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Description of *Typhloseiulus anatolicus* sp. nov. and redescription of two new records of Phytoseiidae (Acari: Mesostigmata) from Turkey

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Original research

ABSTRACT

Surveys were carried out to determine Phytoseiidae (Acari: Mesostigmata) species in oak plantations (*Quercus* spp., Fagaceae) in different regions of Turkey. As a result, *Typhloseiulus anatolicus* **sp. nov.** Döker is described and illustrated based on female and male specimens. The new species is placed in the *simplex* species group of Tsolakis & Ragusa due to the elongated calyx of spermatheca. It differs from its congeners by having seta *J2* more than six times longer than seta *j6*, and seta *S5* about three times longer than seta *R1* as well as eight setae on genu II, in the female. In addition, *Typhlodromus* (*Anthoseius*) *rapidus* Wainstein & Arutunjan, and *Paraseiulus incognitus* Wainstein & Arutunjan are reported for the first time for the Turkish fauna. Although *T.* (*A.*) *rapidus* was reported for the Turkish fauna by an earlier study, we consider the previous report invalid, because it shows three pairs of preanal setae as opposed to four pairs in the original description and the material examined in this study. Furthermore, *P. incognitus* is removed from junior synonymy with *P. soleiger* and redefined. Therefore, in this study, we retain these two species as distinct species due to differences in their adenotaxy.

Keywords predatory mites; taxonomy; new species; Typhlodrominae; biological control
Zoobank http://zoobank.org/76FAAB05-9730-4FD5-A12A-8A6A7115BA7C

Introduction

Species of the family Phytoseiidae (Acari: Mesostigmata) are unique groups of predators in terms of their frequent exploitation of the foliage habitats of higher plants (McMurtry *et al.* 2013). The family consists of three subfamilies, Amblyseiinae Muma, Phytoseiinae Berlese, and Typhlodrominae Wainstein (Chant and McMurtry 1994). Among them, the subfamily Typhlodrominae is characterized by having either or both of setae *z3* and *s6* present on the podosoma and with at least one of setae *Z1*, *S2*, *S4*, and *S5* present on the opisthosoma (Chant and McMurtry 2007).

The present study deals with three species in the subfamily Typhlodrominae; the description of a new species *Typhloseiulus anatolicus* **sp. nov**. Döker, and redescriptions of two new records, *Typhlodromus* (*Anthoseius*) *rapidus* Wainstein & Arutunjan 1968, and *Paraseiulus incognitus* Wainstein & Arutunjan 1967, in Turkey. Although *T.* (*A.*) *rapidus* was reported for the Turkish fauna by Cobanoglu (1997), we consider her redescription invalid due to differences in the number of preanal setae and the location of dorsal solenostomes in comparison with its original description. In addition, we suggested the resurrection of *P. incognitus* as a valid species in the genus *Paraseiulus*.

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Material and methods

Leaves of oak trees (*Quercus* spp., Fagaceae) were collected from different regions in Turkey. They were transferred to the laboratory in an icebox and inspected under stereo binocular. Phytoseiid mites were cleared in 60% lactic acid and mounted on microscope slides in Hoyer's medium. The permanent slides were examined under an Olympus® CX-41 microscope. Illustrations were prepared by using a U-Da drawing attachment, Camera Lucida. Final corrections were made using a computer program Adobe Photoshop (version CS6). Pictures were taken by using compound microscope Axio Imager A2, equipped with differential interference contrast (DIC) optical system and Axiocam 506 color camera (Carl Zeiss, Germany). The taxonomic system follows that of Chant and McMurtry (2007). Dorsal setal nomenclature is based on Lindquist and Evans (1965), as adapted by Rowell *et al.* (1978); ventral setal nomenclature is based on Chant and Yoshida-Shaul (1991). Nomenclature of dorsal solenostomes (gland pores) is based on Athias-Henriot (1975). Leg chaetotaxy follows that of Evans (1963). For each structure, measurements are given in micrometers and presented as the mean followed by the respective range, in parenthesis.

Results

Genus *Typhloseiulus* Chant and McMurtry

Typhloseiulus anatolicus sp. nov. Döker

Zoobank: E621254A-BC10-4865-B055-B44ADCD7D955

(Figures 1–3)

Diagnosis

Female: Idiosomal setal pattern 12A:9B/14:*JV–3*:*ZV* (*r3* and *R1* off shield). Dorsal shield strongly reticulated without waist. Peritremes striated, extending to base of seta *j1*. Dorsal setae thick, thorn-like, most of them slightly serrated, arising from tubercules, except *j4*, *j5*, *z5* and *R1* smooth and not arising from tubercules. Seta *j6* smooth and arising from tubercules. Ratio setae *J2*/*j6* and *S5*/*R1* are about 7.0 and 2.5-3.0, respectively. Sternal shield smooth, with two pairs of setae and one pair of poroids. Setae *ST3* and poroids *pst2* on separate platelets. Ventrianal shield reduced, square, striated; with one pair of preanal setae, without preanal pores. Calyx of spermatheca elongated, flaring distally; atrium knobbed incorporated to base of calyx. Fixed digit of chelicera with four teeth and movable digit with one simple tooth. Genu II with eight setae (2 2/1 2/0 1). Leg IV with one blunt macroseta on basitarsus; other legs without macroseta.

Male: Idiosomal setal pattern 12A:9B/12:*JV*–3,4:*ZV*–3 (*r3* on and *R1* off shield). Peritremes striated, extending to base of seta *j3*. Morphology of dorsal setae similar to female. Ventrianal shield triangular, striated with four pairs of preanal setae. Fixed digit with one tooth and movable digit with one bifid tooth. Spermatophoral process L-shaped with toe blunt tip.

Description

Female — (n=10)

Dorsal idiosoma (Figure 1A). Dorsal setal pattern 12A:9B (*r3* and *R1* off shield). Dorsal shield sclerotized, strongly reticulated, without waist. No solenostomes and poroids visible. Muscle-marks (sigillae) visible mostly on podosoma; length of dorsal shield 372 (368–375), width at level of *s4* 201 (190–225), width at level of *S2* 210 (193–225). Dorsal setae thick, thorn-like, most of them slightly serrated, arising from tubercules, except *j4*, *j5*, *z5* and *R1* smooth and not arising from tubercules. Seta *j6* smooth and arising from tubercules. Measurements of dorsal setae as follows: *j1* 30 (28–33), *j3* 40 (38–43), *j4* 11 (10–12), *j5* 9 (8–10), *j6* 14 (12–15), *J2* 91 (88–95), *J5* 8 (7–8), *z2* 35 (33–38), *z3* 51 (48–53), *z4* 54 (50–55), *z5* 9 (8–10), *Z1* 73

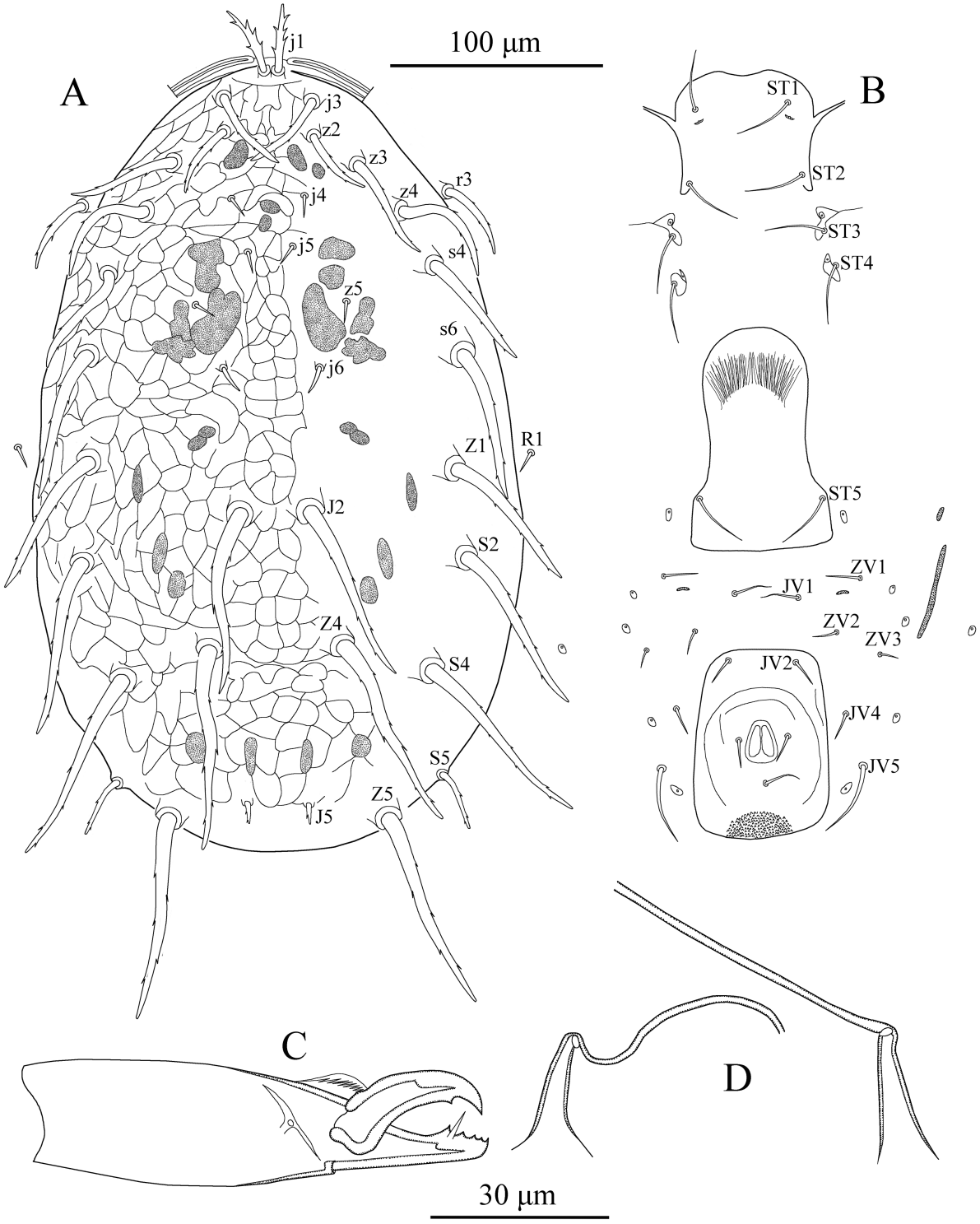

Figure 1 *Typhloseiulus anatolicus* **sp. nov**. Döker, female, A. Dorsal idiosoma; B. Ventral idiosoma; C. Chelicera; D. Spermathecae

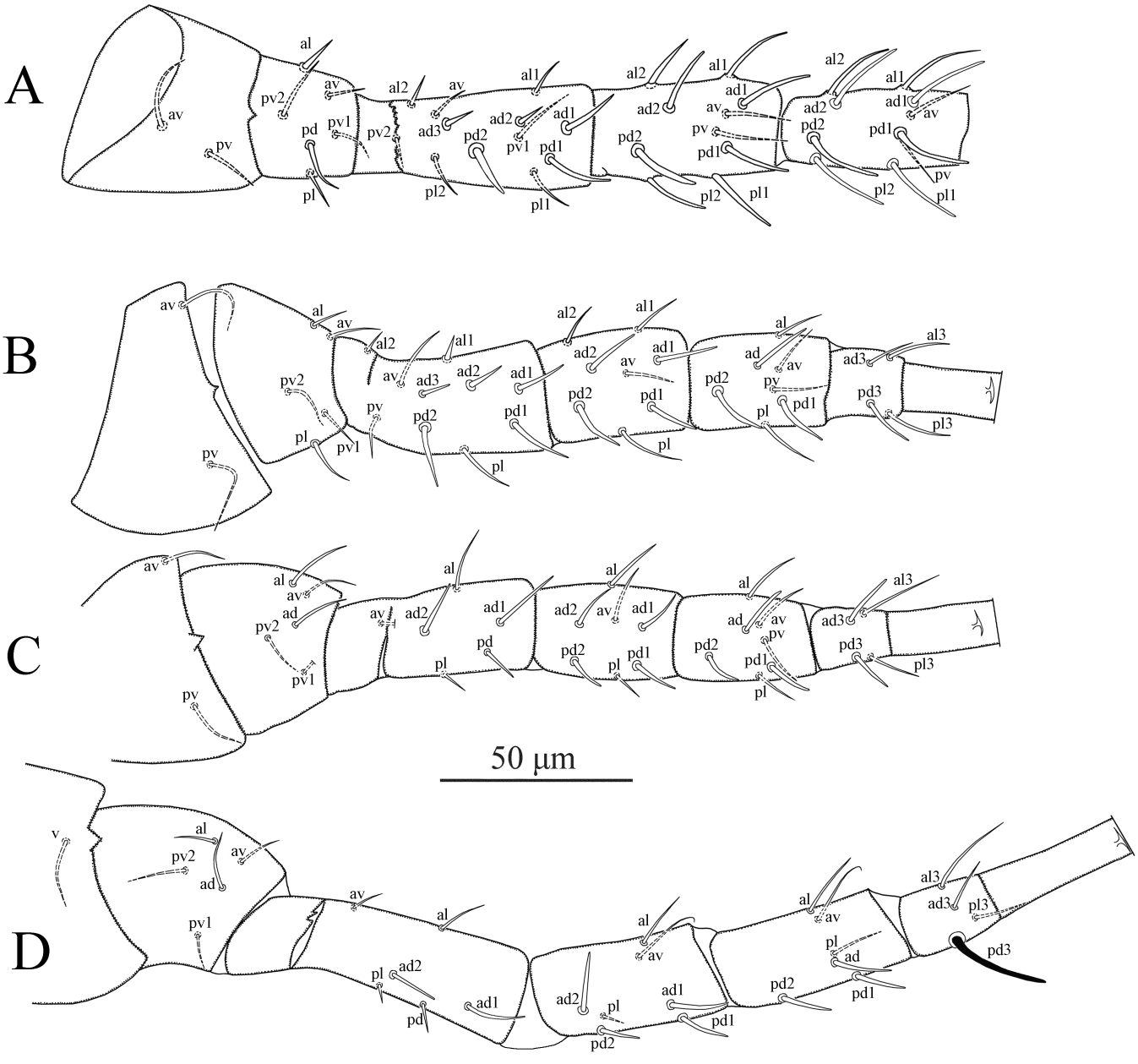

Figure 2 *Typhloseiulus anatolicus* **sp. nov**. Döker, female right legs, A. Leg I; B. Leg II; C. Leg III; D. Leg IV

(70–75), *Z4* 100 (95–103), *Z5* 101 (95–105), *s4* 61 (57–63), *s6* 70 (67–73), *S2* 84 (80–88), *S4* 90 (80–95), *S5* 27 (25–30), *r3* 38 (36–38) and *R1* 10 (9–10). Peritremes striated, extending to base of setae *j1*.

Ventral idiosoma (Figure 1B). Ventral setal pattern 14:*JV–3*:*ZV*. Sternal shield smooth, lightly sclerotized; with two pairs of setae (*ST1* and *ST2*) and one pair of poroids (*pst1*). Setae *ST3* and poroids *pst2* on separate platelets; metasternal setae *ST4* and a pair of pores (*pst3*) on metasternal platelets; distance between *ST1–ST2* 36 (35–38), *ST2–ST2* 56 (55–58). Genital shield smooth; width at level of setae *ST5* 57 (53–60). Ventrianal shield reduced, square, and striated; with one pair of preanal setae (*JV2*) and one pair of paraanal (*Pa*) and a postanal seta

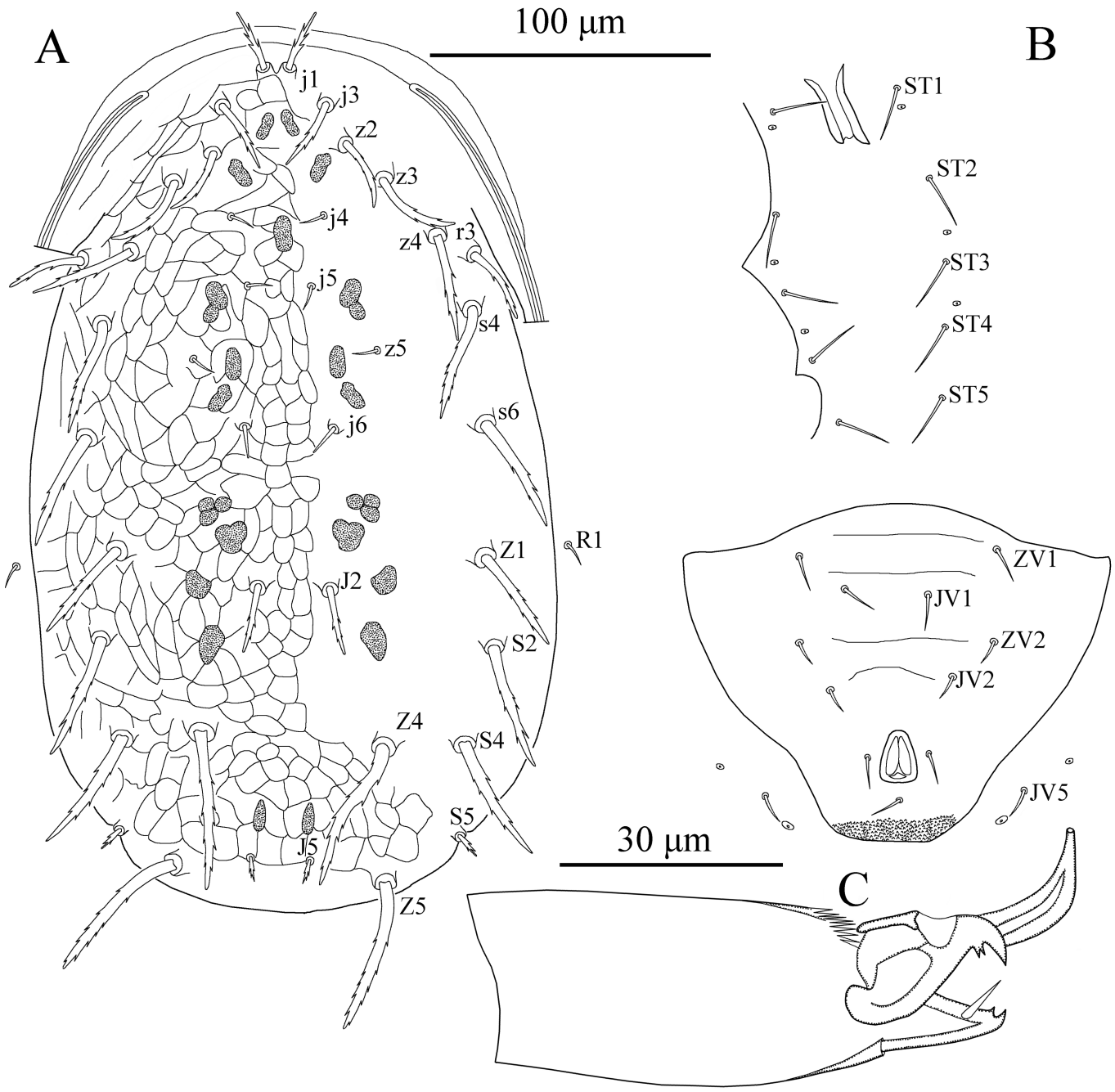

Figure 3 *Typhloseiulus anatolicus* **sp. nov**. Döker, male, A. Dorsal idiosoma; B. Ventral idiosoma; C. Chelicera

(*Pst*); without preanal solenostomes. Length of ventrianal shield 92 (88–95), width at level of paraanal setae 64 (63–65). Setae *JV1*, *JV4*, *JV5*, *ZV1*, *ZV2*, *ZV3* and six pairs of poroids on integument surrounding ventrianal shield. Setae *JV5* smooth, 33 (32–35) in length.

Chelicera (Figure 1C). Fixed digit 26 (25–26) long with four teeth and pilus dentilis; movable digit 26 (25–26) long with one tooth.

Spermatheca (Figure 1D). Calyx elongated, saccular, thick walled, flaring distally, 20 (18–22) in length; major duct long and narrow; minor duct not visible.

Legs (Figures 2A–D). Length of legs (excluding pretarsus): I, 291 (290–295); II, 250

(245–255); III, 248 (245–250); IV, 321 (315–325). Chaetotactic formulae as follows: Leg I: coxa 0 0/1 0/1 0, trochanter 1 0/1 1/2 1, femur 2 3/1 2/2 2, genu 2 2/1 2/1 2, tibia 2 2/1 2/1 2. Leg II: coxa 0 0/1 0/1 0, trochanter 1 0/1 0/2 1, femur 2 3/1 2/1 1, genu 2 2/1 2/0 1, tibia 1 1/1 2/1 1. Leg III: coxa 0 0/1 0/1 0, trochanter 1 1/1 0/2 0, femur 1 2/1 1/0 1, genu 1 2/1 2/0 1, tibia 1 1/1 2/1 1. Leg IV: coxa 0 0/1 0/0 0, trochanter 1 1/1 0/2 0, femur 1 2/1 1/0 1, genu 1 2/1 2/0 1, tibia 1 1/1 2/0 1. Most of antero-dorsal and postero-dorsal, and some lateral setae thick, thorn-like. Leg IV with one blunt macroseta: *StIV* (*pd3*) 25 (23–25) in length. Other legs without macroseta.

Male — (n=2)

Dorsal idiosoma (Figure 3A). Dorsal setal pattern 12A:9B (*r3* on shield and *R1* off shield). Dorsal shield sclerotized, strongly reticulated, without waist. No solenostomes and poroids visible. Muscle-marks (sigillae) visible mostly on podosoma; length of dorsal shield 295–300, width at level of *s4* 170–178, width at level of *S2* 168–178. Dorsal setae thick, thorn-like, most of them slightly serrated, arising from tubercules, except *j4*, *j5*, *z5* and *R1* smooth and not arising from tubercules. Seta *j6* smooth and arising from tubercules. Measurements of dorsal setae as follows: *j1* 20–21, *j3* 25–26, *j4* 10, *j5* 10, *j6* 12, *J2* 20–25, *J5* 5–8, *z2* 20–25, *z3* 32–33, *z4* 35–40, *z5* 10, *Z1* 35–40, *Z4* 55–60, *Z5* 55–57, *s4* 40–47, *s6* 38–45, *S2* 45–47, *S4* 44–50, *S5* 10, *r3* 25–30 and *R1* 8–10. Peritreme striated, extending to base of seta *j3*.

Ventral idiosoma (Figure 3B). Ventral setal pattern 12:*JV*–3,4:*ZV*-3. Sternogenital shield unsclerotized. Sternogenital area with five pairs of setae (*ST1*, *ST2*, *ST3*, *ST4* and *ST5*) and three pairs of poroids (*iv1*, *iv2* and *iv3*); distance between setae *ST1–ST5* 115, distance between setae *ST3* 55–60. Ventrianal shield triangular, striated with four pairs of preanal setae (*JV1*, *JV2*, *ZV1* and *ZV2*), and one pair of para-anal (*Pa*) and a post-anal seta (*Pst*). Length of ventrianal shield 115–121, width at level of setae anterior corners 140–145. Seta *JV5* smooth 10–13 in length.

Chelicera (Figure 3C). Fixed digit with one tooth and pilus dentilis; movable digit with one bifid tooth. Spermatophoral process L-shaped, 20 in length, with toe blunt tip.

Legs. Length of legs I–IV (excluding pretarsus), 250–260, 215–220, 215–220, 280–290, respectively. Chaetotaxy as in female. Leg IV with one blunt macroseta, *StIV* (*pd3*) 20–25 in length. Other legs without macroseta.

Material examined

Holotype female, nine paratype females and two paratype males were collected from *Quercus* sp. (Fagaceae) in Niksar County, Tokat, 40˚35′18“N, 36˚59′23”E, 556 meters above sea level, 27 October 2019. All type materials are deposited in Acarology Laboratory, Department of Plant Protection, Cukurova University, Adana, Turkey.

Etymology

The name of the new species “*anatolicus*” is derived from Anatolia which is the westernmost extension of continental Asia and constitutes most of the territory of Turkey.

Differential diagnosis

Typhloseiulus anatolicus **sp. nov**. Döker belongs to the *simplex* species group by having an elongated calyx of spermatheca as defined by Tsolakis and Ragusa (2017). Among the eight species listed in the *simplex* species group, the new species shows affinity to *T. erymanthii* (Papadoulis and Emmanouel, 1988) and *T. subsimplex* (Arutunjan, 1972) by having thicker and longer setae *S5*. This seta is simple and its length is always ≤ 15 in the other six species known in the species group (Ragusa and Swirski 1976; Kolodochka 1980; Chant and Yoshida-Shaul 1983; Ragusa Di Chiara 1992; Papadoulis *et al.* 2009; Tsolakis and Ragusa 2017). *Typhloseiulus anatolicus* **sp. nov**. Döker can be separated from *T. erymanthii* by having longer dorsal setae especially in *z-Z* and *s-S* series. In addition, *T. erymanthii* has bifid tooth on movable digit of chelicera in contrast to a simple tooth in the new species. *Typhloseiulus anatolicus* **sp. nov**.

Döker is also different from *T. subsimplex* by having all dorsal setae serrated (except *j4*, *j5*, *j6*, *z5*, *R1*), as oppose to only setae *j1*, *Z4*, *Z5*, *S2*, and *S4* serrated in the latter species (Arutunjan 1972; Chant and Yoshida-Shaul 1983). In addition, seta *J2* is 91 (88–95) in length, and it is longer than the distance between its base and that of seta *Z4* in the new species. In contrast, seta *J2* is 66 and it is shorter than the distance between its base and that of seta *Z4* in *T. subsimplex*. Finally, the ratio setae *J2*/*j6* is about 7 in the new species, and this ratio is about 2 and 4 in *T. erymanthii* and *T. subsimplex*, respectively.

Genus *Typhlodromus* Scheuten

Subgenus *Anthoseius* De Leon

Typhlodromus (*Anthoseius*) *rapidus* Wainstein & Arutunjan

Typhlodromus rapidus Wainstein and Arutunjan, 1968: 1240.

(Figures 4–6)

Diagnosis

Idiosomal setal pattern 12A:8A/*JV*:*ZV* (*r3* and *R1* off shield). Dorsal shield reticulated with five pairs of solenostomes (*gd2*, *gd4*, *gd6*, *gd8*, *gd9*). Peritreme extending to level of seta *j1*. Sternal shield smooth, with two pairs of setae, ventrianal shield pentagonal, smooth, with four pairs of preanal setae and small rounded preanal solenostomes. Spermatheca with bulbous atrium and narrow-tubular calyx without neck, annulus visible in middle of calyx. Fixed digit of chelicera with four teeth and movable digit with three teeth. Genu II with eight setae (2 2/1 2/0 1). Leg IV with one knobbed macroseta on tarsus; other legs without macroseta.

Re-description

Female — (n=5)

Dorsal idiosoma (Figure 4A). Dorsal setal pattern 12A:8A (*r3* and *R1* off shield). Dorsal shield entire, well sclerotized, strongly reticulated, with strong waist at level of *R1*, with five pairs of solenostomes (*gd2*, *gd4*, *gd6*, *gd8* and *gd9*) and fourteen pairs of visible poroids (*id1*, *id2*, *id4*, *id5*, *id6*, *idm1*, *idm2*, *idm3*, *idm4*, *idm6*, *is1*, *idl1*, *idl3* and *idl4*). Muscle-marks (sigillae) visible mostly on podosoma; length of dorsal shield 345 (340–350), width at level of *s4* 182 (180–185), width at level of *S2* 192 (188–195). Dorsal setae smooth, except *Z4* and *Z5*, serrated and *Z5* knobbed apically. Measurements of dorsal setae as follows: *j1* 23 (22–24), *j3* 26 (23–28), *j4* 16 (15–18), *j5* 16 (15–17), *j6* 18 (15–20), *J2* 22 (21–25), *J5* 10 (9–10), *z2* 20 (20–21), *z3* 24 (23–25), *z4* 25 (23–28), *z5* 17 (15–18), *Z4* 30 (30–31), *Z5* 53 (50–59), *s4* 27 (26–28), *s6* 29 (26–30), *S2* 29 (28–30), *S4* 34 (30–35), *S5* 24 (23–25), *r3* 27 (25–28) and *R1* 23 (22–24). Peritreme extending to level of seta *j1*.

Ventral idiosoma (Figures 4B, 6). Ventral setal pattern 15:*JV*:*ZV*. Sternal shield smooth, lightly sclerotized; with two pairs of setae (*ST1* and *ST2*) and two pairs of poroids (*pst1* and *pst2*); distance between *ST1–ST2* 38 (37–40), *ST2–ST2* 63 (62–65). Sternal setae *ST3* on soft integument; metasternal setae *ST4* and a pair of pores (*pst3*) on metasternal platelets. Genital shield smooth, narrower than ventrianal shield; width at level of setae *ST5* 63 (60–67). Ventrianal shield pentagonal, smooth; with four pairs of pre-anal setae (*JV1*, *JV2*, *JV3* and *ZV2*); one pair of paraanal (*Pa*) and a postanal seta (*Pst*); with small rounded preanal solenostomes (*gv3*) posterior to setae *JV2*, distance between *gv3–gv3* 27 (24–32). Length of ventrianal shield 112 (110–114), width at level of setae *ZV2* 79 (78–80), width at level of paraanal setae 72 (69–74). Setae *ZV1*, *ZV3*, *JV4* and *JV5* and six pairs of poroids on integument surrounding ventrianal shield. Setae *JV5* smooth, 34 (30–37) in length.

Chelicera (Figure 4C). Fixed digit 26 (25–26) long with four teeth and pilus dentilis; movable digit 26 (26–27) long with three teeth.

Spermatheca (Figure 4D). Calyx narrow, tubular, flaring distally, 29 (28–30) in length, annulus visible in middle of calyx; atrium large nodular attached to calyx without neck.

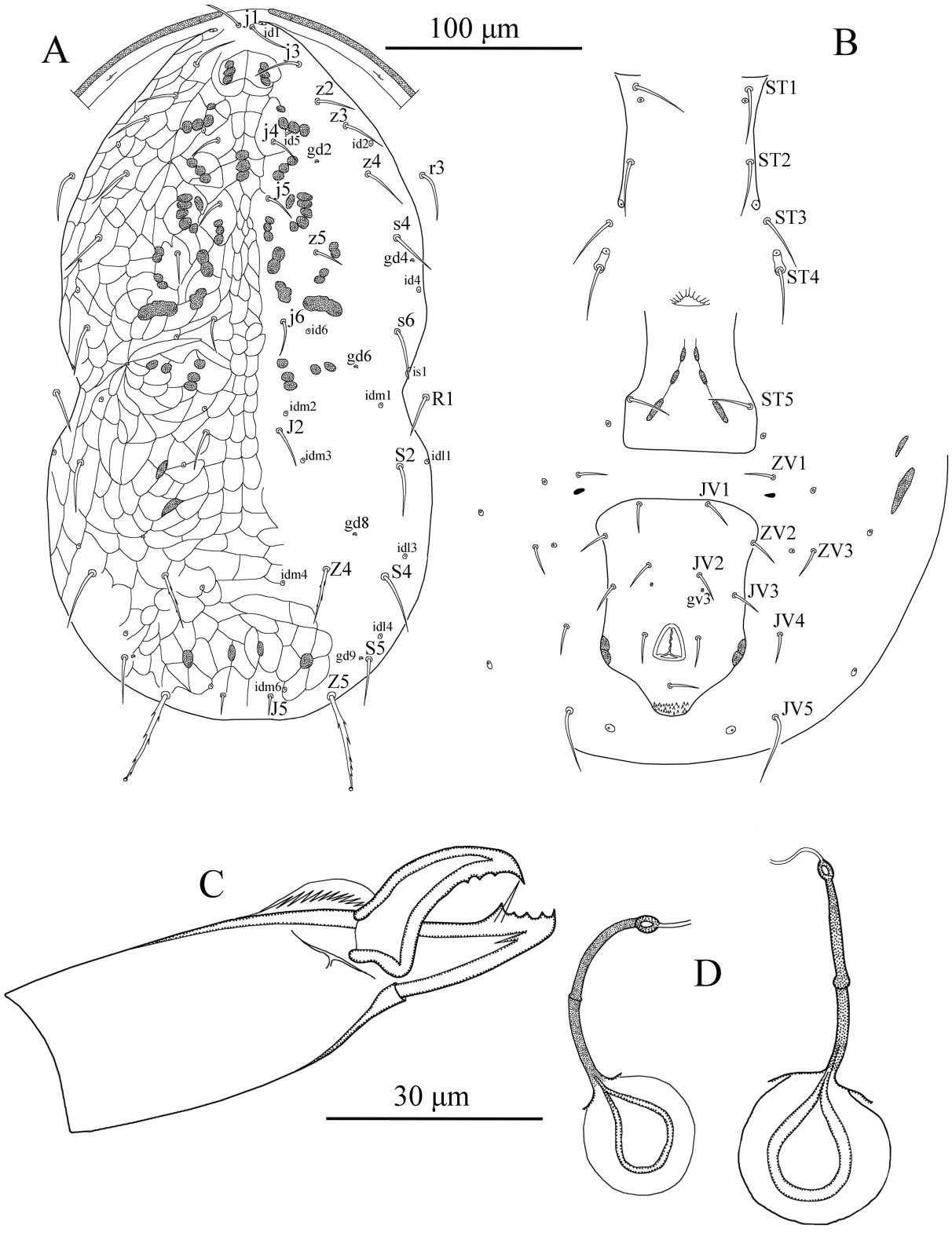

Figure 4 *Typhlodromus* (*Anthoseius*) *rapidus* Wainstein & Arutunjan 1968, female, A. Dorsal idiosoma; B. Ventral idiosoma; C. Chelicera; D. Spermathecae

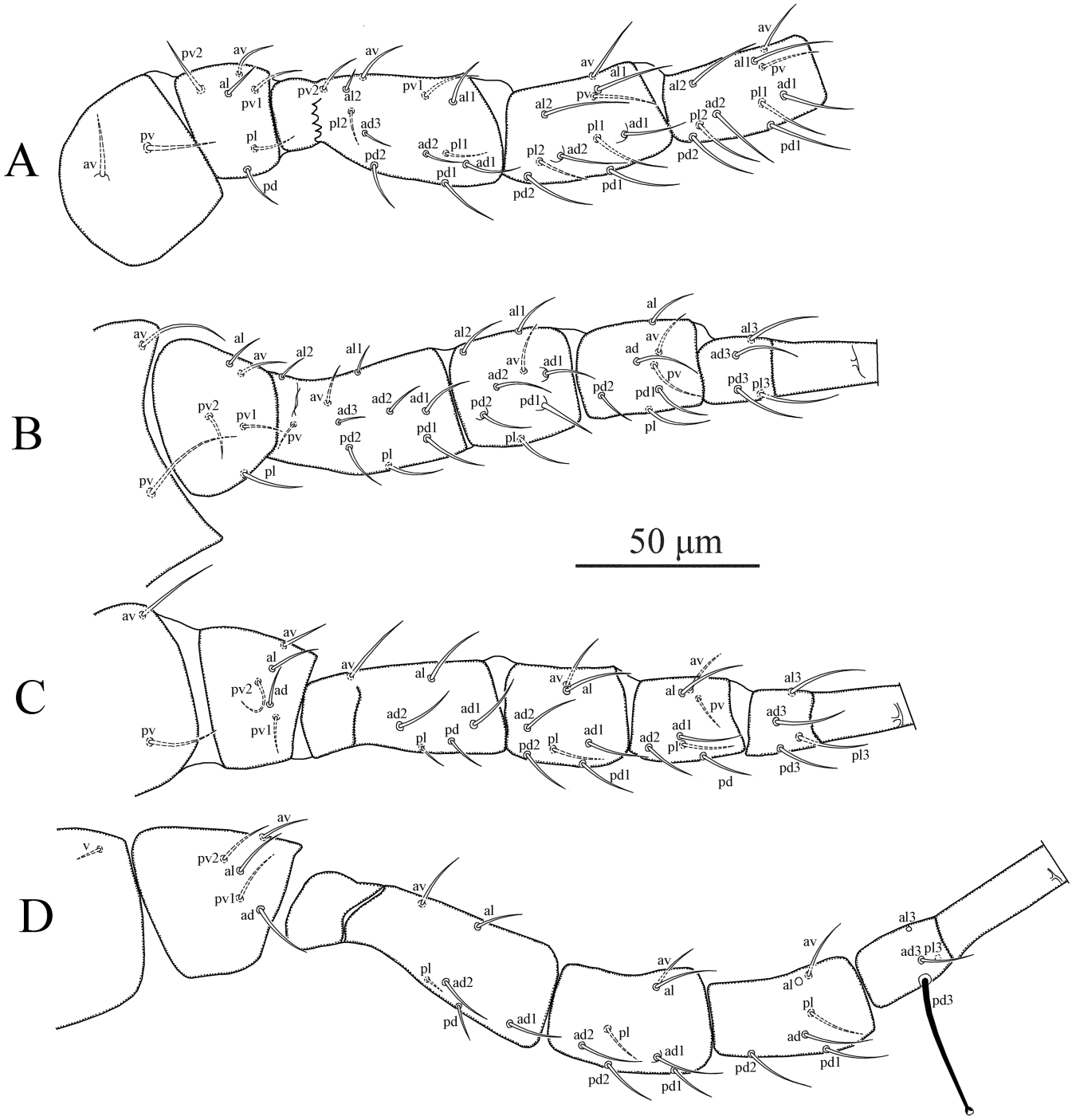

Figure 5 *Typhlodromus* (*Anthoseius*) *rapidus* Wainstein & Arutunjan 1968, female right legs, A. Leg I; B. Leg II; C. Leg III; D. Leg IV

Legs (Figures 5A–D). Length of legs (excluding pretarsus): I, 299 (295–300); II, 254 (250–260); III, 261 (260–265); IV, 339 (330–345). Chaetotactic formulae as follows: Leg I: coxa 0 0/1 0/1 0, trochanter 1 0/1 1/2 1, femur 2 3/1 2/2 2, genu 2 2/1 2/1 2, tibia 2 2/1 2/1 2. Leg II: coxa 0 0/1 0/1 0, trochanter 1 0/1 0/2 1, femur 2 3/1 2/1 1, genu 2 2/1 2/0 1, tibia 1 2/1 1/1 1. Leg III: coxa 0 0/1 0/1 0, trochanter 1 1/1 0/2 0, femur 1 2/1 1/0 1, genu 1 2/1 2/0 1, tibia 1 1/1 2/1 1. Leg IV: coxa 0 0/1 0/0 0, trochanter 1 1/1 0/2 0, femur 1 2/1 1/0 1, genu 1 2/1 2/0

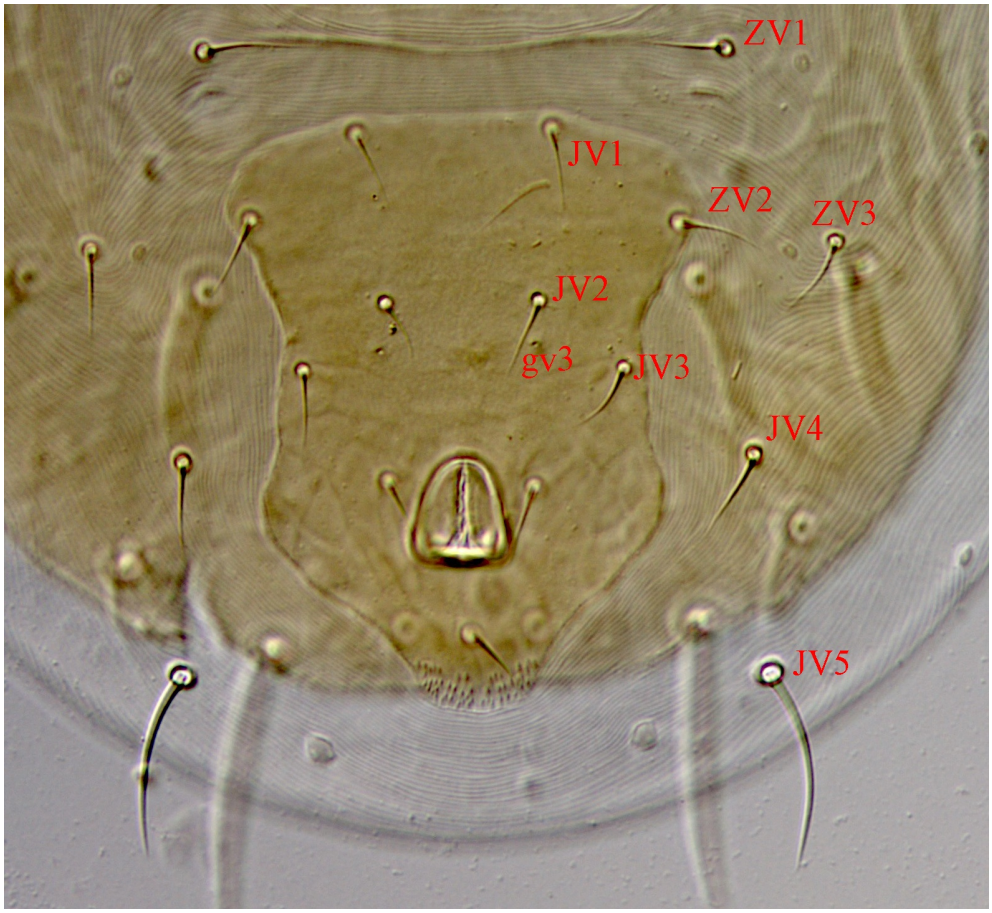

Figure 6 *Typhlodromus* (*Anthoseius*) *rapidus* Wainstein & Arutunjan 1968, female ventrianal shield

1, tibia 1 1/1 2/0 1. Leg IV with one knobbed macroseta: *StIV* (*pd3*) 40 (38–42). Other legs without macroseta.

Male

Not found in this study.

Material examined

Five females from *Quercus* sp. (Fagaceae) in Niksar County, Tokat, 40˚35′18“N, 36˚59′23”E, 556 meters above sea level, 27 October 2019.

Remarks

Typhlodromus (*Anthoseius*) *rapidus* was described by Wainstein and Arutunjan in 1968 based on the material collected from *Quercus* sp. in Tugay, Iori River, Georgia, and apple trees in Karahundj, Goris, Armenia. Many morphological details including measurements of some setae and leg chaetotaxy were missing in the original description and there was no accurate redescription. Therefore, we provide a complementary description of this species for the first time from specimens collected from *Quercus* sp. in Turkey. Morphological characters and measurements of the current material are almost identical to the original description. However, measurements of seta *z3* 24 (23–25) are slightly longer than that provided in the original description (18). We consider this difference as intraspecific variation.

The morphological characteristics of this species including the shape of the calyx of the spermatheca, a clear ring in the middle of the calyx, the nature of dorsal and ventral appearance,

knobbed seta *Z5* and macroseta *StIV* fit well the definition of *porathi* species group by Tsolakis and Ragusa (2015). Therefore, we here included *T.* (*A.*) *rapidus* as a new member of the *porathi* species group.

Cobanoglu (1997) supposedly reported and redescribed this species based on the material collected from *Corylus* sp. (Betulaceae) as a first record for the Turkish fauna. However, her specimens, as having three *versus* four pairs of preanal setae is distinctly different from the type material illustrated by Wainstein and Arutunjan (1968) as well as the material examined in this study (Figure 6). In addition, her illustration of the location of dorsal solenostomes *gd2*, *gd6*, *gd8* and *gd9* showed some discrepancies compared to the original description and the redescription provided here. The number of preanal setae is one of the most important characters used to separate species in the genus *Typhlodromus* (Papadoulis *et al.* 2009; Tixier *et al.* 2016; Döker *et al.* 2021; Ferragut and Baumann 2021). Therefore, the specimens reported by Cobanoglu (1997) definitely represent another species and they should be reconsidered in further studies. As a result, the real *T.* (*A*). *rapidus* is reported for the first time for Turkish fauna in this study.

Genus *Paraseiulus* Muma

Paraseiulus incognitus Wainstein & Arutunjan

Paraseiulus incognitus Wainstein and Arutunjan, 1967: 1768.
(Figures 7–9)

Diagnosis

Idiosomal setal pattern 13A:8A/*JV*–2,3:*ZV* (*r3* and *R1* off shield). Dorsal setae smooth, except *Z5* with few barbs. Dorsal shield strongly reticulated with two pairs of solenostomes (*gd2* and *gd6*). Peritrematal shield without digitiform microvilli, peritreme extending between setae *j1-j3*. Sternal shield smooth, with two pairs of setae, lateral margin with projection at level of setae *ST2*, ventrianal shield elongated, sole-shaped, striated, with two pairs of preanal setae and without preanal solenostomes. Spermatheca with bulbous atrium and narrow-tubular calyx without neck. Fixed digit of chelicera with four teeth and movable digit with one tooth. Genu II with eight setae (2 2/1 2/0 1). Legs without macroseta.

Re-description

Female — (n=5)

Dorsal idiosoma (Figures 7A, 9). Dorsal setal pattern 13A:8A (*r3* and *R1* off shield). Dorsal shield entire, well sclerotized, strongly reticulated, with strong waist at level of *R1*, with two pairs of solenostomes (*gd2* and *gd6*) and fifteen pairs of visible poroids (*id1*, *id2*, *id4*, *id5*, *id6*, *idm1*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *is1*, *idl1*, *idl3* and *idl4*). Muscle-marks (sigillae) visible on podosoma; length of dorsal shield 316 (303–325), width at level of *s4* 160 (153–168), width at level of *S2* 180 (170–188). Dorsal setae smooth, except *Z5* with few barbs. Measurements of dorsal setae as follows: *j1* 16 (15–16), *j3* 26 (24–28), *j4* 21 (20–22), *j5* 22 (21–22), *j6* 24 (22–26), *J2* 28 (28–29), *J5* 9 (7–10), *z2* 25 (23–27), *z3* 26 (25–26), *z4* 28 (26–30), *z5* 21 (20–21), *z6* 24 (23–25), *Z4* 30 (28–32), *Z5* 29 (27–31), *s4* 28 (26–30), *s6* 30 (28–32), *S2* 32 (31–33), *S4* 28 (26–30), *S5* 26 (25–27), *r3* 28 (27–29) and *R1* 25 (24–27). Peritrematal shield without digitiform microvilli, peritreme extending between setae *j1-j3*.

Ventral idiosoma (Figure 7B). Ventral setal pattern 13:*JV*–2,3:*ZV*. Sternal shield smooth, lightly sclerotized; posterior margin with strong median concavity; lateral margin with projection at level of setae *ST2*; with two pairs of setae (*ST1* and *ST2*) and one pair of poroids (*pst1*); distance between *ST1–ST2* 32, *ST2–ST2* 44 (42–45). Poroid *pst2* free on integument, sternal setae *ST3* on separate platelets; metasternal setae *ST4* and a pair of pores (*pst3*) on metasternal platelets. Genital shield mostly smooth, with some striations, as wide as ventrianal shield; width at level of setae *ST5* 44 (43–46). Ventrianal shield elongated, sole-shaped, with

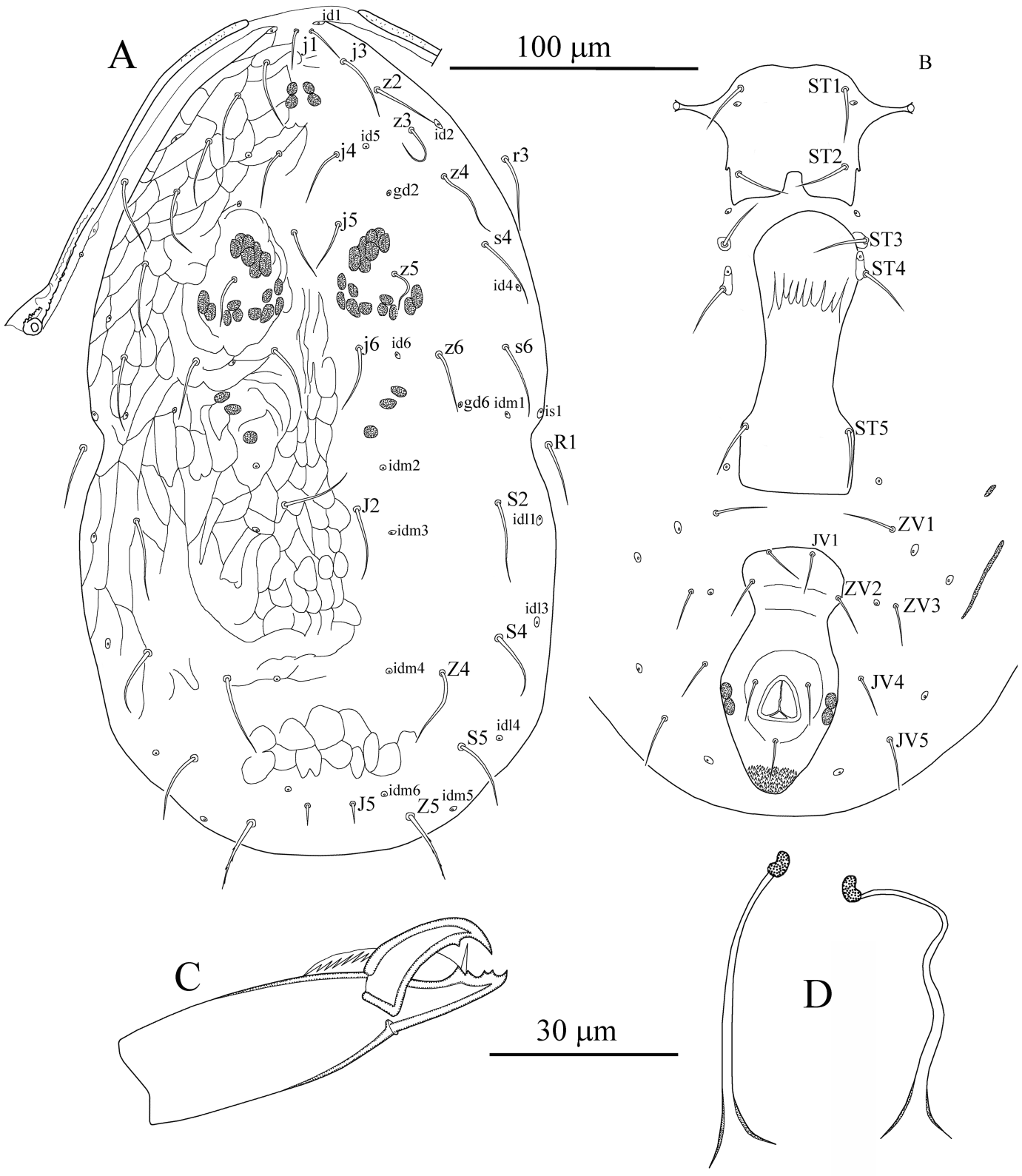

Figure 7 *Paraseiulus incognitus* Wainstein & Arutunjan 1967, female, A. Dorsal idiosoma; B. Ventral idiosoma; C. Chelicera; D. Spermatheca

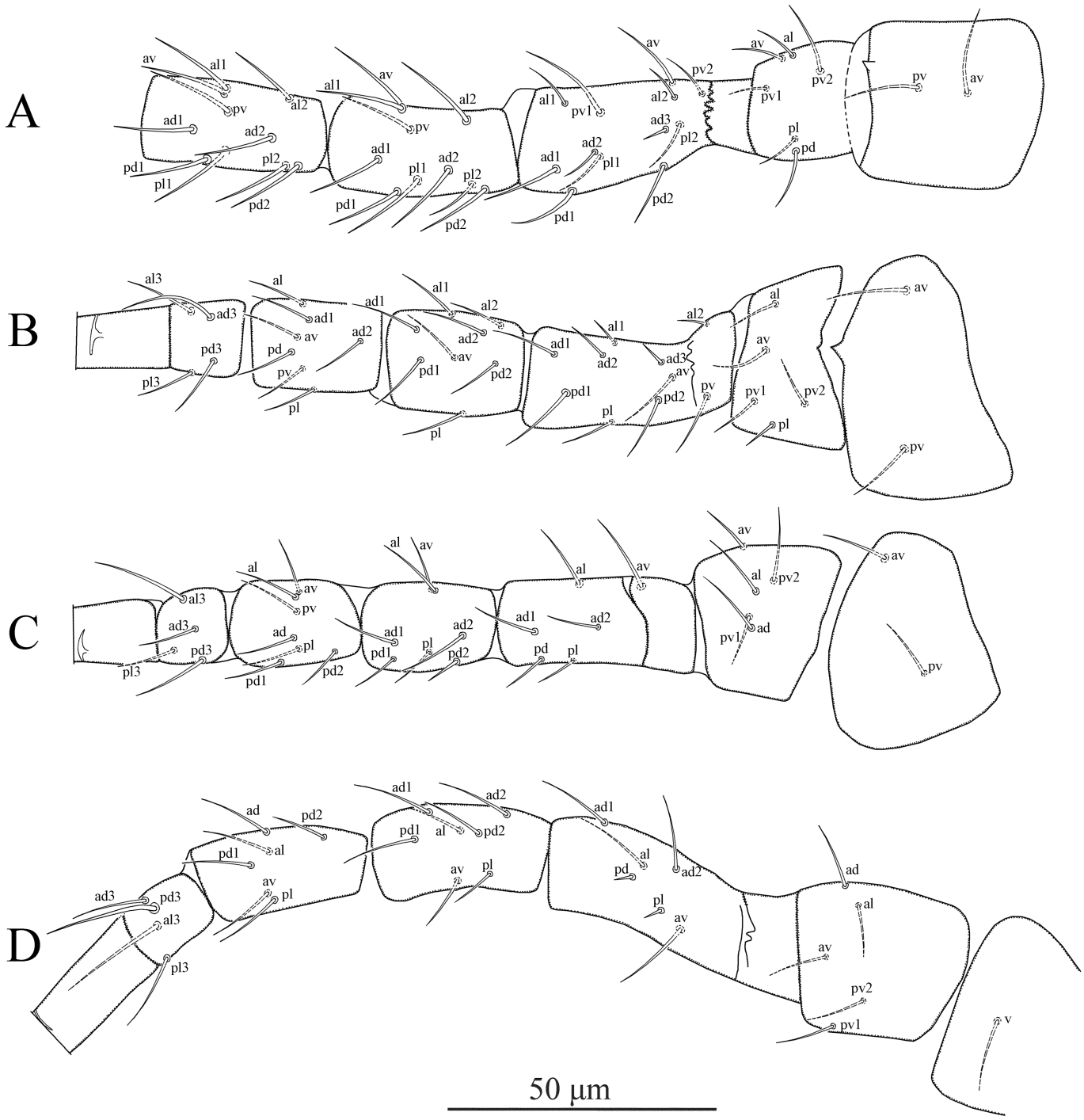

Figure 8 *Paraseiulus incognitus* Wainstein & Arutunjan 1967, female left legs, A. Leg I; B. Leg II; C. Leg III; D. Leg IV

strong waist posterior to setae *ZV2*, smooth; with two pairs of pre-anal setae (*JV1* and *ZV2*); one pair of paraanal (*Pa*) and a postanal seta (*Pst*); without preanal solenostomes. Length of ventrianal shield 98 (97–99), width at level of setae *ZV2* 44 (40–46), width at level of paraanal setae 48 (45–50). Setae *ZV1*, *ZV3*, *JV4* and *JV5* and six pairs of poroids on integument surrounding ventrianal shield. Setae *JV5* smooth, 26 (25–27) in length.

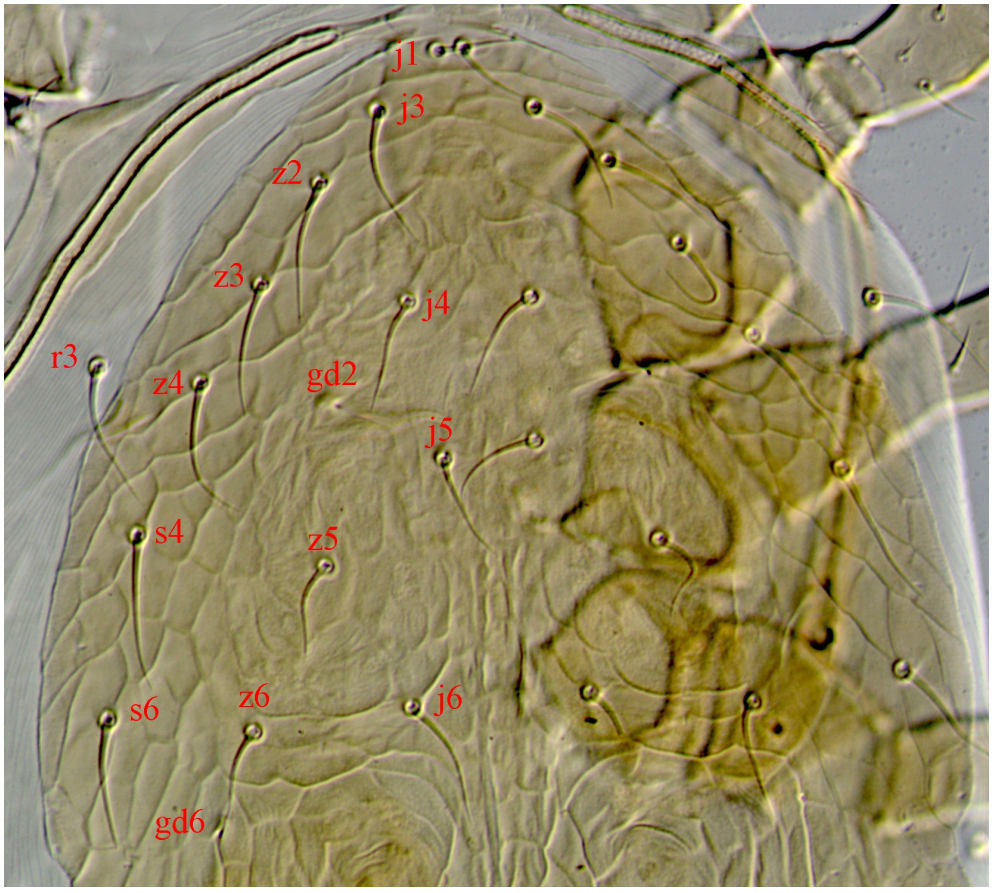

Figure 9 *Paraseiulus incognitus* Wainstein & Arutunjan 1967, female anterior part of dorsal shield including solenostomes *gd2* and *gd6*

Chelicera (Figure 7C). Fixed digit 20 (20–21) long with four teeth and pilus dentilis; movable digit 23 (23–24) long with one tooth.

Spermatheca (Figure 7D). Calyx elongated, narrow, tubular, flaring distally, 42 (40–45) in length; atrium large nodular attached to calyx without neck.

Legs (Figures 8A–D). Length of legs (excluding pretarsus): I, 232 (228–235); II, 198 (188–205); III, 193 (185–200); IV, 249 (243–255). Chaetotactic formulae as follows: Leg I: coxa 0 0/1 0/1 0, trochanter 1 0/1 1/2 1, femur 2 3/1 2/2 2, genu 2 2/1 2/1 2, tibia 2 2/1 2/1 2. Leg II: coxa 0 0/1 0/1 0, trochanter 1 0/1 0/2 1, femur 2 3/1 2/1 1, genu 2 2/1 2/0 1, tibia 1 2/1 1/1 1. Leg III: coxa 0 0/1 0/1 0, trochanter 1 1/1 0/2 0, femur 1 2/1 1/0 1, genu 1 2/1 2/0 1, tibia 1 1/1 2/1 1. Leg IV: coxa 0 0/1 0/0 0, trochanter 1 1/1 0/2 0, femur 1 2/1 1/0 1, genu 1 2/1 2/0 1, tibia 1 1/1 2/0 1. Legs without macroseta.

Male

Not found in this study.

Material examined

Five females from *Quercus* sp. (Fagaceae) near Seydiler, Kastamonu, 41˚42′28“N, 33˚42′37”E, 1167 meters above sea level, 29 October 2019.

Remarks

Paraseiulus incognitus was described by Wainstein and Arutunjan in 1967 based on the material collected from various host plants including, alder, apple, ash, cherry, oak and

pear in Kazakhstan, Crimea, Georgia and Russia, but with the holotype female and the allotype male collected from *Malus* sp. in Alma-Ata, Kazakhstan. This is the first report of *P. incognitus* for the Turkish fauna. The original description is in Russian and lacks many morphological details which are currently used for species delimitation in Phytoseiidae systematics. The redescription by Kolodochka (1983) is reasonably detailed but still lacks in several morphological characteristics such as leg chaetotaxy. During their revision of the genus, known as *soleiger* species group in the genus *Typhlodromus* Scheuten at that time, Chant and Yoshida-Shaul (1982) examined a slide of *P. incognitus* identified by Dr. Wainstein and implied that there was no recognizable difference between *P. incognitus* and *P. soleiger*. As a result, Chant and Yoshida-Shaul (1982) considered this species as a junior synonym of *P. soleiger*. However, *P. incognitus* is distinctly different from *P. soleiger* by having two pairs (*gd2* and *gd6*) of dorsal solenostomes *versus* only one pair (*gd6*) in the latter (Kolodochka 1983; Ferragut 2018) (Figure 9). The presence or absence of dorsal solenostomes are widely used for species delimitation in a series of phytoseiid genera including *Paraseiulus* Muma (Faraji *et al.* 2008; Papadoulis *et al.* 2009; Kreiter *et al.* 2010; Ferragut and Ueckermann 2012; Döker *et al.* 2021). In addition, the taxonomic utility of a single pair of solenostomes to separate closely related species in the genus *Kampimodromus* and *Neoseiulus* have been confirmed by molecular analyses in several cases (Döker *et al.* 2018; Khaustov *et al.* 2022). Therefore, *P. incognitus* and *P. soleiger* are altogether two distinct species and they can be easily separated by the presence or absence of *gd2* solenostomes on the dorsal shield, respectively (Kolodochka 1983).

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