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Immature stages and male *Paraseiulus amacroporus* Faraji *et al.*, (Acari: Mesostigmata: Phytoseiidae) from Southwestern Iran

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ABSTRACT — This study presents the morphological characteristics of immature and adult male stages of *Paraseiulus amacroporus* Faraji, Jalaeian and McMurtry, 2008 (Phytoseiidae) collected from pistachio trees, *Pistacia atlantica* Desf. (Anacardiaceae), Shiraz vicinity (Fars province), South west Iran. The genders of the deutonymphal stage can be determined by the number of paired setae in the opisthogaster (six in female *vs.* four in male).

KEYWORDS — mite; Typhlodrominae; Paraseiulini; predator; pistachio

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INTRODUCTION

The Paraseiulini (subfamily Typhlodrominae) consisted of three genera (*Paraseiulus* Muma, *Australiseiulus* Muma and *Kuzinellus* Wainstein). The genus *Paraseiulus* is distinguished by absence of opisthogastric setae *JV2* and ventrianal shield sole-shaped with two pairs of preanal setae and without pores (Chant and McMurtry, 1994). To date 15 valid species (plus seven junior synonymy species) have been describes and recorded from Eurasia, Africa and America continents (according to Demite *et al*. 2017) and ranks second in the tribe. According to McMurtry *et al.* (2013), representatives of *Paraseiulus* are categorized as specialized predators of tydeoids (Tydeoidea) (Subtype I-c, lifestyle). *Paraseiulus amacroporus* Faraji, Jalaeian and McMurtry, 2008 was described and collected from pistachio trees, Borkhar (Isfahan Province), Iran. In this paper the immature and adult stages [protonymph, deutonymph (♀ & ♂) and male] are described and illustrated.

MATERIALS AND METHODS

The specimens were collected from leaves of pistachio trees, *Pistacia atlantica* Desf. (Anacardiaceae), Shiraz region, (Fars province), Southwestern Iran, under a stereomicroscope (Wild M3®). The mites were mounted on microscope slides in Hoyer's medium for examination under an Olympus BX51 phase and differential interference contrast microscope. Illustrations were done with the aid of a camera Lucida apparatus attached to the microscope and measurements were done with a graded ocu-

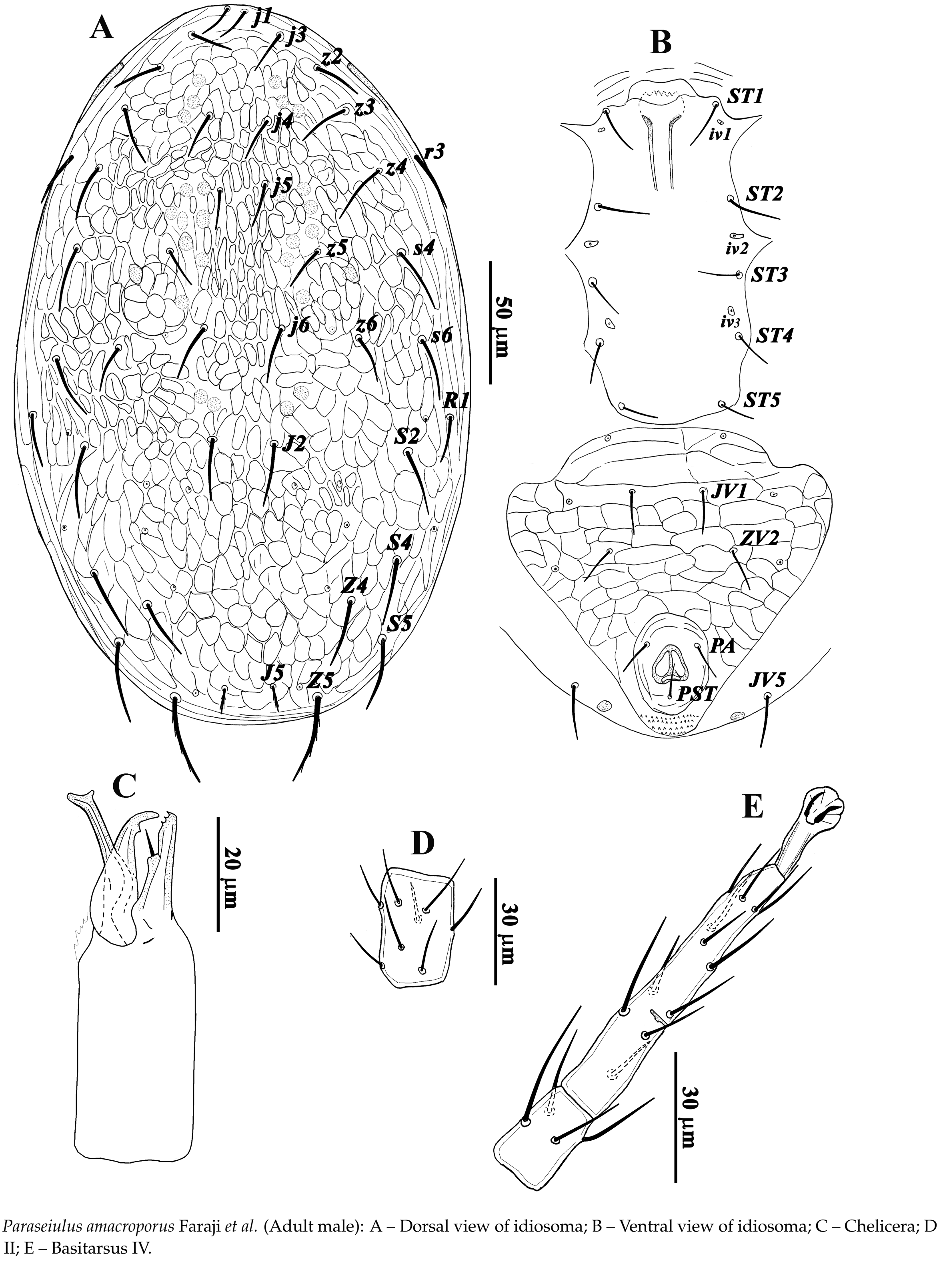

FIGURE 1: *Paraseiulus amacroporus* Faraji *et al.* (Adult male): A – Dorsal view of idiosoma; B – Ventral view of idiosoma; C – Chelicera; D – Genu II; E – Basitarsus IV.

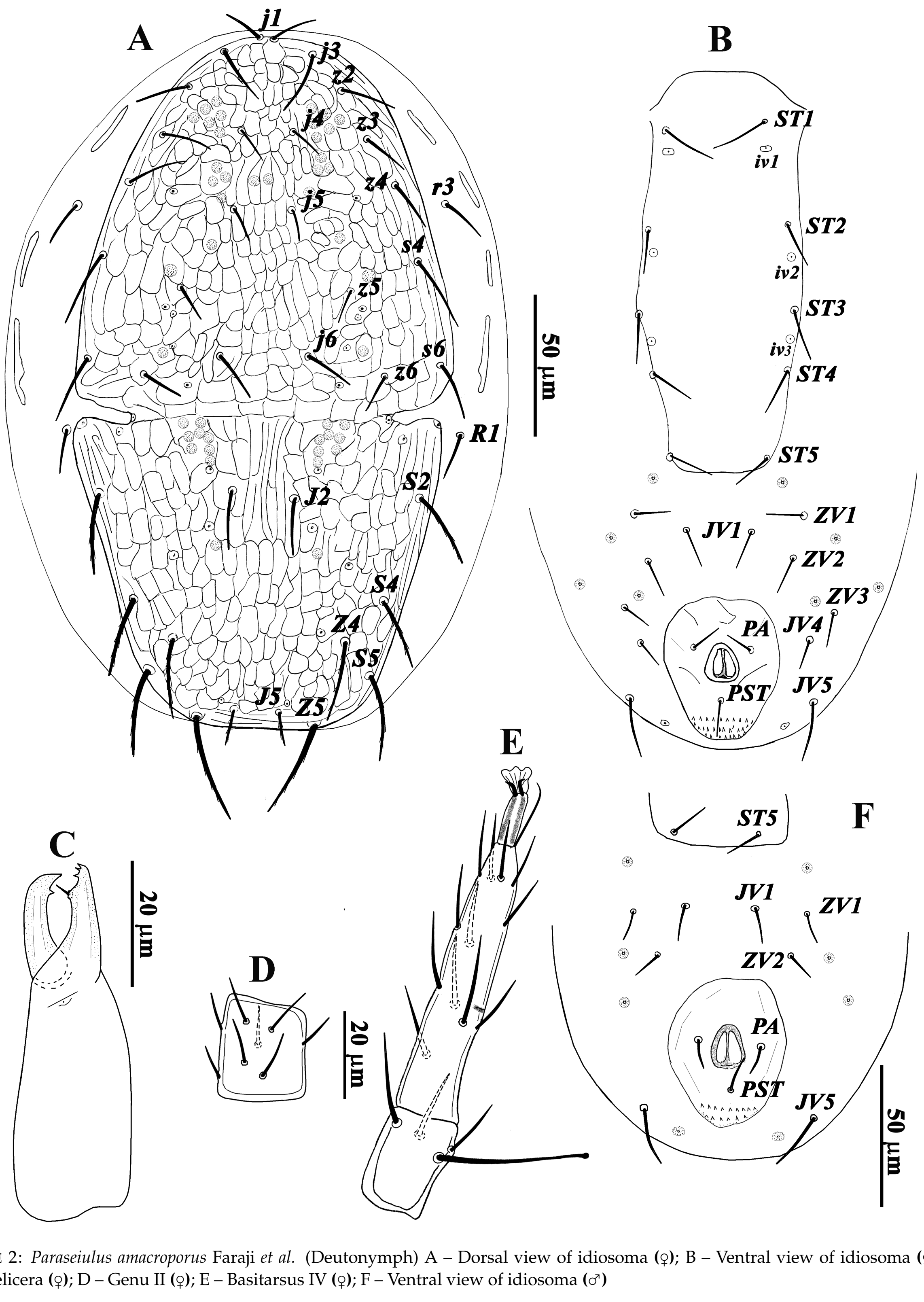

FIGURE 2: *Paraseiulus amacroporus* Faraji *et al.* (Deutonymph) A – Dorsal view of idiosoma (♀); B – Ventral view of idiosoma (♀); C – Chelicera (♀); D – Genu II (♀); E – Basitarsus IV (♀); F – Ventral view of idiosoma (♂)

lar. Measurements are given in micrometers. Leg lengths do not include pretarsus. The classification system used follows that of Chant & McMurtry (2007). The setal notations used follow Lindquist and Evans (1965) as adapted by Rowell *et al.* (1978) and also Rowell & Chant (1979) to phytoseiid mites; dorsal and ventral setal patterns are according to Chant and Yoshida-Shaul (1989 and 1991); organotaxy follows Athias-Henriot (1975).

RESULTS

Phytoseiidae Berlese, 1916: 33.
Typhlodrominae Wainstein, 1962: 131; Chant and McMurtry, 1994: 235.
Paraseiulini Wainstein, 1976: 697-698.
***Paraseiulus* Muma, 1961: 299.**

***Paraseiulus amacroporus* Faraji, Jalaeian and McMurtry, 2008: 65.**

Diagnosis (female) — Dorsal shield without setae *Z3* and solenostomes (prominent pores), with distinct small pores, peritremes extending to level of, or just passing, the bases of setae *z2*, calyx of spermatheca saccular, without neck and with a C-shaped atrium, fixed digit of chelicera with two subapical teeth (Faraji *et al*. 2008).

Female

(See Faraji *et al*. 2008).

Male

(Figure 1) (n= 5)

Idiosoma oval; setal pattern: 13A:8A/10: JV-2, 3, 4: ZV-I,3. All idiosomal and leg setae smooth, except *Z5* and *J5*, barbed.

Dorsum (Fig. 1A) — Dorsal shield reticulated, 260 – 280 long, 170 – 190 wide at level of *R1*, with 21 pairs of setae and 10 pairs of poroids and solenostomes (prominent pores) absent. Length of setae: *j1* 11 – 13, *j3* 14 – 16, *j4* 15 – 16, *j5* 15 – 17, *j6* 20 – 22, *J2* 21 – 23, *J5* 11 – 13, *z2* 20 – 21, *z3* 21 – 23, *z4* 23 – 25, *z5* 14 – 16, *z6* 15 – 17, *Z4* 24 – 26, *Z5* 36 – 38, *s4* 23 – 25, *s6* 24 – 27, *S2* 23 – 25, *S4* 23 – 26, *S5* 27 – 30, *r3* 20 – 23, *R1* 19 – 21.

Venter (Fig. 1B) — Sternogenital shield smooth, 125 – 130 long, anterior and posterior margins convex; five pairs of setae subequal in length (*ST1* 18 – 20, *ST2* 17 – 18, *ST3* 17 – 18, *ST4* 17 – 19, *ST5* 17 – 18); three pairs of poroids (*iv1-iv3*). Ventrianal shield reticulated, subtriangular; anterior margin concave, 113 – 118 long and 120 – 132 wide at level of setae *JV1*; two pairs of pre-anal setae (*JV1* and *ZV2*); three pairs of poroids; no preanal pores. Opisthogastric cuticle with one pair of setae (*JV5*) and one pair of poroids. Length of opisthogastric setae: *JV1* 14 – 15, *JV5* 20 – 21, *ZV2* 15, *PA* 13 – 14 and *PST* 14 – 15.

Peritreme (Fig. 1A) — Extending to level of setae *z2*, 105 – 112 long.

Chelicera (Fig. 1C) — Chelicera 79 – 83 long; fixed digit 16 – 17 long, with two subapical teeth; *pilus dentilis* 3 long; movable digit 16 – 18 long and with one tooth, shaft of spermadactyl 9 – 11 long, arched and heel shaped distally, 4 long.

Legs I-IV (Figs. 1D-E) — Lengths: 228 – 235, 200 – 215, 220 – 225, 280 – 300, respectively. Genu II with eight setae (2 2/1 2/0 1); Basitarsus IV with a pointed macroseta, 25 – 30 long.

Deutonymph (female)

(Figure 2) (n= 6)

Idiosoma oval. All idiosomal and leg setae smooth, except *S2*, *S4*, *S5*, *Z4*, *Z5* and *J5* barbed.

Dorsum (Fig. 2A) — Dorsal shield reticulated, with mediolateral incisions, 265 – 270 long, 140 – 150 wide at level of setae *R1*, with 19 pairs of setae, 13 pairs of poroids and solenostomes (prominent pores) absent. Length of setae: *j1* 13 – 15, *j3* 20 – 21, *j4* 13 – 15, *j5* 12 – 14, *j6* 20, *J2* 19 – 22, *J5* 11 – 13, *z2* 19 – 20, *z3* 18 – 19, *z4* 20 – 23, *z5* 13 – 15, *z6* 13 – 15, *Z4* 30 – 33, *Z5* 34 – 36, *s4* 25 – 26, *s6* 22 – 25, *S2* 29 – 31, *S4* 30, *S5* 31 – 33, *r3* 17 – 19, *R1* 18 – 20.

Venter (Fig. 2B) — Sternal shield smooth, anterior margin convex, with five pairs of setae subequal in length (*ST1* 18 – 21, *ST2* 19 – 20, *ST3* 18 – 19, *ST4* 17 – 18, *ST5* 17 – 18), three pairs of poroids (*iv1-iv3*). Opisthogastric cuticle with six pairs of setae (*JV1*, *JV4*, *JV5*, *ZV1*, *ZV2*, *ZV3*) and five pairs of poroids. Length of opisthogastric setae: *JV1* 14 – 16,

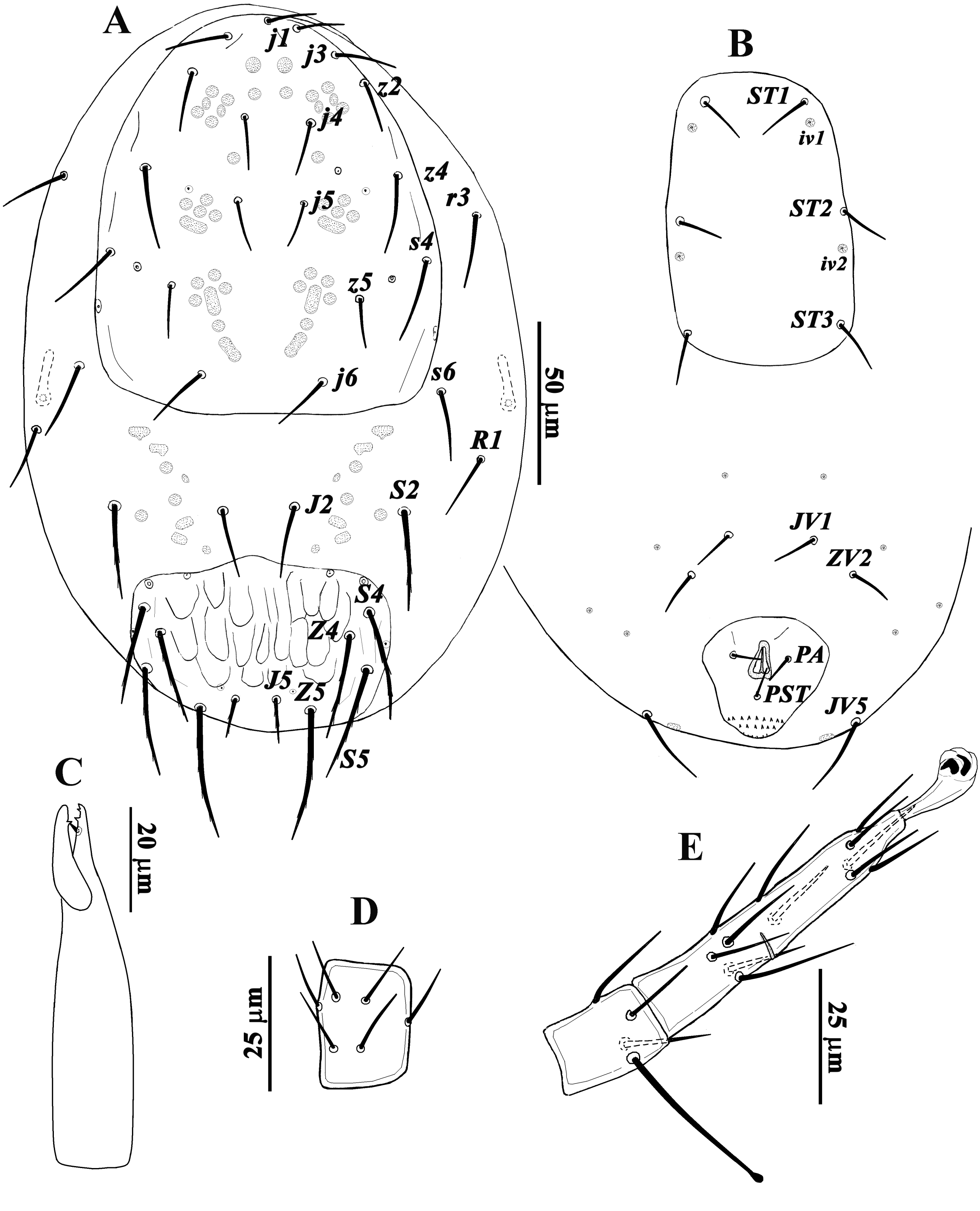

FIGURE 3: *Paraseiulus amacroporus* Faraji *et al.* (Protonymph): A – Dorsal view of idiosoma; B – Ventral view of idiosoma; C – Chelicera; D – Genu II; E – Basitarsus IV.

JV4 11 – 13, *JV5* 22 – 25, *ZV1* 14 – 15, *ZV2* 12 – 14, *ZV3* 10 – 12, *PA* 12 – 13, *PST* 13 – 14.

Peritreme (Fig. 2A) — Incomplete, fragmented.

Chelicera (Fig. 2C) — Chelicera 84 – 95 long; fixed digit 17 – 19 long, with two subapical teeth; *pilus dentilis* 3 – 4 long; movable digit 16 – 18 long and with one tooth.

Legs I-IV (Figs. 2D-E) — Lengths: 260 – 270, 215 – 235, 225 – 235, 280 – 310, respectively. Genu IV with eight setae (2 2/1 2/0 1). Basitarsus IV with a knobbed macroseta, 31 – 35 long.

Deutonymph (male)

(Figure 2) (n= 1)

The idiosomal and cheliceral characters are like those of female deutonymph however it can be distinguished by the number of setae in opisthogastric region (Fig. 2F) and the length of the dorsal shield (225). Opisthogastric cuticle with four pairs of setae (*JV1*, *JV5*, *ZV1*, *ZV2*) and four pairs of poroids. Length of opisthogastric setae: *JV1* 15, *JV5* 21, *ZV1* 11, *ZV2* 12, *PA* 11, *PST* 11.

Legs I-IV — Lengths: 235, 207, 198, 258, respectively. Genu IV with eight setae (2 2/1 2/0 1). Basitarsus IV with a knobbed macroseta, 30 long.

Protonymph

(Figure 3) (n= 3)

Idiosoma oval. All idiosomal and leg setae smooth, except *S2*, *S4*, *S5*, *Z4*, *Z5* and *J5* barbed.

Dorsum (Fig. 3A) — Separate podonotal and opisthonotal shields; podonotal shield smooth, 122 – 127 long and 100 – 105 wide at level of *s4*, with nine pairs of setae (*j1*, *j3*, *j4*, *j5*, *j6*, *z2*, *z4*, *z5*, *s4*), four pairs of poroids and solenostomes (prominent pores) absent. Opisthonotal shield reticulated, 78 – 80 long, 56 – 61 wide at level of *S4*, with five pairs of serrated setae and four pairs of poroids; setae *J2*, *s6*, *S2*, *r3* and *R1* on soft integument (Fig. 3A). Length of setae: *j1* 14 – 15, *j3* 18 – 19, *j4* 12 – 14, *j5* 12 – 13, *j6* 19 – 20, *J2* 19, *J5* 10 – 11, *z2* 20, *z4* 27, *z5* 13, *Z4* 33 – 34, *Z5* 37, *s4* 19 – 21, *s6* 24, *S2* 26 – 27, *S4* 31, *S5* 33, *r3* 18 – 19, *R1* 20.

Venter (Fig. 3B) – Sternal shield smooth, with three pairs of setae subequal in length (*ST1-3*: 17 – 18) and two pairs of poroids (*iv1-iv2*). Opisthogastric cuticle with three pairs of smooth setae (*JV1*, *JV5*, *ZV2*) and five pair of poroids on small platelets. Anal opening surrounded with 3 setae (*PA* and *PST*). Length of opisthogastric setae: *JV1* 15, *JV5* 22, *ZV2* 10 – 11, *PA*12, *PST* 14.

Peritreme (Fig. 3A) — Vestigial; 15 – 18 long.

Chelicera (Fig. 3C) — Chelicera 85 long; fixed digit 15 long, with two teeth; *pilus dentilis* 2 long; movable digit 14 – 15 long and with one tooth.

Legs I-IV (Figs. 3D-E) — Lengths: 210 – 215, 184 – 185, 170 – 175 and 220 – 225, respectively. Genu II with six setae (1 2/0 2/0 1). Basitarsus IV with a knobbed macroseta, 31 long.

Material examined

All specimens are collected from leaves of pistachio trees, *Pistacia atlantica* Desf. (Anacardiaceae), Shiraz region (29°25′41″N, 53°13′37″E and altitude 1755 m a.s.l) (Fars province), Southwestern Iran, 25 vii 2016, by Samira Bakhshi. All specimens are deposited in the mite collection of the Acarology Laboratory of the Bu-Ali Sina University, Hamedan, Iran.

Discussion

Paraseiulus is considered as a genus in the Phytoseiidae where sexual dimorphism occurs, with setae *z6* present in females but variable in males (Chant and McMurtry, 1994). However, in the present species *z6* is present in the males and also in the male and female deutonymphs; Setae *z6* are absent in the protonymph and obviously in the larva. Sexual dimorphism in the deutonymphs is typical for members of the Phytoseiidae (Arutunjan, 1970) [for example number of paired setae in the opisthogaster region in this species 6 (♀) *vs.* 4 (♂) and length of dorsal shield (♀ > ♂)]. Genu II has 8 (2 2/1 2/0 1) setae in adults and deutonymphs but only 6 (1 2/0 2/0 1) in the protonymph. Furthermore, the macrosetae on basitarsus IV in immatures are knobbed in this species while pointed in adults. Comparison of characters of stages are presented in table 1.

TABLE 1: Comparison of characters of stages of *Paraseiulus amacroporus* Faraji *et al.*, 2008. P.: Protonymph, D.: Deutonymph, A.: Adult.

Ch. / Stage	**P.**	**D. (♀)**	**D. (♂)**	**A. (♀)**	**A. (♂)**
L. d. s.*	122-127, 78-80	265-270	225	345-363	260-280
j1	+	+	+	+	+
j3	+	+	+	+	+
j4	+	+	+	+	+
j5	+	+	+	+	+
j6	+	+	+	+	+
J2	+	+	+	+	+
J5	+	+	+	+	+
z2	+	+	+	+	+
z3	-	+	+	+	+
z4	+	+	+	+	+
z5	+	+	+	+	+
z6	-	+	+	+	+
Z4	+	+	+	+	+
Z5	+	+	+	+	+
s4	+	+	+	+	+
s6	+	+	+	+	+
S2	+	+	+	+	+
S4	+	+	+	+	+
S5	+	+	+	+	+
r3	+	+	+	+	+
R1	+	+	+	+	+
ST1	+	+	+	+	+
ST2	+	+	+	+	+
ST3	+	+	+	+	+
ST4	-	+	+	+	+
ST5	-	+	+	+	+
JV1	+	+	+	+	+
JV4	-	+	-	+	-
JV5	+	+	+	+	+
ZV1	-	+	+	+	-
ZV2	+	+	+	+	+
ZV3	-	+	-	+	-
Setae *S2-5*, *Z4*	Serrated	Serrated	Serrated	Smooth	Smooth
Spermadactyl	-	-	-	-	+
Macrosetae on basitarsus IV	+, Knobbed	+, Knobbed	+, Knobbed	+, Pointed	+, Pointed
Genua II**	6	8	8	8	8

*: **L. d. s. =** Length of dorsal shield

**: Numbers of setae.

Acknowledgements

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