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TWO NEW EYELESS MITE SPECIES FROM THE WESTERN PROVINCES OF IRAN: STIGMAEUS LADANAE N. SP. AND STIGMAEUS NASRINAЕ N. SP. (ACARI: STIGMAEIDAE)

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ABSTRACT — Two new species of the genus Stigmaeus, S. ladanae n. sp., collected from soil under apple trees in Abbas Abad Hamedan, Hamedan province and S. nasrinae n. sp., collected from soil under Apera spica-venti (L.) (Poaceae) in Nahavand, Hamedan province, Iran, are described and illustrated.

KEYWORDS — Raphignathoidea; Walnut; first record; predatory mites; Iran

INTRODUCTION

The members of the family Stigmaeidae are found throughout the world and some of them can feed on the eggs and immature stages of spider mites, eriophyid mites and also immature stages of scale (White and Laing, 1977; Santos and Laing, 1985; Khanjani et al., 2010). They are found abundantly on the trees bark, on or in soil, grass, leaf, mulch, lichen, wood boring beetles, crevices in rock and leaf cavities, and a few of them are parasitic on phlebotomine flies (Dönel and Doğan, 2011). The family Stigmaeidae consists of 32 valid genera and about 500 species so far (Doğan et al., 2011). Fourteen species of the genus Stigmaeus have been reported from Iran, namely: S. alvandis Khanjani and Ueckermann, 2002; S. unicus Kuznezov, 1977; S. elongatus Berlese, 1886; S. candidus Fan and Li, 1993 (= S. mazandaranicus Faraji and Ueckermann, 2006); S. malekii Haddad et al., 2006; S. pilatus Kuznetzov, 1987; S. shabestariensis Haddad et al., 2010a; S. shendabadiensis Haddad et al., 2010b; S. boshroyehensis, Khanjani et al., 2010; S. marandiensis Bagheri et al., 2011; S. uckerrmanni Pahlavan Yali et al., 2011; S. longipilis Canestrini, 1889; S. planus Kuznetzov (Doğan et al., 2012), S sphagneti (Hull, 1918): In this paper S. ladanae n. sp. and S. nasrinae n. sp. are described and illustrated from Iran.

MATERIALS AND METHODS

Mites were collected from soil beneath Apera spica-venti (L.) (Poaceae) in Nahavand, and soil under apple trees in Abbas Abad, Hamedan, Hamedan province and mounted directly in Hoyer’s medium (Krantz and Walter, 2009). The specimens were measured, identified and drawn by means of differential interference contrast microscopy 1000X mag-
Figure 1: *Stigmaeus ladane* n. sp. (female): A – Dorsum; B – Venter; C – gnathosoma.
nification of an Olympus BX51. 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 coxa to pre tarsus.

The terminology and setal notations used in the descriptions of the new species follow those of Kethley (1990). All measurements are given in micrometers (µm) and the measurement of the paratypes is followed in brackets.

**FAMILY STIGMAEIDAE OUDEMANS, 1931**

Type genus: *Stigmaeus* Koch, 1836 *Stigmaeus* Koch, 1836

*Stigmaeus ladaneae* n. sp.

(Figs. 1-2)

Diagnosis — All dorsal, ventral and suranal shields reticulated, dorsum with 14 pairs of setae (*c₁, d₁* present), eyes and post ocular bodies absent, median hysterosomal shield with two setae (*c₂, d₁*), genital setae two pairs, aggenital setae four pairs, genua 5(+1κ) - 5 - 2 - 2, propodosomal setae *ve/vi* 1.26 (1.29 – 1.35), ratio *v₁/v₁t*–*v₁: 0.85 (0.54 – 0.80), *c₁/c₁–c₁* 0.52 (0.46 – 0.51); *c₁–c₁*: *d₁–d₁*: *e₁–e₁*: *f₁–f₁*: 0.87 (1 – 1.86): 0.89 (0.81 – 1.60): 0.79 (0.81 – 1.09): 1.0.

Material examined — Holotype female, collected from soil beneath apple trees, *Malus domestica* Borkh. (Rosaceae), Hamedan (34°46′48.13″N, 48°28′11.46″E and altitude 1930 m a.s.l), Hamedan Province, Iran, 8 June 2011, Alireza Nazari; 6 females paratypes with the same data. The holotype female and 5 paratypes females 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.

Female (*n* = 7) — Color in life red. Idiosoma oval. Measurements of holotype with measurements of paratypes in parentheses: Length of body (excluding gnathosoma) 420 (419 – 441), (including gnathosoma) 523 (510 – 548); width 206 (206 – 245); length of leg I 240 (218 – 242); leg II 188 (175 – 193); leg III 185 (153 – 190), leg IV 223 (208 – 246).

Dorsum (Fig. 1A) — Prodorsal shield oblong and reticulated; bearing three pairs of setae (*vi, ve, sci*), eyes and post ocular bodies absent; dorsal hysterosoma with 10 pairs of setae, almost smooth, four pairs of paired and three unpaired shields and surrounded with entire and reticulated (Fig. 1A). Setae *c₂* situated laterally between coxae II-III. Setae *ve* almost as long or slightly longer than setae *vi, ve, sci* on lateral propodosomal shields, reticulated; lengths of dorsal setae: *vi* 23 (20 – 24), *ve* 29 (27 – 31), *sci 1* 28 (22 – 29), *sci 2* 30 (28 – 32), *c₂ 1* 25 (20 – 27), *c₂ 2* 41 (32 – 43), *d₁ 1* 19 (19 – 24), *d₁ 2* 21 (20 – 24), *e₁ 1* 22 (20 – 24), *e₁ 2* 21 (21 – 24), *f₁ 1* 30 (28 – 33), *h₁* 32 (28 – 37), *h₂* 40 (37 – 44); distances between dorsal setae: *vi–vi* 26 (25 – 44), *ve–ve* 50 (46 – 55), *vi–ve* 32 (25 – 34), *sci–sci* 85 (73 – 88), *ve–sci* 135 (131 – 152), *ve–sci* 47 (41 – 50), *sci–sci* 25 (18 – 34), *c₁–c₁* 46 (43 – 53), *c₁–c₂* 73 (57 – 89), *c₂–c₂* 191 (170 – 206), *c₁–d₁* 59 (48 – 64), *d₁–d₁* 47 (37 – 43), *d₁–d₂* 49 (44 – 56), *d₁–e₁* 68 (62 – 71), *d₁–e₂* 51 (48 – 69), *e₂–e₂* 73 (71 – 77), *d₂–d₂* 128 (118 – 151), *e₁–e₁* 42 (25 – 43), *e₂–e₂* 94 (87 – 121), *e₁–e₂* 33 (29 – 40), *e₁–f₁* 40 (30 – 42), *f₁–f₁* 53 (23 – 53), *f₁–h₁* 36 (32 – 45), *h₁–h₁* 33 (31 – 38), *f₁–h₂* 39 (36 – 43), *h₂–h₂* 71 (64 – 72), *h₁–h₂* 17 (15 – 21); ratio: *vi–vi–vi* 0.88 (0.54 – 0.80), *c₁–c₁–c₁* 0.52 (0.46 – 0.51), *d₁–d₁–d₁* 0.40 (0.51 – 0.55), *e₁–e₁–e₁* 0.55 (0.55 – 0.85), *f₁–f₁–f₁* 0.52 (0.62 – 1.21), *h₁–h₁–h₁* 0.96 (0.90 – 0.97), *h₂–h₂–h₂* 0.56 (0.57 – 0.61), *h₁/h₂* 0.80 (0.57 – 0.84), *c₁–c₁*: *d₁–d₁*: *e₁–e₁*: *f₁–f₁*: 0.87(1 – 1.86): 0.89 (0.81 – 1.60): 0.79 (0.81 – 1.09): 1.0.

Venter (Fig. 1B) — Coxae I-IV and surrounded shields reticulated, coxisternal shields I-II and III-IV not fused in mid-line, longitudinal striae; cuticle transversely striate between coxisternal II-III; coxisternal shields I-II and III-IV surrounding with entire and reticulated (Fig. 1B). Length of setae *la* 24 (18 – 25), *lb* 22 (8 – 24), *lc* 29 (21 – 32), *lb* 34 (25 – 35), *2c* 37 (28 – 37), *3a* 23 (18 – 25), *3b* 23 (18 – 24), *3c* 21 (17 – 24), *4a* 21 (18 – 24), *4b* 18 (14 – 19) and *4c* 19 (14 – 20). Aggenital (*ag₁, ag₂, ag₃, ag₄*) setae *ag₁* almost as long as *ag₂, ag₃*; and pseudanal setae *ps₁* less than two times longer than seta *ps₃*; measurements of setae: *ag₁* 18 (14 – 21), *ag₂* 18 (16 – 20), *ag₃* 22 (17 – 23), *ag₄*
FIGURE 2: Stigmaeus ladanae n. sp. (female): A – leg I; B – leg II; C – leg III; D – leg IV.

Gnathosoma (Fig. 1C) — Subcapitulum reticulated and with two pairs of subcapitular setae, $m_23$ (19 – 25) and $n_{18}$ (14 – 21), two pairs of adoral setae, $or_1$ 7 (4 – 8), $or_2$ 9 (7 – 10); distances: $or_1$-$or_1$ 7 (5 – 18), $or_2$-$or_2$ 14 (11 – 16), $m$-$m$ 31 (29 – 36), $n$-$n$ 23.

22 (19 – 26), $g_1$ 19 (16 – 20), $g_2$ 29 (19 – 31), $ps_1$ 52 (36 – 53), $ps_2$ 28 (19 – 28), $ps_3$ 44 (38 – 46). Distances: $ag_1$-$ag_1$ 33 (25 – 33), $ag_2$-$ag_2$ 35 (33 – 38), $ag_3$-$ag_3$ 49 (47 – 53), $ag_4$-$ag_4$ 46 (46 – 61).

Chelicerae free 55 (50 – 63), movable digit 25(22 – 27) (Fig. 1C). Palpi five segmented, palp tarsus with four simple setae + one simple eupathidium + one solenidion (ω) + one tridentate eupathidium, palp tibia with two setae + one well developed claw + one accessory claw, palp genu with one setae and palp femur with three setae.

Legs (Fig. 2) — Legs about half length of body. Leg segments setal formulae as follows: coxae 2 - 2 - 2 - 2; trochanters 1 - 1 - 2 - 1; femora 4 - 4 - 3 - 2, genua 5+1κ - 5 - 2 - 2; tibiae 5+1φρ - 5+1φρ - 5+1φρ - 5+1φρ; tarsi 13 +1ω - 9 +1ω - 7 +1ω - 7 +1ω. Length of solenidia: ωI 19 (16-20), ωII 17 (14-18), ωIII 10 (7 – 12), ωIV 8 (6 – 9).

Male — Unknown.

Remarks — Stigmaeus ladanae n. sp. is closely similar S. shabestariensis Haddad, Lottollahi and Akbari, 2010 in having:

- setae h3,
- entire suranal shield,
- reticulated dorsal shields,
- the same legs chaetotaxy.

However, the new species differs in:

- lateral prodorsal shield reticulate in S. ladanae instead of smooth in S. shabestariensis,
- subcapiltulum faintly reticulated instead of faintly punctate,
- dorsal setae smooth instead of serrated,
- lateral zonal shields unique instead of divided in S. shabestariensis,
- base of setae ps1 reticulated instead of smooth in S. shabestariensis,
- ratio c1/c1-c1 0.52 (0.46 – 0.51) and e1/e1-e1 0.5 (0.55 – 0.8) in S. ladanae opposed to 0.40 (0.20 – 0.40) and e1/e1-e1 0.34 (0.33 – 0.34) in S. shabestariensis,
- coxal plates I-IV and legs segments reticulated in the new species versus smooth in S. shabestariensis,
- aggenital and anal shields reticulated instead of smooth in S. shabestariensis,
- setae ps2 two times longer than ps1 instead of as long as in S. shabestariensis. Also this species resembles Stigmaeus pulchellus Kuznetsov, 1987 and S. alvandis Khanjani and Ueckermann, 2002 in having all dorsal and ventral shields, and leg segments reticulated, eyes absent, two pairs of median zonal shield; however it differs from that: aggenital shields reticulated, setae sce shorter than S. pulchellus, setae ps1 longer than h1, h2, h3 instead of as long as in S. pulchellus and also it differs from S. alvandis in that:

- the suranal shield entire whereas divided in S. alvandis,
- femur IV with two setae opposed to one seta in S. alvandis,
- setae ps1 longer than h1, h2, h3 instead of as long as in S. alvandis.

Etymology — The new species is named in honor of Mrs. Ladan Mohammadi, wife of senior author, who kindly helped us in mite collection and who is already post student (Agricultural Entomology), Department of Plant Protection, College of Agriculture, Bu-Ali Sina University, Hamedan, Iran.

Stigmaeus nasrinae n. sp. (Figs. 3-4)

Diagnosis — Prodorsal area with a few reticulations elements centrally, dorsum with 14 pairs of setae (h3 present), eyes and post ocular bodies absent, genital setae two pairs, aggenital setae four pairs, genua 5 - 2 - 0 - 1, palp tarsi with one bifurcate eupathidium, propodosomal setae ve/vi 3.2, ratio vi/vi - vi 0.59, c1/c1-c1 0.30; d1/d1-d1 0.40; c1-c1; d1-d1: e1-e1: f1-f1 1.06: 0.77: 0.89: 1.

Material examined — Holotype female, collected from soil under Apera spica-venti (L.)
Female (n = 2) — Color in life red. Idiosoma oval. Measurements of holotype: Length of body (excluding gnathosoma) 370 (374); width 197 (203); length of leg I 167 (165); leg II 138 (134); leg III 130 (132), leg IV 162 (164).

Dorsum (Fig. 3A) — Prodorsum with a few reticulations elements centrally; with three pairs of setae (vi, ve, sci), eyes and pob absent (Fig. 3A); dorsal hysterosoma covered with longitudinal stria, with nine pairs of setae, almost smooth and four pairs of paired shields (Fig. 3A). Setae cs2 situated ventrolaterally between coxae II-III. Setae ve-ve and nine pairs of setae, almost smooth and four pairs of

Western area, eyes absent, a few reticulations elements in median prodorsal area; central hysterosoma stiated, suranal shield divided and smooth and bearing three pairs of setae (h1, h2 and h3), h2 almost 1.5 times longer than h1 and h3 (Fig. 3A); lengths of dorsal setae: vi 15 (17), ve 48 (49), sci 13 (16), sce 24 (21), c1 16 (15), c2 38 (39), d1 15 (15), d2 14 (14), c1 15 (15), c2 14 (15), f1 17 (17), h1 18 (18), h2 27 (26), h3 20 (21); distances between dorsal setae: vi-ve 27, ve-ve 35, vi-ve 15 (16), sci-sci 53, sce-sce 124, ve-sci 34 (32), c1-sci 66 (64), c2-sce 124 (127), c1-c1 51 (54), c1-c2 70 (53), c2-c2 172 (175), d1-d1 54 (57), d1-d2 37, d2-d2 49 (50), d1-f1 43 (44), d1-f2 63 (65), d2-f2 55 (57), d2-f3 141 (143), e1-e1 41 (44), e2-e2 128, e1-e2 43 (47), e1-f1 28 (28), f1-f1 48, f1-h1 47 (48), h1-h1 27, f1-h2 48 (46), h2-h2 40 (42); ratio: ve/ve 0.36, c1/c2 0.60, d1/d1 0.40, e1/e1 0.36, f1/f1 0.35, h1/h1 0.66, h2/h2 0.67, h1/h2 0.66 (0.69), c1-c1: d1-d1: e1-e1: f1-f1 1.06: 0.77: 0.89: 1.

Venter (Fig. 3B) — Coxisternal I-II and III-IV present, smooth. Ventral cuticle transversely striate between coxisternal II-III; coxisternallae I-I and III-IV surrounded by longitudinal striae (Fig. 3B). Length of setae 1a 20 (19), 1b 18 (17), 1c 25 (26), 2b 39 (38), 2c 25 (29), 3a 21 (18), 3b 21 (23), 3c 17 (16), 4a 18 (16), 4b 10 (13) and 4c 12 (13). Aggenital (ag1,4) setae ag1 as long as ag2,3; and genital setae g2 longer than g1; pseudanal seta ps3 almost one half length of setae ps1-2; measurements of setae: ag1 16 (15), ag2 14 (13), ag3 21 (23), ag4 23 (24), g1 14 (13), g2 13 (12), ps1 19 (18), ps2 13 (15) ps3 20 (17). Distances: ag1-ag2 24, ag2-ag3 32, ag3-ag4 43, ag4-ag5 36.

Gnathosoma (Figs. 3C, 3D). Subcapitulum with two pairs of subcapitular setae and smooth, m 19 (18) and n 19 (19), two pairs of adoral setae, or1 5 (5), or2 10 (9); distances: or1-or1 8, or2-or2 12, m-m 22, n-n 26, or1-m 33 (34), m-n 7 (Fig. 3D). Chelicerae free 58 (60), movable digit 27 (27). Palpi five segmented, palp tarsus with five simple setae, one solenidion (ω) 5 (6), one bifurcate eupathidium, palp tibia with two setae + one well developed claw + one accessory claw, palp genu with one setae and palp femur with three setae (Fig. 3C).

Legs (Fig. 4) — Legs about half length of body. Setal formulae of leg segments as follows (specialized sensory setae such as solenidia, in parenthesis): coxae I-IV 2-2-2-2; trochanters 1-1-2-1; femora 4-4-3-2, genua 5-2-0-1; tibiae 5+1ϕ+1φ - 5+1ϕp - 5+1ϕp + 1φp; 13 (1ω) - 8 (1ω) - 7 (1ω) - 7 (1ω).

Length of solenidia: ω I 10 (11), ωII 7 (6), ωIII 4 (4), ωIV 4 (4).

Male — Unknown.

Remarks — Stigmaeus nasrinae n. sp. exhibits most features of the S. elongatus Berlese in having a few reticulations elements in median prodorsal area, eyes absent, h3 present, palp tibia with three setae. However the new species differs from the latter in: femora I-IV 4-4-3-2 in the new species instead of 6-6-3-2 in S. elongatus, genua 5-2-0-1 instead of 6-5-3-3 in S. elongatus, tarsi II with 8+1ω oppose to 9+1ω in S. elongates, suranal shield divided instead of entire, aggenital shields with four pairs of setae and two pairs of genital setae instead of five pairs and three pairs respectively in S. elongates. Also closely resembles S. caeculus Barilo in having the same legs chaetotaxy dorsal pattern, however differs from the latter by:

- suranal shield with three pairs of setae (h1,3) in S. nasrinae instead of two pairs in S. caeculus,
FIGURE 3: *Stigmaeus nasrinae* n. sp. (female): A – Dorsum; B – Venter; C – Chelicerae; D – Subcapitulum and palp.
Figure 4: *Stigmaeus nasrinae* n. sp. (female): A – Leg I; B – Leg II; C – Leg III; D – Leg IV.

- *seta* \( f_1 \) set on the platelet in the new species whereas on the soft integument *S. caeculus*,
- aggenital shields entire instead of divided,
- 27 (26) in the new species, 33 in *S. caeculus*.

Etymology — The species is named after Mrs. Nasrin Nazari, who kindly assisted senior author in mite collection.

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