

Short Paper

Fauna of Stigmaeidae and Cryptognathidae (Acari: Trombidiformes) of Lorestan province, with two new records for Iran fauna

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Abstract: A faunistic study on Stigmaeidae and Cryptognathidae families in Lorestan province was carried out during 2012-2013. In this study 18 species were collected and identified, of which *Favognathus amygdalus* and *F. cordylus* (Cryptognathidae) were new records for Iranian fauna, also all of the collected species in this study were new records for fauna of Lorestan province. Stigmaeidae with 14 species and Cryptognathidae with four species had the highest and lowest number of identified species, respectively.

Keywords: Acari, Stigmaeidae, Cryptognathidae, Lorestan province, *Favognathus*

Introduction

Mites of the family Stigmaeidae Oudemans are predatory mites that feed on variety of arthropods. These small red, yellow and orange mites occur in many habitats and form an important component of acarofauna of soil, litter and plants, they are a large cosmopolitan group of genera which are often characterized by particular combinations of dorsal shields (Summers, 1966). After phytoseiid mites, stigmaeids, especially the genera *Agistemus* Summers and *Zetzellia* Oudemans, are considered the most important spider mite predators (Santos and Laing, 1985). Members of the genus *Eustigmaeus* Berlese are often found on mosses (Gerson 1972) and some of them on phlebotomies sandflies (Martinez-Ortega *et al.*, 1983).

Members of the family Cryptognathidae Oudemans have been suggested as predators (Meyer and Ryke, 1960), and they have been recently considered as microphytophages (Swift, 1996; Swift and Goff, 2001). Their small size and delicate mouthparts make it difficult to imagine the type of prey with which they might be associated. Their mouthparts, with a pair of elongate and edentate chelicerae, are often highly extrudable, so that they may be selective feeders on fungal spores too (Luxton, 1973). The needle-like chelicerae may also be adapted to select algal cells or else, and this seems the best of several alternatives, to pierce plant cells and drain the contents (Luxton, 1993). They can be easily recognized by the presence of a protective hood, anterior to the propodosoma and an extremely extendable gnathosomal base.

There is scanty information about the fauna of Stigmaeidae and Cryptognathidae families in Lorestan province and also their distribution, therefore the obtained results in this survey, can provide basic information for further investigation on different aspects of their importance.

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Materials and Methods

Specimens were collected from fields and orchards, mainly in soil and some from foliage during from April 2012 to September 2013 from different parts of Lorestan province, Western Iran. Mites were extracted using a Berlese funnel; samples cleared in Nesbitt's fluid, mounted in Hoyer's medium (Walter and Krantz, 2009) and examined under an Olympus BX40 microscope equipped with phase contrast at 1000x magnification. Length of the idiosoma includes hood and anal covers for Cryptognathidae and from the suture between the gnathosoma and propodosoma to the posterior margin of the suranal shield for the Stigmaeidae. The idiosomal width was measured at the widest point of idiosoma. Setae were measured from alveoli to the tip and legs from the base of the coxa to the base of tarsal claws. Both setae and solenidia are included in the counts for the setal formulae of the legs and palp segments. The terminology and abbreviations are based on Kethley (1990). All measurements are given in micrometers (μm).

Results and Discussion

In this study, eighteen species belonging to two families were collected. Sixteen species were new for Lorestan province and two species were new for Iranian acarofauna. Table 1 presents the list and numbers of the collected species.

Stigmaeidae Oudemans, 1931

Eustigmaeus Berlese, 1910

E. segnis Koch, 1836

Diagnosis

Dorsal shields ornamented with irregular shaped dimples with vacuoles, eyes present, suranal shield ornamented with dimples, coxisternal shields fused and reticulated. dorsal body setae long and serrate, anal covers smooth, only one pair of aggenital setae present, trochanter III with two setae, femur II with five setae, genu II with three setae.

Table 1 The list and numbers of collected mites belonging to two families of Stigmaeidae and Cryptognathidae from Lorestan province, western Iran (2013-2014).

Family	Species	Number of collected specimens
Stigmaeidae	<i>Stigmaeus boshroyehensis</i>	16 ♀
	<i>S. elongatus</i>	10 ♀
	<i>S. nasrinae</i>	2 ♀
	<i>S. miandoabiensis</i>	12 ♀
	<i>Cheyllostigmaeus gharakhanii</i>	5 ♂
	<i>Eustigmaeus nasrine</i>	104 ♀
	<i>E. setiferus</i>	13 ♀
	<i>E. segnis</i>	33 ♀
	<i>E. uechermanii</i>	14 ♀
	<i>Storchia mehrvari</i>	4 ♀
	<i>S. rubusta</i>	51 ♀
	<i>Ledermolleriopsis zahiri</i>	43 ♀
	<i>L. pulmosa</i>	2 ♀
Cryptognathidae	<i>Zetzelia mali</i>	2 ♀
	<i>Favognathus amygdalus</i>	8 ♀
	<i>F. cordylus</i>	5 ♀
	<i>F. distortus</i>	19 ♀
	<i>F. gersoni</i>	3 ♀

Distribution and habitats in Iran

See Beyzavi *et al.* (2013)

Material examined

The specimens of this species were collected from different regions in Lorestan province, including soil of apple orchards in Boroujerd and Aligodarz (June 2012); in soil samples of cucumber fields and plum orchards in Doreh Chegeni (July 2012); soil of the apple orchards in Akbarabad and Zibamohammad (September 2012); soil samples of raspberries in Zorandol (October 2012); soil of the pomegranate orchards in Shorab (October 2012); poplar leaf composts in Doroud (November 2012); soil of the grape orchards in Shojaabad (March 2013); soil and humus under oak trees in Khorramabad (March 2013); soil samples of pine in Faculty of Agriculture,

Lorestan University (March 2013) and soil of willow trees in Shirkhani (June 2013).

Note: This is the first record of this species in Lorestan province.

***E. nasrinae* Khanjani & Ueckermann, 2002**

Diagnosis

Dorsal shields ornamented with irregular shaped dimples with vacuoles, eyes present, suranal shield ornamented with vague dimples and without vacuoles, coxisternal shields fused and smooth, dorsal body setae densely setose and with blunt tips, setae on coxisternal shields barbed, three pairs of aggenital setae present, trochanter III with two setae, femur II with four setae, genu II with four setae.

Distribution and habitats in Iran

Hamedan (Khanjani and Ueckermann, 2002), West Azarbaijan (Bagheri et al., 2011), East Azarbaijan (Lotfollahi et al., 2010; Gheblealivand et al., 2011; Navaei-Bonab et al., 2012), Golestan (Shirinbeik-Mohajer et al., 2012), Fars (Beyzavi and Ostovan 2012). This species was recorded in soil under European pearorchards and weeds, soil samples of alfalfa fields, wheat and sunflower fields, soil of apple orchards and soil and humus under oak trees in Iran (Beyzavi et al., 2013).

Materials examined

This species was collected from soil under apple orchards in Boroujerd and Chaghalvandi (June 2012); soil and humus under walnut trees in Bisheh (June 2012); eucalyptus leaf composts in Veysian (June 2012); soil under oak trees in Shorab (July 2012; January 2013); in cucumber fields in Doreh Chegeni (July 2012); soil of the peach orchards in Sabzevar (August 2012); poplar leaf composts in Sabzevar (August 2012); soil of the alfalfa field in Cheshmehbarghi of Alashtar (September 2012); soil samples of raspberries in Zorandol (October 2012); poplar leaf composts in Zorandol (October 2012); soil samples of pine in Shorab (January 2013); soil and humus samples under oak trees in Khoramabad (March 2013); soil samples of the pine in Faculty of Agriculture, Lorestan University (March 2013); soil of the willow trees in Cham-Anjir (March 2013).

Note: This is the first record of this species in Lorestan province.

***E. setiferus* Bagheri et al., 2011**

Diagnosis

Dorsal shields ornamented with polygonal dimples without vacuoles or vacuoles vague, eyes present, suranal shield ornamented with dimples, coxisternal shields fused and reticulated, dorsal body setae multi-pectinated with hyaline distally, three pairs of aggenital setae present, trochanter III with two setae, femur II with five setae, genu II with four setae.

Distribution and habitats in Iran

West Azarbaijan (Bagheri et al., 2011), East Azarbaijan (Bagheri et al., 2011; Gheblealivand et al., 2011). This species was recorded in soil of apple orchards and weeds.

Materials examined

This species was collected in soil samples under oak trees and eucalyptus leaf composts in Shorab (January 2013); in soil and humus under oak trees in Zarin Chogha (April 2013) and in soil and humus under walnut trees in Veysian (May 2013).

Note: This is the first record of this species in Lorestan province.

***E. ueckermanni* Bagheri & Beyzavi, 2013**

Diagnosis

Dorsal shields almost smooth, eyes absent, suranal shield smooth, coxisternal shields fused and smooth, dorsal body setae short and bushy, three pairs of aggenital setae present, trochanter III with two setae, femur II with four setae, genu II with three setae.

Distribution and habitats in Iran

This species was recorded in soil and humus under oak trees (*Quercus brantii* Lindl., 1840) in Fars province (Bagheri and Beyzavi, 2013).

Materials examined

This species was collected from soil and humus under walnut trees in Bisheh and Veysian (June 2012); soil samples of pine in Faculty of Agriculture, Lorestan University (July 2012); soil of pomegranate orchards in Shorab (October 2012); soil of peach orchards in

Ghalae Sangi (November 2012) and soil of oak trees in Shorab (January 2013).

Note: This is the first record of this species in Lorestan province.

Ledermuelleriopsis Willmann, 1953

L. zahiri Khanjani & Ueckermann, 2002

Diagnosis

Dorsal shields ornamented with irregular shaped dimples with vacuoles, dorsal body setae clavate and serrate, lengths of setae $vi-e_1$ 13-16, f_1 19, c_2 clavate and strongly serrate, accessory claw spine-like, coxisternal shields fused and smooth, three pairs of aggenital setae present, femura I, II 6,4; genu II 3 + κ , tatus II 8 + 1 ω .

Distribution and habitats in Iran

See Beyzavi *et al.* (2013).

Materials examined

This species is widely distributed and was collected in soil samples from different regions of Lorestan Province.

Note: This is the first record of this species in Lorestan province.

L. plumosa Willmann, 1950

Diagnosis

Dorsal shields ornamented with dimples mainly visible on lateral margins, dorsal body setae short and serrate, lengths of setae $vi-e_1$ 15-18, f_1 21, c_2 plumose, accessory claw spine-like, coxisternal shields fused and smooth, three pairs of aggenital setae present, femura I-II 6,4; genu II 3 + κ , tatus II 8 + 1 ω .

Distribution and habitats in Iran

Hamedan (Khanjani and Ueckermann, 2002), West Azarbaijan (Bagheri *et al.*, 2011; Zarei *et al.*, 2011), Kerman (Changizi *et al.*, 2011a, b), East Azarbaijan (Bagheri *et al.* 2006b, 2011; Lotfollahi *et al.*, 2010; Gheblealivand *et al.*, 2011; Navaei-Bonab *et al.*, 2012), Kermanshah (Darbemamieh *et al.*, 2008). This species was recorded in soil under common bean, soil covered with grass, soil of alfalfa fields, in soil of grapevines, soil of wheat and barely fields (Beyzavi *et al.*, 2013).

Materials examined

This species was collected from soil of willow orchards in Cham Anjir (March 2013).

Note: This is the first record of this species in Lorestan province.

Stigmaeus Koch, 1836

S. elongatus Berlese, 1886

Diagnosis

Dorsum of idiosoma nude except for a small reticulate, prodorsal shield bearing setae vi and ve . Median zonal shield forming an area on which striae converge to a posterior point. Eyes absent, Setae e_2 and f on small platelets, suranal shield entire and with setae h_1-h_3 . With five pairs of aggenital and three pairs of genital setae; femura I, II 6, 6; genua III, IV 3, 3.

Distribution and habitats in Iran

See Beyzavi *et al.* (2013).

Materials examined

This species was collected from soil and humus under walnut trees in Dehpir (June 2012); soil samples of raspberries in Zorandol (October 2012) and soil samples of pine in Faculty of Agriculture, Lorestan University (March 2013).

Note: This is the first record of this species in Lorestan province.

S. boshroyehensis Khanjani *et al.*, 2010

Diagnosis

Eyes present; seta v_2 longer than c_2 ; suranal shield entire with 2 pairs of setae (h_{1-2}); median hysterosomal shield with 3 pairs of setae, dorsal shields smooth; with three pairs of aggenital and one pair of genital setae; femura I, II 6, 4; genua I-IV 3(+ κ), 3,1,1.

Distribution and habitats in Iran

South Khorasan (Khanjani *et al.*, 2010), Kerman (Changizi *et al.*, 2011), East Azarbaijan (Gheblealivand *et al.*, 2011). This species was recorded in soil under pistachio orchards and soil samples of orchards and field crops (Beyzavi *et al.*, 2013).

Materials examined

This species was collected from soil of apple orchards in Kakasharaf (August 2012); in soil of apple orchards in Chaghalvandi (August 2012); poplar leaf composts in Cheshme Barghi of Alashtar (September 2012); soil and humus under willow trees in Zorandol (October 2012); soil of lemon orchards in Babazeid (October 2012); soil

and humus of walnut orchards in Ghalae sangi (November 2012) and Veysian (May 2013) and apple orchards in Zagheh (June 2013).

Note: This is the first record of this species in Lorestan province.

***S. miandoabiensis* Bagheri & Zarei, 2012**

Diagnosis

Eyes absent; the center of propodosomal shield reticulated and bears 3 pairs of setae (*vi*, *ve* and *sci*), two pairs of setae (*c*₁ and *d*₁) occur on the central opistosomal shield; suranal shield divided and with 3 pairs of setae (*h*₁, *h*₂ and *h*₃); All of the hystersomal shields smooth; dorsal setae smooth and without serrations; with four pairs of aggenital and two pairs of genital setae; femura I, II 4, 4; genua I- IV 5 (+ κ)- 3-0-1.

Distribution and habitats in Iran

West Azarbaijan (Bagheri and Zarei, 2012), East Azarbaijan (Bagheri and Zarei, 2012). This species was recorded in soil of apple orchards (Beyzavi et al., 2013).

Materials examined

This species was collected from soil of apple orchards in Chaghalvandi (August 2012); soil and humus under willow trees in Bisheh (September 2012) and soil in Makhmalkoh (March 2013).

Note: This is the first record of this species in Lorestan province.

***S. nasrinae* Nazari, Khanjani & Kamali, 2012**

Diagnosis

Eyes absent; prodorsal area with a few reticulations elements centrally; suranal shield divided and with *h*₃; dorsal hysterosoma without shields; palptarsi with one bifurcate eupathidium; with four pairs of aggenital and two pairs of genital setae; femura I, II 4, 4; genua I- IV 5- 2-0-1.

Distribution and habitats in Iran

This species was recorded in soil of apple orchards in Hamedan (Nazari et al., 2012),

Materials examined

This species was collected in soil of willow orchards in Cham Anjir (March 2013).

Note: This is the first record of this species in Lorestan province.

***Storchia* Oudemans, 1923**

***S. robustus* (Berlese, 1885)**

Diagnosis

Dorsum with reticulated and club shaped prodorsal shield; Setae *h*₃ present; *1a*: *3a*: *4a*= 1.0:3.2: 1.1; genital valves with 3 pairs of setae; coxa IV with 2 setae; trochanter III with 1 seta; femura IV with 2 setae; genua I-III with 4 (+ 1κ), 4, 2; tibia I with one solenidion; tarsus IV with 8 (+ 1ω).

Distribution and habitats in Iran

See Beyzavi et al. (2013).

Materials examined

This species was collected from soil of apple orchards in Chaghalvandi and Tajareh (May, 2012); eucalyptus leaf composts in Doreh Chegeni (July 2012); poplar leaf composts in Doroud, Delbarsadat and Sabzevar (July 2012); soil of pomegranate and figs orchards in Zivdar (October 2012); soil samples of raspberries in Zorandol (October 2012); soil of pomegranate orchards in Shorab (October 2012); soil samples of pine in Faculty of Agriculture, Lorestan University (March 2013) and soil of willow orchards in Shirkhani (June 2013).

Note: This is the first record of this species in Lorestan province.

***S. mehrvari* Bagheri & Gheblealivand, 2012**

Diagnosis

Prodorsal shield posteriorly reticulated; Setae *h*₃ present; setae *c*₂ not much longer than the other dorsal setae; *1a*: *3a*: *4a* = 1: 1.8: 1; *c*₁-*c*₁:*d*₁-*d*₁:*e*₁-*e*₁:*f*₁-*f*₁ = 1.8:1.2:1.3:1.0; genital valves with four pairs of setae trochanter III with 1 seta; femura IV with 2 setae; genua I-III with 4 (+ 1κ)-4-2; tarsus I with 13 (+ 1ω).

Distribution and habitats in Iran

This species was recorded in soil of apple orchards and sugar beet fields in East Azarbaijan (Bagheri et al., 2012).

Materials examined

This species was collected from eucalyptus leaf composts in Veysian (June 2012); soil samples of raspberries in Zorandol (October 2012) and soil of pomegranate orchards in Shorab (October 2012).

Note: This is the first record of this species in Lorestan province.

Cheyllostigmaeus Willmann, 1951**C. gharakhanii** Navaei-Bonab & Bagheri, 2011*Diagnosis*

Dorsal setae sheathed distally and serrated in male; endopodal shield divided and smooth in both sexes; femura and genu I-IV and tibia III-IV bear 1 distinct sheathed setae; setae *m* are not placed on wing-like flanges; Bulb of aedeagus is distended and capacious, unciform appendages divergent posteriorly, ending in minute, tapered to acutely upturned points; forcipiform appendages narrow, spatulate, ends lie close beside tip of retracted aedeagus.

Distribution and habitats in Iran

West Azarbaijan (Bagheri *et al.*, 2011b), East Azarbaijan (Navaei-Bonab *et al.*, 2011; Gheblealivand *et al.*, 2011). This species was recorded in soil and leaves of orchards and field crops, orchards and weeds, soil of apple orchards.

Materials examined

This species was collected in soil of the apple orchards in Cham Seyyedi (October 2012).

Note: All characters and measurements of our specimen fit the original description. This is the first record of this species in Lorestan province.

Zetzellia Oudemans, 1927**Z. mali** (Ewing, 1917)*Diagnosis*

Prodorsal and median opisthosomal shields reticulate. Setae *cl* on small platelets. Setal formulae of tibia and genua: 5 (1)-5 (1)-5 (1)-4 and 3-0-0-0, respectively.

Distribution and habitats in Iran

See Beyzavi *et al.* (2013)

Materials examined

This species was collected in soil samples and on apple leaves of apple orchards in Chaghalvandi (August 2012).

Note: This is the first record of this species in Lorestan province.

Cryptognathidae Oudemans, 1902**Favognathus Luxton, 1973****F. amygdalus** Dogan and Ayyildiz, 2009*Diagnosis*

Anterior margin of hood smooth; Dorsal shield reticulate laterally; venter reticulated laterally

and with striation and punctuation; dorsum with cluster of cells associated with setae *c* and *d*; femura 4-3-2-2, genua 5 (+ 1k)-4 (+ 1k)-2-3, tibiae 5 (+ 1φ ρ, 1φ)-5 (+ 1φρ)-4 (+ 1φρ)-3, tarsi 14 (+ 1φρ, 1ω)-12 (+ 1φρ, 1ω)-9 (+ 1ω)-9 (+ 1ω).

Distribution and habitats in Iran

This is the first record for Iranian acarofauna.

Materials examined

This species was collected from poplar leaf composts in Delbarsadat region (Veysian) (July 2012).

Note: All characters and measurements of our specimen fit the original description. This is the first record of this species from Iran.

F. cordylus Loxton, 1993*Diagnosis*

Anterior margin of hood smooth; dorsum ornamented with evenly spaced pores and reticulations laterally; venter reticulated laterally with pores; dorsum without cluster; femura 4-3-2-2; genua 5 (+ 1k)-4 (+ 1k)-2-3; tibiae 5 (+ 1φρ, 1φ)-5 (+ 1φρ)-4 (+ 1φρ)-3.

Distribution and habitats in Iran

This is the first record for Iranian acarofauna.

Materials examined

This species was collected from poplar leaf composts in Veysian region (July 2012).

Note: All characters and measurements of our specimen fit the original description. This is the first record of this species from Iran.

F. distortus (Kuznetsov, 1974)*Diagnosis*

Dorsum completely reticulated with 5-6 pores in the cells; venter with reticulation laterally and fine-striae with pores medially; dorsum with 2 pairs of little clusters of fine-pores present near setae *c*₁ and *d*₁; 15 (+ φρ, ω)-12 (+ φρ, ω)-9 (+ ω)-9 (+ ω); femur I with 4 setae.

Distribution and habitats in Iran

See Bagheri *et al.* (2013)

Materials examined

This species was collected from soil samples of raspberries in Zorandol (October 2012); soil and humus under walnut trees in Bisheh (June 2013).

Note: This is the first record of this species in Lorestan province.

F. gersoni Luxton, 1993*Diagnosis*

Dorsum completely reticulated with evenly spaced pores; venter with reticulations laterally and pores and striations medially; dorsum without cluster; femura 4-3-2-2; genua 5 (+ 1k)-4 (+ 1k)-2-3; tibiae 5 (+ 1φρ, 1φ)-5 (+ 1φρ)-4 (+ 1φρ)-3; tarsi 15 (+ 1φρ, 1ω)-11 (+ 1φρ, 1ω)-9 (+ 1ω)-9 (+ 1ω).

Distribution and habitats in Iran

See Bagheri et al. (2013)

Materials examined

This species was collected from soil of willow trees in Alashtar (Kahman) (September 2012); soil of willow orchards in Vardeh (March 2013).

Note: This is the first record of this species in Lorestan province.

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فون کنه‌های خانواده‌های (Acari: Trombidiformes) Stigmaeidae و Cryptognathidae در استان لرستان، با دو گزارش جدید برای ایران

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چکیده: فون کنه‌های دو خانواده‌ی Stigmaeidae و Cryptognathidae در استان لرستان، طی سال‌های ۱۳۹۱ تا ۱۳۹۲ مورد مطالعه قرار گرفت. در این تحقیق ۱۸ گونه در مجموع جمع‌آوری و شناسایی شدند که گونه‌های *Favognathus amygdalus* و *F. cordylus* از خانواده Cryptognathidae برای فون کنه‌های ایران جدید بوده و همچنین تمام گونه‌های گزارش شده برای فون استان لرستان گزارش جدید هستند. در این تحقیق از خانواده Stigmaeidae تعداد ۱۴ گونه و از خانواده Cryptognathidae تعداد چهار گونه جمع‌آوری و شناسایی شدند.

واژگان کلیدی: کنه، Stigmaeidae، Cryptognathidae، استان لرستان، *Favognathus*