

The genus *Dendroseius* Karg (Acari: Digamasellidae) in Iran, with description of the male and deutonymph of *Dendroseius amoliensis*

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Original research

ABSTRACT

We provide the first descriptions of the adult male, deutonymphal stage and extended morphometric data for adult female of *Dendroseius amoliensis* Faraji, Sakenin-Chelav & Karg, collected from the rotten stump in Guilan province, Iran. Moreover, *Dendroseius vulgaris* Ma, Ho & Wang is recorded for the first time from Iran, collected from the livestock manure and decayed rice bran. Morphometric measurements of *D. vulgaris* based on specimens collected in Iran are given. An updated key to all known species of the genus is also presented.

Keywords Gamasida; morphometric data; new record; Rhodacaroidea; Guilan

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Introduction

Predaceous mites of family Digamasellidae are widespread in soil and decaying organic material such as compost, manure and debris. Some species are found in galleries of bark beetles, bracket fungi or in association with wood-boring beetles. Digamasellid mites feed on collembolans, nematodes, arthropod eggs and possibly fungi (Walter *et al.*, 1988; Lindquist *et al.*, 2009; Walter and Proctor, 2013). Family Digamasellidae currently contains 14 genera, including the genus *Dendroseius* (Castilho *et al.*, 2012; Faraji *et al.*, 2021).

Dendroseius was initially described by Karg (1965), as a subgenus of *Dendrolaelaps* Halbert, 1915 and considered at the generic level by Hirschmann (1974), Lindquist (1975), Evans and Till (1979), Shcherbak (1980), Karg (1993), Faraji *et al.* (2006) and Maśán (2020). Most species of the genus *Dendroseius* are found in soil detritus (*D. amoliensis*, *D. reticulatus*, *D. vulgaris*), wood substrates (*D. congoensis*, *D. vulgaris*, *D. reductus*), and manure or cow dung (*D. badenhorsti*, *D. vulgaris*), deutonymphs of *D. gujarati* was found on an unidentified scarabaeid beetle (Sheals, 1956, 1958; Ryke, 1962; Wiśniewski and Hirschmann, 1989; Wiśniewski and Hirschmann, 1992; Karg, 1993; Faraji *et al.*, 2006; Ma *et al.*, 2014; Maśán, 2020).

During a faunistic survey on Rhodacaroidea in Guilan Province, northern Iran, in 2021–2022, the species *Dendroseius amoliensis* Faraji, Sakenin-Chelav & Karg, 2006 was collected from the rotten stumps. This species was originally described based on female specimens collected from soil and debris in Amol, northern Iran (Faraji *et al.*, 2006). In this paper, we provide the first descriptions of the adult male and deutonymphal stage and extended morphometric data for adult female of *Dendroseius amoliensis* Faraji, Sakenin-Chelav & Karg. Moreover, *Dendroseius vulgaris* Ma, Ho & Wang, 2014 is recorded for the first time from Iran. An updated key to all known species of the genus is also presented.

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Material and methods

Samples were taken weekly from various areas and habitats in Guilan Province, northern Iran. The samples were collected from 2021 to 2022. Mites were extracted from samples of the rotten stump, cow and poultry manure, and decayed rice bran using a Berlese/Tullgren funnel. Mite specimens were preserved in 70% ethanol, cleared in Nesbitt's fluid and mounted in Hoyer's medium on microscope slides. Mites were identified according to Faraji *et al.* (2006) and Mašán (2020). Setal nomenclature for dorsal and ventral idiosomal setae follows Lindquist & Evans (1965), and that for leg and palp setae follows that of Evans (1963a, 1963b). Identification of pore-like structures on the idiosomal integument is based on the morphological observations of Athias-Henriot (1969); notation for these structures such as adenotaxy and poroidotaxy follows Johnston and Moraza (1991). All measurements are given in micrometers (μm). The length of the idiosoma and shields were taken from the anterior to posterior margins along the midline and from widths at their broadest point. The length of legs (I–IV) were taken from the base of the coxa to the apex of the tarsus, without the pretarsus. Setae were measured from the base of their insertions to their tips. The mean of the measurements is given followed by the range in parentheses. Morphological observations, measurements, and illustrations were made using a compound laboratory biological microscope model HP-41 (China) equipped with differential interference contrast and phase contrast optical systems and an Olympus microscope model BH-2 (Japan) equipped with drawing tube, and a Canon camera (EOS Kiss X5; Japan). The voucher specimens of each species were preserved as slide-mounted specimens deposited in the Acari collection of the Department of Plant Protection, Faculty of Agricultural Sciences, University of Guilan and Jalal Afshar Zoological Museum, Tehran, Iran.

Results

Digamasellidae Evans, 1957

Dendroseius Karg, 1965

Dendrolaelaps (*Dendroseius*) Karg, 1965: 297.

Dendrolaelaps (*Dendroseius*) Karg, 1971: 317.

Dendroseius Lindquist, 1975: 12; Shcherbak, 1980: 172.

Type species: *Dendrolaelaps scotarius* Sheals, 1958, by original designation (objective junior synonym of *Digamasellus reticulatus* Sheals, 1956).

Diagnosis — Dorsal setae *j*2 situated between setae *j*1 and *j*3, not in a transverse setal row between *j*1 and *z*1; deutosternum with seven transverse furrows of which none is reaching beyond the lateral borders of the groove; movable digit of chelicera with three teeth in addition to the apical tooth; opisthonotal shield with straight anterior margin; sperm induction system associated with coxae IV.

Dendroseius amoliensis Faraji, Sakenin-Chelav & Karg, 2006

Description

Adult male — five specimens measured. (Figures 1, 3A–B and 4)

Pale yellow colored, idiosoma oval, length 303 (296–312), width 197 (180–212). All setae smooth.

Dorsal idiosoma (Figures 1A, 4A) – Dorsal shield divided to podonotal and opisthonotal. Podonotal shield 162 (158–168) long with 21 pairs of setae (*j*1–*j*6, *z*1–*z*6, *s*1–*s*6, *r*2 and *r*4–*r*5), five pairs of lyrifissures (*id*1, *id*2, *id*4, *id*5, *id*6) and two pairs of gland pores (*gd*1, *gd*2). Opisthonotal shield 146 (140–148) long with 20 pairs setae (*J*1–*J*5, *Z*1–*Z*5, *S*1–*S*5 and *R*1–*R*5) and nine pairs of lyrifissures (*id*m2, *id*m3, *id*m4, *id*m5, *id*m6, *id*l1, *id*l2, *id*l3, *id*l4). Measurements of setae: *j*1 11 (8–14), *j*2 18 (17–20), *j*3 20, *j*4 18 (16–20), *j*5 18 (16–19), *j*6 17

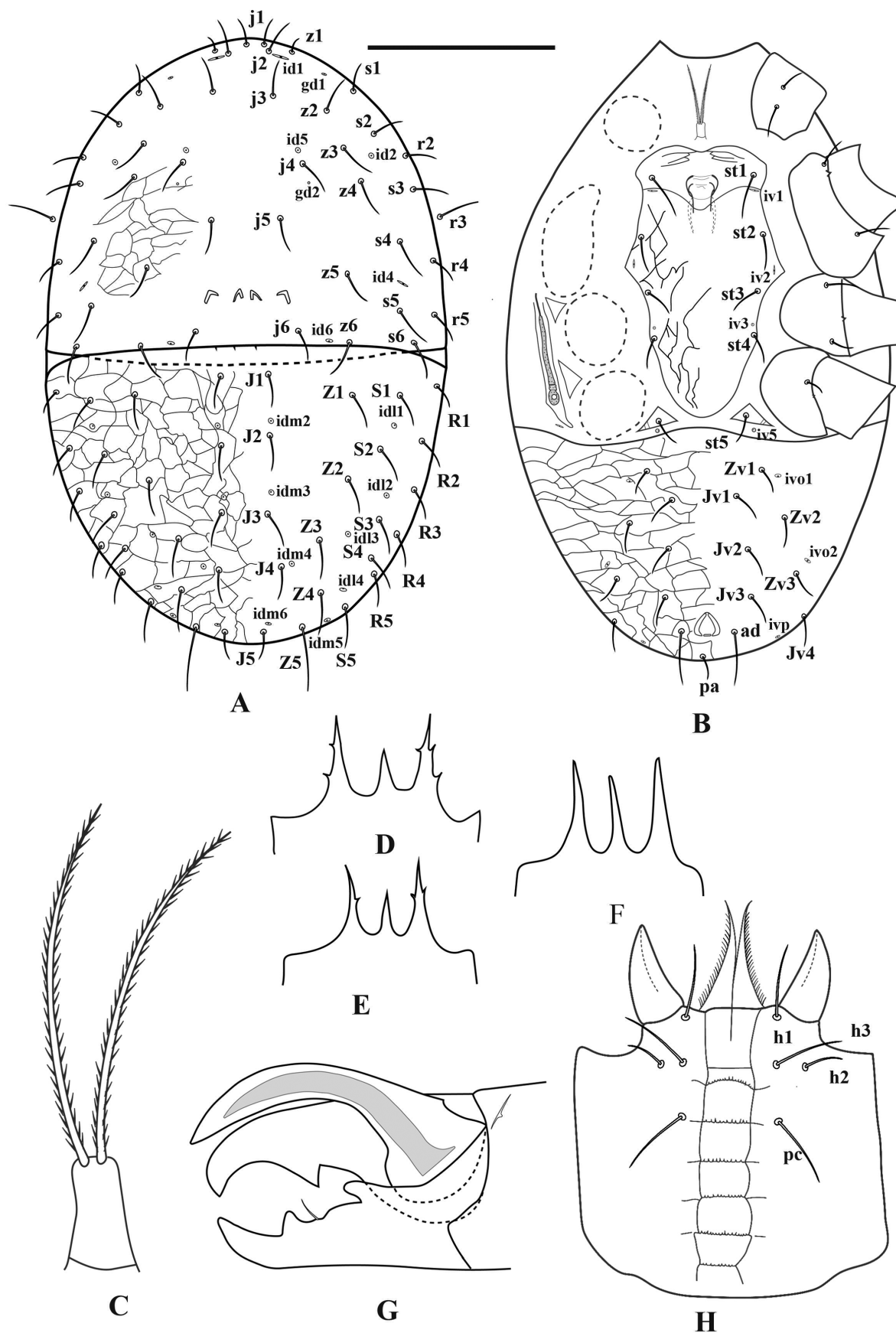


Figure 1 *Dendroseius amoliensis* male: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Tritosternum; D-F – Epistome; G – Chelicerae; H – Hypostome. Scale bar: 90 μ m for A and B; 15 μ m for C; 30 μ m for D, E and F; 20 μ m for G; 40 μ m for H.

(16–19), *z1* 8 shortest, *z2* 19 (18–20), *z3* 19 (18–20), *z4* 20, *z5* 18, *z6* 19 (16–20), *s1* 15 (12–17), *s2* 18 (16–20), *s3* 20, *s4* 21 (20–22), *s5* 21 (20–22), *s6* 19 (18–20), *r2* 17 (16–18), *r3* 24, *r4* 15 (12–18), *r5* 16 (14–20), *J1* 18, *J2* 19 (17–20), *J3* 19 (18–20), *J4* 20, *J5* 14, *Z1* 19 (17–20), *Z2* 20, *Z3* 21, *Z4* 22, *Z5* 29 (28–30) longest, *S1* 18 (16–19), *S2* 20, *S3* 20, *S4* 20, *S5* 21 (20–22), *R1* 13 (12–14), *R2* 16 (14–17), *R3* 16, *R4* 17 (16–18), *R5* 18 (17–20). Setae *r3* on soft cuticle along dorsal shield lateral margins. All setae smooth. Two pairs of scleronoduli are located between setae *j5* and *j6*.

Ventral idiosoma (Figures 1B, 4B) – Tritosternum (Figure 1C) 44 (40–46) long, base 9 (8–10) long and 7 (4–6) wide, laciniae 35 (32–38) long, totally separated. Sternogenital shield 146 (140–150) long and 80 (78–84) wide, smooth but slightly striated on the lateral sides, with four pairs of setae, *st1* 23 (20–24), *st2* 21 (20–22), *st3* 19 (18–20), *st4* 17 (16–18) and three pairs of lyrifissures (*iv1* posterior to *st1*, *iv2* the level between coxae II–III and *iv3* anterior to *st4*). Setae *st5* 16 on a pair of separate subtriangular plates posterolateral of sternogenital shield, a pair of lyrifissures located in soft cuticle posterior to *st5* plates (*iv5*). Ventrianal shield 126 (122–130) long, reticulated; fused laterally and posteriorly with opisthonotal shield, with seven pairs of preanal setae, *Jv1* 16, *Jv2* 16, *Jv3* 17 (16–18), *Jv4* 16, *Zv1* 13 (10–14), *Zv2* 16 (14–17), *Zv3* 15 (14–16), para-anal 26, post-anal 13 (12–14) and three pairs of lyrifissures (*ivo1*, *ivo2*, *ivp*). Peritreme shortened 56 (52–60) long, with anterior end reaching to the anterior level of coxa III. Peritrematic shield well developed, free from podonotal shield with narrowed ends. Exopodal shield fragmented in two parts: between coxa II and III and between coxa III and IV.

Gnathosoma – Epistome (Figures 1D–F, 4E and F) with three-pointed prongs, middle prong 11 (8–13) shorter than the lateral prongs 16 (12–19); variations in the shape of the epistome were observed. Palp apotele two-tined. Fixed cheliceral digit 30 (26–32) long, with two teeth in addition the apical tooth and a setiform pilus dentilis; movable cheliceral digit 31 (28–32) long, with one tooth in addition to apical tooth; spermatodactyl 34 long, sickle-shaped, slightly longer than movable cheliceral digit (Figures 1G, 4D). Corniculi horn-like. Deutosternum with seven rows; six rows (2–7) with tiny denticles. Hypostomal setae smooth, *h1* 17 (16–20), *h2* 10 (8–11), *h3* 17 (16–18), *pc* 17 (16–18) (Figures. 1H, 4G).

Legs – All legs with pretarsi, claws well sclerotized and pulvilli well developed. Lengths, excluding pretarsi: leg I 294 (280–300), leg II 222 (220–228), leg III 202 (200–208), leg IV 276 (272–280). Chaetotactic pattern of legs: leg I – coxa 0 0/1, 0/1 0 (2), trochanter 1 1/1, 0/2 1 (6), femur 2 3/2, 2/2 2 (13), genu 2 3/2, 2/1 2 (12), tibia 2 3/2, 2/1 2 (12); leg II – coxa 0 0/1, 0/1 0 (2), trochanter 1 0/1, 0/2 1 (5), femur 2 2/1, 2/2 1 (10), genu 2 3/1, 2/1 2 (11), tibia 2 2/1, 2/1 2 (10); leg III – coxa 0 0/1, 0/1 0 (2), trochanter 1 1/1, 0/2 0 (5), femur 1 2/1, 1/0 1 (6), genu 2 2/1, 2/1 1 (9), tibia 2 1/1, 2/1 1 (8); leg IV – coxa 0 0/1, 0/0 0 (1), trochanter 1 1/1, 0/2 0 (5), femur 1 2/1, 1/0 1 (6), genu 1 2/1, 2/0 1 (7), tibia 1 1/1, 2/1 1 (7). All leg setae aciculate, except femur II, genu II and tibia II each with a spur-like macrosetae (Figures. 3A–B, 4C).

Deutonymph — five specimens measured. (Figures 2, 3C–D and 5)

Pale yellow colored, idiosoma oval, length 282 (272–300), width 163 (152–168).

Dorsal idiosoma (Figures 2A, 5A) – Dorsal shield divided to podonotal and opisthonotal. Podonotal shield 157 (152–164) long, slightly reticulated; with 19 pairs of setae (*j1–j6*, *z1–z6*, *s1–s6* and *r2*) and five pairs of lyrifissures (*idl1*, *idl2*, *idl4*, *idl5*, *idl6*) and two pairs of gland pores (*gd1*, *gd2*). Opisthonotal shield 129 (124–136) long, slightly reticulated with 15 pairs of setae (*J1–J5*, *Z1–Z5* and *S1–S5*) and nine pairs of lyrifissures (*idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *idl1*, *idl2*, *idl3*, *idl4*). Measurements of setae: *j1* 15 (14–16), *j2* 16, *j3* 18 (16–20), *j4* 16, *j5* 15 (14–16), *j6* 14, *z1* 7 (6–8), *z2* 18, *z3* 15 (14–16), *z4* 17 (16–18), *z5* 14 (12–16), *z6* 14, *s1* 14 (12–16), *s2* 14 (10–16), *s3* 17 (16–18), *s4* 19 (18–20), *s5* 19 (18–20), *s6* 14 (12–16), *r2* 14, *r3* 20, *r4* 13 (12–14), *r5* 13 (12–15), *J1* 14, *J2* 14, *J3* 16, *J4* 17 (16–18), *J5* 12, *Z1* 16, *Z2* 17 (16–18), *Z3* 17 (16–18), *Z4* 20, *Z5* 31 (28–32), *S1* 14 (12–16), *S2* 17 (16–18), *S3* 15 (14–16), *S4* 17 (16–18), *S5* 18 (16–20), *R1* 11 (10–12), *R2* 10, *R3* 11 (10–12), *R4* 11 (10–12), *R5* 12. Setae *r3–r5* and *R1–R5* on soft cuticle along lateral margins of dorsal shield. All setae smooth. Peritreme extending anteriorly to level of *s1*.

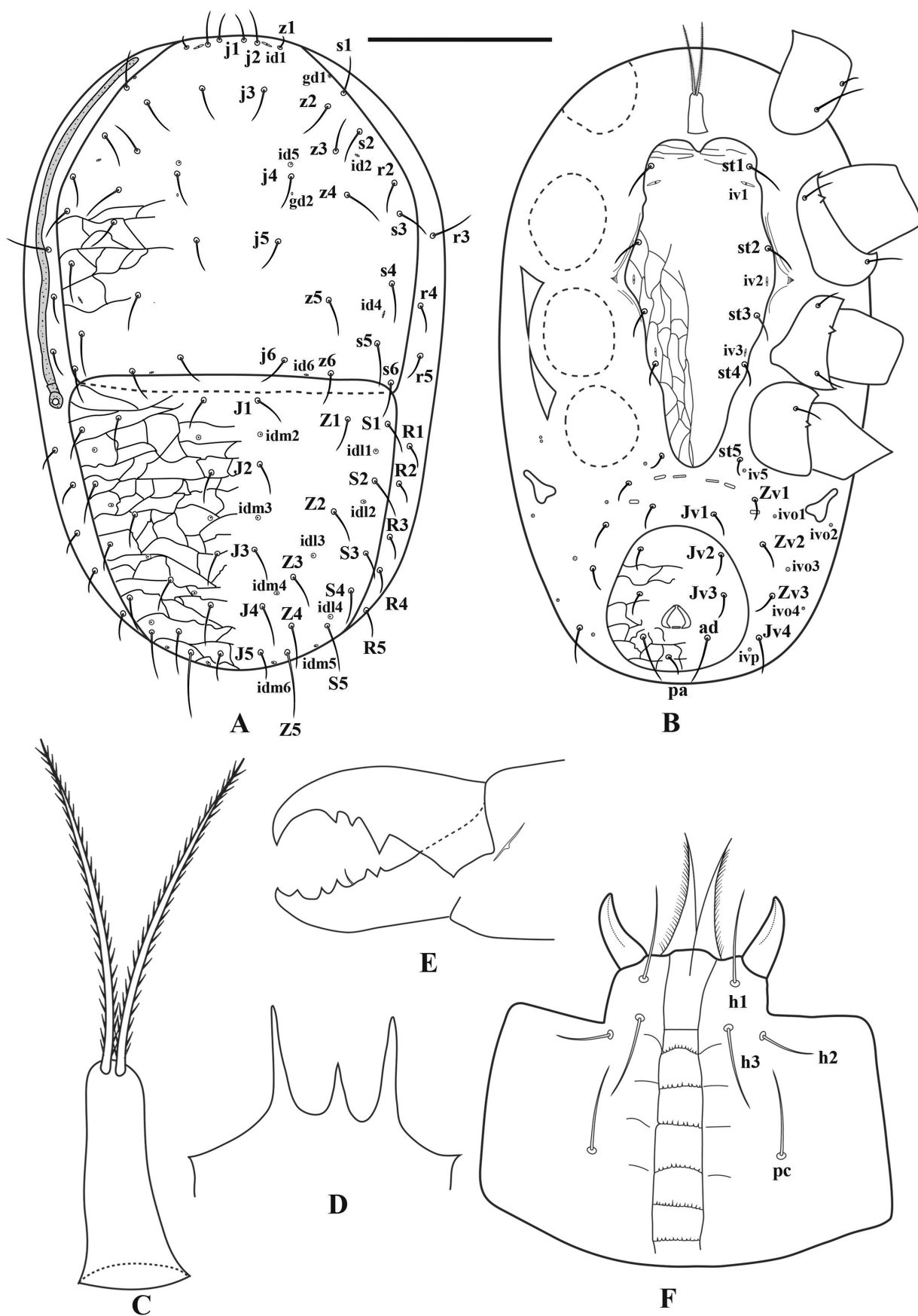


Figure 2 *Dendroseius amoliensis* deutonymph: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Tritosternum; D – Epistome; E – Chelicerae; F – Hypostome. Scale bar: 80 μ m for A and B; 15 μ m for C; 20 μ m for D and E; 30 μ m for F.

Ventral idiosoma (Figures 2B, 5B) – Tritosternum (Figure 2C) base 20 (18–22), laciniae 32 (30–34) long, totally separated. Sternal shield 147 (144–150) long and 64 (62–66) wide, smooth, with four pairs of setae *st1* 15 (14–16), *st2* 13 (12–14), *st3* 11 (10–12), *st4* 10 and three pairs of lyrifissures (*iv1*, *iv2*, *iv3*). Setae *st5* 9 (8–10) on soft cuticle posterolaterad of sternal shield. Ventrianal shield approximately round-shaped, 66 (64–70) long, 62 (60–64) wide, reticulated, with two pairs of pre-anal setae *Jv2* 10 and *Jv3* 10 in addition to para-anal setae 21 (20–24) and post-anal seta 10 (10–12). Soft cuticle along margins of the ventrianal shield with five pairs of setae *Jv1* 10, *Jv4* 15 (14–17), *Zv1* 10, *Zv2* 11 (10–12), *Zv3* 10, and six pairs of lyrifissures (*iv5*, *ivo1*, *ivo2*, *ivo3*, *ivo4*, *ivp*). Metapodal plates pear-shaped; one pair of lyrifissures laterad of metapodal plates. Peritreme located on the lateral margin of the podonotal shield, extending anteriorly to the level of setae *s1*. Exopodal shield fragmented in two parts: between coxa II and III and between coxa III and IV.

Gnathosoma – Epistome (Figures 2D, 5E) with three prongs, middle prong 9 (8–10) shorter than the lateral prongs 13 (12–14). Palp apotele two-tined. Fixed cheliceral digit 30 (28–32) long, with five teeth in addition to the apical tooth and a setiform pilus dentilis; movable cheliceral digit 29 (28–30) long, with three teeth in addition to the apical tooth (each with the same number of the tooth as female) (Figures 2E, 5D). Corniculi horn-like. Deutosternum with seven rows, anterior row smooth, and rows 2–7 with tiny denticles. Hypostomal setae smooth, *h1* 16 (14–18), *h2* 9 (8–10), *h3* 15 (12–18), *pc* 16 (14–18) (Figures 2F, 5C).

Legs – Lengths of legs, excluding pretarsi: leg I 249 (240–260), leg II 194 (180–208), leg III 177 (164–192), leg IV 234 (224–240). Chaetotactic pattern of legs: leg I – coxa 0 0/1, 0/1 0 (2), trochanter 1 1/1, 0/2 1 (6), femur 2 2/2, 2/2 2 (12), genu 2 3/2, 2/1 2 (12), tibia 2 3/2, 2/1 2 (12); leg II – coxa 0 0/1, 0/1 0 (2), trochanter 1 0/1, 0/2 1 (5), femur 2 2/1, 2/2 1 (10), genu 2 3/1, 2/1 2 (11), tibia 2 2/1, 2/1 2 (10); leg III – coxa 0 0/1, 0/1 0 (2), trochanter 1 1/1, 0/2 0 (5), femur 1 2/1, 1/0 1 (6), genu 2 2/1, 2/1 1 (9), tibia 2 1/1, 2/1 1 (8); leg IV – coxa 0 0/1, 0/0 0 (1), trochanter 1 1/1, 0/2 0 (5), femur 1 2/1, 1/0 1 (6), genu 1 2/1, 2/0 1 (7), tibia 1 1/1, 2/1 1 (7). All leg setae are aciculate. All legs with pretarsi, each with two claws and pulvilli well developed (Figures 3C–D).

Female — five specimens measured. (Figure 6)

Dorsal idiosoma (Figure 6A) – Dorsal shield, 354 (344–364) long; *j1* 19 (16–20), *j2* 20 (18–22), *j3* 20 (18–22), *j4* 20, *j5* 19 (18–20), *j6* 20, *z1* 9 (8–10) shortest, *z2* 20 (18–21), *z3* 21 (18–24), *z4* 22 (20–24), *z5* 20, *z6* 21 (20–22), *s1* 16 (15–18), *s2* 17 (16–18), *s3* 18, *s4* 20 (18–22), *s5* 22 (20–24), *s6* 21 (20–22), *r2* 18 (14–20), *r3* 29 (28–30), *r4* 19 (18–20), *r5* 20, *J1* 21 (20–22), *J2* 23 (22–24), *J3* 23 (22–25), *J4* 24 (22–25), *J5* 19 (18–20), *Z1* 22, *Z2* 23 (22–24), *Z3* 25 (22–26), *Z4* 28, *Z5* 40 (38–42) longest, *S1* 21 (18–23), *S2* 23 (21–25), *S3* 24 (22–25), *S4* 28 (26–29), *S5* 29 (28–30), *R1* 16 (14–17), *R2* 20, *R3* 21 (20–22), *R4* 23 (21–24), *R5* 24 (22–25). Ventral idiosoma (Figure 6B): Sternal shield 105 (102–108) long and 80 (76–82) wide, with four pairs of setae, *st1* 24 (20–26), *st2* 24 (20–26), *st3* 23 (20–24), *st4* 22 (20–23). Genital shield 54 wide, setae *st5* 22 (20–24); ventrianal shield 120 (118–122) long; with seven pairs of preanal setae, *Jv1* 18 (16–20), *Jv2* 19 (16–20), *Jv3* 19 (16–20), *Jv4* 23 (20–26), *Zv1* 16, *Zv2* 18 (16–19), *Zv3* 17 (16–18), para-anal 27 (24–30), post-anal 13 (12–14). Metapodal plate length 24 (20–26). Anus length 16 (14–18). Gnathosoma: Epistome (Figure 6D) with three-pointed prongs, middle prong 13 (12–14) shorter than the lateral prongs 18 (17–20). Palp apotele two-tined. Fixed cheliceral digit 38 (36–40) long, with five teeth in addition to the apical tooth and a setiform pilus dentilis; movable cheliceral digit 37 (36–39) long, with three teeth in addition to apical tooth. Corniculi horn-like; deutosternum with seven rows; six rows (2–7) with tiny denticles; hypostomal setae smooth, *h1* 18 (16–20), *h2* 10, *h3* 18 (15–20), *pc* 17 (16–18). Legs: All legs with pretarsi, claws well sclerotized and pulvilli well developed. Lengths, excluding pretarsi: leg I 287 (272–304), leg II 226 (220–240), leg III 196, leg IV 270 (260–280).

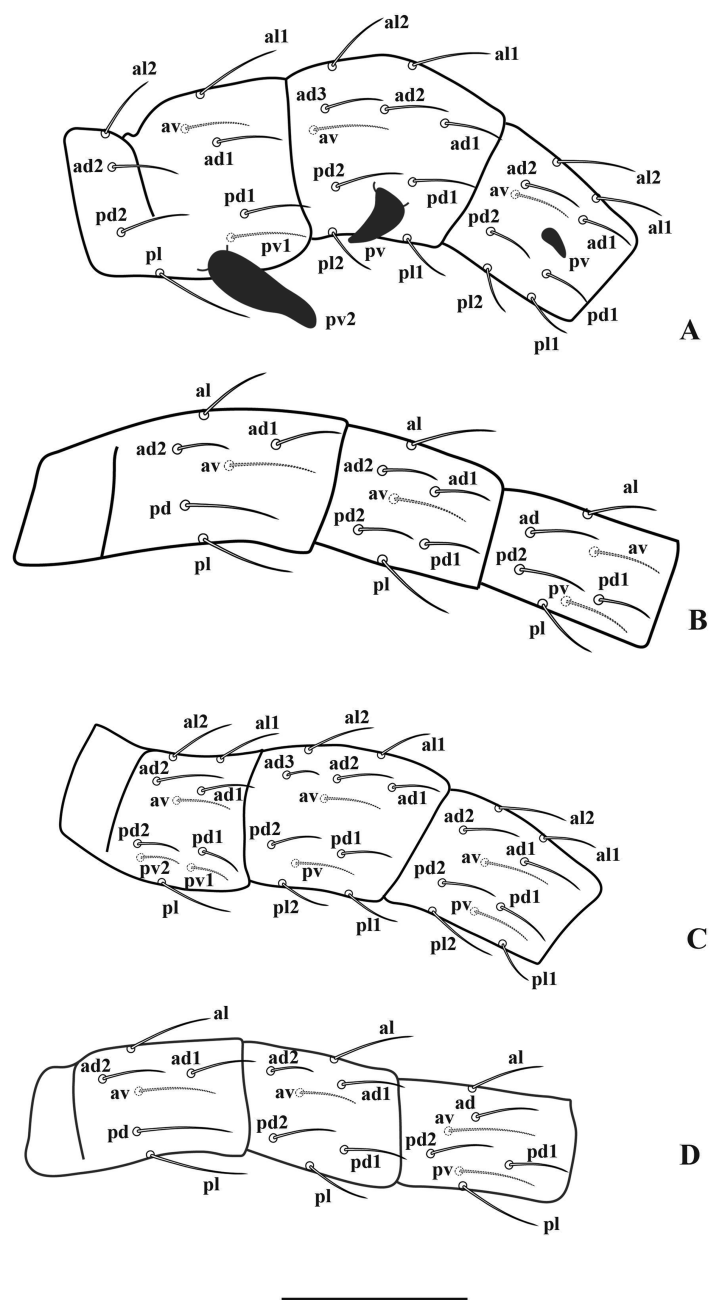


Figure 3 *Dendroseius amoliensis* (Male): A – Femur, genu, tibia of leg II, B – Femur, genu, tibia of leg IV; (Deutonymph): C – Femur, genu, tibia of leg II, D – Femur, genu, tibia of leg IV. Scale bar: 35 μ m for A-D.

Material examined

Nineteen females, 11 males, ten deutonymphs, Rasht County, Saravan forest, (37°04'15.8"N, 49°37'50.2"E, alt. 72 m), rotten wood, 11 December, 2021, collector: Leila Mohammadi.

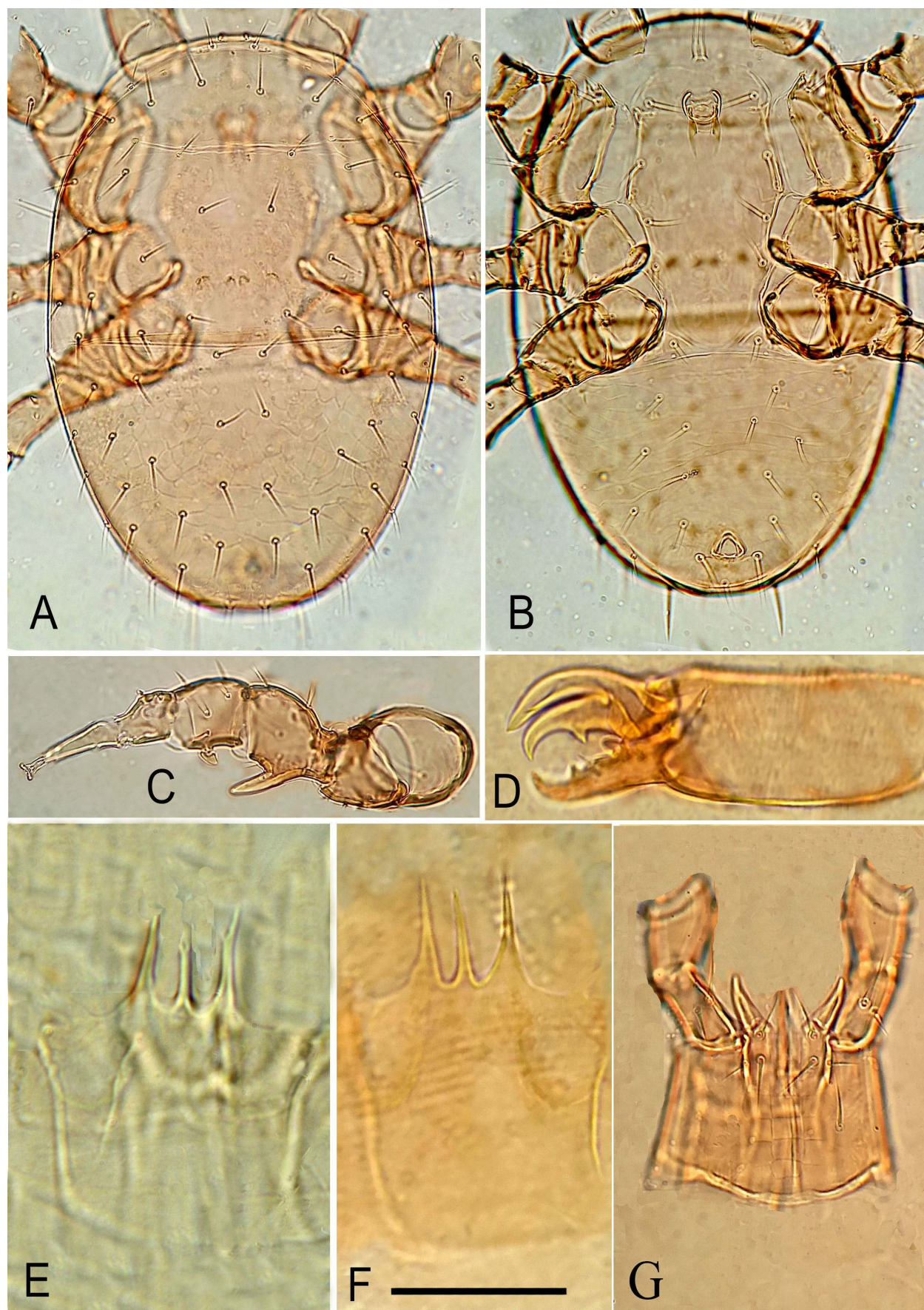


Figure 4 *Dendroseius amoliensis* male, photomicrographs: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Leg II; D – Chelicerae; E-F – Epistome; G – Hypostome. Scale bar: 90 μ m for A and B; 85 μ m for C; 40 μ m for D; 25 μ m for E and F; 75 μ m for G.

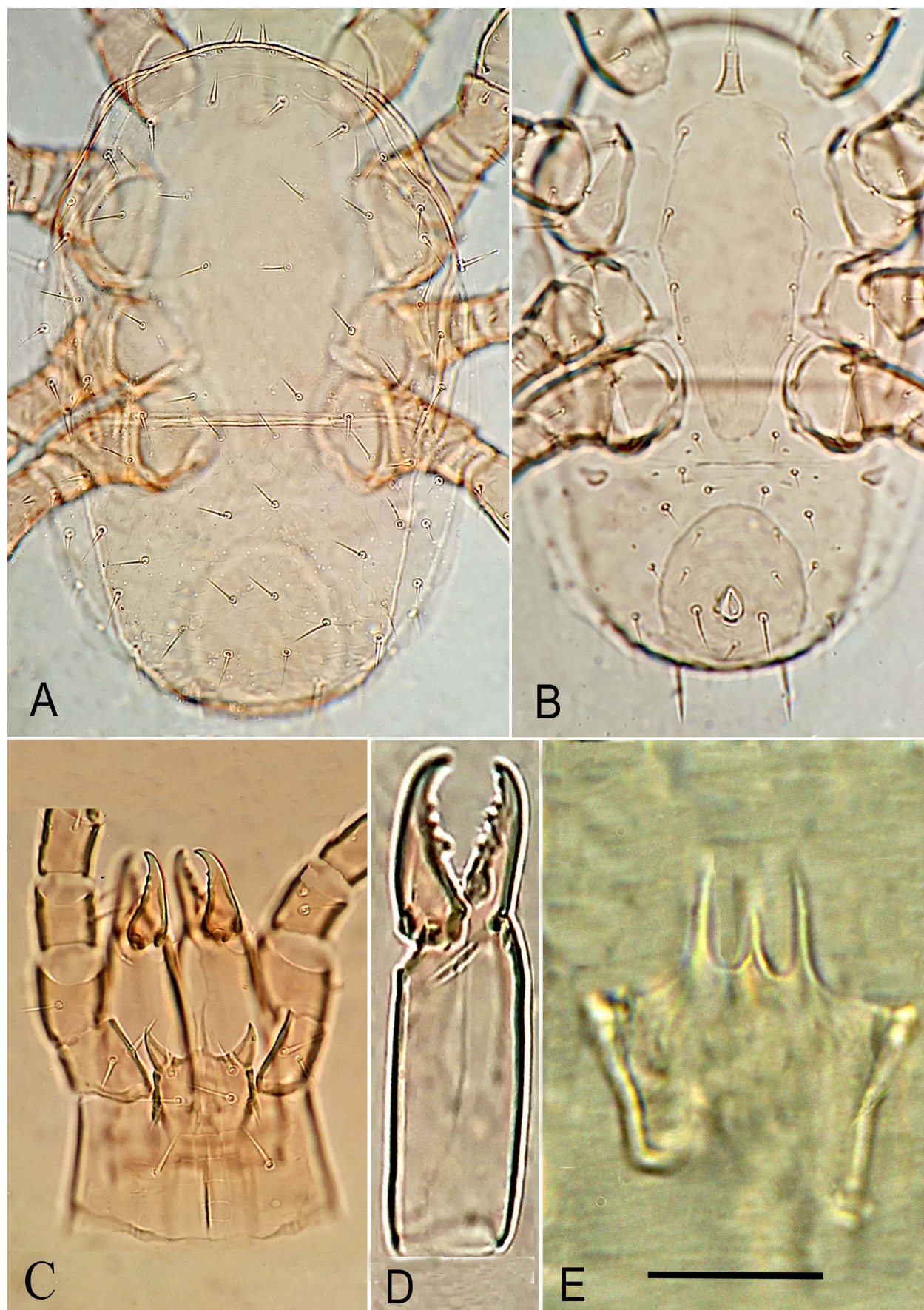


Figure 5 *Dendroseius amoliensis* deutonymph, photomicrographs: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Hypostome; D – Chelicerae; E – Epitome. Scale bar: 70 μ m for A and B; 55 μ m for C; 30 μ m for D; 20 μ m for E.

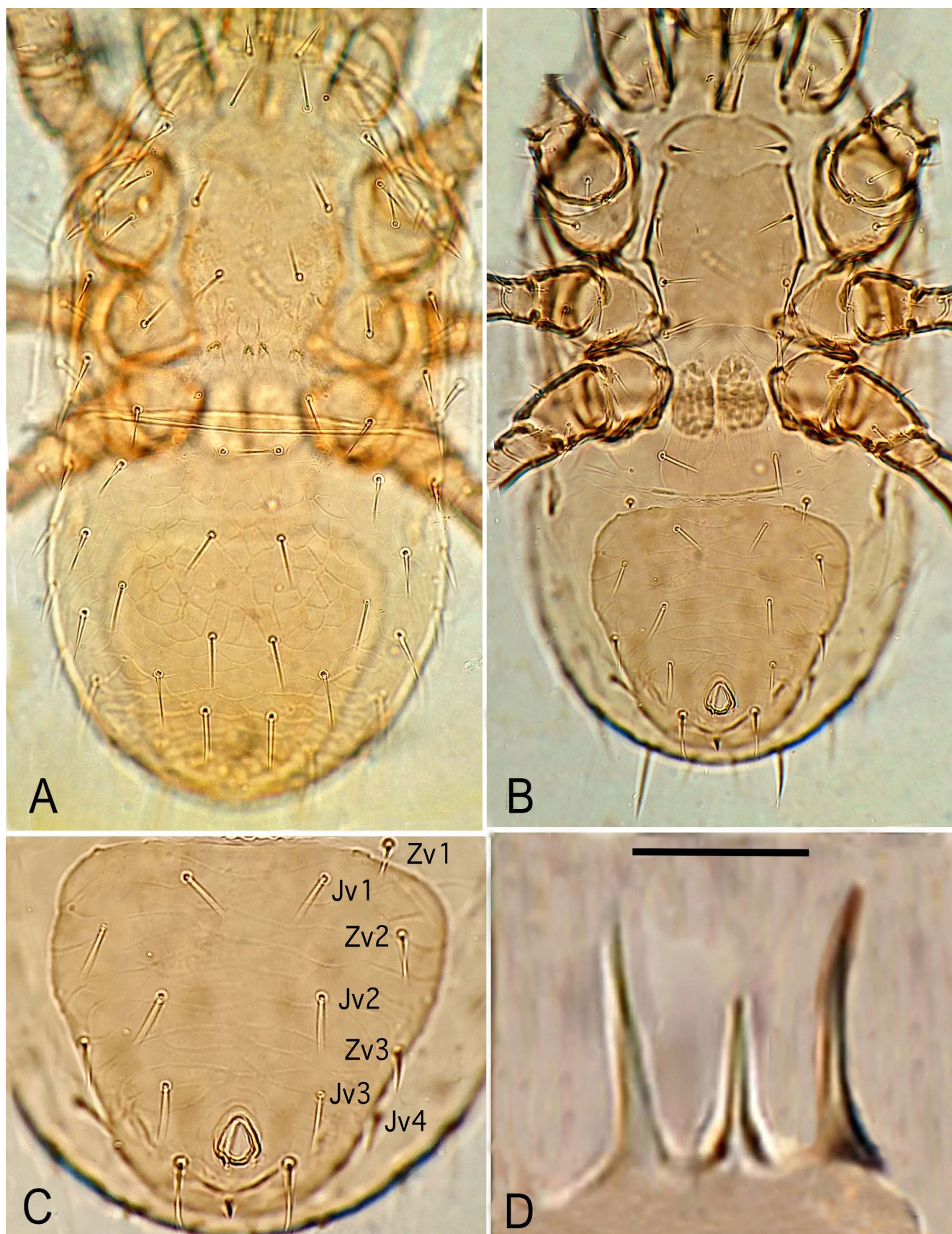


Figure 6 *Dendrozeius amoliensis* female, photomicrographs: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Ventrianal shield; D – Epistome. Scale bar: 80 μ m for A and B; 50 μ m for C; 20 μ m for D.

Remarks

Comparison of some metric characters of *Dendroseius amoliensis* female specimens collected in Guilan province Iran, with those of the original description shows similarities for most of the measurements, only a small difference observed in the size of *z1* (9 vs. 11), *st1* (24 vs. 28), *st2* (24 vs. 27), *Jv4* (23 vs. 25), *Zv3* (17 vs. 20), *h1* (18 vs. 22), *h2* (10 vs. 13), *pc* (17 vs. 20), para-anal (27 vs. 32) and post-anal (13 vs. 18) setae and width of ventrianal shield (117 vs. 123) that are slightly shorter in our specimens. Also, length of *S4* (28 vs. 26), *r3* (29 vs. 27) setae, length of ventrianal shield (120 vs. 116) and fixed digit of chelicerae (38 vs. 35) are slightly longer in our specimens. We consider these negligible differences in size as intraspecific morphological variation. Despite these, we could find a significant difference in the position of setae *Zv3* which in the original description, *Zv3* are off the ventrianal shield while in the examined specimens *Zv3* located on the ventrianal shield (Figure 6C).

Dendroseius vulgaris Ma, Ho & Wang, 2014

Female — five specimens measured (Figure 7)

Dorsal idiosoma (Figure 7A) – Dorsal shield, 352 (336–376) long. Podonotal shield 167 (160–174) long and 179 (170–190) wide; opisthonotal shield 194 (180–208) long and 176 (160–190) wide; *j1* 21 (20–22), *j2* 25 (23–28), *j3* 33 (30–35), *j4* 28 (26–30), *j5* 30, *j6* 26 (24–28), *z1* 16 (12–24) shortest, *z2* 30, *z3* 32, *z4* 35 (34–36), *z5* 28 (26–32), *z6* 26 (23–28), *s1* 19 (14–24), *s2* 27 (26–28), *s3* 33 (32–34), *s4* 33 (30–36), *s5* 33 (32–36), *s6* 31 (30–32), *r2* 21 (14–24), *r3* 31 (26–34), *r4* 20 (18–22), *r5* 22 (20–24), *J1* 27 (26–30), *J2* 32, *J3* 32 (30–34), *J4* 40, *J5* 30, *Z1* 37 (34–40), *Z2* 38 (36–40), *Z3* 36 (34–40), *Z4* 42 (40–44), *Z5* 48 (44–50) longest, *S1* 34 (32–36), *S2* 34, *S3* 35 (32–38), *S4* 37 (34–42), *S5* 37 (34–44), *R1* 20 (16–22), *R2* 26 (24–28), *R3* 30, *R4* 32 (30–34), *R5* 35 (34–36). Ventral idiosoma (Figure 7B): Tritosternum (Figure 7C) base 20 and Lacinae 38 (34–40) long; sternal shield 69 (64–74) long and 70 (62–74) wide, with four pairs of setae, *st1* 24 (22–26), *st2* 24 (22–26), *st3* 24 (22–26), *st4* 24; genital shield 56 (52–62) wide, Setae *st5* 21 (20–22); ventrianal shield 128 (118–144) long and 118 (104–125) wide; with seven pairs of preanal setae, *Jv1* 20 (18–22), *Jv2* 26, *Jv3* 29 (28–30), *Jv5* 34 (28–36), *Zv1* 18 (16–20), *Zv2* 18 (12–22), *Zv3* 22, para-anal 32 (30–34), post-anal 19 (16–22). Gnathosoma: Epistome (Figure 7E) with three-pointed prongs; palp apotele two-tined; fixed cheliceral digit 32 long, with seven teeth in addition the apical tooth and a setiform pilus dentilis; movable cheliceral digit 33 (32–36) long, with three teeth in addition to apical tooth (Figure 7D); corniculi horn-like; deutosternum with seven rows; hypostomal setae smooth, *h1* 19 (18–20), *h2* 9 (8–10), *h3* 21 (20–22), *pc* 19 (16–20) (Figure 7C). Legs: Lengths, excluding pretarsi: leg I 289 (280–296), leg II 202 (200–208), leg III 174 (160–184), leg IV 248 (240–260).

Male — five specimens measured. (Figure 8)

Dorsal idiosoma (Figure 8A) – Dorsal shield, 298 (284–320) long and 189 (176–200) wide. Podonotal shield 146 (140–160) long; opisthonotal shield 157 (146–170) long; *j1* 15 (14–16), *j2* 23 (22–24), *j3* 29 (28–30), *j4* 24 (22–25), *j5* 24 (22–25), *j6* 22 (20–24), *z1* 15 (12–18) shortest, *z2* 26 (20–30), *z3* 28 (26–30), *z4* 30, *z5* 23 (22–24), *z6* 23 (22–24), *s1* 22 (20–26), *s2* 26 (24–28), *s3* 29 (28–30), *s4* 31 (30–34), *s5* 28 (26–30), *s6* 27 (26–30), *r2* 24 (20–26), *r3* 30 (26–32), *r4* 23 (18–26), *r5* 22 (20–24), *J1* 20, *J2* 25 (24–28), *J3* 25 (22–30), *J4* 30 (28–32), *J5* 24, *Z1* 28 (26–30), *Z2* 28 (26–30), *Z3* 28 (26–30), *Z4* 32 (30–34), *Z5* 40 longest, *S1* 28 (20–30), *S2* 27 (26–30), *S3* 29 (26–32), *S4* 28 (26–30), *S5* 29 (27–32), *R1* 18 (14–20), *R2* 20 (18–24), *R3* 24 (20–28), *R4* 25 (22–26), *R5* 24 (22–26). Ventral idiosoma (Figure 8B): Tritosternum (Figure 8D) base 6 (4–8) and lacinae 29 (24–32) long; sternogenital shield 118 (116–120) long and 65 (62–70) wide, with four pairs of setae, *st1* 19 (14–22), *st2* 22 (20–26), *st3* 18 (16–20), *st4* 18 (14–21); setae *st5* 16 (14–20); ventrianal shield 124 (116–132) long; with seven pairs of preanal setae, *Jv1* 18 (16–20), *Jv2* 21 (20–22), *Jv3* 24 (22–26), *Jv5* 26 (24–28), *Zv1* 16 (14–18), *Zv2* 17 (16–20), *Zv3* 18 (16–20) para-anal 31 (30–32), post-anal 16 (14–18). Gnathosoma: Epistome (Figure 8F) with three-pointed prongs; fixed cheliceral

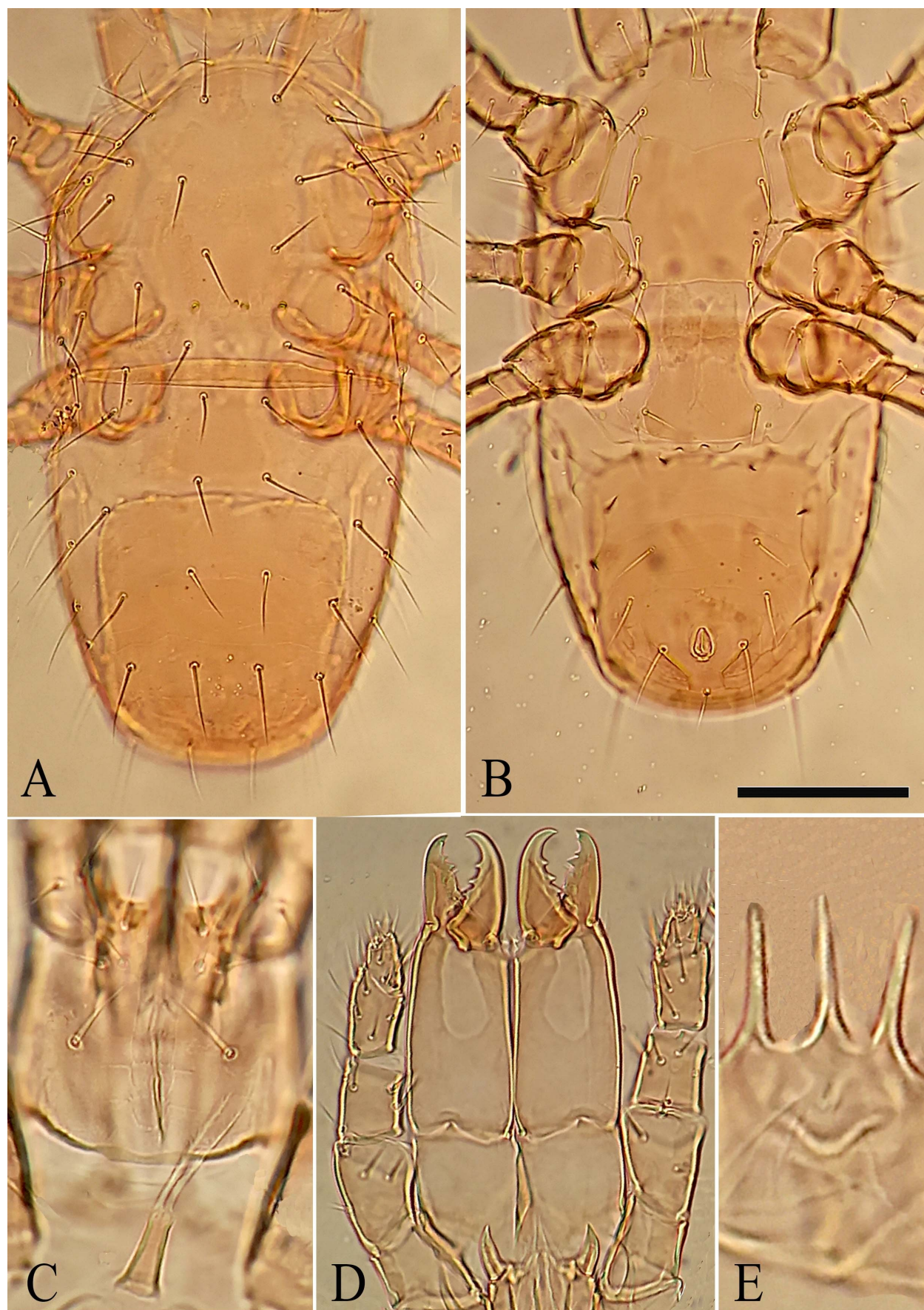


Figure 7 *Dendroseius vulgaris* female, photomicrographs: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Hypostome and tritosternum; D – Chelicerae and palp; E – Epitome. Scale bar: 85 μm for A and B; 38 μm for C; 57 μm for D; 23 μm for E.

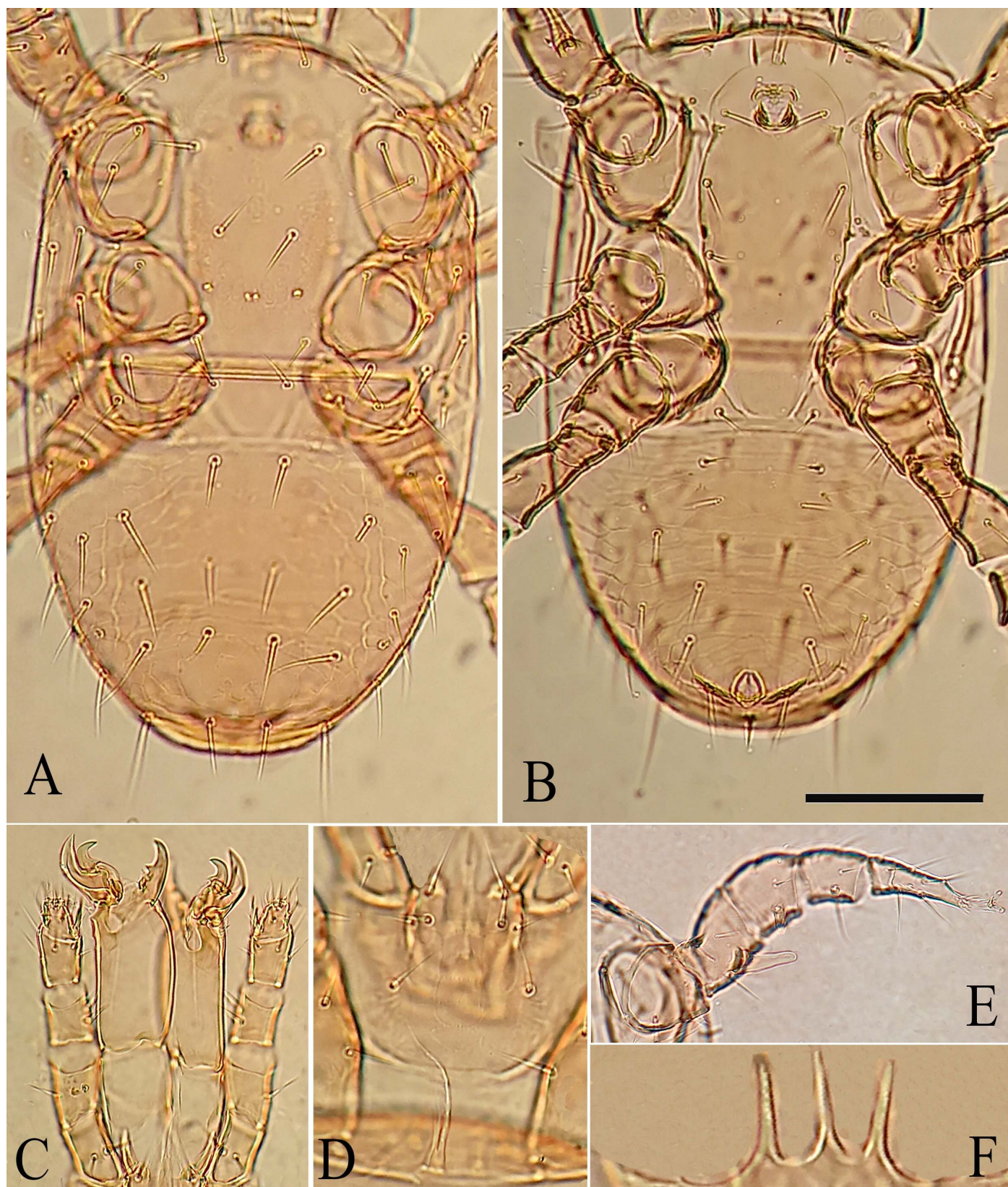


Figure 8 *Dendroseius vulgaris* male, photomicrographs: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Chelicerae and palp; D – Hypostome and tritosternum; E – Leg II; F – Epitome. Scale bar: 77 μm for A and B; 52 μm for C; 53 μm for D; 98 μm for E; 20 μm for F.

digit 27 (26–30) long, movable cheliceral digit 24 (22–26) long, each with the same number of teeth as the adult female, spermatodactyl 22 long (Figure 8C); deutosternum with seven rows; hypostomal setae smooth, *h1* 17 (14–20), *h2* 8, *h3* 18 (16–20), *pc* 16 (14–18) (Figure 8D). Legs: Lengths, excluding pretarsi: leg I 277 (260–284), leg II 197 (180–204), leg III 170 (160–172), leg IV 246 (240–252).

Material examined

Eleven females, three males and four deutonymphs, Iran, Guilan Province, Rasht County, (37°16'41.1"N, 49°36'23.4"E, alt. –7 m), livestock manure and decayed rice bran, 22 September, 2021; 14 October, 2021; 27 September, 2021; 13 August, 2021. Four females, Kuchesfahan district (37°15'25"N, 49°46'30"E, alt. 0 m), decayed rice bran, November 15, 2021. Four females, one male, Lashtnesh district (37°21'57.7"N, 49°51'28.0"E, alt. 24 m), livestock manure and decayed rice bran, 15 November, 2021. One female, Khomam district, (37°21'56.2"N, 49°41'12.1"E, alt. –17 m), decayed rice bran, 15 November, 2021. Sixteen females, three males and one deutonymph, Sangar district (37°10'18.5"N, 49°42'48.3"E, alt. 31 m), livestock manure and decayed rice bran, 14 October, 2021, all specimens collected by Leila Mohammadi.

Remarks

Comparison of some metric characters of *Dendroseius vulgaris* female specimens collected in Guilan province Iran, with those of the original description shows that most measurements are similar, only a small difference observed in the size of *z1* (16 vs. 20), *z6* (26 vs. 29), *Z5* (48 vs. 52), *s1* (19 vs. 24), *r2* (21 vs. 23), *r3* (31 vs. 35), *r4* (20 vs. 28), *r5* (22 vs. 25), *R1* (20 vs. 22), *R2* (26 vs. 28), *st2* (24 vs. 27), *Jv1* (20 vs. 22), *Jv5* (34 vs. 36), *Zv2* (18 vs. 23), *h2* (9 vs. 11), idiosoma length (352 vs. 360), idiosoma width (189 vs. 232), fixed cheliceral digit (32 vs. 35) ventrianal length (128 vs. 138), ventrianal width (118 vs. 131), and post-anal seta (19 vs. 23) that are slightly shorter in our specimens. Also, length of *j1* (21 vs. 16), *J1* (27 vs. 24), *z3* (32 vs. 29), *Jv2* (26 vs. 24), and para-anal (32 vs. 30) setae are slightly longer in our specimens. For males of this species like females, some small differences observed in the size of, *J4* (30 vs. 32), *J5* (24 vs. 26), idiosoma length (298 vs. 315), idiosoma width (189 vs. 204), tritosternum base (6 vs. 10), laciniae (29 vs. 23), sternogenital shield length (118 vs. 128), sternogenital shield width (65 vs. 68), ventrianal length (124 vs. 139), and post-anal seta (16 vs. 22) that are slightly shorter in our specimens. Also length of *j3* (29 vs. 27), *j5* (24 vs. 20), *J1* (20 vs. 18), *J2* (25 vs. 21), *z3* (28 vs. 24), *z4* (30 vs. 28), *z5* (23 vs. 21), *z6* (23 vs. 20), *Z2* (28 vs. 25), *Z5* (40 vs. 37), *s2* (26 vs. 24), *s3* (29 vs. 25), *s4* (31 vs. 26), *s5* (28 vs. 25), *s6* (27 vs. 21), *S5* (29 vs. 26), *R2* (20 vs. 17), *Jv2* (21 vs. 19), *Jv3* (24 vs. 19), *Zv2* (17 vs. 15), *h1* (17 vs. 15), *h3* (18 vs. 15), para-anal (31 vs. 29) setae, fixed cheliceral digit (27 vs. 25) and spermatodactyl length (22 vs. 18) are slightly longer in our specimens. We consider these slight differences in size as geographical intraspecific variation.

Updated key to world species of *Dendroseius* (deutonymph and female)

The key to the world species of the *Dendroseius* (females) presented by Mašán (2020), is modified here to accommodate the deutonymph stage (only for species with described deutonymph stage).

1. Female stage 5
— Deutonymph stage 2
2. Setae *Z5* twice the length of *j4* 3
— Setae *Z5* more than twice the length of *j4* 4
3. Fix digit of chelicerae with two teeth
..... *Dendroseius congoensis* Wiśniewski et Hirschmann, 1992 (Africa)

- Fix digit of chelicerae with three teeth
..... *Dendroseius amoliensis* Faraji, Sakenin-Chelav & Karg, 2006 (Iran)
4. Setae *Z5* 2.4 times the length of *j5*, fix digit of chelicerae with seven teeth, length of idiosoma 308 µm long *Dendroseius vulgaris* Ma, Ho & Wang, 2014 (Taiwan)
— Setae *Z5* 3½ times the length of *j5*, fix digit of chelicerae with four teeth, length of idiosoma 325 µm long *Dendroseius gujarati* Wiśniewski et Hirschmann, 1989 (India)
5. Ventrianal shield nearly triangular, with posterior margin convex, peritreme anteriorly reaches to the level of the middle of coxa III, length of idiosoma 367 µm
..... *Dendroseius amoliensis* Faraji, Sakenin-Chelav & Karg, 2006 (Iran)
— Ventrianal shield subquadrate or subrectangular, with posterior margin only moderately curved, peritreme relatively longer, anteriorly reaches to the level coxae II 6
6. Podonotal soft integument with at most two pairs of setae (*r4*, *r5*); *r2* situated on dorsal shield; length of idiosoma 364 µm *Dendroseius badenhorsti* (Ryke, 1962) (South Africa)
— Podonotal soft integument with at least three pairs of setae (*r2*, *r4*, *r5*); sometimes *s1* situated on soft integument 7
7. Dorsal shield setae shorter (*J1–J4* normally less than 15 µm in length); setae *r5* and *Z5* similar in length (26–32 µm); ventrianal shield wider than long (L 95–100 µm; W 120–135 µm), length of idiosoma 260–290 µm
..... *Dendroseius reticulatus* (Sheals, 1956) (Europe, North Africa)
— Dorsal shield setae longer (*J1–J4* normally more than 18 µm in length); setae *r5* 1.5–2 times shorter than *Z5* (*r5* 23–28 µm, *Z5* 35–55 µm); ventrianal shield similar in width and length (L 105–143 µm; W 112–135 µm), length of idiosoma 315–375 µm 8
8. Central process of epistome shortened (about 1/2 length of the lateral process); dorsal shield setae generally shorter: *j5* 17–20 µm, *J1–J4* 19–23 µm, *J5* 17–19 µm, *S1–S3* 21–25 µm; *Z5* 35–40 µm; ventrianal shield slightly wider than long (L 105–115 µm; W 112–130 µm); length of idiosoma 315–345 µm *Dendroseius reductus* Mašán (Slovakia)
— Epistome with three well-developed prongs, central process slightly longer than lateral ones; dorsal shield setae generally longer: *j5* 25–30 µm, *J1–J4* 23–42 µm, *J5* 26–38 µm, *S1–S3* 24–30 µm; *Z5* 48–55 µm; ventrianal shield slightly longer than wide (L 131–143 µm; W 128–135 µm); length of idiosoma 353–375 µm
..... *Dendroseius vulgaris* Ma, Ho & Wang, 2014 (Taiwan)

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References

- Athias-Henriot C. 1969. Les organes cuticulaires sensoriels et glandulaires des Gamasides. Poroidotaxie et adenotaxie. Bull. Soc. Zool. Fr., 94:458-492.
- Castilho R.C. Moraes G.J. de Halliday B. 2012. Catalogue of the mite family Rhodacaridae Oudemans, with notes on the classification of the Rhodacaroidea (Acari: Mesostigmata). Zootaxa, 3471: 1- 69. <https://doi.org/10.11646/zootaxa.3471.1.1>

- Evans G.O. 1963a. Observations on the chaetotaxy of the legs in the free-living Gamasina (Acari: Mesostigmata). *Bull. Brit. Mus. (Nat. Hist.) Zool.*, 10(5): 277-303. <https://doi.org/10.5962/bhl.part.20528>
- Evans G.O. 1963b. Some observations on the chaetotaxy of the pedipalps in the Mesostigmata (Acari). *Ann. Mag. Nat. Hist.*, 13(6): 513-527. <https://doi.org/10.1080/00222936308651393>
- Evans G.O. Till W.M. 1979. Mesostigmatic mites of Britain and Ireland (Chelicerata: Acari - Parasitiformes). An introduction to their external morphology and classification. *Trans. Zool. Soc. Lond.*, 35: 145-270. <https://doi.org/10.1111/j.1096-3642.1979.tb00059.x>
- Faraji F. Sakenin-Chelav H. Karg W. 2006. A new species of *Dendroseius* Karg from Iran (Acari: Rhodacaridae), with a key to the known species. *Zootaxa*, 1221: 63-68. <https://doi.org/10.11646/zootaxa.1221.1.2>
- Faraji F. Zare M. Rahmani H. 2021. A new genus and species of Digamasellidae (Acari: Mesostigmata) displaying some extraordinary gnathosomal structures. *Acarologia* 61(4): 967-977. <https://doi.org/10.24349/oOsa-j8xy>
- Hirschmann W. 1974. Gangsystematik der Parasitiformes. Teil 190. Die Gattung *Dendrolaelaps* Halbert, 1915, Hirschmann nov. comb. Nova Subgenera *Multidendrolaelaps*, *Tridentrolaelaps* Hirschmann. *Stadien von 4 neuen Dendrolaelaps-Arten*. *Acarologie*, 20: 50-70.
- Johnston D. E. Moraza M. L. 1991. The idiosomal adenotaxy and poroidotaxy of Zerconidae (Mesostigmata: Zerconina). In: Dusbabek F. Bukva V. (eds.), *Modern Acarology 2*. Amsterdam (Netherlands): Prague and SPB Academic Publishing. p. 349-356.
- Karg W. 1965. Larvalsystematische und phylogenetische Untersuchung sowie Revision des Systems der Gamasina Leach, 1915 (Acarina, Parasitiformes). *Mitt. Zool. Mus. Berlin*, 41(2): 193-340. <https://doi.org/10.1002/mmzn.19650410207>
- Karg W. 1993. Acari (Acarina), Milben Parasitiformes (Anactinochaeta) Cohors Gamasina Leach. *Raubmilbe. - Die Tierwelt Deutschlands*: 59, Second Edition, Gustav Fischer Verlag, Jena, Germany: 523 pp.
- Lindquist E.E. Evans G.O. 1965. Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). *Mem. Entomol. Soc. Canada*, 47: 1-64. <https://doi.org/10.4039/entm9747fv>
- Lindquist E.E. Krantz G.W. Walter D.E. 2009. Order Mesostigmata. In: Krantz G.W. D.E. Walter (eds.), *A Manual of Acarology*. Third Edition, Texas Tech University Press, p. 124-232.
- Ma L.M. Ho C.C. Wang S.C. 2014. Two new species of Digamasellidae from Taiwan (Acari: Mesostigmata). *Zootaxa*, 3768: 43-58. <https://doi.org/10.11646/zootaxa.3768.1.3>
- Mašán P. 2020. A new wood-inhabiting mite species of the genus *Dendroseius* Karg, 1965 (Acari, Mesostigmata, Rhodacaridae) from Central Europe (Slovakia). *ZooKeys*, 984: 49-57. <https://doi.org/10.3897/zookeys.984.57256>
- Ryke P.A.J. 1962. The subgenera *Digamasellus* Berl. and *Euryparasitus* Oudemans of the genus *Cyrtolaelaps* Berlese (Acarina: Rhodacaridae). *Entomol. Soc. South. Africa*, 25: 88-115.
- Shcherbak G.I. 1980. *The Palearctic Mites of the family Rhodacaridae*. Naukova Durnka, Kiev, 215 pp.
- Sheals J.G. 1956. Notes on a collection of soil Acari. *Entomol. Mon. Mag.*, 92: 99-103.
- Sheals J.G. 1958. A revision of the British species of *Rhodacarus* Oudemans and *Rhodacarellus* Willmann (Acarina, Rhodacaridae). *Ann. Mag. Nat. Hist.*, 1: 298-304. <https://doi.org/10.1080/00222935808650949>
- Walter D.E. Hunt H.W. Elliott E.T. 1988. Guilds or functional groups? An analysis of predatory arthropods from a shortgrass steppe soil. *Pedobiologia*, 31: 247-260.
- Walter D.E. Proctor H. 2013. *Mites: Ecology, Evolution and Behaviour*. Second Edition. Springer, Dordrecht, 494 pp. <https://doi.org/10.1007/978-94-007-7164-2>
- Wiśniewski J. Hirschmann W. 1989. Neue *Dendroseius*- und *Dendrolaelaps*-Arten (Acarina, Trichopygidiina) aus Indien, Java, Peru und Bulgarien. *Pol. Pismo Entomol.*, 59: 319-333.
- Wiśniewski J. Hirschmann W. 1992. *Dendroseius congoensis* nov. spec. (Acarina, Mesostigmata) auf importierten Holz in Polen. *Bull. Soc. Amis Sci. Poznań, Ser. D*, 29: 63-67.