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Article

New occurrence of *Ledermuelleriopsis aminiae* (Acariformes: Stigmaeidae) in Turkey and first descriptions of its nymphal stages

Salih Doğan^{1*} and Sibel Doğan²

1. Erzincan Binali Yıldırım University, Faculty of Arts and Sciences, Erzincan, Turkey; E-mail: salihdogan@erzincan.edu.tr

2. Erzincan Binali Yıldırım University, Vocational School of Health Services, Erzincan, Turkey; E-mail: sibel.dogan@erzincan.edu.tr

* Corresponding author

ABSTRACT

Seventy-two females, one male, seven deutonymphs and two protonymphs specimens of *Ledermuelleriopsis aminiae* Nazari & Khanjani, 2017 were collected from Pülümür Valley, Turkey. Descriptions and illustrations of the nymph stages on the collected specimens of the species were given and the adult specimens were briefly described. This is the first record of *L. aminiae* from Turkey, and the first description of nymphal stages of the species. In addition, abnormalities in the number of intercoxal and aggenital setae in the female and male specimens of *L. aminiae* were mentioned here.

KEY WORDS: Abnormality; *Ledermuelleriopsis*; mite; nymph; Pülümür Valley; record.

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INTRODUCTION

Stigmaeidae (Acari: Raphignathoidea) with more than 600 species and 33 genera is the most diverse and largest family in the Raphignathoidea (Fan *et al.* 2016, 2019; Akyol 2019; Doğan and Doğan 2020). Members of the family are known as predators and discovered from all biogeographical regions (Fan and Zhang 2005). The genus *Ledermuelleriopsis* is one of the mite genera in the family, with 35 known species in the world (Akyol and Gül 2019; Doustaresharaf and Bagheri 2019). By now, 12 species of this genus have been reported from Turkey (Doğan 2007, 2019; Erman *et al.* 2007; Bingül and Doğan 2016; Akyol and Gül 2019).

In this paper, one more species, *Ledermuelleriopsis aminiae* Nazari & Khanjani, 2017 only known from Iran was found from Pülümür Valley, Turkey. Until now, adult female and male of this species were described, but its immature stages were unknown. Protonymph and deutonymph specimens with adults of this species were found in Pülümür Valley, Turkey. It was observed abnormalities in the number of intercoxal and aggenital setae in the adult specimens of *L. aminiae*. The findings in this study contributed to both the determination of the biodiversity of the Valley and knowledge of mites present in Turkey. This study also contributed to the data about abnormalities in the family Stigmaeidae.

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MATERIAL AND METHODS

Soil, litter and moss samples were collected from Pülümür Valley, Turkey. The mite specimens were extracted by using Berlese-Tullgren funnels, cleared in 60% lactic acid and mounted on microscope slides in Hoyer's medium. The specimens of *L. aminiae* were examined and illustrated by using a Leica DM 4000B phase-contrast microscope. The measurements were taken in micrometres (μm) with the aid of the Leica Application Suite (LAS) Software Version 3.8. Dorsal and leg setal designations follow Kethley (1990) and Grandjean (1944), respectively. Specimens examined were deposited in EBYU (Acarology Laboratory of Erzincan Binali Yıldırım University, Erzincan, Turkey).

RESULTS

Superfamily Raphignathoidea Kramer Family Stigmaeidae Oudemans Genus *Ledermuelleriopsis* Willmann

Ledermuelleriopsis aminiae Nazari & Khanjani, 2017

Description

Female (Figs. 1, 7–9) – Length of body 316–332, width 209–235. Dorsum of body covered with shields. Side anterior and lateral of idiosoma with large pits and vacuoles. Propodosomal shield carrying setae *vi*, *ve*, *sci* and a pair of eyes. Metapodosomal and opisthosomal shields partially separated. Setae *c*₁, *d*₁, *d*₂ on the metapodosomal shield, opisthosomal shield bearing setae *e*₁, *e*₂, *f*₁. Suranal shield with two pairs of setae (*h*₁, *h*₂). All dorsal setae clavate, spinose. Humeral shields punctuated and situated ventro-laterally. Setae *c*₂ on the humeral shields and slimmer than all dorsal setae. Coxisternal shields undivided and bearing three pairs of intercoxal setae (1*a*, 3*a* and 4*a*). Three pairs of aggenital setae (*ag*_{1–3}) present on the aggenital shield. Anal shields bearing three pairs of pseudanal setae (*ps*_{1–3}). Counts of setae on legs I–IV: coxae 2–2–2–2, trochanters 1–1–2–1, femora 6–4–3–2, genua 3(+1*κ*)–3(+1*κ*)–1–1, tibiae 5(+1*φ**p*+1*φ*)–5(+1*φ**p*)–5(+1*φ**p*)–5(+1*φ**p*), tarsi 13(+1*ω*)–9(+1*ω*)–7(+1*ω*)–7.

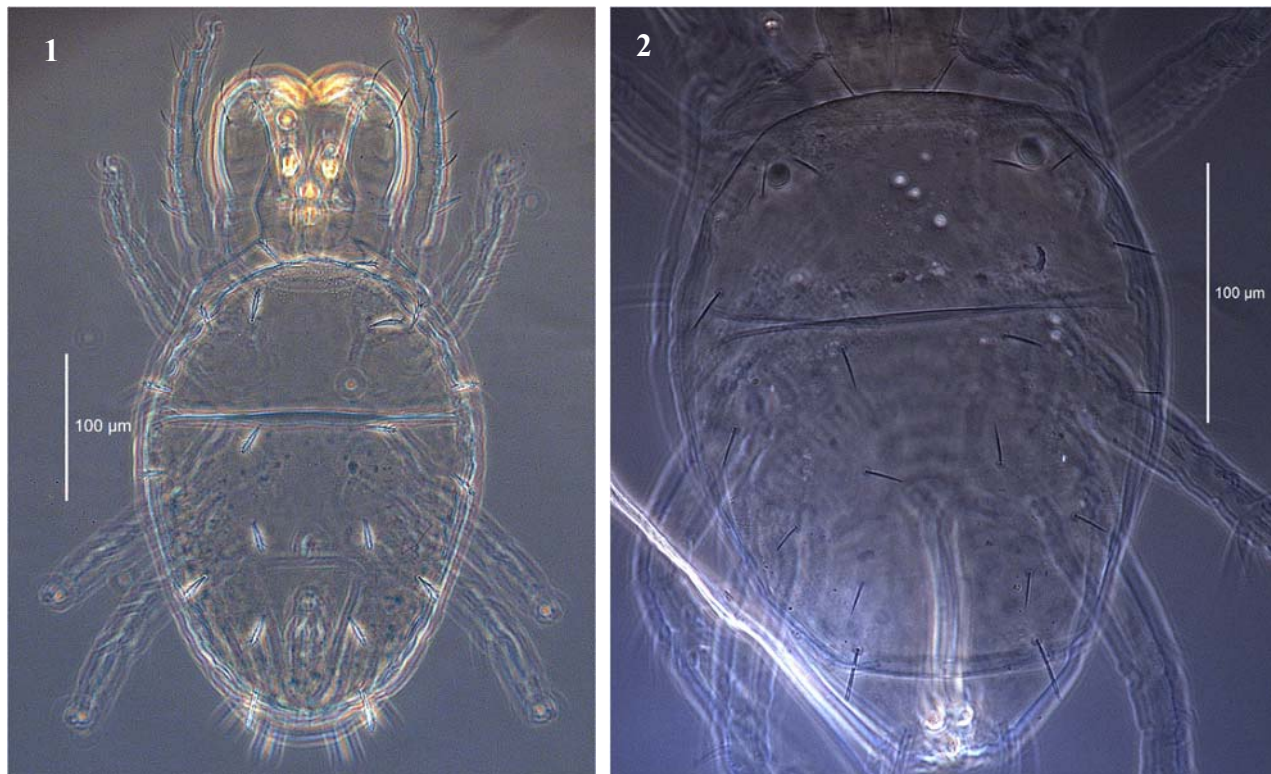
Male (Figs. 2, 10) – Length of body 272, width 191. Dorsum as in female. Propodosoma with a few vacuoles. metapodosomal and opisthosomal shields not ornamented. All dorsal setae serrated. Humeral shields smooth and bearing setae *c*₂. Coxisternal shields undivided and bearing three pairs of intercoxal setae (1*a*, 3*a* and 4*a*). Three pairs of aggenital setae (*ag*_{1–3}) present on the aggenital shield. Anal shields bearing three pairs of pseudanal setae (*ps*_{1–3}). Counts of setae as in female except for additional solenidia on all tarsi.

Deutonymph (Figs. 3, 4) – Length of body 276–287, width 189–209.

Dorsum (Fig. 3). Dorsum of body covered with shields. The anterior side of propodosomal shield punctated, but ornamentations of other dorsal shields undistinguished. Propodosomal shield carrying a pair of eyes and setae *vi*, *ve* and *sci*. Eyes 8–9 in diameter. Metapodosomal and opisthosomal shields partially separated. Setae *c*₁, *d*₁, *d*₂ on the metapodosomal shield, opisthosomal shield bearing setae *e*₁, *e*₂, *f*₁. Suranal shield with two pairs of setae (*h*₁, *h*₂). All dorsal setae spinose. Lengths and distances of dorsal setae as follows: *vi* 14–18, *ve* 19–22, *sci* 12–13, *sce* 14–17, *c*₁ 12–17, *c*₂ 28–32, *d*₁ 13–16, *d*₂ 12–16, *e*₁ 14–18, *e*₂ 14–18, *f*₁ 25–27, *h*₁ 21–27, *h*₂ 21–23, *vi-vi* 31–37, *ve-ve* 63–71, *vi-ve* 38–40, *sci-sci* 112–118, *ve-sci* 20–22, *sce-sce* 151–172, *sci-sce* 35–38, *c*₁-*c*₁ 55–63, *d*₂-*d*₂ 166–174, *c*₁-*d*₁ 57–60, *c*₁-*d*₂ 57–59, *d*₁-*d*₁ 61–64, *d*₂-*d*₁ 55–62, *e*₂-*e*₂ 123–131, *d*₂-*e*₂ 64–72, *d*₁-*e*₁ 46–52, *d*₁-*e*₂ 41–49, *e*₁-*e*₁ 49–53, *e*₂-*e*₁ 36–40, *f*₁-*f*₁ 52–56, *e*₁-*f*₁ 37–39, *e*₂-*f*₁ 64–69, *h*₁-*h*₁ 25–27, *h*₂-*h*₂ 55–58, *h*₁-*h*₂ 14–15.

Venter (Fig. 4). Humeral shields smooth and situated ventro-laterally. Setae *c*₂ on the humeral shields and slimmer than all dorsal setae. Coxisternal shields divided and bearing three pairs of

intercoxal setae (*1a*, *3a* and *4a*). Lengths and distance of these setae: *1a* 8–9, *3a* 9–10, *4a* 9–10, *1a-1a* 22–24, *3a-3a* 31–36, *4a-4a* 23–26. Three pairs of aggenital setae (*ag*_{1–3}) present on the aggenital shield. Anal shields bearing three pairs of pseudanal setae (*ps*_{1–3}). Lengths of aggenital and pseudanal setae: *ag*₁ 7–8, *ag*₂ 8–9, *ag*₃ 9–10, *ps*₁ 15–16, *ps*₂ 11–13, *ps*₃ 10–11.



Figures 1–2. *Ledermuelleriopsis aminiae* – 1. Dorsal view of female; 2. Dorsal view of male.

Gnathosoma. 59–65, chelicerae 78–80, palp 99–103 long. Subcapitulum with two pairs of adoral setae (*or*_{1,2}) and two pairs of subcapitular setae (*m*, *n*). Lengths and distance between subcapitular setae, *m* 8–12, *n* 9–10, *m-m* 14–15, *n-n* 20–23, *m-n* 7–9.

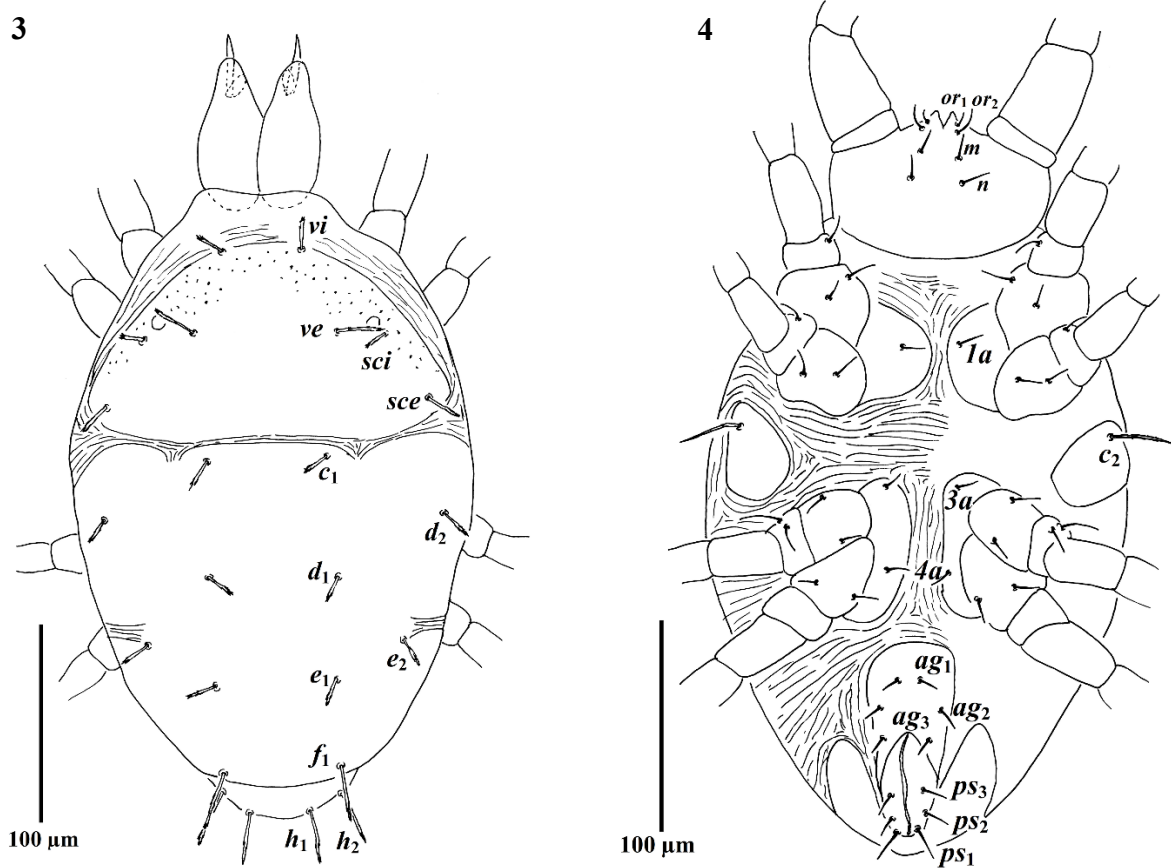
Legs. Leg I 144–161, leg II 120–130, leg III 117–125, leg IV 131–137 long. Counts of setae on legs I–IV: coxae 2–2–2–2, trochanters 1–1–2–0, femora 6–4–3–2, genua 3(+1 κ)–3(+1 κ)–0–0, tibiae 5(+1 ϕ +1 ϕ)–5(+1 ϕ)–5(+1 ϕ)–5(+1 ϕ), tarsi 13(+1 ω)–8(+1 ω)–7(+1 ω)–7.

Protonymph (Figs. 5, 6) – Length of body 217–238, width 170–174.

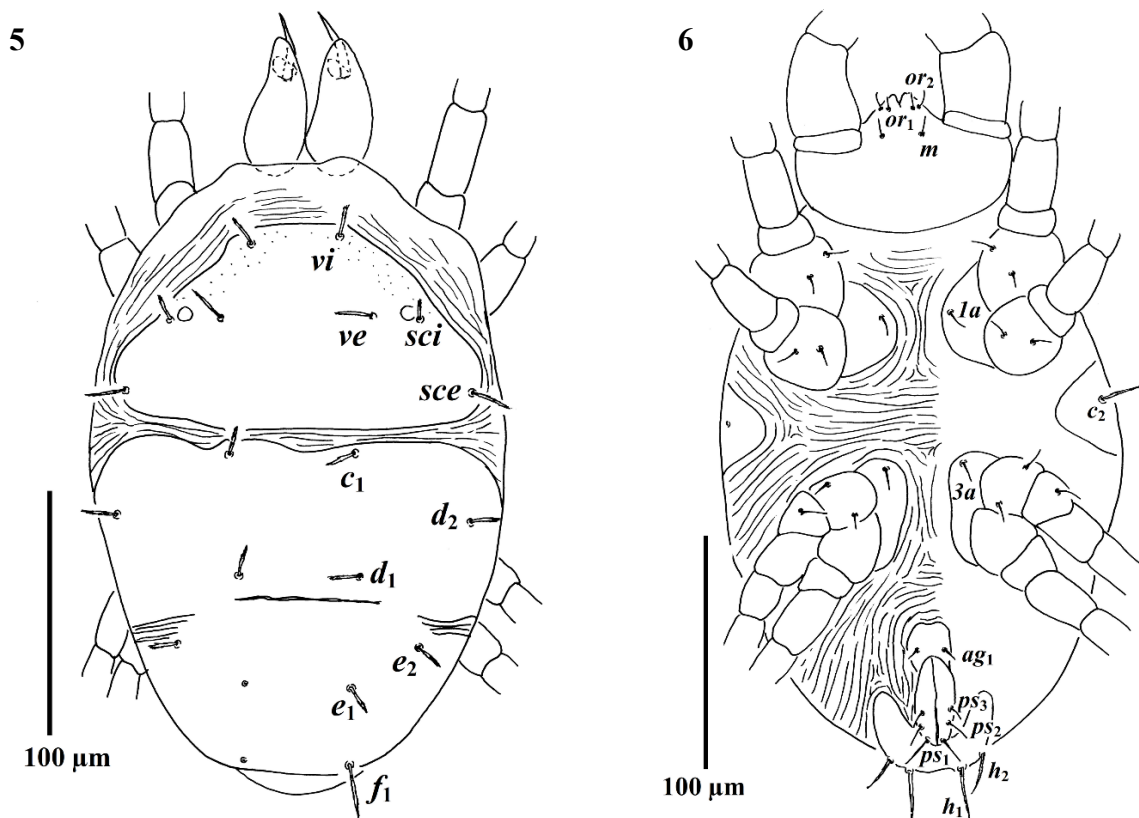
Dorsum (Fig. 5). Dorsum as in deutonymph. Eyes 7–7 in diameter. Lengths and distances of dorsal setae as follows: *vi* 11–12, *ve* 16–18, *sci* 9–11, *sce* 12–14, *c*₁ 10–12, *c*₂ 20–23, *d*₁ 12–14, *d*₂ 12–13, *e*₁ 13–14, *e*₂ 11–12, *fi* 20–22, *h*₁ 20–21, *h*₂ 18, *vi-vi* 30–32, *ve-ve* 58–61, *vi-ve* 32–32, *sci-sci* 96–98, *ve-sci* 15, *sce-sce* 131–137, *sci-sce* 33–46, *c*_{1-c}₁ 47–49, *d*_{2-d}₂ 132–139, *c*_{1-d}₁ 45–47, *c*_{1-d}₂ 49–50, *d*_{1-d}₁ 45–48, *d*_{2-d}₁ 43–51, *e*_{2-e}₂ 88–91, *d*_{2-e}₂ 43–56, *d*_{1-e}₁ 28–43, *d*_{1-e}₂ 28–32, *e*_{1-e}₁ 40, *e*_{2-e}₁ 24–27, *fi-fi* 36–38, *e*_{1-fi} 28–29, *e*_{2-fi} 48–50, *h*_{1-h}₁ 20, *h*_{2-h}₂ 38–42, *h*_{1-h}₂ 7–10.

Venter (Fig. 6). Venter as in deutonymph, except setae *4a* absent and aggenital shield with a pair of setae (*ag*₁). Lengths and distance of ventral setae: *1a* 8–9, *3a* 8–9, *1a-1a* 26–27, *3a-3a* 31–32, *ag*₁ 7–8, *ps*₁ 11–13, *ps*₂ 7–8, *ps*₃ 7–8.

Gnathosoma. 54–56, chelicerae 67–70, palp 88–92 long. Subcapitulum with two pairs of adoral setae (*or*_{1,2}) and one pair of subcapitular setae (*m*); *m* 10–11, *m-m* 14.

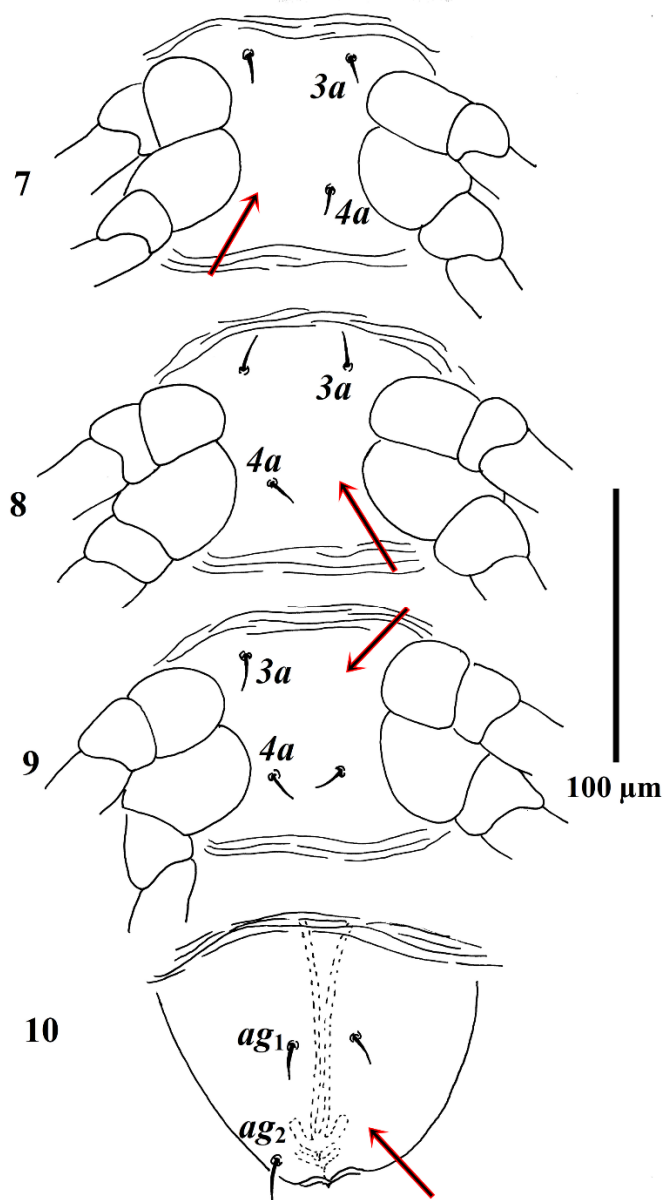


Figures 3–4. *Ledermuelleriopsis aminiae* (Deutonymph) – 3. Dorsal view; 4. Ventral view.



Figures 5–6. *Ledermuelleriopsis aminiae* (Protonymph) – 5. Dorsal view; 6. Ventral view.

Legs. Leg I 122–127, leg II 109–112, leg III 103–107, leg IV 112–118 long. Counts of setae on legs I–IV: coxae 2–2–2–2, trochanters 0–0–1–0, femora 4–4–3–1, genua 3(+1 κ)–2(+1 κ)–0–0, tibiae 5(+1 ϕ +1 ϕ)–5(+1 ϕ)–5(+1 ϕ)–5(+1 ϕ), tarsi 13(+1 ω)–8(+1 ω)–7(+1 ω)–7.



Figures 7–10. *Ledermuelleriopsis aminiae* – Asymmetric variations in the number of intercoxal and aggenital setae, 7–9. Female, 10. Male.

Material examined

One female from soil and litter under *Astragalus* sp., 39° 24' 30.4" N, 39° 51' 56.4" E, 1712 m a.s.l., 13 October 2018; one female from moss and litter under *Juniperus* sp., 39° 11' 30.3" N, 39° 44' 09.8" E, 1125 m a.s.l., 13 October 2018; four females from moss on soil, 39° 11' 30.3" N, 39° 44' 09.8" E, 1125 m a.s.l., 13 October 2018; two females from litter under *Juniperus* sp., 39° 11' 00.1" N, 39° 46' 30.4" E, 1450 m a.s.l., 13 October 2018; three females from soil and litter under *Juniperus* sp., 39° 09' 28.3" N, 39° 40' 20.5" E, 1060 m a.s.l., 13 October 2018; two females from moss on rock, 39° 35' 01.9" N, 39° 53' 00.7" E, 1314 m a.s.l., 27 October 2018; one female from soil under pinecone, 39° 31' 24.1" N, 39° 50' 57.5" E, , 1928 m a.s.l., 27 October 2018; two females and one deutonymph

from litter and soil under *Juniperus* sp., 39° 11' 29.4" N, 39° 42' 50.5" E, 1016 m a.s.l., 27 October 2018; seven females from soil under rock, 39° 15' 33.6" N, 39° 46' 00.3" E, 1076 m a.s.l., 10 November 2018; seven females from soil and litter oak area, 39° 15' 33.6" N, 39° 46' 00.3" E, 1076 m a.s.l., 10 November 2018; two females from soil under rock, 39° 14' 52.3" N, 39° 45' 46.8" E, 1058 m a.s.l., 10 November 2018; five females and one male from soil and litter *Juniperus* sp., 39° 08' 27.3" N, 39° 37' 29.5" E, 1020 m a.s.l., 10 November 2018; three females and one deutonymph from soil and litter *Juniperus* sp., 39° 11' 28.1" N, 39° 43' 52.5" E, 1034 m a.s.l., 24 November 2018; three females from moss and grassy soil, 39° 11' 26.5" N, 39° 42' 19.0" E, 988 m a.s.l., 24 November 2018; one female from moss and grassy soil, 39° 08' 26.9" N, 39° 38' 22.0" E, 940 m a.s.l., 08 December 2018; one female from moss and grassy soil, 39° 08' 03.8" N, 39° 29' 46.1" E, 994 m a.s.l., 10 February 2019; two females from soil under, 39° 30' 09.1" N, 39° 52' 11.5" E, 1681 m a.s.l., 13 April 2019; three females from soil under *Quercus* sp., 39° 17' 19.7" N, 39° 46' 36.6" E, 1167 m a.s.l., 27 May 2019; two females from soil and litter under *Juniperus* sp., 39° 11' 37.2" N, 39° 43' 46.8" E, 1031 m a.s.l., 27 May 2019; three females from grassy soil and litter under *Juniperus* sp., 39° 10' 38.9" N, 39° 40' 57.4" E, 982 m a.s.l., 27 May 2019; seven females from grassy soil and litter oak area, 39° 05' 54.6" N, 39° 37' 41.0" E, 1012 m a.s.l., 27 May 2019; six females from soil molehill, 39° 05' 54.6" N, 39° 37' 41.0" E, 1012 m a.s.l., 27 May 2019; three females, five deutonymphs and two protonymphs from soil and litter under *Juniperus* sp., 39° 11' 30.9" N, 39° 44' 08.9" E, 1112 m a.s.l., 18 August 2019; one female from soil and litter under *Juniperus* sp., 39° 11' 29.4" N, 39° 42' 50.5" E, 1016 m a.s.l., 14 September 2019; PÜLÜMÜR VALLEY, TUNCELI, TURKEY.

Distribution

Iran (Nazari and Khanjani 2017; Fan *et al.* 2019).

Remarks

Seventy-two females, one male, seven deutonymphs and two protonymphs of *Ledermuelleriopsis aminiae* were found in Pülümür Valley, Turkey. This paper reports the presence of the species *L. aminiae* in Turkey, with the first descriptions of the protonymph and deutonymph stages based on specimens collected from the valley. The Pülümür specimens are very similar to those of Iran. In the two female specimens, metapodosomal and opisthosomal shields appear to be completely separated, but these are understood to be folds from preparation.

During the observation, asymmetric variations in the number of intercoxal setae (3a, 4a) and aggenital setae (ag2) of adult specimens were detected. Right seta 4a is absent in one female (Fig. 7), left seta 4a is absent in three females (Fig. 8), left seta 3a is absent in one female (Fig. 9) and seta ag2 on left side of aggenital shield is absent in the male specimen (Fig. 10).

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ظهور جدید *Ledermuelleriopsis aminiae* (Acariformes: Stigmaeidae) در ترکیه و توصیف مراحل پورگی آن

صالح دوغان^{۱*} و سیبل دوغان^۲

۱. دانشگاه بینالی ایلدیریم ارزینکان، دانشکده هنر و علوم، ارزینکان، ترکیه؛ رایانامه: salihdogan@erzincan.edu.tr

۲. دانشگاه بینالی ایلدیریم ارزینکان، دانشکده حرفه‌ای خدمات بهداشتی، ارزینکان، ترکیه؛ رایانامه: sibel.dogan@erzincan.edu.tr

* نویسنده مسئول

چکیده

هفتاد و دو ماده، یک نر، هفت پوره سن دوم و دو پوره سن یکم *Ledermuelleriopsis aminiae* Nazari & Khanjani, 2017 از دره پولومور، ترکیه جمع‌آوری شدند. توصیف‌ها و شکل‌های مراحل پورگی نمونه‌های جمع‌آوری شده این گونه ارایه و نمونه‌های کامل مختصری توصیف شدند. این نخستین گزارش *L. aminiae* از ترکیه و نخستین توصیف مراحل پورگی گونه است. افزون بر این، ناهنجاری در شمار موهای بین‌پیش‌رانی و جنسی در نمونه‌های ماده و نر *L. aminiae* آورده شده است.

واژگان کلیدی: ناهنجاری؛ *Ledermuelleriopsis*؛ کنه؛ پوره؛ دره پولومور؛ گزارش.

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