehiensis* Khanjani *et al*. 2014.

A. malayeriensis Ueckermann and Khanjani, 2004

Material examined

Three females from soil in apple orchards, July 2013, Marand and Shabestar, East Azerbaijan; one female from soil in apple orchards, June 2013, Urmia, West Azerbaijan; two females from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Previous provincial records from Iran

Hamedan (Ueckermann and Khanjani 2004; Rostami *et al*. 2010b), Fars (Beyzavi and Ostovan 2012), East Azerbaijan (Navaei-Bonab and Kazazi 2013; Navaei-Bonab 2014), West Azerbaijan (Zarei *et al*. 2011b), Razavi Khorasan (Rahmdeli *et al*. 2013)

A. bonabjadidiensis Navaei-Bonab, 2011

Material examined

Three females from soil in apple orchards, July 2013, Marand, East Azerbaijan; one female from soil in alfalfa, June 2013, Urmia, West Azerbaijan.

Previous provincial records from Iran

East Azerbaijan (Navaei-Bonab *et al*. 2011a; Navaei-Bonab and Kazazi 2013; Navaei-Bonab 2014).

Differential diagnosis

The northwestern collected specimens completely resemble the type specimens collected by Navaei-Bonab (2011).

A. sinai Bagheri, 2013

Material examined

Five females from soil in apple orchards, July 2014, Marand and Shabestar, East Azerbaijan; one larva from soil in apple orchards, June 2014, Marand, East Azerbaijan; two females from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Table 1. The collected stigmaeid mite species of East Azerbaijan, West Azerbaijan and Ardabil.

Genus	Species	East Azerbaijan	West Azerbaijan	Ardabil
Stigmaeus	*S. alvandis* Khanjani & Ueckermann, 2002	✓	–	This study
	S. boshroyehensis Khanjani *et al*. 2010	✓	–	–
	S. elongatus Berlese, 1886	✓	✓	–
	S. fissicomus Ueckermann & Smith-Meyer, 1987	–	–	✓
	S. haddadi Bagheri & Zarei, 2012	This study	✓	–
	S. iranensis Bagheri & Gheblealivand, 2012	✓	This study	–
	S. longipilis (Canestrini, 1889)	–	–	✓
	S. malekii Haddad Irani-Nejad, 2006	✓	✓	–
	S. maraghehiensis Bagheri & Ueckermann, 2012	✓	–	–
	S. marandiensis Bagheri & Ueckermann, 2011	✓	✓	This study
	S. miandoabiensis Bagheri & Zarei, 2012	✓	✓	–
	S. pilatus Kuznetzov, 1978	✓	✓	This study
	S. pulchellus Kuznetzov, 1978	–	✓	–
	S. shabestariensis Haddad Irani-Nejad *et al*. 2010	✓	✓	This study
	S. shendabadiensis Haddad Irani-Nejad *et al*. 2010	✓	✓	–
	S. *siculus* (Berlese, 1883)	✓	–	–
	S. sphagneti (Hull, 1918)	✓	–	–
	S. ueckermanni Pahlavan-Yali *et al*. 2011	This study	–	✓
	S. unicus Kuznetzov 1977	✓	–	–
	S. cariae Khanjani *et al*. 2012	✓	✓	–
	S. makouiensis Bagheri & Maleki, 2013	–	✓	–
	S. echinopus Summers, 1962	✓	–	–
	S. hashtrudiensis Bagheri & Maleki, 2014	✓	✓	–
	S. sinai Swift, 1987	–	–	–
	S. corticeus Kuznetzov & Wainstein, 1977	✓	✓	–
	S. kamili Dogan & Ayyildiz, 2003	✓	–	–
Eustigmaeus	*E. segnis* (Koch, 1836)	✓	✓	This study
	E. dogani Khanjani *et al*. 2011	This study	–	–
	E. nahidae Gheblealivand & Bagheri, 2012	✓	–	–

✓ Previously reported; – not reported

… continued on next page

Table 1. Continued.

Genus	Species	East Azerbaijan	West Azerbaijan	Ardabil
	E. ioaniensis Kapaxidi & Papadoulis, 1999	✓	✓	This study
	E. azerbaijanensis Haddad Irani-Nejad *et al*. 2011	✓	✓	–
	E. plumifer (Halbert, 1923)	✓	–	–
	E. anauniensis Canestrini, 1889	This study	This study	–
	E. nasrinae Khanjani & Ueckermann, 2002	✓	✓	–
	E. sculptus Doğan *et al*. 2003	✓	–	–
	E. setiferus Bagheri *et al*. 2010	✓	✓	–
	C. iranensis Khanjani & Ueckermann, 2002	✓	This study	–
Cheylostigmaeus	*C. gharakhanii* Navaei-Bonab & Bagheri, 2011	✓	✓	This study
	C. hassanpouri Bagheri, 2011	✓	✓	This study
Ledermuelleriopsis	*L. zahiri* Khanjani & Ueckermann, 2002	✓	✓	This study
	L. plumosa Willmann, 1950	✓	✓	This study
Mediolata	*M. belfieldi* Momen, 1987	–	✓	–
Agistemus	*A. collyerae* Gonzalez-Rodriguez, 1963	–	–	✓
	A. industani Gonzalez-Rodriguez, 1965	✓	–	–
Eryngiopus	*E. nelsonensis* Wood, 1971	✓	–	–
Prostigmaeus	*P. khanjanii* Bagheri & Ghorbani, 2010	✓	–	–
Storchia	*S. ardabiliensis* Safasadati *et al*. 2010	–	–	✓
	S. mehrvari Bagheri & Gheblealivand, 2012	✓	–	–
	S. robustus (Berlese, 1885)	✓	✓	✓
	S. yazdaniani Bagheri, 2011	✓	–	–
Zetzellia	*Zetzellia mali* (Ewing, 1917)	✓	✓	This study

✓ Previously reported; – not reported

Previous provincial records from Iran

East Azerbaijan (Bagheri *et al*. 2013a; Navaei-Bonab and Kazazi 2013; Bagheri *et al*. 2014; Navaei-Bonab 2014), West Azerbaijan (Bagheri *et al*. 2013a).

Differential diagnosis

The collected specimens from Ardabil and West Azerbaijan completely resemble to type specimens. Also the collected specimens from Marand exhibit all features of the descrided species by Bagheri *et al*. (2013), but they are differing from type specimens in tibia I. In Marandian specimens tarsi II with 8 setae (solenidia included) vs. 10 setae in type specimens.

A. tauricus Livshitz and Mitrofanov, 1973

Material examined

Two females from soil in apple orchards, July 2013, Marand and Shabestar, East Azerbaijan; three females from soil in hazelnut trees, July 2013, Namin (Fandoghlu region), Ardabil.

Previous provincial records from Iran

Hamedan (Ueckermann and Khanjani 2004), Fars (Beyzavi and Ostovan 2012), East Azerbaijan (Bagheri *et al*. 2014; Navaei-Bonab 2014), West Azerbaijan (Zarei *et al*. 2011b).

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فون کنه‌های استیگمئید و سودوکیلید (Acari: Prostigmata) شمال غرب ایران همراه با توصیف کنهٔ نر و بازتوصیف کنهٔ مادهٔ *Mediolata belfieldi* Momen

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چکیده

فون کنه‌های استیگمئید و سودوکیلید در استان‌های شمال غربی ایران در طی سال‌های ۲۰۱۲-۲۰۱۴ بررسی شد. در این بررسی، ۲۴ گونه (متعلق به ۷ جنس) از خانواده Stigmaeidae و ۴ گونه (متعلق به ۱ جنس) از خانواده Pseudocheylidae جمع آوری و شناسایی شدند. در این مقاله، کنهٔ نر *Mediolata belfieldi* Momen, 1987 توصیف و کنهٔ ماده این گونه بازتوصیف شد.

واژگان کلیدی: بالاخانوادهٔ Anystoidea ؛ *Mediolata* ؛ Pseudocheylidae ؛ Raphignathoidea ؛ Stigmaeidae ؛ Trombidiformes.

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