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Article

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A new species of the genus *Eustigmaeus* (Acari: Stigmaeidae) from Isfahan province, Iran

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Abstract

A new species of the genus *Eustigmaeus, E. isfahaniensis* **sp**. **nov**. is described and illustrated based on female and male collected from soil under lichen, Najaf Abad town, Isfahan province, Iran.

Key words: Lichen, predator, Iran, family, Najaf Abad.

Introduction

Eustigmaeus Berlese is one of the largest genera in the family Stigmaeidae and occur all over the world. The members of this genus generally are free living on mosses, lichens, grasses and various litters and a few are parasitic on sandflies (Gerson 1972; Flechtmann 1985; Zhang & Gerson 1995; Doğan 2005; Khanjani *et al*. 2011, Khanjani *et al*. 2013). Up to present, 17 species of the genus *Eustigmaeus* have been reported from Iran, namely: *Eustigmaeus anauniensis* (Canestrini, 1889)[by Doĝan *et al*. 2012]; *E. azerbaijanensis* Haddad Irani-Nejad *et al.* 2011; *E. dogani* Khanjani *et al*., 2011; *E. ioaniensis* Kapaxidi & Papadoulis, 1999 [by Navaei–Bonab *et al*. 2012]; *E. johnstoni* Zhang & Gerson, 1995 [by Badakhshan *et al*. 2011]; *E. jiangxiensis* Hu, Chen & Huang, 1996 [by Kheradmand *et al*. 2007]; *E. nahidae* Gheblealivand *et al*. 2012; *E. nasrinae* Khanjani & Ueckermann, 2002; *E. ornatus* Ueckermann & Smith-Meyer, 1987 [by Kamali *et al*. 2006]; *E. pulmifer* (Halbert, 1923)[by Bagheri *et al*. 2011]; *E. rhodomela* (Koch, 1841) [by Khanjani *et al*. 2013]; *E. seemani* Khanjani *et al*. 2013; *E. segnis* (Koch, 1836) [by Khanjani & Ueckermann 2002]; *E. setiferus* Bagheri *et al*., 2011; *E. spathatus* Ueckermann & Meyer, 1987 [by Darvishzadeh & Kamali 2009]; *E. sculptus* Doĝan *et al*. 2003 [by Lotfollahi *et al*. 2010]; *E. ueckermanni* Bagheri & Beyzavi, 2013. In this paper *E. isfahaniensis* **sp.nov.** is described from Isfahan province, Iran.

Material and methods

Mites were collected from soil under lichen in Mohammad Abad village, Najaf Abad vicinity, Isfahan province and mounted directly in Hoyer's medium. The specimens were measured, identified and drawn by means of an Olympus BX51 differential interference contrast microscope at 1000× magnification. Body length measurements represent the distance between base of gnathosoma and end of idiosoma; width was

measured above coxa III. Setae were measured from the setal base to the tip of the seta; distances between setae were measured between setal bases. Legs measurements are from trochanter to pretarsus.

The terminology and abbreviation are used in the description of the new species follows that of Kethley (1990) and Fan & Zhang (2005). All measurements are given in micrometers and the measurements of the paratypes are given in parentheses.

Results

Family Stigmaeidae Oudemans, 1931

Genus *Eustigmaeus* Berlese, 1910

Stigmaeus (*Eustigmaeus*) Berlese, 1910: 206.

Type species: *Stigmaeus kermesinus* Koch, 1841, by original designation. Elevated to genus by Oudemans, 1923a: 143.

Ledermuelleria Oudemans, 1923b: 150. Type species: *Ledermuelleria segnis* Koch, 1836. Synonymy by Wood, 1973: 182.

Diagnosis (based on Fan & Zhang (2005)): Idiosoma broadly oval in dorsoventral view, generally red or dark red in life. Chelicerae separate. Palptibial claw subequal to palptarsus; accessory claw stout, conical; terminal eupathidia on palptarsus basally fused and split halfway into three long prongs; counts of setae and solenidia from palptrochanter to palptarsus: 0, 3, 2, 2 + 1 claw + 1 accessory claw, 4 + 1ω + 1 subterminal spine-like eupathidium + 3 eupathidia (basally fused). Ventral infracapitulum with two pairs of subcapitular setae, *m* anterolaterad of pharynx, *n* posteriorad of *m*. Prodorsum covered with a large shield, bearing four pairs of setae (*vi*, *ve*, *sci*, *sce*); eyes often present, *Pob* absent. Dorsal hysterosomal area C-F covered with a large shield, with six pairs of setae (c_1, d_1, d_2, e_1, e_2, f_1); humeral shields large, ventrolateral, with setae c_2. Suranal shield entire, ventroterminal, with two pairs of setae (h_1, h_2), h_3 absent. Endopodal shields I-II and III-IV present, divided or fused along midline. Ventral opisthosoma with 1–3 pairs of aggenital setae; genital valves with three pairs of pseudanal setae, genital setae absent. Leg tarsal claws robust; empodial shafts branching into tenent hairs before extending beyond tips of claws, with three pairs of tenent hairs. Number of setae and solenidia on legs I-IV: coxae (excluding *1a*, *3a* & *4a*) 2 + 1*elcp*, 2, 2, 2; trochanters 1, 1, 1–2, 0–1; femora 6, 4–5, 3, 2–3; genua 3 + 1*k*, 3 + 1*k*, 1, 1; tibiae 5 + 1φ + 1*φp*, 5 + 1*φp*, 5 + 1*φp*, 5 + 1*φp*; tarsi 13 + 1ω, 8–9 + 1ω, 7 + 1ω, 7 + 0–1ω.

Male. Solenidia on tarsi I-IV: 2, 2, 2, 2.

Eustigmaeus isfahaniensis sp. nov. (Figs. 1–16)

Diagnosis

Female: Dorsal shields with irregular reticulation which is distinct laterally, fade away medially. Eye present. Humeral callosities present, tarsus IV with solenidion ω. c_1–c_1: d_1–d_1: e_1–e_1: f_1–f_1 1.70 (1.67–1.89): 1.73 (1.66–1.68): 2.23 (1.54–1.97): 1.00 (1.00–1.00).

Male: As in female but: ratio c_1–c_1: d_1–d_1: e_1–e_1: f_1–f_1 1.53: 1.35: 1.22: 1.00; one pair of callosities; tarsi I-IV with 13+2ω, 9+2ω, 7+2ω, 7+2ω.

Material examined

Holotype female, eight female and one male paratypes collected from soil under lichen, Iran: Isfahan Province, vicinity of Najaf Abad town, Mohammad Abad, 32º 36′ N, 51˚22′ E, 1655 m a.s.l., 29 October 2012, coll. P. Rafiean. The holotype female, seven female paratypes and one male are deposited as slide-mounted specimens in the Collection of the Acarology Laboratory, University of Bu-Ali Sina, Hamadan, Iran and one paratype female will be deposited in the National Collection of Arachnida, Plant Protection Research, Pretoria, South Africa.

Description

Female (n= 9) (Figs. 1–8). Color in life red. Idiosoma oval. Length of body 362 (411–442); width 389 (345–376); length of leg I 212 (200–246); leg II 156 (160–191); leg III 162 (162–192), leg IV 199 (198–215).

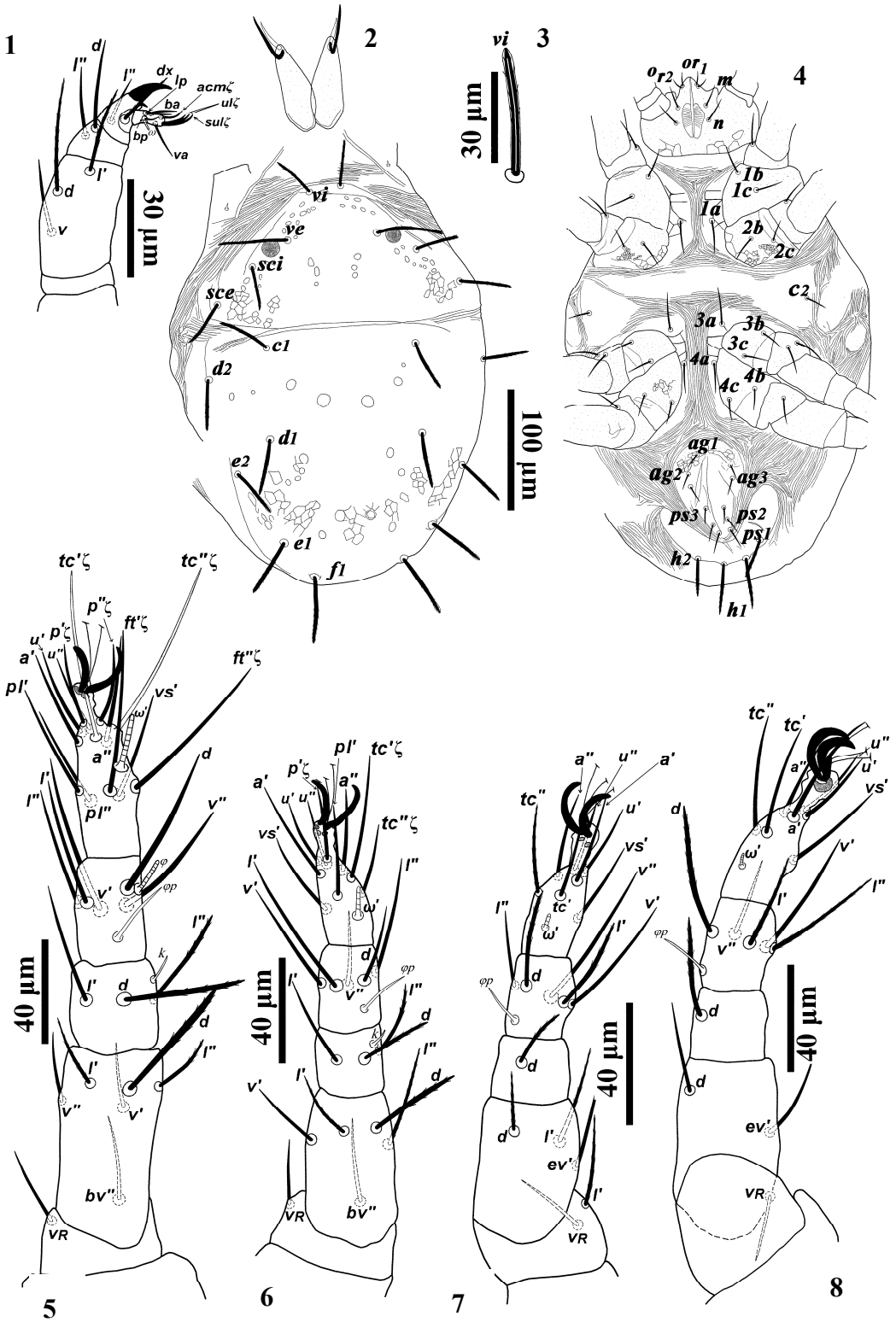
Dorsum (Figs. 2–3). Dorsum with two large shields on prodorsum and opisthosoma, lateral reticulation distinct and fade away medially or almost smooth; prodorsum anteriorly and laterally with small pits and bearing four pairs of setae (*vi*, *ve*, *sci*, *sce*). Eyes 14 (13–15) in diameter; setae *ve* longer than *vi*; opisthosoma with a few pits and with six pairs of setae (c_1, d_1, d_2, e_1, e_2, f_1); humeral shields large, ventro-lateral, with setae c_2. All dorsal setae slender, slightly serrated, with hyaline sheath (except seta c_2). Suranal shield entire, ventrally, with two pairs of setae (h_1, h_2). Lengths of dorsal setae: *vi* 43 (39–47), *ve* 62 (55–70), *sci* 42 (37–44), *sce* 48 (42–50), c_1 49 (40–48), c_2 20 (16–22), d_1 51 (43–51), d_2 47 (41–48), e_1 54 (48–58), e_2 47 (42–53), f_1 60 (57–65), h_1 45 (41–46), h_2 34 (33–39). Distances between dorsal setae: *vi–vi* 30 (31–40), *ve–ve* 82 (83–95), *sci–sci* 149 (157–182), *sce–sce* 224 (223–257), c_1–c_1 140 (141–167), c_2–c_2 203 (167–193), d_1–d_1 142 (140–148), d_2–d_2 250 (228–289), e_1–e_1 183 (130–174), e_2–e_2 209 (212–238), f_1–f_1 82 (84–98), h_1–h_1 20 (23–26), h_2–h_2 60 (65–74), *vi–ve* 50 (49–55), *sci–sce* 49 (45–54), *ve–sci* 40 (39–48), c_1–d_1 82 (81–91), d_1–d_2 80 (82–98), d_1–e_1 93 (95–106), e_1–e_2 72 (72–87), e_1–f_1 42 (42–53), h_1–h_2 23 (20–30).

Venter (Fig. 4). Endopodal shields between I-II and III-IV separated along midline with longitudinal striae and faintly reticulated. Ventral cuticle between coxae II and III with transverse striae. Humeral regions with one pair of triangular punctated humeral shields with seta c_2 and two pairs of punctated callosities, outer callosities larger than inner callosities (Fig. 4). Aggenital shield reticulated with three pairs of setae ($ag_{1–3}$); Anal area with three pairs of setae ($ps_{1–3}$); suranal shield smooth and with two pairs of setae ($h_{1–2}$). Length of ventral setae *la* 33 (30–35), *1b* 28 (27–31), *1c* 23 (23–28), *2b* 23 (25–32), *2c* 21 (17–23), *3a* 33 (29–35), *3b* 23 (20–24), *3c* 23 (20–27), *4a* 26 (21–26), *4b* 22 (18–24), *4c* 21 (18–22), ag_1 14 (14–17), ag_2 16 (15–18), ag_3 17 (15–17), ps_1 22 (19–24), ps_2 16 (15–19), ps_3 15 (15–17). Aggenital setae ag_1 almost as long as ag_2.

Gnathosoma (Figs. 1, 2 & 4). Ventral infracapitulum with two pairs of subcapitular setae, *m* 20 (20–27) and *n* 21 (25–28), two pairs of adoral setae, or_1 12 (10–16), or_2 12 (11–16) (Fig. 4). Chelicerae free 87 (86–92), movable digit 51 (49–59) (Fig. 2). Palp five segmented, palp tarsus with 4 simple setae + one simple eupathidion + one solenidion [ω 5 (4–6)] + one tridentate eupathidium, palp tibia with two setae + one well developed claw + one accessory claw, palp genu with one seta and palp femur with three setae (Fig. 1).

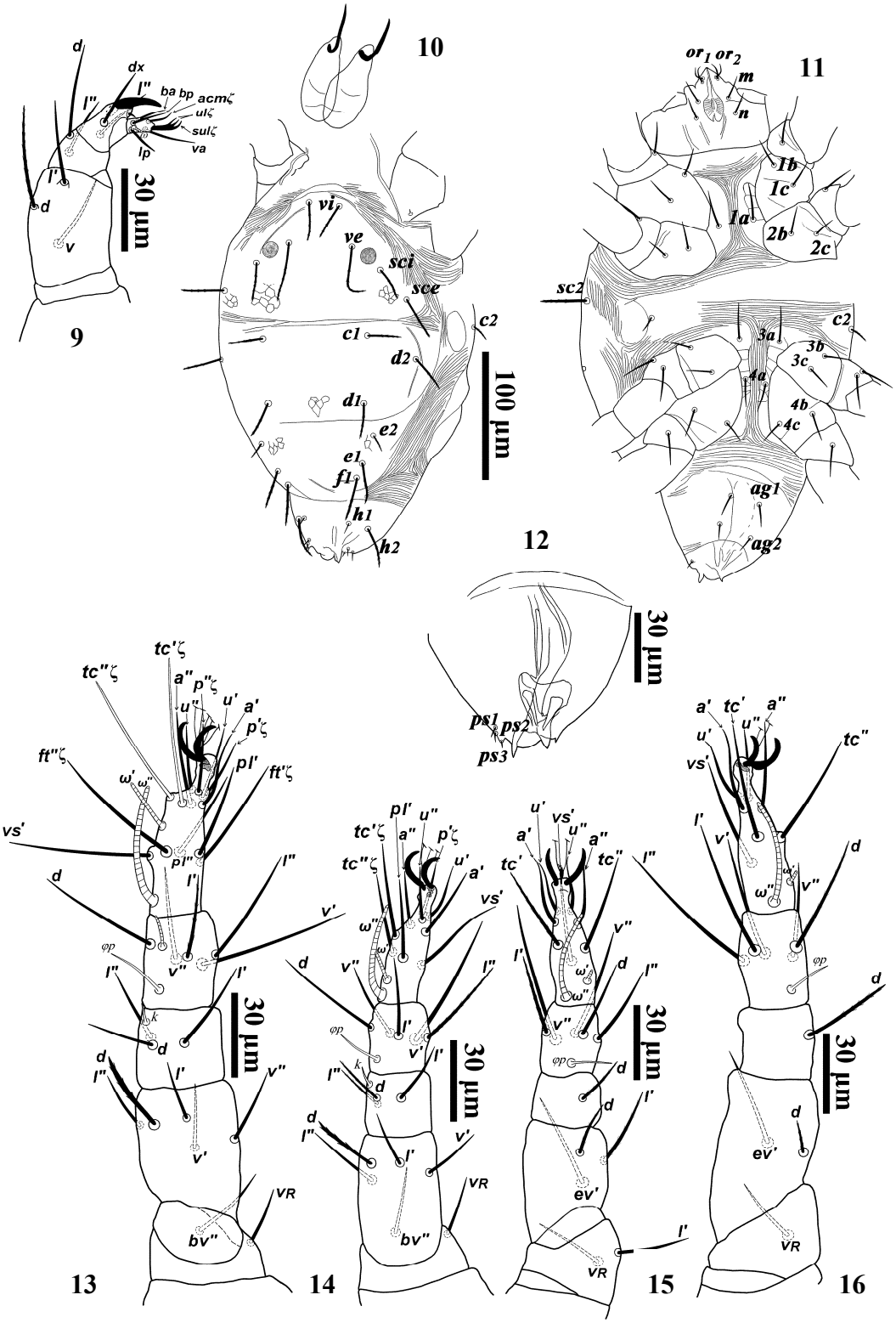
Legs (Figs. 5–8). Legs about half length of body. Leg setal formulae as follows: coxae 2, 2, 2, 2; trochanters 1, 1, 2, 1; femora 6, 5, 3, 2, genua 3 + 1κ, 3 + 1κ, 1, 1; tibiae

5 + 1φ + 1$\varphi\rho$, 5 + 1$\varphi\rho$, 5 + 1$\varphi\rho$, 5 + 1$\varphi\rho$; tarsi 13 + 1ω, 9 + 1ω, 7 + 1ω, 7 + 1ω. Length of solenidia: ω I 19 (21–25), ω II 12 (13–17), ω III 5 (5–8), ω IV 5 (4–7), $\varphi\rho$ I 23 (24–30), φ I 11 (12–16), $\varphi\rho$ II 18 (15–23), $\varphi\rho$ III 15 (16–20), $\varphi\rho$ IV 19 (17–22), κ I 10 (8–11), κ II 5 (4–6).



Figures 1–8. *Eustigmaeus isfahaniensis* **sp. nov.** (Female). 1. Palp; 2. Dorsal view of body; 3. Dorsal seta *vi*; 4. Ventral view of body; 5. Leg I; 6. Leg II; 7. Leg III; 8. Leg IV.

Male (n= 1) (Figs. 9–16). Idiosoma oval. Length of body 297; width 200; length of leg I 193; leg II 157; leg III 155, leg IV 192.



Figures 9–16. *Eustigmaeus isfahaniensis* **sp. nov.** (Male). 9. Palp; 10. Dorsal view of body; 11. Ventral view of body; 12. Genital shield; 13. Leg I; 14. Leg II; 15. Leg III; 16. Leg IV.

Dorsum (Fig. 10). Dorsum with two large shields; dorsal reticulation not so clear; prodorsum bearing four pairs of setae (*vi*, *ve*, *sci*, *sce*) and one pairs eyes, 13 in diameter; opisthosoma with eight pairs of setae (c_1, d_1, d_2, e_1, e_2, f_1, h_1, h_2); humeral shields large, with setae c_2. All dorsal setae slender, slightly serrated (except seta *c2*). Lengths of dorsal setae: *vi* 31, *ve* 47, *sci* 30, *sce* 35, c_1 27, c_2 14, d_1 29, d_2 32, e_1 32, e_2 13, f_1 35, h_1 10, h_2 34. Distances between dorsal setae: *vi–vi* 25, *ve–ve* 50, *sci–sci* 98, *sce–sce* 145, c_1–c_1 83, c_2–c_2 148, d_1–d_1 73, d_2–d_2 157, e_1–e_1 66, e_2–e_2 86, f_1–f_1 54, h_1–h_1 35, h_2–h_2 56, *vi–ve* 34, *sci–sce* 33, *ve–sci* 30, c_1–d_1 52, d_1–d_2 48, d_1–e_1 53, e_1–e_2 24, e_1–f_1 13, f_1–$h_1$33, h_1–h_2 15.

Venter (Figs. 11–12). Endopodal shields between I-II and III-IV separated along midline with longitudinal striae and faintly reticulated. Ventral cuticle between coxae II and III with transverse striae. Humeral regions with one pairs of triangular humeral shields with seta c_2 and one pair of callosities. Aggenital shield with two pairs of setae ($ag_{1–2}$); anal area with three pairs of setae ($ps_{1–3}$); Length of ventral setae *la* 27, *1b* 24, *1c* 21, *2b* 22, *2c* 17, *3a* 26, *3b* 22, *3c* 23, *4a* 20, *4b* 20, *4c* 16, ag_1 18, ag_2 14, ps_1 9, ps_2 5, ps_3 6. Genital shield indicated in Fig. 12.

Gnathosoma (Figs. 9–11). Ventral infracapitulum with two pairs of subcapitular setae, *m* 18 and *n* 18, two pairs of adoral setae, or_1 12, or_2 12 (Fig. 11). Chelicerae free 71, movable digit 43 (Fig. 9). Palp five segmented, palp tarsus with 4 simple setae + one simple eupathidium + one solenidion [ω (4)] + one tridentate eupathidium, palp tibia with two setae + one well developed claw + one accessory claw, palp genu with one seta and palp femur with three setae (Fig. 9).

Legs (Figs. 13–16). Leg setal formulae as follows: coxae 2, 2, 2, 2; trochanters 1, 1, 2, 1; femora 6, 5, 3, 2, genua 3 + 1κ, 3 + 1κ, 1, 1; tibiae 5 + 1φ + 1$\varphi\rho$, 5 + 1$\varphi\rho$, 5 + 1$\varphi\rho$, 5 + 1$\varphi\rho$; tarsi 13 + 2ω, 9 + 2ω, 7 + 2ω, 7 + 2ω. Length of solenidia: ω' I 19, ω'' I 43, ω' II 12, ω'' II 36, ω' III 4, ω'' III 35, ω' IV 6, ω'' I 39, $\varphi\rho$ I 22, φ I 11, $\varphi\rho$ II 17, $\varphi\rho$ III 15, $\varphi\rho$ IV 16, κ I 6, κ II 4.

Immature stages: unknown.

Etymology

The species is named after the locality where it was collected, namely Isfahan province.

Remarks

The new species *Eustigmaeus isfahaniensis* **sp. nov.** resembles *E. rhodomela* (Koch, 1841) in having the same leg chaetotaxy, dorsal setae and two pairs of callosities. However it differs from the latter in: 1) dorsum with a few pits, without vacuoles and with reticulation in the new species instead of completely covered with pits and vacuoles in *E. rhodomela*; 2) callosities punctated in new species vs. with pores in *E. rhodomela*; 3) endopodal shields incompletely reticulated vs. completely reticulated in *E. rhodomela*.

Key to species of the genus in *Eustigmaeus* in Iran (female)

1. Eyes absent……..…….……2
– Eyes present……..……..……..…..……..…..……4

2. Coxisternal shield separated, with two pairs of *ag* setae……..…..
……. *E. azerbaijanensis* Haddad *et al*., 2011
– Coxisternal shield fused, with three pairs of *ag* setae…….……..……3
3. Trochanter III with 1 seta, femur II with 5 setae.....
.....*E. johnstoni* Zhang & Gerson, 1995
– Trochanter III with 2 setae, femur II with 4 setae.....
.....*E. ueckermanni* Bagheri & Beyzavi, 2013
4. Trochanter III with 1 seta..... *E. plumifer* (Halbert, 1923)
– Trochanter III with 2 setae.....5
5. Humeral callosities present, tarsus IV with solenidion *ω* ……..……..……...6
– Humeral callosities absent, tarsus IV without solenidion *ω* ……...…..7
6. Dorsum completely covered with pits and vacuoles …….... *E. rhodomela* (Koch, 1841)
– Dorsum covered with a few small pits and without vacuoles....*E. isfahaniensis* **sp. nov.**
7. Dorsal setae serrated, spatulate or otherwise except bushy…….……..….12
– Dorsal setae bushy ……...……...……...…...…8
8. Femur II with 5 setae ……...……...…….…….9
– Femur II with 4 setae ……...…...……...…....10
9. Dorsal setae with hyaline, tarsi I with 12(1*ω*) setae.....*E. dogani* Khanjani *et al*., 2011
– Dorsal setae without hyaline, tarsi I with 13(1*ω*) setae....*E. sculptus* Doğan *et al*., 2003
10. Coxisternal shield smooth ……..…11
– Coxisternal shield reticulated ……...……..…..…..*E. seemani* Khanjani *et al*., 2013
11. Suranal shield ornamented, setae on coxisternal shields barbed……...
……...…..….. *E. nasrinae* Khanjani & Ueckermann, 2002
– Suranal shield smooth, setae on coxisternal shields smooth……..……..
……...…..…*E. anauniensis* (Canestrini, 1889)
12. Seta *4a* present ……..……...…….13
– Seta *4a* absent……..…….……*E. jiangxiensis* Hu *et al*., 1996
13. Coxisternal shields separated, genu I with 4 setae …..……...…….14
– Coxisternal shields fused, genu I with 3 setae ……...…..…15
14. Tarsi II with 8(1*ω*), with 1 pair of *ag* setae…….……..
……...*E. ornatus* Ueckermann & Smith-Meyer, 1987
– Tarsi II with 9(1*ω*), with 2 pairs of *ag* setae…….
..... *E. nahidae* Geblalivand & Bagheri, 2012
15. Femur II with 4 setae ……...……...……16
– Femur II with 5 setae …….……..17
16. Dorsal setae spatulate, coxisternal shields smooth …….……..
…..…….……*E. spathatus* Ueckermann & Meyer, 1987
– Dorsal setae serrated, coxisternal shields reticulated ……...…..….
……...…...*E. ioaniensis* Kapaxidi & Papadoulis, 1999
17. One pair of *ag* setae, dorsal setae without hyaline ...…….. *E. segnis* (Koch, 1836)
– Three pairs of *ag* setae, dorsal setae with hyaline …….*E. setiferus* Bagheri *et al*., 2011

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گونه جدیدی از جنس *Eustigmaeus* (Acari: Stigmaeidae) از استان اصفهان، ایران

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چکیده

گونه جدیدی کنه از جنس *Eustigmaeus*، *E. isfahaniensis* **sp. nov.** بر اساس افراد نر و ماده جمع‌آوری شده از خاک زیر گلسنگ در استان اصفهان، ایران جمع‌آوری و توصیف می‌شود.

واژگان کلیدی: گلسنگ، شکارگر، ایران، خانواده، نجف آباد.

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