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Four new species (Trombidiformes: Eriophyoidea: Eriophyidae) and one new record of *Aceria* from arid and semi-arid areas in East Iran

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Abstract

During the field study of eriophyoid mites from autochthonous plants in semi-arid and arid environment in East Iran (Birjand, South Khorasan, from 2016 to 2017), four new *Aceria* species (Trombidiformes: Eriophyoidea: Eriophyidae) were collected. They are *Aceria halothamni* **sp. nov.** on *Halothamnus auriculus* (Moq.) Botsch. (Amaranthaceae), *Aceria acanthophylli* **sp. nov.** on *Acanthophyllum sordidum* Bunge ex Boiss. (Caryophyllaceae), *Aceria samoli* **sp. nov.** on *Samolus valerandi* L. (Primulaceae), *Aceria aeluropi* **sp. nov.** on *Aeluropus littoralis* (Gouan) Parl. (Poaceae). In addition, *Aceria atriplicis* Wilson & Oldfield, 1966 was also found on *Atriplex leucoclada* Boiss. (Amaranthaceae), which is a new record for Iran. All these species are illustrated and described herein. They appear to be vagrants and no symptom was observed on their infested plants.

Key words: South Khorasan, autochthonous plants, Amaranthaceae, Caryophyllaceae, Primulaceae, Poaceae, survey, vagrants

Introduction

A lot of Iranian autochthonous plants are well adapted in saline and dry conditions of arid and semi-arid environments, as well as near the seasonal rivers or lakes in mountains of semi-desert environments. *Halothamnus auriculus* (Moq.) Botsch. (synonym: *Salsola auricula* Moq.) and *Atriplex leucoclada* Boiss. belong to the Amaranthaceae family (formerly they were assigned to the Chenopodiaceae). *Holothamnus auriculus* can be found in Iran, Afghanistan, Turkmenistan, Pakistan, Tajikistan, Kirghizstan and Uzbekistan; *Halothamnus* species are commonly known as saltbush, which refers to their ability to accumulate salts and grow in salty habitats. *Halothamnus auriculus* can be cultivated as fodder for animals exploiting salty habitats (Musaddiq *et al*. 2015; The Plant List 2013). *Atriplex leucoclada* Boiss. is a shrub well adapted to saline-alkaline soils or arid and semi-arid environments (Amouei 2013). *Aeluropus littoralis* (Gouan) Parl., commonly known as Indian walnut, belongs to Poaceae; it is perennial and usually grows in sandy desert of Iran. Because of its rapid growth rate, high biomass production and ability to live in saline habitats, it is used for forage in saline rangeland and fixing sandy areas (Rad *et al*. 2013; Rezvani & Zaefarian 2011). *Acanthophyllum sordidum* Bunge ex Boiss. belongs to Caryophyllaceae; this perennial shrubby plant with woody rootstock can grow in dry habitats and has also been used as medicinal plant in Iran (Meratan *et al*. 2009). The genus *Acanthophyllum* C.A.Mey., with approximately 38

species in Iran, is a mainly Irano-Turanian genus distributed in North East Iran and in neighboring areas of Afghanistan and Turkmenistan. Many species of this genus, like *A. sordidum*, are potential sources of pharmaceutical compounds (Pirani *et al*. 2014; Meratan *et al*. 2009). *Samolus valerandi* L., a perennial herbaceous, belonging to Primulaceae, has a worldwide distribution and has pharmaceutical properties making it potential tonic (The plant list 2013; Sadat-Hosseini *et al*. 2017).

No eriophyoid mites have been reported from plants of the genera *Halothamnus*, *Aeluropus*, *Acanthophyllum* and *Samolus* throughout the world. Furthermore, no eriophyid mites have been reported on *Atriplex leucoclada* Boiss (Amrine and de Lillo's databases, unpublished data).

Some previous studies regarding eriophyid-fauna from arid and semi-arid environments in East Iran were done by the authors of this paper, but still many autochthonous plant species have not been investigated for their eriophyoid-fauna. In order to elevate our knowledge, a study was carried out during the summer of 2016 and 2017 searching for eriophyoids on some autochthonous host plants from arid and semi-arid environments in Birjand, South Khorasan, in East Iran.

Materials and methods

Green organs were collected from autochthonous plants in the vicinity of Birjand (South Khorasan, East Iran) during the summers 2016 and 2017. Plant samples were examined, and mites were collected directly under a dissecting stereomicroscope and from washed solutions after sample washing (Monfreda *et al*. 2007). Some specimens were preserved in 70% ethanol and the resting in Oudemans' solution (Krantz & Walter 2009). Specimens were cleared and mounted in Keifer's media protocol (Keifer 1975). Some cotton-like (kapok) fibers were added in the mounting medium between the slide and the cover slip in order to allow mite rotations around body longitudinal axis, making measurements and drawings easier and possible taken from the same mite, and avoiding artifacts and flattening of the mite body (de Lillo *et al*. 2010). The morphological terminology and setal notation followed Lindquist (1996). Identification to genus level was done through the generic key of Amrine *et al.* (2003). Phase contrast microscope Olympus BX50 was used for line drawings following de Lillo *et al*. (2010), and taking measurements following Amrine and Manson (1996) as modified by de Lillo *et al*. (2010). The holotypes' measurements are followed by the range values of the paratypes in parentheses. Measurements are given in micrometers (μm), rounded off to the nearest integer, and regard the length of the morphological traits unless otherwise specified. Abbreviations used in the drawings follow Amrine *et al.* (2003). The host plants were identified by Mohammad Reza Joharchi, botanist at the Plant Science Research Institute, Ferdowsi University of Mashhad, Iran. Three paratypes of each new species are deposited at the Entomological and Zoological Section, Department of Soil, Plant and Food Sciences (DiSSPA), University of Bari Aldo Moro, Italy (UNIBA), formerly indicated as UBI by Zhang (2018). The remaining paratype and the holotype specimens are deposited in the collection of the Acarology Laboratory, Department of Plant Protection, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran (FUM).

Results

Aceria halothamni sp. nov. (Fig. 1)

Description

FEMALE (n = 10). Body vermiform, 180 (180–200, including gnathosoma), 44 (40–45) wide, 35 (35–41) thick. **Gnathosoma** 19 (18–20) projecting downward, pedipalp coxal setae *ep* 2 (no

range), dorsal pedipalp genual setae *d* 6 (5–6), unbranched, palp tarsus setae *v* 1 (no range), cheliceral stylets 17 (15–17). **Prodorsal shield** 24 (23–24), including frontal lobe, 22 (20–22) wide; with subtriangular and acuminate frontal lobe 3 (2–3) over gnathosomal base. Median line present on about posterior half of the shield. Admedian lines complete, sinuate, posteriorly convergent and not reaching to rear of margin. Submedian lines complete, sinuate, posteriorly divergent. A few microtubercles located posteriorly to admedian and submedian regions. Tubercles of scapular setae *sc* on rear shield margin, 16 (15–17) apart, scapular setae *sc* 31 (29–31), backwards. **Leg I** 25 (25–26), femur 7 (7–8), genu 3 (3–4), tibia 4 (4–5), tarsus 5 (4–5), solenidion *ω* 6 (no range), curved down, distally simple, empodium 4 (4–5), simple, 5-rayed; femoral setae *bv* 8 (8–9), genual setae *l″* 18 (16–19), tibial setae *l′* 5 (no range), tarsal setae *ft′* 9 (7–9), setae *ft″* 20 (17–21). **Leg II** 23 (22–23), femur 7 (no range), genu 4 (no range), tibia 4 (no range), tarsus 5 (5–6), solenidion *ω* 6 (no range), curved down, distally simple, empodium 4 (no range), simple, 5-rayed; femoral setae *bv* 7 (7–8), genual setae *l″* 9 (7–9), tarsal setae *ft′* 6 (5–6), setae *ft″* 20 (20–22). **Coxae I** and coxae II ornamented with some microtubercles and dashes; setae *1b* 12 (10–13), tubercles *1b* 7 (6–7) apart, setae *1a* 25 (24–26), tubercles *1a* 5 (5–6) apart, setae *2a* 40 (37–42), tubercles *2a* 15 (14–16) apart, prosternal apodeme 5 (4–5). **Opisthosoma** dorsally arched with 73 (69–73) dorsal semiannuli, with elliptical microtubercles, and 63 (62–65) ventral semiannuli, with elliptical microtubercles; 6 (5–6) semiannuli with fine microtubercles between coxae and genital coverflap; last 4 (4–5) annuli with elongated microtubercles. Setae *c2* 28 (26–30), on ventral semiannulus 10 (10–11); setae *d* 60 (59–66), on ventral semiannulus 21 (21–24); setae *e* 20 (19–26), on ventral semiannulus 38 (37–40); setae *f* 27 (24–27), on ventral semiannulus 59 (58–60), 4 (4–5) annuli after setae *f*. Setae *h2* 73 (67–78), setae *h1* 6 (5–7). **Genital coverflap** 9 (9–10), 19 (19–21) wide, coverflap with 10 (no range) longitudinal striae, setae *3a* 16 (15–17), 9 (9–10) apart; with two transversal rows of granulated lines at the genital coverflap base. **Internal female genitalia** with anterior, trapezoidal transversal apodeme, longitudinal bridge and oblique apodeme present; spermathecal tubes and spermathecae not visible.

MALE (n = 1). Body vermiform, 180 (including gnathosoma), 40 wide, 41 thick. **Gnathosoma** 19 projecting downward, chelicerae 17, palp coxal setae *ep* 2, palp genual setae *d* 6, unbranched, palp tarsus setae *v* not detectable, cheliceral stylets 16. **Prodorsal shield** 23, including frontal lobe, 22 wide, frontal lobe 2. Shield pattern similar to that of female. Tubercles of scapular setae *sc* on rear shield margin, 17 apart, setae *sc* 25. **Leg I** 26, femur 6, genu 4, tibia 5, tarsus 6, solenidion *ω* 6, curved down, distally simple, empodium 4, simple, 5-rayed; femoral setae *bv* 9, genual setae *l″* 19, tibial setae *l′* 5, tarsal setae *ft′* 8, setae *ft″* 18. **Leg II** 23, femur 7, genu 4, tibia 4, tarsus 5, solenidion *ω* 6, curved down, distally simple, empodium 4, simple, 5-rayed; femoral setae *bv* 7, genual setae *l″* 8, tarsal setae *ft′* 6, setae *ft″* 23. **Coxae** similar to those of female; setae *1b* 7, tubercles *1b* 7 apart, setae *1a* 20, tubercles *1a* 4 apart, setae *2a* 37, tubercles *2a* 15 apart. Prosternal apodeme 5. **Opisthosoma** dorsally arched with 67 semiannuli; 61 ventral semiannuli; 5 semiannuli between coxae and genital region. Setae *c2* 25 on ventral semiannulus 10, setae *d* 58 on ventral semiannulus 21; setae *e* 13 on ventral semiannulus 36; setae *f* 25 on ventral semiannulus 56, 4 annuli after setae *f*. Setae *h2* 68; setae *h1* 6; setae *3a* 18, 12 apart.

Type host plant

Halothamnus auriculus (Moq.) Botsch. (Amaranthaceae)

Relation to the host plant.

Vagrant on stems and leaves. No symptom was observed on the infested plants.

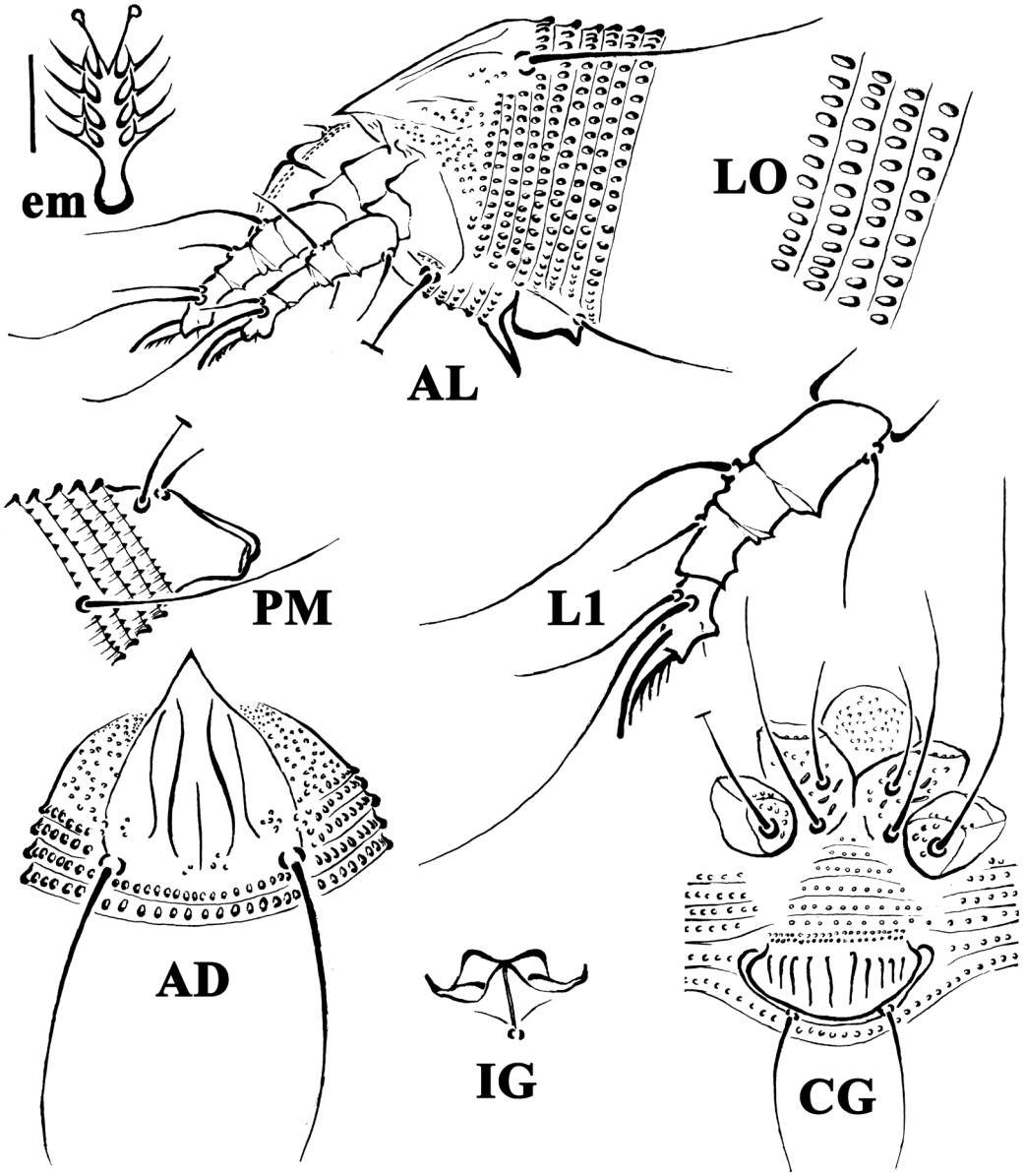

FIGURE 1. Line drawings of *Aceria halothamni* **sp. nov.**: **AD**. Prodorsal shield; **AL**. Lateral view of anterior body region; **CG**. Female coxigenital region; **em**. Empodium; **IG**. Internal female genitalia; **LO**. Lateral view of annuli; **L1**. Leg I; **PM**. Lateral view of posterior opisthosoma. Scale bar: 10 μm for **AD**, **AL**, **CG**, **IG**, **PM**; 5 μm for **LO**, **L1**; 2.5 μm for **em**.

Type locality

Shoorestan village, Birjand, Iran, 32°32'20.785"N, 59°39'3.208"E, 1899 m above sea level; 1 August 2016, coll. Arash Honarmand.

Type material

Holotype: single female on a microscope slide (slide code: AH95-10-1); paratypes: 12 females (slide code: AH95-10-2 to AH95-10-6 and AH95-10-8 to AH95-10-14) and 1 male (slide code: AH95-10-7) mounted on separate microscope slides.

Other material

Mites preserved in 70% ethanol and in Oudemans' solution extracted from the same sample as the type specimens.

Etymology

The specific epithet comes from the genus name *Halothamnus* of the type host plant in the genitive case.

Differential diagnosis

Aceria halothamni **sp. nov.** seems to be morphologically close to *Aceria amaranthi* Abou-Awad & El-Banhawy, 1992, which was found on *Amaranthus* sp. (Amaranthaceae) in Dar El-Salam, Tanzania. There are some similarities between these two species like complete admedian lines and 5-rayed empodium but they differ by the median line, which is complete in *A. amaranthi* whereas it covers half the shield in *A. halothamni* **sp. nov.**, and also by accessory setae *h1* and frontal lobe, which are absent in *A. amaranthi* but present in *A. halothamni* **sp. nov**.. Further differences concern the length of setae *c2* (28 *A. halothamni* **sp. nov.** *versus* 11 in *A. amaranthi*), setae *e* (20 in *A. halothamni* **sp. nov.** *versus* 9 in *A. amaranthi*), setae *f* (27 in *A. halothamni* **sp. nov.** *versus* 16 in *A. amaranthi*), number of coverflap striae (10 in *A. halothamni* **sp. nov.** *versus* 12 in *A. amaranthi*) and, finally, ornamentation of the coxae that consists of few lines on coxae I of *A. amaranthi* whereas microtubercles and dashes are in *A. halothamni*.

Remarks

This is the first report of an eriophyid mite in association with a plant of the genus *Halothamnus.*

***Aceria acanthophylli* sp. nov. (Fig. 2)**

Description

FEMALE (n = 10). Body vermiform, 210 (180–230, including gnathosoma), 31 (31–39) wide, 39 (39–40) thick. **Gnathosoma** 20 (20–21) projecting downward, pedipalp coxal setae *ep* 2 (no range), dorsal pedipalp genual setae *d* 5 (5–6), unbranched, palp tarsus setae *v* 1(no range), cheliceral stylets 19 (18–19). **Prodorsal shield** 20 (20–22), including frontal lobe, 30 (30–31) wide; short rounded frontal lobe 3 (2–3) over gnathosomal base. Median line not reaching frontal lobe, complete and forming 'V' shape at its posterior end; median line a bit shorter than admedian and submedian lines. Admedian lines complete and sinuate, submedian line posteriorly divergent and arched on posterior half. Some short dashes and microtubercles on lateral sides of shield. Tubercles of scapular setae *sc* on rear shield margin, 15 (15–17) apart, scapular setae *sc* 15 (15–16), convergent backwards. **Leg I** 28 (28–29), femur 8 (8–9), genu 4 (4–5), tibia 5 (no range), tarsus 7 (6–7), solenidion *ω* 8 (8–9), curved down, distally simple, empodium 5 (4–5), simple, 5-rayed; femoral setae *bv* 10 (10–11), genual setae *l″* 20 (17–21), tibial setae *l′* 6 (5–6), tarsal setae *ft′* 10 (9–10), setae *ft″* 20 (20–23). **Leg II** 25 (24–25), femur 8 (8–9), genu 5 (5–6), tibia 5 (4–5), tarsus 7 (6–7), solenidion *ω* 8 (8–9), curved down, distally simple, empodium 5 (no range), simple, 5-rayed; femoral setae *bv* 10 (10–11), genual setae *l″* 10 (10–12), tarsal setae *ft′* 4 (4–5), setae *ft″* 22 (20–23). **Coxae I** and coxae II ornamented with sparse granules; setae *1b* 7 (7–9), tubercles *1b* 8 (8–9) apart, setae *1a* 24 (23–25), tubercles *1a* 6 (5–6) apart, setae *2a* 37 (37–40), tubercles *2a* 18 (17–18) apart, prosternal apodeme 4 (3–4). **Opisthosoma** dorsally arched with 70 (68–73) dorsal semiannuli, with rounded microtubercles, and 69 (65–71) ventral semiannuli, with rounded microtubercles; 5 (4–5) semiannuli with fine microtubercles between coxae and genital coverflap; last 6 (5–6) annuli with elongated

microtubercles. Setae *c2* 35 (33–40), on ventral semiannulus 9 (9–11); setae *d* 55 (40–50), on ventral semiannulus 23 (21–24); setae *e* 40 (38–45), on ventral semiannulus 40 (39–42); setae *f* 21 (20–25), on ventral semiannulus 64 (64–66), 6 (5–6) annuli after setae *f*. Setae *h2* 90 (85–91), setae *h1* 5 (5–6). **Genital coverflap** 10 (10–11), 18 (18–19) wide, coverflap with 11 (10–11) longitudinal striae, setae *3a* 26 (25–28), 15 (14–15) apart; with two transversal rows of strong granulated lines at the genital coverflap base. **Internal female genitalia** with anterior, trapezoidal transversal apodeme, longitudinal bridge relatively long; spermathecal tubes and spermathecae not visible.

MALE (n = 1). Body vermiform, 180 (including gnathosoma), 39 wide, 39 thick. **Gnathosoma** 20 projecting downward, chelicerae 19, palp coxal setae *ep* not detectable, palp genual setae *d* 4, unbranched, palp tarsus setae *v* not detectable. **Prodorsal shield** 25, including frontal lobe, 28 wide, frontal lobe 3. Shield pattern similar to that of female. Tubercles of scapular setae *sc* on rear shield margin, 18 apart, setae *sc* 13, divergently backwards. **Leg I** 25, femur 8, genu 4, tibia 4, tarsus 6, solenidion *ω* 8, curved down, distally simple, empodium 5, simple, 5-rayed; femoral setae *bv* 10, genual setae *l″* 20, tibial setae *l′* 5, tarsal setae *ft′* 9, setae *ft″* 20. **Leg II** 24, femur 8, genu 5, tibia 4, tarsus 6, solenidion *ω* 8, curved down, distally simple, empodium 5, simple, 5-rayed; femoral setae *bv* 10, genual setae *l″* 10, tarsal setae *ft′* 4, setae *ft″* 20. **Coxae** similar to those of female; setae *1b* 6, tubercles *1b* 8 apart, setae *1a* 12, tubercles *1a* 6 apart, setae *2a* 25, tubercles *2a* 18 apart. Prosternal apodeme 3. **Opisthosoma** dorsally arched with 69 semiannuli; 62 ventral semiannuli; 4 semiannuli between coxae and genital region. Setae *c2* 22 on ventral semiannulus 9, setae *d* 45 on ventral semiannulus 20; setae *e* 30 on ventral semiannulus 35; setae *f* 17 on ventral semiannulus 57, 5 annuli after setae *f*. Setae *h2* 90; setae *h1* 4; setae *3a* 24, 13 apart.

Type host plant

Acanthophyllum sordidum Bunge ex Boiss. (Caryophyllaceae)

Relation to the host plant.

Vagrant on leaves and flowers. No symptom was observed on the infested plants.

Type locality

Akbarabad village, Birjand, Iran, 32°43'26.231"N, 59°21'26.226"E, 2198 m above sea level; 5 August 2017, coll. Arash Honarmand.

Type material

Holotype: single female on a microscope slide (slide code: AH96-12-3); paratypes: 12 females (slide code: AH96-12-1, AH96-12-2, AH96-12-4, AH96-12-6 to AH96-12-14) and 1 male(slide code: AH96-12-5) mounted on separate microscope slides.

Other material

Mites preserved in 70% ethanol and in Oudemans' solution extracted from the same sample as the type specimens.

Etymology

The specific epithet comes from the genus name *Acanthophyllum* of the type host plant in the genitive case.

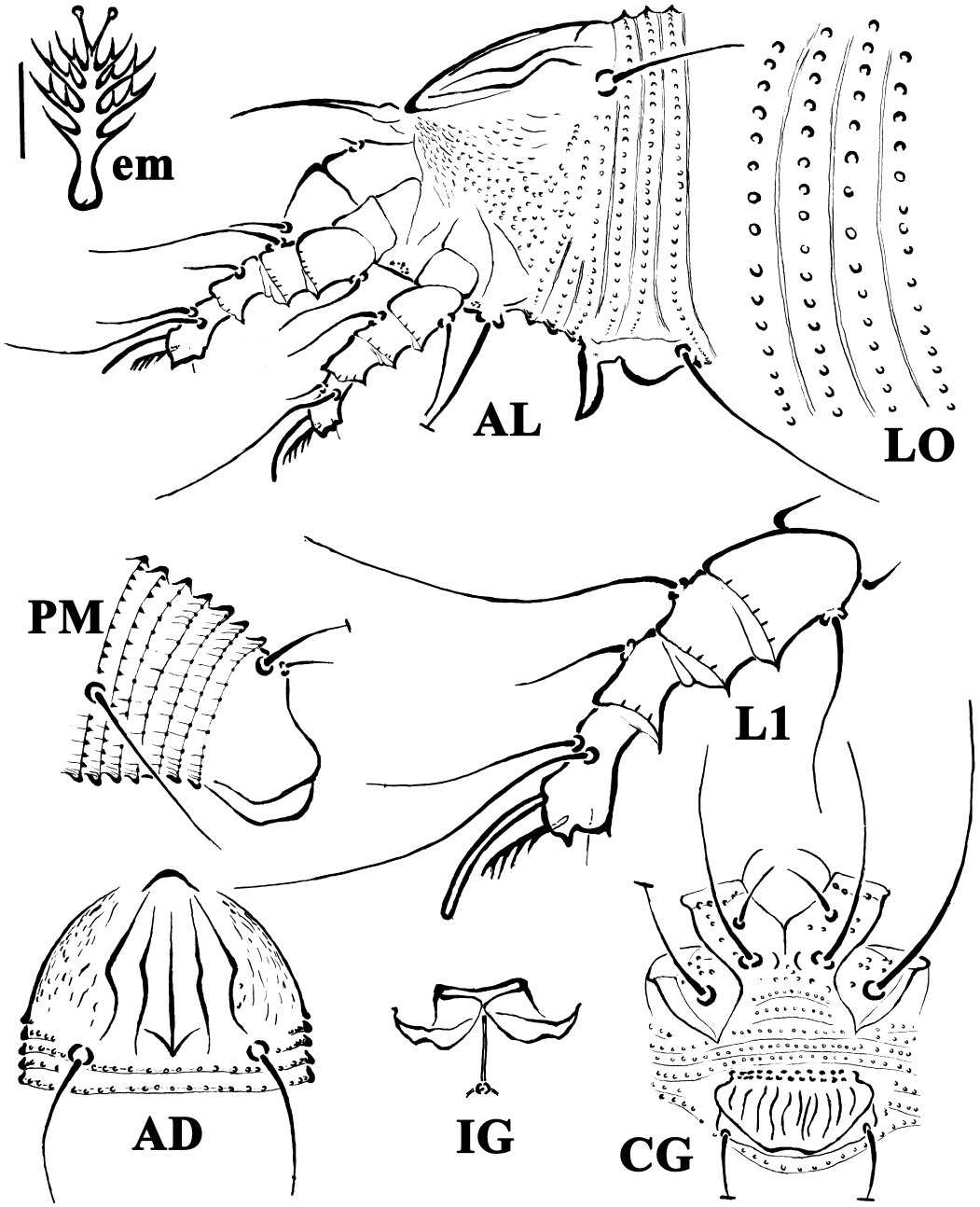

FIGURE 2. Line drawings of *Aceria acanthophylli* **sp. nov.**: **AD**. Prodorsal shield; **AL**. Lateral view of anterior body region; **CG**. Female coxigenital region; **em**. Empodium; **IG**. Internal female genitalia; **LO**. Lateral view of annuli; **L1**. Leg I; **PM**. Lateral view of posterior opisthosoma. Scale bar: 10 μm for **AD**, **AL**, **CG**, **IG**, **PM**; 5 μm for **LO**, **L1**; 2.5 μm for **em**.

Differential diagnosis

Aceria acanthophyllii **sp. nov.** appears to be morphologically close to *Aceria georghioui* Keifer, 1959, which was found on *Dianthus* sp. (Caryophyllaceae) in Nicosia, Cyprus. *Aceria acanthophylli* **sp. nov.** and *A. georghioui* have both complete median and admedian lines, V-shaped line on the posterior end of the median line, similar number of semiannuli in the coxigenital region. There are

two pairs of submedian lines for *A. georghioui* but *A. acanthophylli* **sp. nov.** is provided with one pair of them. The new species can be differentiated by the length of setae *sc* (15 in *A. acanthophylli* **sp. nov.** *versus* 20 in *A.georghioui*), number of empodium rays (5 in *A. acanthophylli* **sp. nov.** *versus* 7 in *A. georghioui*), setae *3a* length (26 in *A. acanthophylli* **sp. nov.** *versus* 13 in *A. georghioui*), number of coverflap striae (11 in *A. acanthophylli* **sp. nov.** *versus* 14 in *A. georghioui*), setae *e* length (40 in *A. acanthophylli* **sp. nov.** *versus* 12 in *A.georghioui*) and coxal ornamentation (sparse granules in *A. acanthophylli* **sp. nov.** *versus* many granules in *A. georghioui*).

Remarks

This is the first report of an eriophyid mite in association with a plant of the genus *Acanthophyllum.*

***Aceria samoli* sp. nov. (Fig. 3)**

Description

FEMALE (n = 10). Body vermiform, 200 (200–230, including gnathosoma), 51 (48–51) wide, 50 (49–51) thick. **Gnathosoma** 20 (20–21) projecting downward, pedipalp coxal setae *ep* 3 (2–3), dorsal pedipalp genual setae *d* 7 (7–8), unbranched, palp tarsus setae *v* not detectable, cheliceral stylets 19 (18–20). **Prodorsal shield** 32 (31–33), including frontal lobe, 33 (33–35) wide; subtriangular and acuminate frontal lobe 5 (4–5) over gnathosomal base. Median line present on about posterior 4/5 of shield. Admedian lines complete, divergently, forming arches on about posterior third and reaching rear margin. Inner submedian lines arched like admedian lines, but shorter. Outer submedian lines divergent, complete and broken in the middle. A few granules at posterior part of shield, between admedian and inner submedian lines; a few short dashes on lateral sides of shield. Tubercles of scapular setae *sc* on rear shield margin, 23 (20–23) apart, scapular setae *sc* 40 (40–41), backwards. **Leg I** 29 (29–30), femur 9 (9–10), genu 5 (no range), tibia 6 (6–7), tarsus 7 (6–7), solenidion *ω* 9 (no range), curved down, distally simple, empodium 7 (6–7), simple, 7-rayed; femoral setae *bv* 12 (11–13), genual setae *l″* 29 (29–31), tibial setae *l′* 10 (9–10), tarsal setae *ft′* 11 (10–12), setae *ft″* 24 (21–25). **Leg II** 27 (27–28), femur 10 (no rang), genu 5 (no range), tibia 5 (no range), tarsus 6 (5–6), solenidion *ω* 9 (9–10), curved down, distally simple, empodium 6 (no range), simple, 7-rayed; femoral setae *bv* 12 (10–12), genual setae *l″* 11 (11–15), tarsal setae *ft′* 9 (9–10), setae *ft″* 28 (27–30). **Coxae I** ornamented with some short dashes and coxae II with some microtubercles and few short dashes; setae *1b* 10 (10–11), tubercles *1b* 9 (9–10) apart, setae *1a* 20 (19–21), tubercles *1a* 6 (5–6) apart, setae *2a* 40 (38–41), tubercles *2a* 19 (19–20) apart, prosternal apodeme 6 (6–7). **Opisthosoma** dorsally arched with 66 (65–68) dorsal semiannuli, with elliptical microtubercles, and 65 (64–67) ventral semiannuli, with elliptical microtubercles on rear margin; 5 (no range) semiannuli with fine microtubercles between coxae and genital coverflap; last 7 (6–7) annuli with elongated microtubercles. Setae *c2* 40 (37–42), on ventral semiannulus 11 (11–12); setae *d* 60 (59–63), on ventral semiannulus 24 (23–25); setae *e* 25 (25–30), on ventral semiannulus 40 (37–40); setae *f* 30 (24–30), on ventral semiannulus 59 (58–61), 7 (6–7) annuli after setae *f*. Setae *h2* 60 (59–70), setae *h1* 5 (5–6). **Genital coverflap** 11 (11–12), 22 (21–22) wide, coverflap with 11 (11–12) longitudinal striae, setae *3a* 30 (30–34), 16 (15–16) apart; with two transversal rows of strong granulated lines at the genital coverflap base. **Internal female genitalia** with anterior, trapezoidal transversal apodeme, longitudinal bridge relatively long; oblique apodeme present; spermathecal tubes short, directed latero-posterad; spermathecae oval-shaped.

MALE. not found.

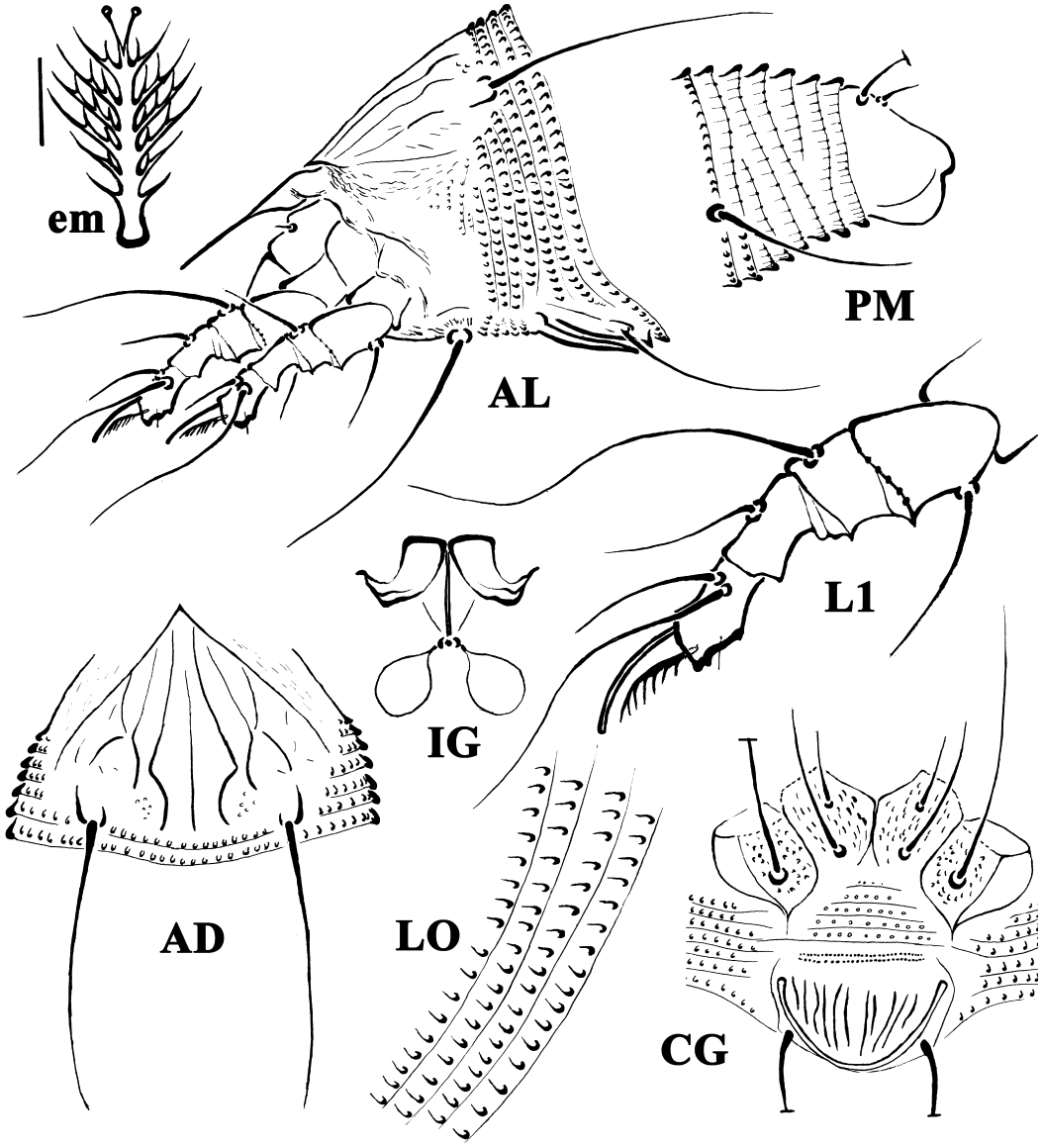

FIGURE 3. Line drawings of *Aceria samoli* **sp. nov.**: **AD**. Prodorsal shield; **AL**. Lateral view of anterior body region; **CG**. Female coxigenital region; **em**. Empodium; **IG**. Internal female genitalia; **LO**. Lateral view of annuli; **L1**. Leg I; **PM**. Lateral view of posterior opisthosoma. Scale bar: 12 μm for **AD**, **AL**, **CG**, **IG**, **PM**; 6 μm for **LO**, **L1**; 3 μm for **em**.

Type host plant

Samolus valerandi L. (Primulaceae), seaside brookweed.

Relation to the host plant

Vagrant on stems, leaves and flowers. No symptom was observed on the infested plants.

Type locality

Tajnood village, Birjand, Iran, 33°40'36.934"N, 60°1'52.885"E, 788 m above sea level; 21 July 2017, coll. Arash Honarmand

Type material

Holotype: single female on a microscope slide (slide code AH96-20-2); paratypes: 13 females mounted on separate microscope slides (slide codes: AH96-20-1, AH96-20-3 to AH96-20-14.

Other material

Mites preserved in 70% ethanol and in Oudemans' solution extracted from the same sample as the type specimens.

Etymology

The specific epithet comes from the genus name *Samolus* of the type host plant in the genitive case.

Differential diagnosis

Aceria samoli **sp. nov.** appears to be close to *Aceria magnoliae* (Keifer, 1939), which was originally found on *Magnolia fraseri* Walt. (Magnoliaceae) in California (USA). Prodorsal shield pattern is largely similar between the two species. They differ in a slightly longer median line and an outer submedian line broken in its middle in *A. samoli* **sp. nov.**, and a V-shaped mark at the rear end of the median line for *A. magnoliae*. In addition, the new species can be differentiated by scapular setae *sc* length (40 in *A. samoli* **sp. nov.** *versus* 16 in *A. magnoliae*), number of empodium rays (7 in *A. samoli* **sp. nov.** *versus* 6 in *A. magnoliae*), coxal ornamentation (smooth in *A. magnoliae versus* dashes and granules in *A. samoli* **sp. nov.**), setae *c2* length (40 in *A. samoli* **sp. nov.** *versus* 20 in *A. magnoliae*) and setae *3a* length (30 in *A. samoli* **sp. nov.** *versus* 13 in *A. magnoliae*).

Remarks

This is the first report of an eriophyid mite in association with a plant of the genus *Samolus.*

***Aceria aeluropi* sp. nov. (Fig. 4)**

Description

FEMALE (n = 10). Body vermiform 200 (190–225, including gnathosoma), 45 (45–50) wide, 41 (40–42) thick. **Gnathosoma** 20 (19–20) projecting downward, pedipalp coxal setae *ep* not detectable, dorsal pedipalp genual setae *d* 6 (5–6), unbranched, palp tarsus setae *v* not detectable, cheliceral stylets 18 (16–18). **Prodorsal shield** 33 (31–33), including frontal lobe, 28 (26–29) wide; minute frontal lobe 2 (no range) over gnathosomal base. Median and admedian lines complete, anteriorly thin, posteriorly thick; median line shorter than admedian lines. Inner submedian lines on about anterior half of shield, posteriorly divergent and arched, outer submedian lines on about half of shield and bifurcated posteriorly; short convergent lines present between submedian lines. Some dashes between admedian lines and tubercles of setae *sc*. Some granules on lateral sides of shield. Tubercles of scapular setae *sc* on rear shield margin, 18 (17–19) apart, scapular setae *sc* 38 (37–42), backwards. **Leg I** 26 (26–27), femur 9 (no range), genu 4 (4–5), tibia 4 (4–5), tarsus 6 (5–6), solenidion ω 9 (8–9), curved down, distally simple, empodium 5 (5–6), simple, 7-rayed; femoral setae *bv* 10 (8–10), genual setae *l″* 25 (25–26), tibial setae *l′* 9 (8–9), tarsal setae *ft′* 16 (16–17), setae *ft″* 24 (22–24). **Leg II** 22 (22–23), femur 8 (no range), genu 4 (4–5), tibia 4 (4–5), tarsus 6 (5–6), solenidion ω 9 (no range), curved down, distally simple, empodium 5 (5–6), simple 7-rayed; femoral setae *bv* 14 (14–15), genual setae *l″* 10 (10–11), tarsal setae *ft′* 10 (9–11), setae *ft″* 25 (25–26). **Coxae I** and coxae II with some dashes; setae *1b* 11 (10–11), tubercles *1b* 10 (10–11) apart, setae *1a* 20 (19–21), tubercles *1a* 5 (4–5) apart, setae *2a* 39 (39–41), tubercles *2a* 19 (19–21) apart, prosternal

apodeme 7 (6–7). **Opisthosoma** dorsally arched with 65 (61–68) dorsal semiannuli, with spiny microtubercles; 63 (63–67) ventral semiannuli, with rounded microtubercles; 5 (no range) semiannuli with fine microtubercles between coxae and genital coverflap; last 6 (5–6) annuli with elongated microtubercles. Setae *c2* 40 (39–46), on ventral semiannulus 10 (8–10); setae *d* 59 (53–59), on ventral semiannulus 22 (21–23); setae *e* 45 (45–48), on ventral semiannulus 38 (37–38); setae *f* 27 (25–27), on ventral semiannulus 62 (58–62), 6 (5–6) annuli after setae *f*. Setae *h2* 62 (60–72), setae *h1* 4 (4–5). **Genital coverflap** 11 (11–12), 20 (19–21) wide, coverflap with 10 (8–10) longitudinal striae, setae *3a* 38 (38–40), 14 (13–14) apart; with two transversal rows of strong granulated lines at genital coverflap base. **Internal female genitalia** with anterior, trapezoidal transversal apodeme, longitudinal bridge relatively long; oblique apodeme present; short spermathecal tubes, directed laterad; spermathecae oval-shaped, relatively small.

MALE (n = 1). Body vermiform, 200 (including gnathosoma), 50 wide, 40 thick. **Gnathosoma** 20 projecting downward, chelicerae 19, palp coxal setae *ep* not detectable, palp genual setae *d* 6, unbranched, palp tarsus setae *v* not detectable, cheliceral stylets 16. **Prodorsal shield** 33, including frontal lobe, 28 wide, frontal lobe 2. Shield pattern similar to that of female. Tubercles of scapular setae *sc* on rear shield margin, 18 apart, scapular setae *sc* 28, backwards. **Leg I** 24, femur 9, genu 4, tibia 5, tarsus 5, solenidion *ω* 8, curved down, distally simple, empodium 6, simple, 7-rayed; femoral setae *bv* 10, genual setae *l″* 21, tibial setae *l′* 8, tarsal setae *ft′* 12, setae *ft″* 20. **Leg II** 20, femur 7, genu 4, tibia 3, tarsus 5, solenidion *ω* 9, curved down, distally simple, empodium 6, simple, 7-rayed; femoral setae *bv* 13, genual setae *l″* 13, tarsal setae *ft′* 10, setae *ft″* 25. **Coxae** similar to those of female; setae *1b* 7, tubercles *1b* 11 apart, setae *1a* 15, tubercles *1a* 6 apart, setae *2a* 30, tubercles *2a* 21 apart, prosternal apodeme 6. **Opisthosoma** dorsally arched with 61 semiannuli; 62 ventral semiannuli; 5 semiannuli between coxae and genital region. Setae *c2* 31 on ventral semiannulus 8, setae *d* 40 on ventral semiannulus 18; setae *e* 26 on ventral semiannulus 34; setae *f* 25 on ventral semiannulus 57, 5 annuli after setae *f*. Setae *h2* 50; setae *h1* 4; setae *3a* 25, 15 apart.

Type host plant

Aeluropus littoralis (Gouan) Parl. (Poaceae), Indian walnut.

Relation to the host plant.

Vagrant on leaves, stems and fruits. No symptom was observed on the infested plants.

Type locality

Pokht village, Birjand, Iran, 32°34'54.566"N, 59°37'20.852" E, 1921 m above sea level; 1 August 2016, coll. Arash Honarmand.

Type material

Holotype: female on a microscope slide (slide code: AH95-13-1); paratypes: 10 females (slide codes: AH95-13-2, AH95-13-4 to AH-95-13-12), 1 male (slide code: AH95-13-3) mounted on separate microscope slides.

Other material

Mites preserved in 70% ethanol and in Oudemans' solution extracted from the same sample as the type specimens.

Etymology

The specific epithet comes from the genus name *Aeluropus* of the type host plant in the genitive case.

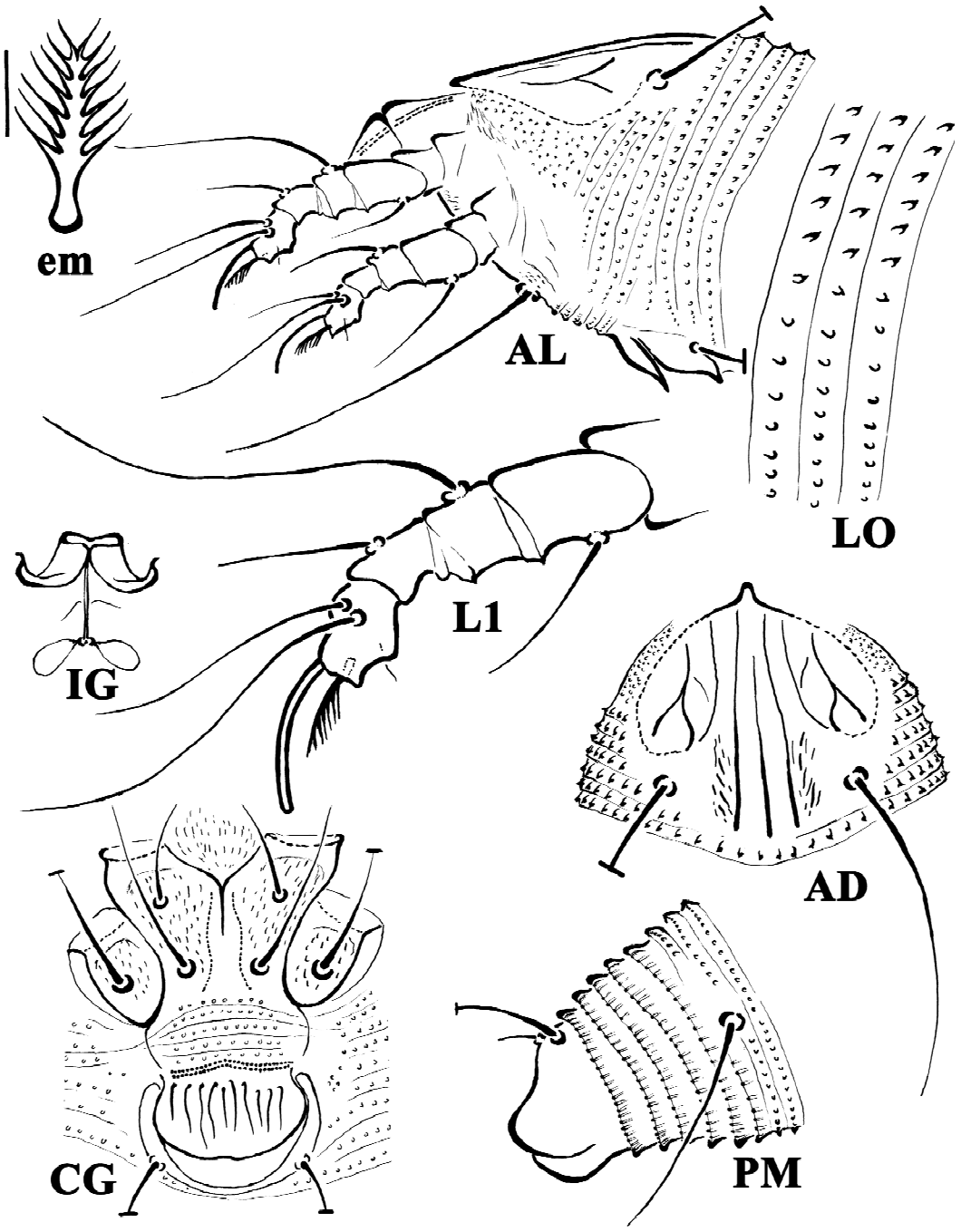

FIGURE 4. Line drawings of *Aceria aeluropi* **sp. nov.**: **AD**. Prodorsal shield; **AL**. Lateral view of anterior body region; **CG**. Female coxigenital region; **em**. Empodium; **IG**. Internal female genitalia; **LO**. Lateral view of annuli; **L1**. Leg I; **PM**. Lateral view of posterior opisthosoma. Scale bar: 10 μm for **AD**, **AL**, **CG**, **IG**, **PM**; 5 μm for **LO**, **L1**; 2.5 μm for **em**.

Differential diagnosis

Aceria aeluropi **sp. nov.** has prodorsal shield pattern and body length similar to those of *Aceria neocynodonis* Keifer,1960, which was associated with *Cynodon dactylon* (L.) Pers. (family Poaceae) in California, USA. They have other similarities such as the length of the tibial setae *l′* (9), number of dorsal semiannuli (65), and length of setae *f* (27). The admedian lines are sinuous in *A. neocynodonis* whereas they are straight in *A. aeluropi* **sp. nov.**, which is provided with less dashes on the whole prodorsal shield than *A. neocynodonis*. Dorsal microtubercles are spiny in *A.aeluropi* **sp. nov.** and rounded in *A. neocynodonis*. The new species can be differentiated also by the number of empodial rays (7 in *A. aeluropi* **sp. nov.** *versus* 6 in *A. neocynodonis*), setae *e* length (45 in *A. aeluropi* **sp. nov.** *versus* 7 in *A. neocynodonis*), setae *3a* length (38 in *A. aeluropi* **sp. nov.** *versus* 7 in *A. neocynodonis*).

Remarks

This is the first report of an eriophyid mite in association with a plant of the genus *Aeluropus.*

***Aceria atriplicis* Wilson & Oldfield, 1966**

Material studied

Mites of this species were collected from *Atriplex leucoclada* Boiss., Wild Orache, Raghl, in Ark village, Birjand, South Khorasan of Iran (33°1'11.089" N, 58°41'32.014"E, 1397 m above sea level; 14 August 2016; coll. Arash Honarmand; 10 females mounted on separate microscope slides, slide code AH95-10-1 to AH95-10-10).

Relation to the host

Vagrant on leaves and stems. No symptom was observed on the infested plant.

Geographical distribution

Aceria atriplicis Wilson & Oldfield was first described from *Atriplex polycarpa* (Torr.) S.Watson in Carrizo Creek, near Palms to Pines Hwy., Riverside, Co., California (USA), 3000 m above sea level in July 30, 1964 by George N. Oldfield (Wilson & Oldfield 1966). Iranian population and original description show no significant morphological differences, but this mite was associated with leaf bead galls on *A. polycarpa* in USA (Nearctic), whereas it appears to be vagrant on *A. leucoclada* in Iran (Palearctic).

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