



A new species of *Aculops* (Acari: Eriophyoidea: Eriophyidae) from *Euphorbia helioscopia* L. (Euphorbiaceae) in Iran

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ABSTRACT

During the survey on eriophyoid mite fauna of Lorestan province (Iran), samplings were done on *Euphorbia helioscopia* L. (Euphorbiaceae) plants in Malavi Rural District of Pol-e Dokhtar County. One new species, *Aculops helioscopiae* Delfan, Jafari & Lotfollahi **sp. nov.** was discovered, described and illustrated. This is the first record of eriophyoid mites on *E. helioscopia*. A list of eriophyoid mite species collected on plants of the family Euphorbiaceae in Iran and their type host, type locality and relation to the host plant, a gross comparison of some important traits among *Aculops* species associated to Euphorbiaceae plants of the world, and a key for their identification are provided.

KEYWORDS

Anthocoptini, checklist, description, key, Lorestan, Phyllocoptinae, Trombidiformes

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INTRODUCTION

The family Euphorbiaceae Juss. is the 5th largest angiosperm plant family with 7,500 species organized into 300 genera. *Euphorbia* L. is the largest genus in this family comprising about 2,000 known species, widely distributed throughout both hemispheres and ranging in morphology from large desert succulents to trees and even some small herbaceous plant types (The World Flora Online 2025).

The sun spurge or madwoman's milk, *Euphorbia helioscopia* L., is an annual plant, native to most of northern Africa, Europe and eastward through most of Asia. It is important as weed for winter crops and vegetables, such as wheat, lentil, chickpea, potato, and pea. However, it showed various types of biological activities such as an antitumor, antiviral, antibacterial, nematocidal, antifungal and molluscicidal effects. The presence of secondary metabolites revealed that *E. helioscopia* can be used in future for finding various biological potential compounds for prevention of various human diseases (Singh *et al.* 2018).

More than 111 eriophyoid species were found on plants of the family Euphorbiaceae where 17 of them were collected on the plants of the genus *Euphorbia*, among which four belong to the genus *Aculops*. In Iran four eriophyoid species were found on the plants of family Euphorbiaceae species and three of them are endemic to Iran (Table 1).

To expand our understanding of the eriophyoid fauna associated with Euphorbiaceae plants of Iran, a study was conducted during summer 2024 to survey eriophyoid mites in Lorestan Province.



Table 1. Eriophyoid mite species collected on plants of the family Euphorbiaceae in Iran and their type host, type locality and relation to the host plant.

Species	Type host	Type locality	Relation to the host plant
<i>Eriophyes euphorbiae</i> (Nalepa, 1891)	<i>Euphorbia cyparissias</i> L.	Not stated by the author. Samples were sent to Nalepa by Schlechtendal who worked in Germany	Leaf twisted, deformed with narrow enrolling of margin; usually several adjacent leaves, or all at shoot tip, can be affected, sometimes forming a loose tuft; flowers may be deformed, remaining closed, sometimes becoming leafy.
<i>Eriophyes urmiae</i> Lotfollahi & Mohammad-Doustaresharaf, 2023	<i>Euphorbia</i> sp.	Qaleh Sardar, Nazluchay Rural District, Urmia County, West Azerbaijan, Iran	Vagrant on leaves; no apparent damage was observed.
<i>Aceria cheiradeniae</i> Lotfollahi, Haddad Irani-Nejad, Khanjani, Moghadam & de Lillo, 2012	<i>Euphorbia cheiradenia</i> Boiss. et Hohen	Kandovan, Iran	Vagrant on leaves; no apparent damage was observed.
<i>Aculops seguieranae</i> Lotfollahi, Irani-Nejad, Khanjani, Moghadam & de Lillo, 2012	<i>Euphorbia seguierana</i> Necker	Kandovan, Iran	Vagrant on leaves; no apparent damage was observed.

MATERIAL AND METHODS

In order to investigate eriophyoid mite fauna of Lorestan Province, samplings were done on *E. belioscopia* L. plants in Malavi Rural District of Pol-e Dokhtar County. Eriophyoid mites were recovered from the plant material by means of a modified washing method developed by Lotfollahi and Masoudi-Rad (2024). The collected specimens were slide mounted according to Lotfollahi and Masoudi-Rad (2024). The terminology and the setal notation in the morphological description of the mite follow mainly Lindquist (1996). All morphological measurements were taken using an Olympus BX53 microscope, through a phase contrast 100x oil immersion objective at 1,000 magnification, according to Amrine and Manson (1996) as modified by de Lillo *et al.* (2010). Counting of dorsal, ventral and coxigenital semiannuli follows Lotfollahi and Masoudi-Rad (2024). Measurements and means are rounded off to the nearest integer when required, except for very minute characters. Measurements refer to the length of the morphological trait unless otherwise specified and are in micrometers (μm). In the female description, the holotype measurements are followed by range values of the studied population (*i.e.* holotype and paratypes) set between parentheses; only the range values are given for males and immature stages. Line drawings were hand-drawn by the last author through a *camera lucida* according to de Lillo *et al.* (2010). Plates were edited with Adobe Photoshop® CC 2017. The abbreviations labelling schematic drawings in figures follow mainly Amrine *et al.* (2003). The genera classification follows Amrine *et al.* (2003) and comparisons were also made with new genera described since that publication. Host plant names and their synonymies are in accordance with "*The World Flora Online*" (2025).

Type materials are deposited at the Acarology Laboratory, Department of Plant Protection, Faculty of Agriculture, Azerbaijan Shahid Madani University, Tabriz (Iran), except for one paratype of each species which are deposited in the Acarological Collection, Jalal Afshar Zoological Museum (JAZM), Faculty of Agriculture, University of Tehran, Karaj, Iran.

RESULTS

TAXONOMY

Family Eriophyidae Nalepa

Subfamily Phyllocoptinae Nalepa

Tribe Anthocoptini Amrine & Stasny

NEW ACULOPS FROM IRAN

Genus *Aculops* Keifer*Aculops helioscopiae* Delfan, Jafari & Lotfollahi sp. nov.

<http://zoobank.org/urn:lsid:zoobank.org:act:BE3F959B-D838-48F6-8C5D-9DD71BB7C673>

Description

FEMALE (Figs 1, 2, 3A–C; measured specimens = 5) – Body fusiform, 215 (210–234, excluding gnathosoma), 68 (64–70) wide. **Gnathosoma** projecting obliquely downwards, cheliceral stylets 25 (24–28), palp 27 (27–29), palp coxal setae *cp* 3 (3–4), dorsal palp genual setae *d* 10 (10–11), unbranched; subapical pedipalp tarsal setae *v* 2 (2–3). Suboral plate rounded anteriorly, dense dashes. **Prodorsal shield** 46 (46–48) including frontal lobe, 55 (54–55) wide, sub-triangular; with a long apically pointed frontal lobe, 10 (10–12), over gnathosomal base. Shield pattern faint, consisting of incomplete median line on shield basal $\frac{3}{4}$, complete zigzag admedian and inner submedian lines, reaching the frontal lobe and its base, one pair of complete outermost lateral lines; median and admedian lines connected each other by two pair of transverse lines, admedian and inner submedian lines connected each other by two pair of transverse lines, inner submedian and outermost lateral lines connected each other by two pairs of transverse lines, several small granules between lateral side of prodorsal shield and coxal region in lateral view. Tubercles of scapular setae *sc* on rear shield margin, 26 (25–27) apart, setae *sc* 21 (19–21), directed posterior. **Legs** with all usual segments and setae. Leg I 40 (40–44), trochanter 8 (7–8), femur 11 (11–12), genu 7 (6–8), tibia 10 (no variation), tarsus 8 (8–9), tarsal solenidion ω 10 (8–10), curved down, distally enlarged and tapered, empodium simple, 10 (8–10), 7-rayed; basiventral femoral setae *bv* 18 (15–18), antaxial genual setae *l''* 29 (26–29), paraxial tibial setae *l'* 9 (8–10), located at basal $\frac{1}{3}$ of tibia, paraxial fastigial tarsal setae *ft'* 25 (24–29), antaxial fastigial tarsal setae *ft''* 30 (29–31), paraxial unguinal tarsal setae *u'* 7 (no variation). Leg II 38 (37–39), trochanter 7 (7–8), femur 12 (11–12), genu 6 (6–7), tibia 7 (7–8), tarsus 8 (no variation), tarsal solenidion ω 10 (9–10), curved down, distally tapered, empodium simple, 10 (8–10), 7-rayed; femoral setae *bv* 19 (17–19), genual setae *l''* 14 (13–14), paraxial fastigial tarsal setae *ft'* 9 (7–9), antaxial fastigial tarsal setae *ft''* 28 (25–28), paraxial unguinal tarsal setae *u'* 7 (6–7). **Coxisternal region.** Prosternal apodeme 7 (7–8), entire, anterior setae on coxisternum I *1b* 20 (14–20), 12 (10–12) apart; proximal setae on coxisternum I *1a* 37 (29–37), 9 (8–9) apart; proximal setae on coxisternum II *2a* 42 (40–56), 25 (23–25) apart; 7 (no variation) microtuberculate semiannuli between coxae and genital coverflap plus 4 (3–4) transversal lines at the base of the coverflap. Coxae with dense lines and discrete dashes. **External genitalia** 18 (14–20), 24 (22–26) wide, coverflap with one rank of 12 (12–13) longitudinal striae; setae *3a* 50 (50–59), 15 (14–16) apart. **Internal genitalia:** spermathecae ovoid, oriented posterolaterad; spermathecal tubes relatively short; transverse genital apodeme trapezoidal, distally folded. **Opisthosoma** dorsally evenly rounded, with 42 (38–43) dorsal semiannuli, 65 (61–65) ventral semiannuli. **Microtubercles:** triangular, on posterior margin of dorsal semiannuli; minute triangular, on posterior part of ventral semiannuli; elongated and linear on last 5 (no variation) ventral semiannuli. Setae *c2* 46 (42–46) on ventral semiannulus 12 (12–13), setae *d* 54 (53–70) on ventral semiannulus 25 (24–26); setae *e* 58 (50–62) on ventral semiannulus 40 (38–40); setae *f* 48 (48–57) on ventral semiannulus 59 (56–59); 5 (no variation) annuli posterior to setae *f*. Setae *b1* 6 (4–6), *b2* 120 (114–130) apically very fine.

MALE (Figs 1GM, 2D; measured specimens = 2) – Similar in shape and prodorsal shield arrangement to female. Body smaller than female, 201–207, 57–60 wide; palp genual setae *d* 10–11; prodorsal shield 43–45, 50 wide, frontal lobe 8–9; setae *sc* 25–26, 24–25 apart. Opisthosoma with 33 dorsal semiannuli and 62–64 ventral semiannuli; 8–9 semiannuli between coxae and genitalia, with microtubercles similar to that of female. Setae: *1b* 12–14, 9–10 apart; *1a* 27–34, 7 apart; *2a* 55, 20–21 apart; *c2* 29–31, on ventral semiannulus 13; *d* 78, on ventral semiannulus 23; *e* 58, on ventral semiannulus 26; *f* 53, on ventral semiannulus 56; *b1* 4–5, *b2* 104. Male genitalia 19 wide, setae *3a* 50–53, 14 apart. Legs I and II empodia 7-rayed.

NYMPH (Figs 3E–F; measured specimen = 1). Body vermiform, 139 (excluding gnathosoma), 48 wide; palp genual setae *d* 6. Prodorsal shield 35 including frontal lobe, 36 wide, sub-triangular; with a

short frontal lobe, 6, over gnathosomal base. Shield pattern faint, consisting of most longitudinal lines of female's prodorsal shield. Tubercles of *sc* setae on rear shield margin, 20 apart, setae *sc* 18, directed posterior. Opisthosoma with 45 dorsal semiannuli with round microtubercles set on rear margin of semiannuli, 46 ventral semiannuli with oval microtubercles, elongated on the posterior semiannuli. Setae: *1b* 7, 8 apart; *1a* 6 apart; *2a* 23, 18 apart; *c* 2 14, on ventral semiannulus 7; *d* 19, on ventral semiannulus 16; *e* 21, on ventral semiannulus 25; *f* 29, on ventral semiannulus 40; *h* 2 46. Setae *3a* 10, 7 apart on semiannulus 7 after coxae. Legs I and II empodia 6-rayed.

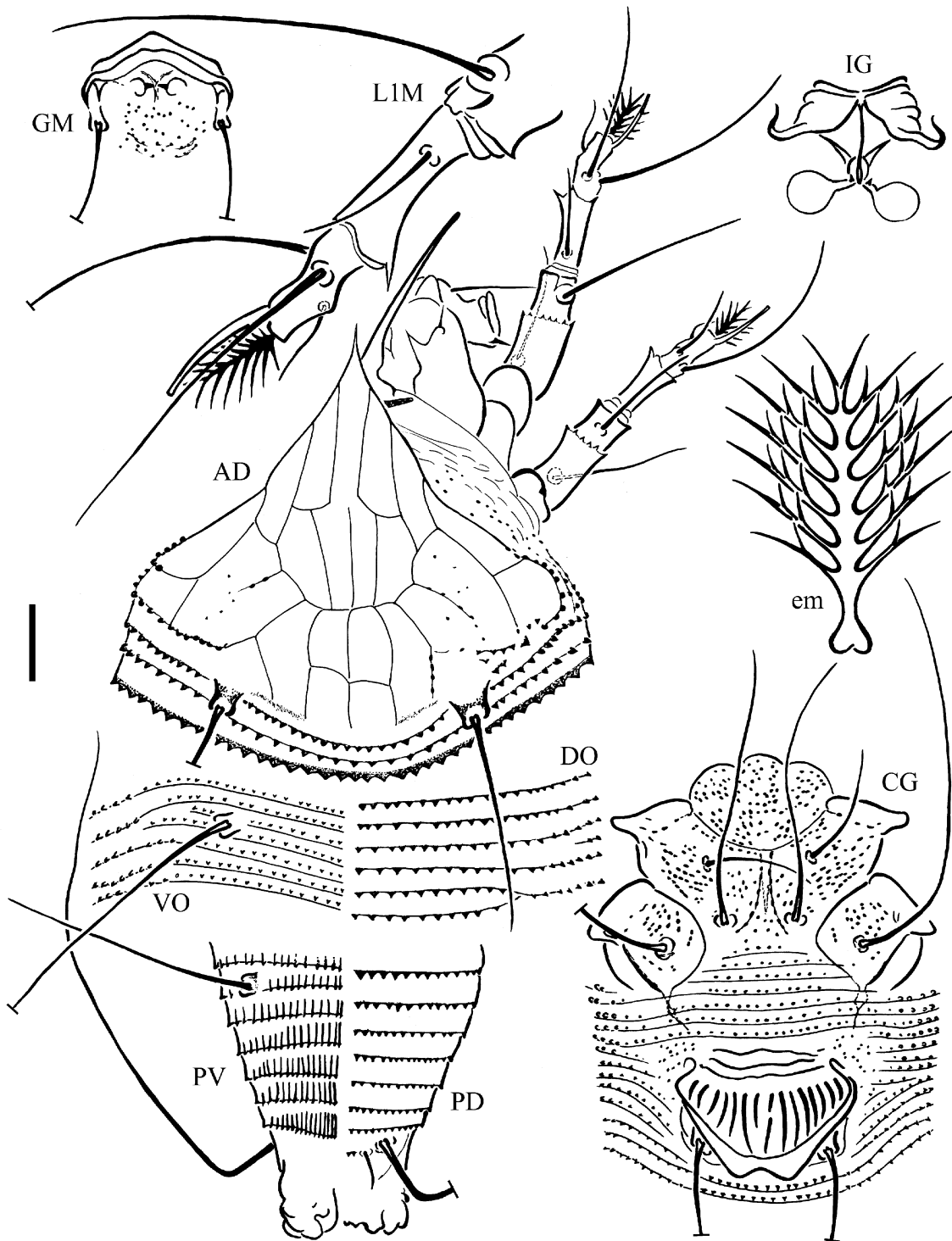


Figure 1. Schematic drawings of *Aculops helioscopiae* Delfan, Jafari & Lotfollahi **sp. nov.** – AD. Dorsal view of female anterior body region; CG. Female coxigenital region; DO. Dorsal view of female annuli; em. Empodium; GM. Male genital region; IG. Internal female genitalia; L1. Leg I of male; PD. Dorsal view of female posterior opisthosoma; PV. Ventral view of female posterior opisthosoma; VO. Ventral view of female annuli. Scale bar: 10 μ m for AD, CG, DO, GM, IG, PD, PV, VO; 5 μ m for L1; 2.5 μ m for em.

Type host plant

Euphorbia helioscopia L. (Euphorbiaceae), the sun spurge or madwoman's milk.

Type locality

Malavi Rural District, Pol-e Dokhtar County, Lorestan Province, Iran (33° 15' 28.77" N, 47° 48' 09.50" E), 754 m above sea level, coll. A. Delfan, 05 August 2024.

Type material

Holotype: single female on a microscope slide (EH-IL-PR-MI-24-AD-1). Paratypes: Four females, two males and one nymph mounted singly on separate microscope slides (EH-IL-PR-MI-24-AD-2–8).

Other material

Mites preserved in a vial (EH-IL-PR-MI-24-AD) of Oudemans' fluid (Walter and Krantz 2009) as extracted from the same sample as the type specimens.

Relation to the host plant

Vagrant; no apparent symptom was observed.

Etymology

The specific epithet, *helioscopiae* is derived from host plant species name, *helioscopia*.

Differential diagnosis

The new species was compared with all *Aculops* species associated to *Euphorbia* plants of the world (Table 2) and it was found more similar to *Aculops seguieranae* Lotfollahi, Haddad, Khanjani, Moghadam & de Lillo, 2012 described on the host plant, *E. seguierana* Necker in Kandovan village, Osku County, East Azerbaijan Province, Iran. They are similar in number of dorsal and ventral semiannuli and semiannuli between coxae and genital coverflap, number of empodial rays, length of setae *sc*, *c2*, *d*, *e* and *3a* and number of striae on female genitalia coverflap (Table 2). The two species differ mainly in the pattern of the prodorsal shield and the length and shape of the frontal lobe. The prodorsal shield of the new species is reticulated and median line extended on its basal $\frac{3}{4}$, while the prodorsal shield of *A. seguieranae* is not reticulated and median line is shorter and extended on its basal $\frac{1}{2}$ (Fig. 3A). In the new species the frontal lobe is longer and not two layered. In addition, the length of setae *f* is different (48–57 in the new species versus 25–36 in *A. seguieranae*).

Remarks

This is the first record of eriophyoid mites on *E. helioscopia*.

Table 2. Gross comparison of some important traits among *Aculops helioscopiae* Delfan, Jafari & Lotfollahi **sp. nov.**, *Aculops euphorbicolus* (Keifer, 1964), *Aculops glabriflorae* (Petanović & de Lillo, 1992), *Aculops montenegrinus* (Petanović & de Lillo, 1992) and *Aculops seguieranae* Lotfollahi, Haddad, Khanjani, Moghadam & de Lillo, 2012.

Characters	<i>A. helioscopiae</i> Delfan, Jafari & Lotfollahi sp. nov.	<i>A.</i> <i>euphorbicolus</i>	<i>A.</i> <i>glabriflorae</i>	<i>A.</i> <i>montenegrinus</i>	<i>A.</i> <i>seguieranae</i>
Dorsal semiannuli number	38–43	53	39–52	48–53	38–42
Ventral semiannuli number	61–65	60	68	71–89	58–64
Number of semiannuli between coxae and genital coverflap	7	5 (d)	9 (d)	10 (d)	6–7
Number of empodial rays	6	7	7	7	6
Setae <i>sc</i> length	20–38	17	22	23	15–22
Setae <i>c2</i> length	42–46	20	30	36	39–55
Setae <i>d</i> length	53–70	54	35	31	60–91
Setae <i>e</i> length	50–62	16	27	27	33–57
Setae <i>f</i> length	48–57	21	22	32	25–36

d: according to original drawings

Table 2. Continued.

Charahcters	<i>A. helioscopiae</i> Delfan, Jafari & Lotfollahi sp. nov.	<i>A.</i> <i>euphorbicolus</i>	<i>A.</i> <i>glabriflorae</i>	<i>A.</i> <i>montenegrinus</i>	<i>A.</i> <i>seguierana</i> <i>e</i>
Setae <i>3a</i> length	50–59	16	13	14	35–60
Coverflap striae number	12–13	10	10	10–12	13
Host plant	<i>E. helioscopia</i>	<i>E. corollate</i> L.	<i>E. glabriflora</i> Vis.	<i>E. myrsinites</i> L.	<i>E. seguierana</i>



Figure 2. Phase contrast light microscopy images of *Aculops helioscopiae* Delfan, Jafari & Lotfollahi sp. nov. **A.** Female dorsal view; **B.** Female ventral view; Scale bar: 10 μ m.

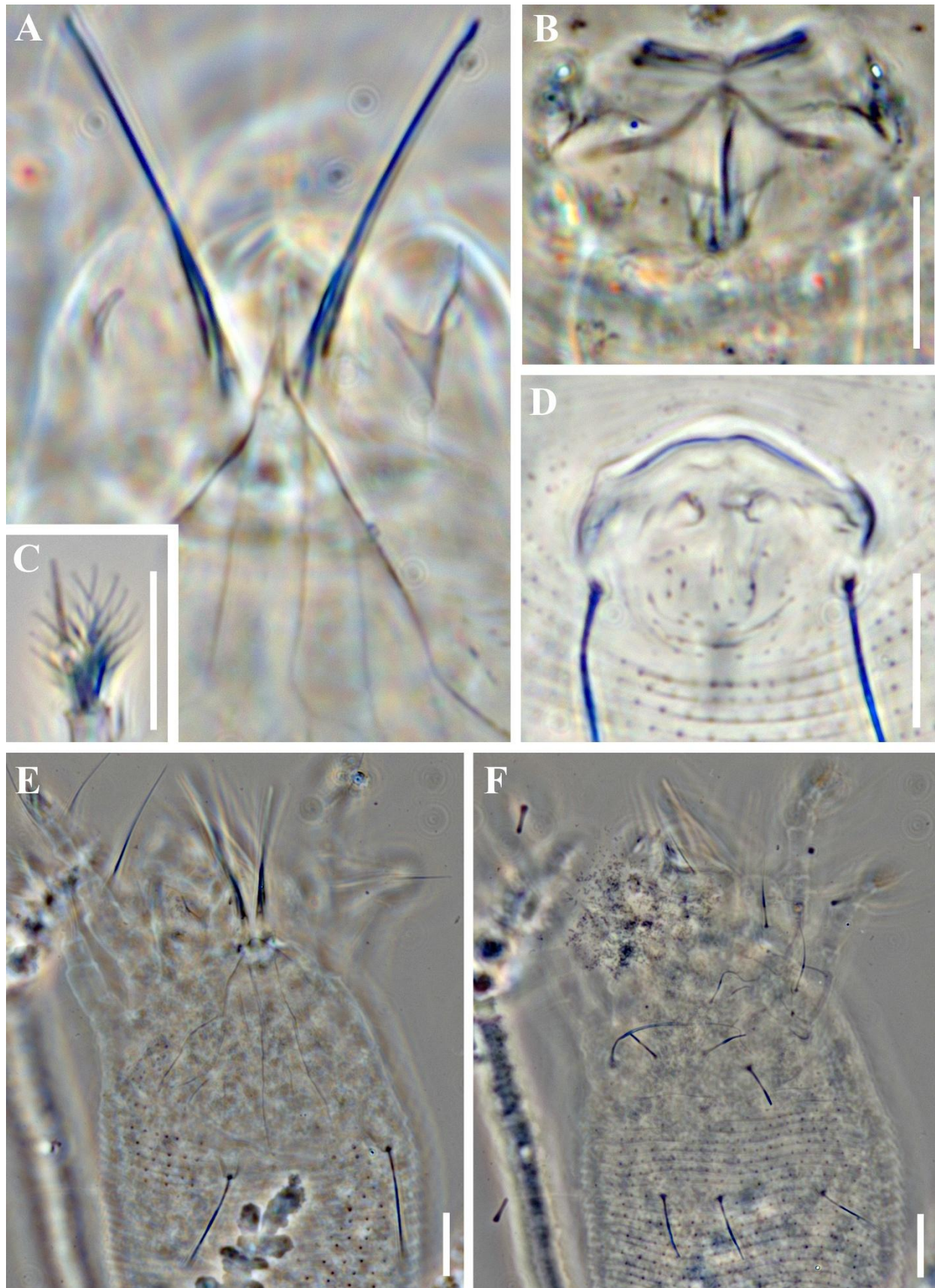


Figure 3. Phase contrast light microscopy images of *Aculops helioscopiae* Delfan, Jafari & Lotfollahi **sp. nov.** – **A.** Female frontal lobe; **B.** Female internal genitalia; **C.** Female empodium; **D.** Male external genitalia; **E.** Nymph prodorsal shield; **F.** Nymph coxigenital region; Scale bar: 10 μ m.

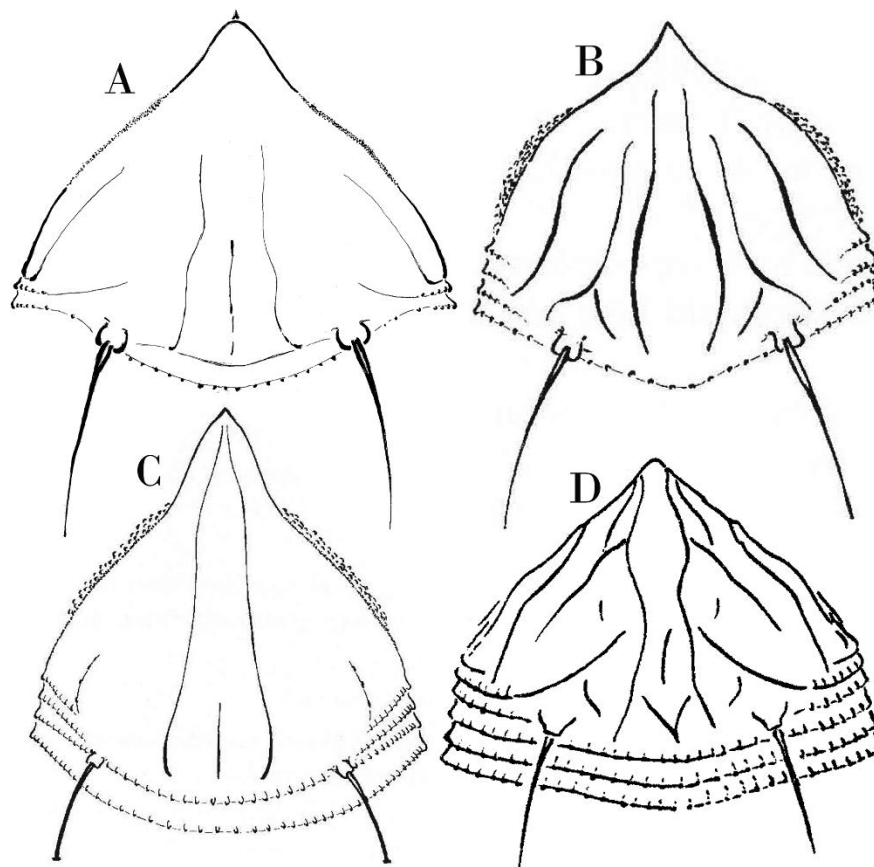


Figure 4. Schematic drawings of prodorsal shields of: **A.** *Aculops seguieranae* Lotfollahi, Haddad, Khanjani, Moghadam & de Lillo, 2012; **B.** *Aculops glabriflorae* (Petanović & de Lillo, 1992); **C.** *Aculops montenegrinus* (Petanović & de Lillo, 1992); **D.** *Aculops euphorbicolus* (Keifer, 1964).

Key of *Aculops* species associated to Euphorbiaceae plants of the world

1. Setae *3a* longer than 30, empodium 6-rayed 2
 - Setae *3a* shorter than 30, empodium 7-rayed 3
2. Prodorsal shield reticulated, median line extended on basal $\frac{3}{4}$ of shield, setae *f* 48–57
 - *Aculops helioscopiae* Delfan, Jafari & Lotfollahi **sp. nov.** (Fig. 1AD)
 - Prodorsal shield not reticulated, median line extended on basal $\frac{1}{2}$ of shield, setae *f* 25–36
 - *Aculops seguieranae* Lotfollahi, Haddad, Khanjani, Moghadam & de Lillo, 2012 (Fig. 3A)
3. Median line absent *Aculops glabriflorae* (Petanović & de Lillo, 1992) (Fig. 3B)
 - Median line present 4
4. Admedian lines not connected to any kind of lines
 - *Aculops montenegrinus* (Petanović & de Lillo, 1992) (Fig. 3C)
 - Admedian lines connected to other lines by transverse lines
 - *Aculops euphorbicolus* (Keifer, 1964) (Fig. 3-D)

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Consent for publication: All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

Competing interests: The authors declare no conflict of interest.

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گونه جدیدی از *Aculops* (Trombidiformes: Eriophyoidea: Eriophyidae) روی *Euphorbia helioscopia* L. (Euphorbiaceae) در ایران

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چکیده

طی بررسی فون کنه‌های اریوفیوئید استان لرستان (ایران)، نمونه‌برداری‌هایی از گیاهان *Euphorbia helioscopia* L. (Euphorbiaceae) در دهستان ملاوی شهرستان پلدختر انجام شد. یک گونه جدید به نام *Aculops helioscopiae* sp. nov. کشف، توصیف و ترسیم شد. این نخستین گزارش از کنه‌های اریوفیوئید روی *E. helioscopia* می‌باشد. فهرستی از گونه‌های کنه‌های اریوفیوئید جمع‌آوری‌شده روی گیاهان خانواده Euphorbiaceae در ایران و میزبان تیپ آنها، محل تیپ و ارتباط آنها با گیاه میزبان، مقایسه کلی برخی از صفات مهم بین گونه‌های *Aculops* مرتبط با گیاهان خانواده Euphorbiaceae در جهان و کلیدی برای شناسایی آنها ارائه شده است.

واژگان کلیدی: Anthocoptini، فهرست، توصیف، کلید، لرستان، Phyllocoptinae، Trombidiformes.

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پذیرش

۴ آذر ۱۴۰۴

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دبیر تخصصی

ع. صبوری

