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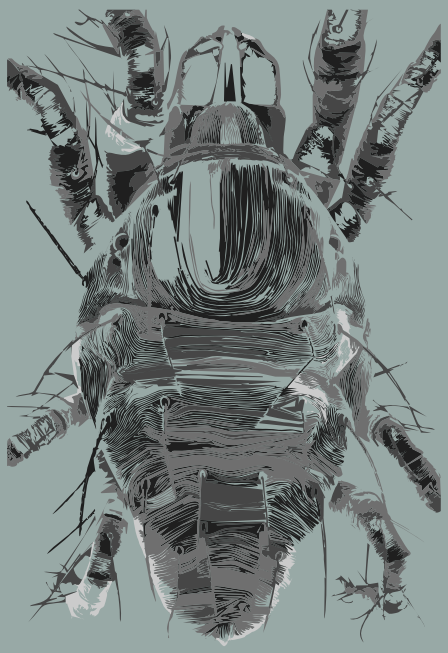

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RESEARCH ARTICLE

Biology of the oribatid mite *Acrotritia clavata* (Märkel, 1964) from the mangrove ecosystems of North Kerala, India

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ABSTRACT: In this study, the development of the oribatid mite species *Acrotritia clavata* (Märkel, 1964) was studied for the first time under laboratory conditions in 2015. The postembryonic development was documented in plastic culture cells with a base of plaster of Paris-charcoal mixture (4:1 ratio) at room temperature of 28±2°C and relative humidity (RH) of 79±2%. The total duration of the life stages of *A. clavata* from egg to adult was 61-72 days in saline water (pH 7.9) collected from its natural habitat, which was used for rearing. Morphological features of all juvenile stages were studied. The present study revealed the morphology of all the juvenile stages and the duration of post-embryonic development of *A. clavata* collected from the mangrove ecosystem of North Kerala, India.

Keywords: Juveniles, mangrove, Oribatida, pneumatophores, biology, larviposition, moulting.

Zoobank: http://zoobank.org/65F8E951-F0DA-4C37-8D86-AA487B4BDBC4

INTRODUCTION

The dynamic mangrove ecosystem supports numerous soil microbes and a rich diversity of microarthropods (Chakraborty, 2011). Oribatid mites, which are commonly called moss mites or beetle mites, serve as one of the most numerically dominant groups of arthropods in every organic soil horizon (Wissuwa et al., 2013), and inhabiting a wide variety of microhabitats like the litter, humus layers, lichens, moss, algae and fungal cushions (Bücking et al., 1998). They also inhabit the marine environment (Schuster, 1979), including the bark of trees, mangrove pneumatophores and tidal debris (Syamjith and Ramani, 2013). However, knowledge of the real diversity and distribution of mangrove mites is far from complete (Chatterjee et al., 2018).

Oribatid mites have six life-cycle stages: pre-larva, larva, proto-, deuto-, tritonymph and adult (Søvik, 2004). The oribatid mite genus *Acrotritia* Jacot, 1923 (Euphthiracaridae), which comprises 31 species and 5 subspecies (Subias, 2004, updated in 2019). Biological studies on development have been conducted for relatively small groups of oribatid mites, including the immature stages of *Sabacarus* Ramsay and Sheals, 1969 and *Paratritia* Moritz, 1966 (Oribotriitidae), and juveniles of *Acrotritia clavata sextiana* (Lions, 1967) (Euphthiracaridae). The life cycle of the largest soil litter dwelling oribatid mite, *Steganacarus magnus* Nicolet, 1855 has also been recorded (Webb, 1978). Recently, the morphology of juveniles of a similar species *Acrotritia ardua* (Koch, 1841), was described and illustrated (Ermilov, 2011).

Pioneering work on oribatid mites provided data on the postembryonic development of two species of *Galumna* Heyden, 1826, two species of *Scheloribates* Berlese, 1908, and one species of *Rostrozetes* Woodring, 1965 (Haq and Ramani, 1984). Observations on the biology of oribatid mites by Woodring (1962) helped document all the developmental stages of *Ceratozetes cisalpinus* Berlese, 1908, *Scheloribates laevigatus* Koch, 1835 and *Oppia neerlandica* Oudemans, 1900, with the complete description of all stages. The fine structures of spermatophores and the spermatozoa of 10 species of Hermanniidae, Liacaridae, Hermanniellidae, Scutoverticidae, Achipteriidae, Euzetidae, Chamobatidae and Pelopidae were described Fernandez et al. (1991). The structure of the egg (Baran and Ayyildiz, 2000), and morphologies of the prelarva (Lions, 1967) and adult of *Acrotritia ardua*, (Koch, 1841) (Krivolutskiy, 1975; Weigmann, 2006) have been described and illustrated. And the relationship between female body size and egg number and size of *A. ardua* has been examined (Bingül et al., 2016). In addition, the extreme life history of Arctic populations of the littoral mite, *Ameronothrus lineatus* Thorell, 1871, was reported by Søvik (2004).

For most oribatid mite species, the data on the juvenile stages remain poorly known or unknown. The present work attempted to gather information in the duration of the life stages of *Acrotritia clavata* (Märkel, 1964) from mangrove ecosystems, which still represent a mostly unexplored realm as far as oribatid diversity is concerned. Moreover, this is the first attempt to establish the duration of the life stages, F_1 generation of *A. clavata* in the laboratory conditions.

MATERIALS AND METHODS

Study Site and Sample Collection

The mangrove dwelling oribatid mite, *A. clavata*, was selected for making detailed observations on its developmental biology. For that purpose, samples of soil, litter, dead pneumatophores, barks and decaying twigs were collected from the floor of a mangrove forest, namely Kadalundi- Vallikkunnu community reserve mangrove

(11°07′ 33.76″ N and 75°49′49.40″ E) in North Kerala, India (Fig. 1). The sampling was carried out between December 2013 to March 2014.

Extraction of Oribatid Mite Species

Live oribatid mites were extracted from dead and decaying pneumatophores and the bark of the mangrove plant, *Avicennia marina* (Forssk.) Vierh., through direct examination under a stereo zoom microscope or through extraction under an open brass funnel apparatus.

Experimental Design for Developmental Studies

The live mites detected under the stereo-zoom microscope were transferred with the help of a camel hair brush to plastic culture vials of 4 cm x 6cm basal area containing a mixture of Plaster of Paris and charcoal at a ratio of 4:1 ratio (Haq and Ramani, 2002). The bases were adequately moistened with saline water collected from the same habitat and maintained at room temperature of 28±2°C and relative humidity (RH) of 79±2%. The mites were reared on moistened leaf pieces, decayed pieces of moistened barks and pneumatophores of *A. marina* collected from their habitat. The culture cells containing the live individuals were regularly observed under a stereo-zoom microscope with the minimum light intensity. For easy observation, individual mite specimens with its ontogenic stages (larva, 3 nymphal stages) were reared separately in the culture cells. Frequent observations were made to collect information on various developmental characteristics such as incubation, hatching, active stages, quiescent periods and moulting.

Figure 1. Geographical description of mangrove ecosystems at Kadalundi-Vallikkunnu Community Reserve (Image accessed via Google Earth Pro Software).

Photography

Photographs of the mite species included in the study were made with a Cal Zeiss stereomicroscope (Stemi 2000-C) and processing of the images was done by using Zoom Browser EX Software.

Scanning Electron Microscopy (SEM)

SEM images of specimens of *A. clavata* were taken at the National Institute of Technology (NIT), Calicut by using a Hitachi SU6600 Variable Pressure Field Emission Scanning Electron Microscope (FESEM).

RESULTS

Larviposition

Unlike all other species of oribatid mites, oviposition was absent in *A. clavata* in the culture cells in the present study. The gravid females carried oval-shaped eggs, which contained embryos which gradually developed into prelarva, inside their bodies (Figs 2 A,B). After 14-18 days of development within the body cavity of the female mite, larviposition was observed, which was evidenced by the birth of a fully developed six-legged larva.

Duration of Life Stages

The newly emerged larva was very delicate and remained inactive for about 10 minutes, as shown in (Fig. 2C). Single larva was noticed from a single female specimen. It then it crawled on the substratum, and started wandering inside the culture cell in search of food. It showed a preference to feed on both fresh and dead algal filaments of *Microspora* sp. and the cortex tissue of the pneumatophore of *Avicennia marina.* After 5-6 days of active feeding, the larva became completely immobile, after which it enlarged its body size and moved into the 1st quiescent stage. The larval quiescence period, which extended for 3-5 days, was terminated by the moulting process and met-

amorphosed into the protonymph stage (Fig. 2D). The active period of the protonymph lasted for 3-4 days and then it stopped its feeding activity, became sluggish and then turgid condition, and then entered the 2nd quiescent phase of 5-6 days duration. On subsequent moulting, the deutonymph (Fig. 2E) that emerged and was a voracious feeder on decayed filaments of the green alga, *Microspora* sp. Feeding was evident through the formation of a food bolus in the digestive tract which could be clearly seen through the transparent body. The white colour of the deutonymph later changed to off-white. After an active feeding period of 3-5 days, it entered the 3rd quiescent phase of 6-9 days duration. The 3rd quiescent stage moulted into the transparent tritonymphal stage (Fig. 2F) which was the largest among all other nymphal stages. The tritonymph exhibited active feeding on dead pneumatophores for a period of 10–11 days and then it passed through the 4th and final quiescent stage of 7–9 days duration and moulted into the light brown coloured adult (Figs 2 G,H). Under laboratory conditions of 28±2°C and 79±2% RH, *A. clavata* completed its development from egg to adult within 61-72 days (Table 1). The newly emerged females produced eggs 8-11 days after their emergence but they remained inside their body cavity until larviposition, i.e., giving birth to larvae.

Table 1. Duration of development of life stages of Acrotritia clavata (Märkel, 1964) at 28±2°C, RH = 79±2% (in days).

Sl No	Egg	Larva	I Quiescent	Pro-tonymph	II Quiescent	Deu-tonymph	III Quies-cent	Tri-tonymph	IV Quies-cent	Total
1	14	5	3	4	5	5	6	11	8	61
2	17	6	3	3	5	3	6	10	8	61
3	14	4	3	4	5	5	8	11	9	63
4	18	6	5	4	6	5	9	10	9	72
5	17	6	3	4	5	5	7	9	7	63
6	16	5	4	3	5	4	6	10	9	62
7	16	5	4	3	5	5	6	9	9	62
8	17	5	3	3	6	4	6	10	8	62
9	15	5	3	4	5	4	7	11	7	61
10	15	5	3	4	5	4	7	11	10	64
Range	14-18	5-6	3-5	3-4	5-6	3-5	6-9	10-11	7-9	61-72

Morphological Description of Life Stages of *A. clavata* (Märkel, 1964)

Egg

Length: 173-185 µm; width: 57-62 µm. Small, oval, white, transparent and inside the body of the adult female.

Prelarva

Detected inside the body of weakly sclerotized females. Prelarva more or less oval in appearance enclosed inside the eggshell and possessing 3 pairs of monodactylous legs.

Larva

Dorsal region (Fig. 3A). Length: 173-186 µm; width: 74-82 µm.

The larva could be easily distinguished by the possession of 3 pairs of legs. The cuticle of the larva was weakly sclerotized, colourless and smooth. The rutella of the subcapitulum and its digits showed very little sclerotization and were light brown.

Prodorsum: Prodorsum relatively short with a broadly round rostrum; setae *ro*, *le* and *in* long, setiform and smooth; seta *ro* inserted at the tip of rostrum, seta *le* inserted anteromedial to seta *in*; length of setae varies in the sequence *in>ro>le*; bothridial cups not well developed; seta *ex* inconspicuous.

Notogaster: Notogaster with 10 pairs of setae (*c1*, *c2*, *c3*, *cp*, *d1*, *d2*, *e1*, *e2*, *h1* and *h2*) setae *ps1-3*, absent.

Ventral region: Infracapitulum stenarthric, setae *h*, *m*, *a* setiform, smooth, setae *m* little shorter than the other; epimeres with paired, smooth plates having weakly defined borders, epimeralsetal formula 3–1–2, all setae setiform, smooth, with flagellate tip; genital, aggenital, anal and adanal setae not developed.

Legs: All legs monodactylous.

Protonymph

Dorsal region (Fig. 3B). Length: 270-292 µm; width: 119-128 µm.

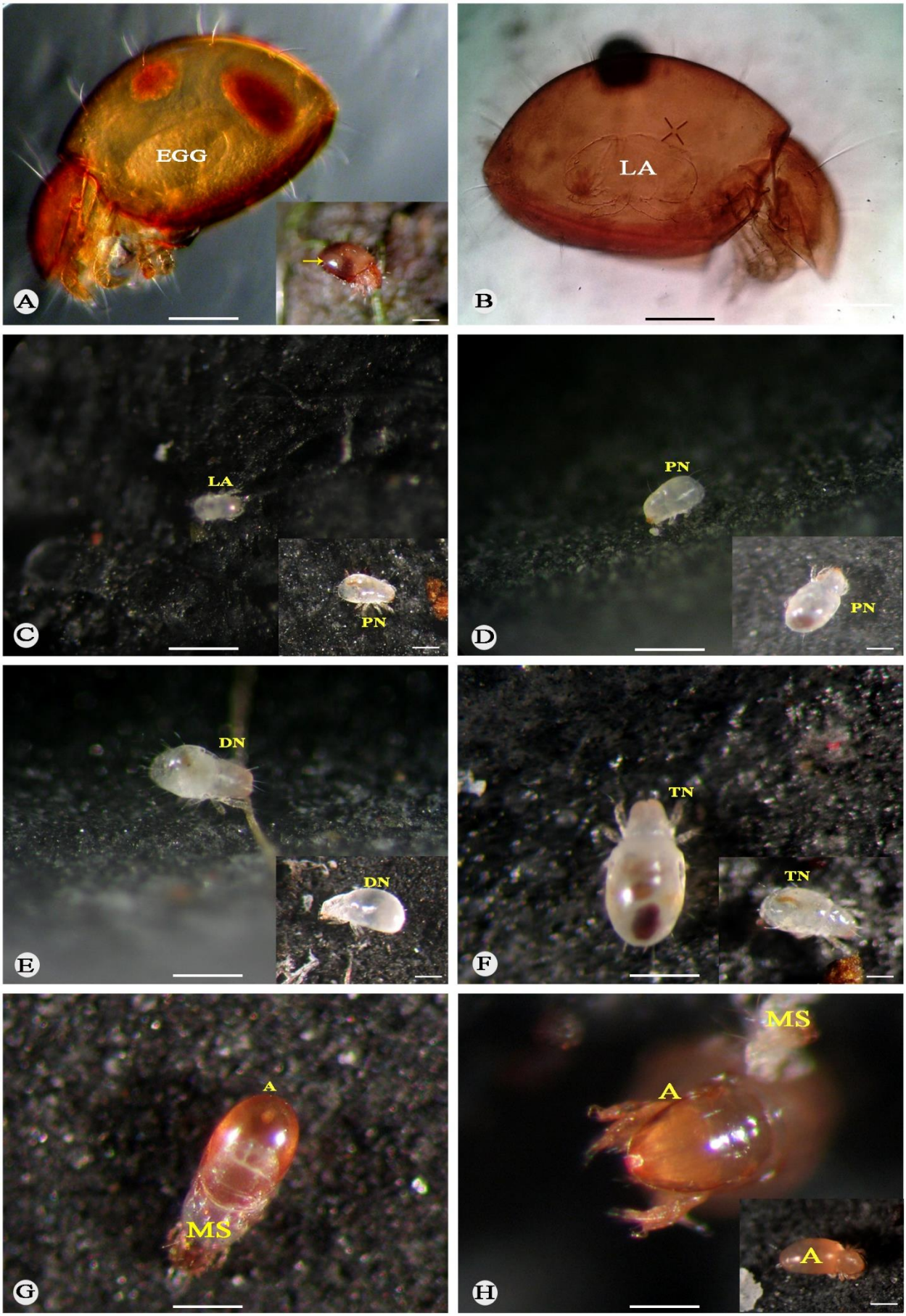

Figure 2. A. Adult of *Acrotritia clavata* showing egg inside the body, **B.** Adult of *A. clavata* with fully developed larva (LA), **C.** Newly emerged larva (LA) and protonymph (PN), **D.** Protonymph and its quiescent phase, **E.** Deutonymph (DN) feeding on dead filaments of *Microspora* sp. and quiescent deutonymph, **F.** Tritonymph (TN) and quiescent tritonymph, **G.** Moulting of quiescent tritonymph to adult (A) and moulting skin (MS) of quiescent tritonymph, **H.** Newly emerged adult (A) (Scale bar=1mm).

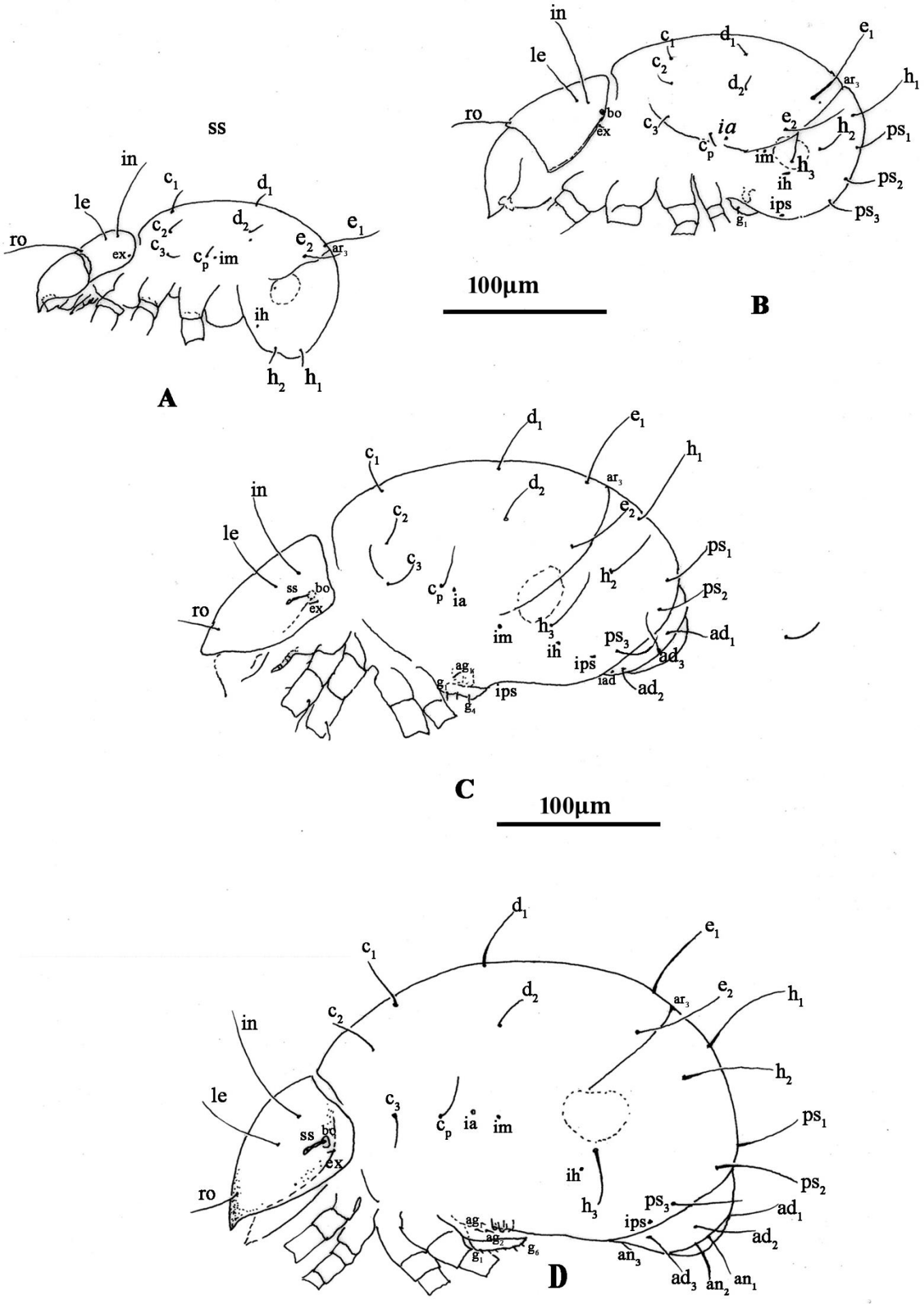

Figure 3. *Acrotritia clavata* (lateral view). **A.** Larva, **B.** Protonymph, **C.** Deutonymph, **D.** Tritonymph.

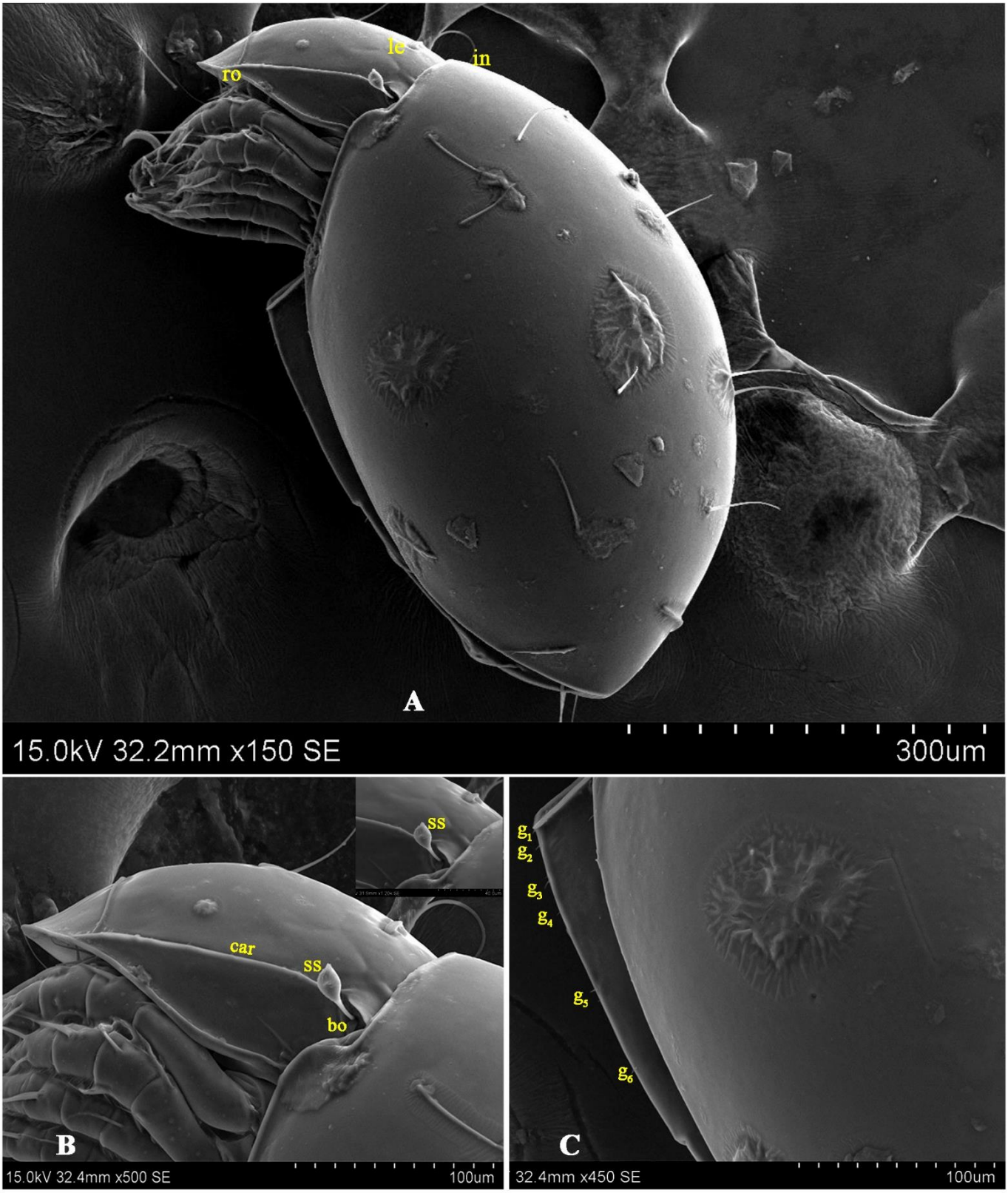

Figure 4. SEM image of *Acrotritia clavata* (lateral view). **A.** Aspis with prodorsal setae (*in*, *le* and *ro*), **B.** Enlarged view of aspis showing clavate sensillus (ss), bothridium (bo) and lateral carina (car), **C.** Genital plate with 6 pairs of small fine genital setae (*g1-6*).

Larger than the larva and easily identified by the presence of 4 pairs of legs. Body almost cylindrical in appearance, and not ptychoid. One pair of genital suckers present.

Prodorsum: Comparatively short and reaching about half the length of the notogaster; rostrum widely rounded, all prodorsal setae, smooth with flagellate tip; length of setae *in>ro>le*; bothridium and setae *ex* present.

Notogaster: Notogastral surface smooth, 14 pairs of smooth setae inserted on the notogaster, setae *h3*, *ps1*, *ps2* and *ps3* newly added in this stage, setae *e1*, *h1* long-

est, other setae much shorter; distinct simple transverse linear groove (*ar3*) present, posterior to setae of *e*- series.

Ventral region: Infracapitulum stenarthric, setae *h*, *m*, *a* setiform and smooth; epimeral plates with weakly defined borders; epimeral setal formula 3–1–2–1, all setae setiform, smooth, longest with flagellate tip, 1 pair of genital setae and one pair of genital suckers present; anal and adanal setae not developed.

Deutonymph

Dorsal region (Fig. 3C). Length: 306-314 µm; width: 146-160 µm.

Prodorsum: Prodorsal integument smooth; rostrum elongated; prodorsal setae smooth and of varying size, seta *in* the longest, length of prodorsal hairs varies in the order *in*>*le*>*ro*; seta *ex* conspicuous; sensillus clavate; bothridial cups well developed.

Notogaster: Notogastral integument delicate, smooth; number of notogastral setae same as that of the protonymphal stage, setae *e1*, *e2*; *h1-3* and *ad1-3* long with flagellate tip; lyrifissures *ia*, *im* and *ip* clearly visible in lateral view.

Ventral region: Infracapitum stenarthric type, bearing 3 pairs of simple, smooth setae; epimeralsetal formula 3–1–3–2, all setae smooth and setiform; genital plates with 4 pairs of simple, minute genital setae (*g1-4*) and 2 pairs of genital suckers; 2 pairs of minute aggenital setae present on the lateral margins of the aggenital plates; 3 pairs of long, smooth, adanal setae (*ad1-3*) present; anal setae absent.

Tritonymph

Dorsal region (Fig. 3D). Length: 327-340 µm; width: 210-224 µm.

Body off–white in colour. Largest among the juvenile stages and easily distinguishable due to the larger size, presence of 3 pairs of genital suckers and the off-white colouration. Tip of the rostrum sclerotized with light brown colouration.

Prodorsum: Extended into an elongated rostrum; prodorsal surface ornamented with very fine granules, prodorsal integument pale brown in colour; carinae developed as narrow line below the bothridium; all prodorsal setae well developed, smooth, setiform with flagellate tips.

Notogaster: 14 pairs of setae, setae of series *e1*, *h1* and *ps1* longer than the rest; notogastral integument smooth and delicate.

Ventral region: Infracapitulum stenarthric type with 3 pairs of simple, smooth setae; epimeralsetal formula 3–1–3–3, all setae setiform, smooth, setae *1b, 3c* and *4c* equal in size and with flagellate tip; anogenital plates conspicuous; 6 pairs of minute, simple genital setae (*g1-6*) present; 3 pairs of adanal and 3 pairs of anal setae present on the fused ano-adanal plates, seta *an3* small, located near the interlocking triangle area.

Legs: All legs monodactylous.

Adult

(Figs 4 A-C). Length: 622-743µm; width: 534-581 µm.

Prodorsum: Prodorsum with a pair of lateral carina; setae on aspis more delicate than those of other species of the genus, the posterior most pair conspicuously long and somewhat curved; length of setae: *in*>*le*>*ro*>*ex*; lamella incised medially and above bothridium; exobothridial setae small; sensilli with a narrow stalk and clubbed head, rough, almost smooth; bothridium not distinctly spiral in top view, but appears as a distinctly spiral structure in semi-oblique view; entire prodorsal surface punctated.

Notogaster: Notogaster with 14 pairs of fine, short, rigid setae, without sign of shagreen appearance, setae *c1* and *c2* considerably remote from anterior margin, setae *c3* closer to margin; opening of latero-opisthosomal gland distinct; 5 lyrifissures and 2 vestigial setae present on both sides; ornamented with punctations under higher magnification (400x).

Ventral region: Infracapitulum with seta *h* longer than their mutual distance; palps 3 segmented with a setal formula of 2–2–7, palp tarsus carries a single solenidion (*ω)*; epimeralsetal formula 3–1–3–3, all setae smooth and setiform; genito-aggenital plates almost smooth, genital plates carry 6 pairs of small, fine setae, 2 pairs of short, smooth aggenital setae, inserted one behind the other; 3 pairs of anal (*an1-3*) detected, of which seta *an*3 the smallest; 3 pairs of long, setiform adanal setae, *ad*1 inserted conspicuously far from *ad2* and *ad3*.

Legs: All legs monodactylous with strong claw, chaetotaxy of leg I: 3–2(2)–4(1)–15(1).

DISCUSSION

The present study described the embryonic development of the oribatid mite species, *Acrotritia clavata*, under laboratory conditions. The reproductive pattern of oribatids inhabiting mangrove ecosystems shows variation, depending on their environmental, physiological and morphological characteristics (Schulte, 1976; Ernst, 1995; Karasawa and Hijii, 2004). The species A. clavata completed its development from egg to adult within 61-72 days. This species was found associated with mangrove litter, dead pneumatophores and from algal cushions (*Microspora* sp.) growing on the barks and twigs of the mangrove plant, *Avicennia marina*. In the culture cells, both aggregation and wandering was observed; some crawled on the substratum and started wandering, apparently in search of food (Schulte et al., 1975; Schulte, 1976; Convey, 1994; Bücking et al., 1998; Søvik, 2004). Krisper and Schuster (2008) observed aggregations in littoral Ameronothridae; such aggregations are hypothesized to be protection against wave action (Schulte et al., 1975; Bücking et al., 1998; Søvik, 2004). The individual difference in duration of development could be attributa-

ble to the difference in the microhabitat and life style of the oribatid mites (Luxton, 1966). Moreover, the feeding and breeding habits of the intertidal oribatids have to be synchronized with tidal rhythms (Chatterjee et al., 2018) which were not possible under laboratory conditions.

In the present study, the adult females of *A. clavata* had developed pre-larvae inside their body cavities. The occurrence of a pre-larval stage has been reported as a feature in many oribatids (Behan-Pelletier 1999; Krivolutskiy, 1975; Liu and Chen, 2015) and is very common among phthiracaroids. In the present study, females of *A. clavata* carrying mature pre-larvae gave birth to fully developed larvae among the feeding substrates in the culture cells, and no oviposition was noticed. Prelariviposition and lariviposition have been previously reported in terrestrial oribatids (Clement and Haq, 1984). Members of the littoral Ameronothridae are also known to be mainly larviparous (Luxton, 1966; Bücking et al., 1998; Søvik, 2003). Viviparity is commonplace among littoral mites, suggesting that this provides an advantage by eliminating the vulnerable egg stage and/or by reducing the washing effects of tidal waves (Luxton, 1964, 1967).

Terrestrial oribatids possess two types of lariviposition in which larvae either emerge from the egg found inside the gravid female and are then deposited (true larviparity or viviparity), or larvae may hatch soon after deposition, a phenomenon termed ovoviviparity (Bücking et al., 1998). Intertidal mites of the genus *Ameronothrus* Berlese, 1896 inhabiting the littoral zone and estuaries show larviparity as an ancestral plesiotypic trait (Ermilov, 2011; Lions, 1966; Luxton, 1964). Larviparity has several advantages over oviparity in intertidal mites which are constantly exposed to flooding; occurrence of lariviposition would help to overcome the washing effects of tidal currents (Lions, 1966). The occurrence of viviparity in salt-marsh acarines under tidal conditions shows that it provides an ecological advantage (Chakraborty, 2011). However, details are lacking on the feeding and reproductive traits of marine/mangrove littoral inhabiting intertidal oribatids (Ermilov, 2011).

During the present study, the completion of studies on the feeding and biological aspects of the subject intertidal zone oribatid mite was a difficult task because of some limitations in the laboratory conditions. Concerning the reproduction of littoral oribatid mites, there has not been a detailed study (Pfingstl, 2013). The mangrove environment undergoes temporal changes in tidal rhythms, temperature and wind, salinity (Luxton, 1990) so it was found difficult to provide such specified natural climatic conditions in the laboratory for the successful establishment of the species.

In depth studies on the physiology, ecology and feeding biology of individual intertidal oribatid species is essential for the confirmation/elucidation of their active role in extremely productive ecosystems like mangroves.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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RESEARCH ARTICLE

Türkiye'den yeni bir *Favognathus* (Acariformes: Cryptognathidae) türü ve cinsin diğer üyeleri hakkında bazı taksonomik yorumlar

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ÖZET: Bu çalışmada, (1) Türkiye'den *Favognathus rosulatus* **sp. nov.** türünün tanımı yapılmıştır. (2) *Favognathus dakotaensis* türünün Türkiye'den ilk kaydı verilmiştir. (3) Daha önce *Cryptognathus* cinsine ait olan ve Mısır'dan tanımlanan iki türün (*Favognathus aegyptiaca* **comb. nov.** ve *Favognathus rosetta* **comb. nov.**) *Favognathus* cinsine dâhil edilmesi uygun görülmüştür. (4) Flechtmann (1971) tarafından verilen *Favognathus agapictus* ile Chaudhri vd. (1979) tarafından verilen *Favognathus dama* isimlerinin Uluslararası Zoolojik İsimlendirme Yasası'na (ICZN – International Code of Zoological Nomenclature) göre taksonomik olarak geçerliliğinin olmadığı belirlenmiştir. Flechtmann (1971) ve Chaudhri vd. (1979), ICZN'ye göre zoolojik isimlendirme amacıyla yayımlanmış sayılmamalıdır ve bu çalışmalarda geçen *F. agapictus* ve *F. dama* ***çıplak isimler*** olarak kabul edilmelidir. (5) Bagheri vd. (2015) tarafından İran'dan kaydedilen *Favognathus orbiculatus* türünün *Favognathus kamili* türüne aktarılması uygun görülmüştür.

Anahtar Kelimeler: Akar, taksonomi, geçersiz isim, yeni kayıt, yeni kombinasyon, yeni tür, Pülümür Vadisi, Türkiye.
Zoobank: http://zoobank.org/2CBD5628-48E8-49BD-A41A-81EA56C2C4BD

A new species of the genus *Favognathus* (Acariformes: Cryptognathidae) from Turkey, with some taxonomic comments on other members of the genus

ABSTRACT: In this study; (1) A new species, *Favognathus rosulatus* **sp. nov.**, from Turkey is described. (2) *Favognathus dakotaensis* is recorded for the first time from Turkey. (3) Two species (*Favognathus aegyptiaca* **comb. nov.** and *Favognathus rosetta* **comb. nov.**) previously described from Egypt are transferred from *Cryptognathus* to *Favognathus*. (4) It has been determined that the names of *Favognathus agapictus* proposed by Flechtmann (1971) and *Favognathus dama* proposed by Chaudhri et al. (1979) are not taxonomically valid according to International Code of Zoological Nomenclature (ICZN). The works of Flechtmann (1971) and Chaudhri et al. (1979) are not to be regarded as published for the purposes of zoological nomenclature according to ICZN, and the names of *F. agapictus* and *F. dama* in these works are regarded as ***nomina nuda***. (5) It is considered that the specimens given under the name of *Favognathus orbiculatus* by Bagheri et al. (2015) from Iran should be transferred to *Favognathus kamili*.

Keywords: Mite, taxonomy, invalid name, new combination, new record, new species, Pülümür Valley, Turkey.

GİRİŞ

Cryptognathidae (Acari: Trombidiformes) üyeleri genellikle döküntü, yosun ve liken gibi habitatlarda yaşamaktadır (Dönel ve Doğan, 2011). Vücut oval, sırt karın yönünde yassılaşmış ve idiosoma üstten öne doğru çıkıntı yaparak terek şeklinde koruyucu yapı oluşturmuştur. Gnathosomanın uzatılabilir yapıda olması bu grubun tipik bir özelliğidir (Luxton, 1973, 1993; Koç ve Ayyıldız, 1999).

Cryptognathidae familyasından şimdiye kadar üç cins tanımlanmıştır. Bunlar; *Cryptognathus* Kramer, *Favognathus* Luxton ve *Cryptofavognathus* Doğan ve Dönel'dir (Kramer, 1879; Luxton, 1973, 1987; Doğan ve Dönel, 2010). Türkiye'den şimdiye kadar bu üç cinse ait toplam 18 türün kaydı verilmiş olup (Erman vd., 2007; Doğan, 2007, 2008, 2019), bu kayıtlardan 11'i *Favognathus* cinsine aittir (Koç ve Ayyıldız, 1999; Doğan ve Ayyıldız, 2002, 2004; Koç ve Akyol, 2004; Doğan, 2008, Akyol ve Koç, 2017; Akyol, 2011; Dönel ve Doğan, 2011; Uluçay ve Koç, 2013). Pülümür Vadisi'nden (Tunceli) toplanan cryptognathid akarların değerlendirildiği bu çalışmada *Favognathus dakotaensis* (McDaniel ve Bolen) ve *Favognathus rosulatus* **sp. nov.** türleri ile bu sayı 13'e yükselmiştir.

Çalışmada ayrıca *Favognathus* cinsine ait birkaç tür hakkında bazı taksonomik değerlendirmeler yapılmıştır. Bu kapsamda, *Favognathus aegyptiaca* (Flechtmann) ile *Favognathus dama* (Chaudhri, Akbar ve Rasool) isimlerinin taksonomik olarak geçerli olmadığı belirlenerek, ***çıplak isimler*** olarak önerilmiştir. *Favognathus aegyptiaca* (Fawzy, Khalil ve Yassin) **comb. nov.** ve *Favognathus rosetta* (Fawzy, Khalil ve Yassin) **comb. nov.** türlerinin cinsleri *Favognathus* olarak yeniden düzenlenmiştir. Ayrıca İran'dan *Favognathus orbiculatus* (Livshitz) olarak verilen örneklerin *F. kamili* Dönel ve Doğan türüne ait olduğu değerlendirilmiştir.

MATERYAL VE YÖNTEM

Bu çalışmanın materyali; faunistik bir çalışma kapsamında (TÜBİTAK-118Z469), Ekim 2018 ve Eylül 2019 yılları arasında, Pülümür Vadisi'nden (Tunceli) toplanan akar örnekleri içerisinden seçilmiştir. Akar örneklerinin habitatı ve özellikleri ile tarih ve rakımı içeren bilgiler tür tanımlarının verildiği "İncelenen Örnekler" başlığı altında ayrıntılı olarak sunulmuştur. Örnekleme çalışmaları T.C. Tarım ve Orman Bakanlığı, Tarımsal Araştırmalar ve Politikalar Genel Müdürlüğü (50411936-604.02-E.2200901) ile Doğa Koruma ve Milli Parklar Genel Müdürlüğü'nden (72784983-488.04-44455) yasal izinler alındıktan sonra gerçekleştirilmiştir. Örneklerinin toplanması, ayıklanması, ağartılması, preparasyonu, ölçümü ve görüntüleme işlemlerinde Fan ve Zhang (2005) ile Walter ve Krantz (2009) tarafından belirtilen yöntemler izlenmiştir. Çizim ve fotoğraflama işlemleri faz-kontrast donanımlı ışık mikroskobunda (Leica DM 4000B) gerçekleştirilmiştir. Akarların ölçümleri LAS V3,8 programı yardımıyla µm cinsinden yapılmıştır. Metinde geçen ölçümlerde ilk değer ortalamayı, yay ayraç içerisindeki değerler ise değişim aralığını ifade etmektedir. Yeni olarak tanımlanan türde ise ilk değer holotipi, yay ayraç içindekiler ise paratip aralığını vermektedir. Çalışmada, Grandjean (1944) ve Kethley (1990) tarafından önerilen terminoloji takip edilmiştir. Örnekler, Erzincan Binali Yıldırım Üniversitesi, Akaroloji Laboratuvarında (EBYU) saklanmaktadır.

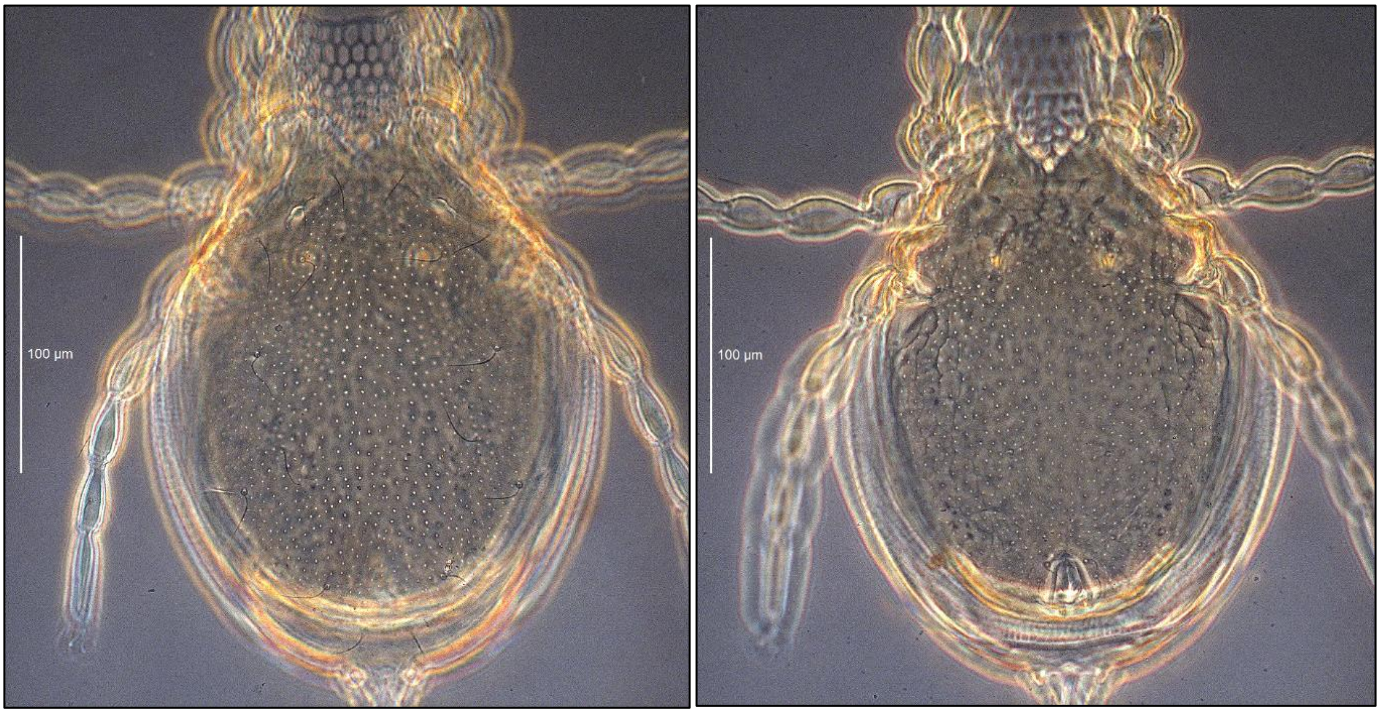
BULGULAR VE TARTIŞMA

Tür Tanımları

Favognathus dakotaensis (McDaniel ve Bolen)

Cryptognathus (*Favognathus*) *dakotaensis* McDaniel ve Bolen, 1979: 97.

Favognathus dakotaensis (McDaniel ve Bolen) Swift, 1996: 86; Krisper ve Schneider, 1998: 201; Doğan, 2008: 1676.



A **B**

Şekil 1. *Favognathus dakotaensis* (Dişi). **A.** Üstten görünüm, **B.** Alttan görünüm.

Dişi: Vücut oval, terek dâhil 297 (293-315) µm uzunluğunda ve 186 (170-190) µm genişliğindedir (Şekil 1).

Palp 95 (87-100) µm, keliser 99 (98-100) µm uzunluğundadır. Kılların palp parçaları üzerindeki dağılımı trokanterden tarsusa kadar şu şekildedir: 0, 3, 2, 3, 4+1ω+4 öpatidiyum. Gnathosomanın ön kısmına yerleşmiş iki çift adoral kıl ($ro_{1,2}$) ve farinksin arka kısmına yerleşmiş bir çift subkapitulum kılı (*m*) bulunur.

İdiosoma tereği 56 (51-58) µm uzunluğundadır. Tereğin ön kenarı dişçiksiz olup, boyuna sırada 7 veya 8 çukurluk bulunur. Sırt plağı tamamen noktalı yapıdadır, ağsı desen ve çizgilenme yoktur. *sci* ile *sce* kılları arasında birer çift göz ve gözardı cisim vardır (Şekil 1A). Sırtta, uzunlukları 24 (18-27) µm arasında değişen, 11 çift, düz yapılı kıl bulunur. Kıllar aralarındaki mesafeler şu şekildedir; *vi*–*vi* 35 (34-41), *ve*–*ve* 32 (30-33), *vi*–*ve* 10 (9-14), *ve*–*sci* 10 (9-11), *sci*–*sci* 48 (46-49), *sce*–*sce* 94 (92-97), c_1–c_1 59 (56-62), *sce*–c_1 19 (18-23), c_1–d_1 43 (41-45), d_1–d_1 99 (96-101), d_1–e_1 40 (38-43), e_1–e_1 76 (68-82), e_1–e_2 22 (20-24), e_2–e_2 107 (97-116), e_1–f_1 59 (58-60), f_1–f_1 46 (42-51), f_1–h_1 25 (21-26), h_1–h_1 18 (18-20), h_1–h_2 24 (21-26), h_2–h_2 66 (63-67) µm.

Prosternal apronda 17-20 çukurluk vardır. Karın sırttaki gibi tamamen noktacıklı ve yanlarında ağsı desen gözlenir. Karın plağı zayıf çizgili yapıda olup, sırt kıllarından daha küçük yapılı altı çift kıl (*1a*, *3a*, *4a*, ag_{1-3}) taşır (Şekil 1B). Koksisternal bölge noktasız ve çizgisiz yapıdadır. Genital plağın dış yanlarında iki çift genital kıl ($g_{1,2}$) vardır. Anal plak vücudun arka uç kısmındadır ve üç çift kıl (ps_{1-3}) taşır.

Bütün bacaklar iki tırnaklı ve ışınlı empodiyumludur. Bacak uzunlukları sırasıyla; I.B 201 (198-215), II.B 167 (165-169), III.B 164 (162-170), IV.B 183 (175-198) µm'dir. Bacak parçaları üzerindeki kılların dağılımı şöyledir; koksa 2–1–2–1, trokanter 1–1–2–1, femur 4–3–2–2, genu 5(+1κ)–4(+1κ)–2–3, tibiya 5(+1φ+1φρ)–5(+1φρ)–4(+1φρ)–3, tarsus 15(+1φρ+1ω)–11(+1φρ+1ω)–9(+1ω)–9(+1ω). I.-III. trokanterler üzerinde noktalanma vardır. II. tarsustaki *tc* kılları şekil ve büyüklük bakımından birbirinden farklıdır.

İncelenen Örnekler: 2 ♀♀, Dağyolu Köyü, Armağan mezrası, meşe (*Quercus* sp.) altından döküntü ve toprak, 39°35'04,3''K 39°52'42,2''D, 1310 m, 24.11.2018; 3 ♀♀, Doğanpınar Köyü, Mutu mezrası, ardıç (*Juniperus* sp.) ve meşe altından karışık döküntü toprak, 39°35'10,1''K 39°52'13,5''D, 1455 m, 22.03.2019; 2 ♀♀, Dereköy, toprak üzeri yosun, 39°34'51,8''K 39°48'03,8''D, 1622 m, 11.05.2019; 1 ♀, Kırmızıköprü, Akdik köyü yakını, meşe altından döküntü ve toprak, 39°23'51,4''K 39°46'50,3''D, 1508 m, 22.06.2019; PÜLÜMÜR VADİSİ, TÜRKİYE.

Yayılışı: ABD (McDaniel ve Bolen, 1979; Swift, 1996; Doğan, 2008).

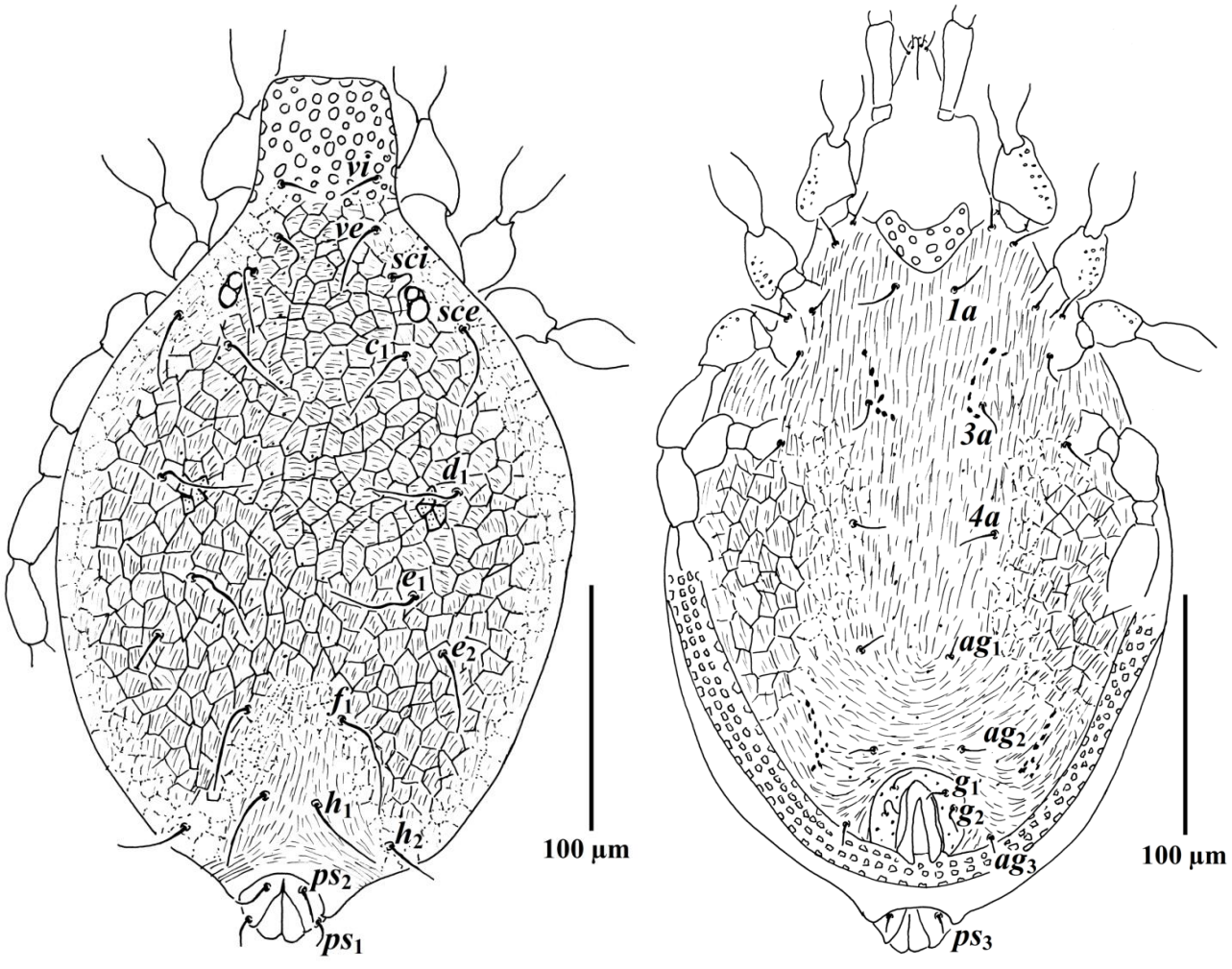
Tartışma: Bu tür, sırt ve karın bölgelerinin noktalı yapıda olması ve ağsı desenin yalnızca karın bölgesinde ve yanlarda bulunmasıyla cinsin diğer üyelerinden ayrılmaktadır (McDaniel ve Bolen, 1979). Örneklerimiz türün tipik karakterlerini yansıtmakla birlikte, bazı morfolojik farklılıklara sahiptir. Türkiye örneklerinde tereğin ön tarafı düzdür oysa tip örneklerinde tereğin ön tarafı dişçikli olmasa da dalgalı görünümdedir. Türkiye örneklerinde prosternal apronda 17-20 arasında değişen sayıda çukurluk vardır. Tip örneklerinin tanımında çukurluk sayısından bahsedilmemekle birlikte ventral çizimde daha fazla sayıda (26 adet) çukurluk bulunduğu anlaşılmaktadır. Türkiye örneklerinde koksisternal bölgede çizgi ayırt edilememektedir oysa tip örneklerinde bu bölgenin çizgili olduğu belirtilmektedir (McDaniel ve Bolen, 1979).

Türkiye örnekleri, tereğin ön tarafının düz olması ve koksisternal bölgede çizgilerin bulunmaması gibi özellikleriyle *F kamili* Dönel ve Doğan'a oldukça benzerlik göstermektedir. Bununla birlikte, II. tarsustaki *tc* kıllarının şekil ve büyüklük bakımından birbirinden farklılık göstermesi ve karın bölgesinin yanlarında belirgin şekilde ağsı desenin varlığıyla *F kamili*'den ayrılmaktadır.

Bu tür, tip yeri dışında ilk defa kaydedilmiş olup, Palaearktik bölgesi ve Türkiye faunası için yeni kayıt niteliğindedir.

Favognathus rosulatus **sp. nov.**

Dişi: Vücut oval, terek dâhil 350 (341-361) µm uzunluğunda ve 213 (199-215) µm genişliğindedir (Şekil 2-4).



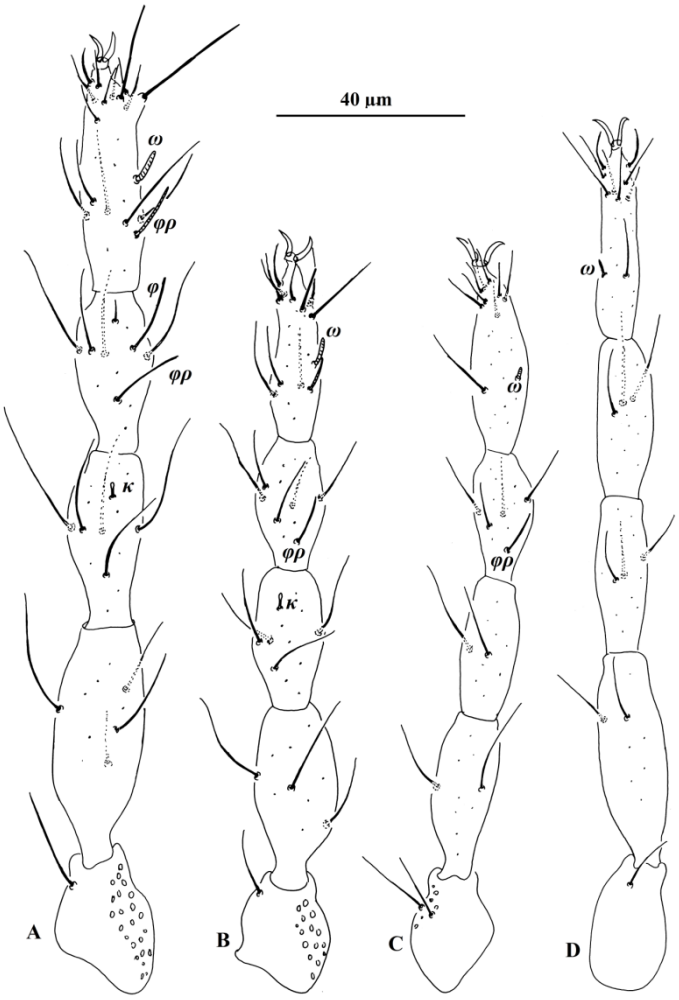
Şekil 2. *Favognathus rosulatus* **sp. nov.** (Holotip dişi). **A.** Üstten görünüm, **B.** Alttan görünüm.

Palp 97 (96-101) µm, keliser 114 (103-116) µm uzunluğundadır. Kılların palp parçaları üzerindeki dağılımı trokanterden tarsusa kadar şu şekildedir: 0, 3, 2, 3, 4+1ω+4 öpatidiyum. Tibiyada tırnak ayırt edilememiştir. Gnathosomanın ön kısmına yerleşmiş iki çift adoral kıl (*ro*$_{1,2}$) ve arka kısmına yerleşmiş bir çift subkapitulum kılı (*m*) bulunur.

İdiozoma tereği 51 (47-56) µm uzunluğundadır. Tereğin ön kenarı dişçiksiz olup, boyuna sırada 6 veya 7 çukurluk bulunur. Sırt plağı tamamen ağsı desenli ve çizgili yapıdadır. Ağsı desenler f_1 ve h_1 kılları civarında belirgin değildir. Sırtta ayrıca seyrek noktalanmalar mevcuttur. Noktalar d_1 kılları hizasında, 3-5 arasında değişen sayıda ağsı hücreler üzerinde toplanarak, bir çift rozet oluşturmuştur (Tablo 1). *sci* ile *sce* kılları arasında birer çift göz ve gözardı cisim vardır. Sırtta üç çift fissür vardır. Bunlardan ilk çifti (*ia*) *sce* kıllarının hemen aşağısında, ikinci çifti (*im*) e_2 kıllarının dış yan kesimlerinde, üçüncü çifti ise (*ip*) h_2 kıllarının dış yan kesimlerinde yer alır (Şekil 2A, 4A). Sırtta 11 çift düz yapılı kıl bulunur. Sırt kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; *vi* 26 (22-24), *ve* 32 (30-33), *sci* 32 (30-34), *sce* 36 (35-38), c_1 39 (40-43), d_1 40 (40-43), e_1 38 (40-43), e_2 42 (40-45), f_1 38 (39-44), h_1 37 (36-41), h_2 33 (32-38), *vi*–*vi* 36 (32-39), *ve*–*ve* 37 (38-40), *vi*–*ve* 18 (14-18), *ve*–*sci* 16 (13-17), *sci*–*sci* 57 (58-63), *sce*–*sce* 119 (106-117), *sci*–*sce* 32 (30-39), c_1–c_1 73 (75-81), c_1–d_1 56 (52-60), d_1–d_1 121 (122-134), d_1–e_1 43 (47-51), e_1–e_1 89 (83-92), e_1–e_2 24 (24-34), e_2–e_2 113 (117-124), e_2–f_1 47 (52-59), e_2–h_1 77 (83-92), e_2–h_2 78 (77-85), d$_1$–e_2 63 (69-73), e_1–f_1 58 (59-71), f_1–f_1 34 (30-36), f_1–h_1 32 (31-37), h_1–h_1 17 (17-20), h_1–h_2 32 (31-36), h_2–h_2 79 (79-86) µm'dir.

Prosternal apronda sayıları 12-16 arasında değişen çukurluk vardır (Tablo 1). Karın sırttaki gibi tamamen çizgili yapıda ve seyrek noktalıdır. Ağsı desenler ise yanlarda gözlenir. Koksisternal bölge noktasız yapıdadır. Karın plağı sırt kıllarından daha küçük ve zayıf yapılı altı çift kıl (*1a*, *3a*, *4a*, *ag*$_{1-3}$) taşır (Şekil 2B, 4B). *ih* ayırt edilememiştir. Genital plağın dış yanlarında iki çift genital kıl (*g*$_{1,2}$) vardır. Anal plak vücudun arka uç kısmındadır ve üç çift kıl (*ps*$_{1-3}$) taşır.

Bütün bacaklar iki tırnaklı ve ışınlı empodiyumludur (Şekil 3). Bacak parçaları nokta desenlidir. I. ve II. trokanterler belirgin tüberküllüdür. III. trokanterde de az da olsa tüberkül bulunur ancak IV. trokanterde tüberkül ayırt edilememektedir. Bacak uzunlukları sırasıyla; I.B 227 (206-222), II.B 174 (165-189), III.B 174 (167-184), IV.B 212 (181-226) µm'dir. Bacak parçaları üzerindeki kılların dağılımı şöyledir; koksa 2–1–2–1, trokanter 1–1–2–1, femur 4–3–2–2, genu 5(+1κ)–4(+1κ)–2–3, tibiya 5(+1φ+1φρ)–5(+1φρ)–4(+1φρ)–3, tarsus 15(+1φρ+1ω)–10(+1φρ+1ω)–9(+1ω)–9(+1ω). II. tarsustaki *tc* kılları şekil ve büyüklük bakımından birbirinden farklıdır.



Şekil 3. *Favognathus rosulatus* **sp. nov.** (Paratip dişi). **A.** I. bacak, **B.** II. bacak, **C.** III. bacak, **D.** IV. bacak.

Tablo 1. *Favognathus rosulatus* **sp. nov.**'da rozetleri oluşturan hücrelerin ve prosternal aprondaki çukurlukların sayılarındaki anomaliler.

	Sol rozetteki hücre sayısı	Sağ rozetteki hücre sayısı	Prosternal aprondaki çukurluk sayısı
Holotip ♀	4	4	13-14
Paratip-1 ♀	3	5	12-13
Paratip-2 ♀	4	5	12
Paratip-3 ♀	3	4	15-16
Paratip-4 ♀	3	3	?
Paratip-5 ♀	3	5	12

Şekil 4. *Favognathus rosulatus* **sp. nov.** (Holotip dişi). **A.** Üstten görünüm, **B.** Alttan görünüm.

Tip Örnekleri: Holotip ♀, Ardıçlı köyü, çürümüş söğüt kütüğü, kabuğu ve üzeri yosun ve liken, 39°29'52,4''K 39°51'27,6''D, 1610 m, 27.10.2018; Pülümür Vadisi, Türkiye. Paratipler: 3 ♀♀, holotip ile aynı yerden; 1 ♀, Gökçekonak köyü, alıç ağacının (*Crataegus* sp.) altından döküntü ve toprak, 39°24'30,3''K 39°51'56,4''D, 1694 m, 13.10.2018; 1♀, Tüneller bölgesi, 8. tünel, Hilbeş köprüsü civarı, çürümüş meşe gövdesi ve üzeri yosun, 39°20'33,3''K 39°47'28,7''D, 1293 m, 14.09.2019; Pülümür Vadisi, Türkiye.

Etimoloji: Sırtta rozet şeklinde desen bulunmasından dolayı türe "*rosulatus*" ismi verilmiştir.

Tartışma: *Favognathus rosulatus* **sp. nov.**, sırt deseni bakımından *F. bafranus* Doğan türüne benzemektedir (Doğan, 2008). Bununla birlikte; sırtta iki çift yerine, bir çift rozetin bulunması ve prosternal aprondaki çukurluk sayısının 11'den fazla olması bakımından bu türden ayrılmaktadır.

Favognathus rosulatus **sp. nov.**, *F. distortus* Kuznetsov, *F. insularis* (Luxton) ve *F. manisaensis* Akyol Koç türlerine de yakın getirilebilir (Luxton, 1973; Kuznetsov ve Livshitz, 1974; Akyol ve Koç, 2017). Bununla birlikte; sırt plağının tamamen ağsı desenli olması (*F. insularis*'de kısmen ağsı desenli), sırtta bir çift rozetin varlığı (*F. distortus* ve *F. manisaensis*'de iki çift), koksisternal bölgenin noktasız yapıda olması (diğer türlerde koksalar arası bölgenin ortasında boyuna sıralı ve II. ile III. koksalar arasında çapraz konumlu noktalanmalar mevcut) gibi kombine/toplu karakterlerle bahsi geçen türlerden ayrılmaktadır.

İncelenen Diğer Türler ve Taksonomik Değerlendirmeler

Favognathus kamili Dönel ve Doğan

Favognathus kamili Dönel ve Doğan, 2011: 375; Uluçay ve Koç, 2013: 494; Doğan vd., 2015: 573; 2018: 671; Bingül vd., 2016: 952; Akyol, 2017: 213; Gül ve Akyol, 2017: 74.

Favognathus orbiculatus (Livshitz) Bagheri vd., 2015: 44 **(yanlış teşhis/misidentification)**.

İncelenen Örnekler: 1 ♀, Nazımiye, Demirci köyü, Soğukmeşe mezrası yolu, meşe ve ardıç altından karışık döküntü ve yosun, 39°11'30,3''K 39°44'09,8''D, 1125 m, 13.10.2018; 2 ♀♀, Doğanpınar Köyü, Mutu mezrası, meşe altından döküntü ve toprak, 39°09'28,2''K 39°40'20,6''D, 1297 m, 27.10.2018; 1 ♀, Pülümür, Dağyolu (Şeteri) Köyü, Armağan mezrası, Karataş mevkii, alıç ve meşe altından döküntü ve toprak, 39°35'01,9''K 39°53'00,7''D, 1314 m, 27.10.2018; 1 ♀, Dağyolu (Şeteri) Köyü, Armağan mezrası, Karataş mevkii, kaya üzeri yosun, 39°35'01,9''K 39°53'00,7''D, 1314 m, 27.10.2018; 1 ♀, Doğanpınar Köyü, Büklü Dede Türbe yolu, sürünür ardıç ve geven altından toprak üzeri yosun, 39°35'19,8''K 39°51'08,7''D, 1404 m, 27.10.2018; 1 ♀, Göneli Kaynak Tuzlası yolu, adi ardıç altından döküntü ve toprak, 39°31'24,1''K 39°50'57,5''D, 1928 m, 27.10.2018; 1 ♀, Ardıçlı köyü yakını, toprak üzeri yosun, 39°29'52,4''K 39°51'27,6''D, 1610 m, 27.10.2018; 1 ♀, Nazımiye, Seyithan köprüsü, türbe yanı, kaya kovuğundan toprak, 39°11'29,2''K 39°42'50,3''D, 1009 m, 27.10.2018; 1 ♀, Teşnik köyü, meşe altından döküntü ve büyükbaş hayvan gübresi, 39°05'43,8''K 39°38'21,4''D, 987 m, 10.11.2018; 1 ♀, Dağyolu Köyü, Armağan mezrası,

meşe altından döküntü ve toprak, 39°35'04,3''K 39°52'42,2''D, 1310 m, 24.11.2018; 1 ♀, Seyit Musa Dede Türbe yolu, meşe kovuğundan döküntü ve toprak, 39°33'22,4''K 39°53'35,8''D, 1559 m, 24.11.2018; 1♀, Seyit Musa Dede Türbe yolu, mazı (*Thuja* sp.) altından döküntü ve yosun, 39°33'22,0''K 39°53'55,8''D, 1704 m, 24.11.2018; 1 ♀, Kutuderesi mevkii, meşe altından çimenli toprak, 39°11'27,8''K 39°41'28,1''D, 972 m, 24.11.2018; 1 ♀, Doğanpınar Köyü yakını, geven altından çimenli ve yosunlu toprak, 39°35'16,7''K 39°51'19,8''D, 1451 m, 08.12.2018; 1 ♀, Doğanpınar Köyü yakını, meşe ve ardıçlık alan, ardıç altından döküntü ve toprak, 39°35'16,7''K 39°51'19,8''D, 1451 m, 08.12.2018; 1 ♀, Taht mevkii, çimenli ve yosunlu toprak, 39°08'03,8''K 39°29'46,1''D, 994 m, 10.02.2019; 1 ♀, Kırmızıköprü, çürümüş meşe kütüğü ve üzeri yosun, 39°23'34,2''K 39°47'03,2''D, 1526 m, 13.04.2019; 1 ♀, Zağge, IV. Çat köprüsü, çürümüş meşe kütüğü ve kovuğu, 39°16'09,7''K 39°46'19,7''D, 1072 m, 09.06.2019; Pülümür Vadisi, Türkiye.

Yayılışı: İran ve Türkiye (Dönel ve Doğan, 2011; Uluçay ve Koç, 2013; Bagheri vd., 2015; Doğan vd., 2015; Bingül vd., 2016; Akyol, 2017; Gül ve Akyol, 2017; Doğan, 2019).

Tartışma: Örneklerimiz türün daha önce verilen örnekleriyle benzerlik göstermektedir. Diğer taraftan, Bagheri vd. (2015) tarafından İran'dan kaydedilen ve *Favognathus orbiculatus* (Livshitz) olarak teşhis edilen örneklerin aslında bu türe ait olduğu değerlendirilmektedir. İran örnekleri *Favognathus kamili* Dönel ve Doğan türün tipik karakterlerini yansıtmaktadır.

Favognathus aegyptiaca (Fawzy, Khalil ve Yassin) **comb. nov.**

Cryptognathus (*Favognathus*) *aegyptiaca* Fawzy vd., 2011: 850.

Favognathus rosetta (Fawzy, Khalil ve Yassin) **comb. nov.**

Cryptognathus (*Favognathus*) *rosetta* Fawzy vd., 2011: 849.

Fawzy vd. (2011) tarafından Mısır'dan *Cryptognathus* (*Favognathus*) *aegyptiaca* ve *Cryptognathus* (*Favognathus*) *rosetta* adında iki yeni tür tanımlamıştır. Yazarlar tarafından verilen tanımlarda her iki türün prosternal apronlarının çukurluklu olduğu ve ikişer çift genital kıl taşıdıkları anlaşılmaktadır. Bunlar *Favognathus*'un tipik karakterleri olması nedeniyle bu türlerin cinsleri *Favognathus* olarak yeniden tertip edilmiştir.

Her iki türün orijinal tanım ve çizimleri, diğer türlerden ayırt edilebilmeleri için yeterli değildir. Çalışmada ayrıca *Favognathus aegyptiaca* türünün holotipinin birden fazla örneğe dayandırıldığı da anlaşılmaktadır. Bunlar şimdilik *şüpheli türler* (*nomina dubia*) olarak önerilmemiş olup, türlere ait örneklerin daha fazla araştırması gerektiği değerlendirilmektedir.

Nomina Nuda

Favognathus dama (Chaudhri, Akbar ve Rasool) **nom. nud.**

Cryptognathus dama Chaudhri vd., 1979: 169.

Chaudhri vd. (1979) bir proje raporunda *Cryptognathus dama*'yı Pakistan'dan yeni tür olarak tanımlamıştır. Bu çalışma, Uluslararası Zoolojik İsimlendirme Yasası'nın (ICZN – International Code of Zoological Nomenclature) 8. Maddesine göre zoolojik isimlendirme açısından yayımlanmış sayılmadığından türün ve "*dama*" isminin taksonomik olarak geçerliliği yoktur.

Favognathus agapictus (Flechtmann) **nom. nud.**

Cryptognathus agapictus Flechtmann, 1971: 47.

Favognathus agapictus (Flechtmann) Krisper ve Schneider, 1998: 200; Doğan, 2008: 1674; Paktinat-Saeij vd. 2020: 17.

Flechtmann (1971) doktora tezinde *Cryptognathus agapictus*'u Brezilya'dan yeni tür olarak tanımlamıştır. Bu çalışma da Uluslararası Zoolojik İsimlendirme Yasası'nın 8. ve 9. Maddelerine göre zoolojik isimlendirme açısından yayımlanmış sayılmadığından, daha önce kataloglarda da (Krisper ve Schneider, 1998; Doğan, 2008) yer alan "*agapictus*" isminin taksonomik olarak geçerliliği yoktur. Paktinat-Saeij vd. (2020) tarafından da ICZN'ye göre türün geçersiz olduğundan söz edilmiş ve benzer karakterler taşımaları nedeniyle *F. insularis* (Luxton) ile türdeş olabileceği belirtilmiştir.

Bilindiği üzere, yüksek lisans ve doktora derecesi alabilmek için genelde tez adı verilen bilimsel bir yapıt ortaya koymak gereklidir. Bu eserler genelde öğrencilerin sadece tez jüri veya komite üyelerine dağıtılmakta, kütüphanelerde ya da ulusal tez merkezlerinde yazarın isteğine bağlı olarak süreli veya sınırlı erişime açılabilmektedir. Bu durum, tezin taksonomik anlamda geçerli yayın olma ölçütlerini sağlamamaktadır. Yasanın (Kodun) 8. Maddesi yayın ölçütlerini şu şekilde ortaya koymaktadır: Kamuya açık ve kalıcı olarak arşivlenmiş, ücretsiz veya ücret karşılığında edinilebilir, çok sayıda aynı ve kalıcı kopyaları üretebilen bir yöntemle aynı anda elde edilebilir nüshalar içeren bir edisyonda üretilmiş olmalıdır.

Tez çalışması isteğe bağlı olarak baskı/yayın formuna dönüştürülürken editöryal süreç belirginse ancak yayımlanmış sayılmaktadır ve sadece elektronik olarak yayımlanmış ise çalışmanın Zoolojik Nomenklatur Resmi Kayıt Bankası'na (ZooBank) kaydedilmesi zorunludur. Elektronik olarak düzenlenen ve dağıtılan bir çalışmadaki ismin taksonomik olarak geçerli sayılabilmesi için çalışmanın ZooBank'a kayıtlı olması ve kaydın gerçekleştiğine dair kanıt içermesi gerekmektedir (ICZN – Madde 8.5.3). Bu husus, Uluslararası Zoolojik İsimlendirme Komisyonu tarafından Uluslararası Zoolojik İsimlendirme Yasası'nda yapılan bir değişiklikle zorunlu hale getirilmiştir (ICZN, 2012a,b).

Fon sağlayıcılar

Bu çalışma, Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) tarafından 118Z469 numaralı proje ile desteklenmiştir.

Çıkar ilişkisi

Yazarlar, çalışma kapsamında herhangi bir kişisel çıkar çakışması olmadığını veya rekabet alanlarının bulunmadığını bildirmektedir.

Teşekkür

Bu çalışma, Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) tarafından desteklenen 118Z469 numaralı projenin verilerine dayalı olarak hazırlanmıştır. Çalışmayı maddi olarak destekleyen TÜBİTAK'a, örneklerin toplanmasına izin veren T.C. Tarım ve Orman Bakanlığı Tarımsal Araştırmalar ve Politikalar Genel Müdürlüğü ile Doğa Koruma ve Milli Parklar Genel Müdürlüğü'ne teşekkür ederiz.

Arazi çalışmalarını güvenli bir şekilde gerçekleştirmemize yardımcı olan ve kolaylık sağlayan bölgenin mülki idare amirliklerine, tüm kolluk kuvvetlerine ve özellikle T.C. Tunceli Valiliği İl Jandarma Komutanlığı'na teşekkürlerimizi sunarız.

Favzy vd. (2011) literatürünün tam metnini temin etmemize yardımcı olan Dr. Mohamed W. NEGM'e (Assiut Üniversitesi, Mısır ve Ibaraki Üniversitesi, Japonya) teşekkür ederiz.

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RESEARCH ARTICLE

First record of the genus *Afrotrachytes* Kontschán (Acari: Uropodina) in Peru with the description of a new species

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ABSTRACT: *Afrotrachytes peruensis* **sp. nov.** is described based on four females collected from soil in ACP Panguana, Peru. This is the second data of this genus in the Neotropical region. The new species differs from the congener in the ornamentation of female genital shield, the shape of sternal setae and caudal setae on dorsal idiosoma.

Keywords: Mite, Mesostigmata, taxonomy, Neotropical region.
Zoobank: http://zoobank.org/1D3CE48B-B19F-4AC3-924B-F5E3AFA58538

INTRODUCTION

The genus *Afrotrachytes* was established by Kontschán (2006a) for the *Afrotrachytes seticaudatus* Kontschán collected in Angola. In the same year, another new species was discovered and described (*Afrotrachytes longicaudatus* Kontschán) from Tanzania (Kontschán, 2006b). Three years later, the third African species was also described (*A. mirabilis* Kontschán) from Cameroon, together with the first Neotropical species (*A. bercziki* Kontschán) from Ecuador (Kontschán, 2009). Based on our current knowledge, this genus occurs in South-America and Africa, and its occurrence shows a typical amphiatlantic distribution type (Kontschán, 2009).

During the investigation of the Peruvian Uropodina, we found the second South-American species of the genus which is described herein.

MATERIALS AND METHODS

Specimens of the new *Afrotrachytes* were collected in Peru, Dept. Huánuco, Rio Yuyapichis, ACP Panguana. Mite specimens were cleared in lactic acid for two weeks and then investigated on half covered excavated slides. The illustrations were made with the aid of a drawing tube on a Leica 1000 scientific microscope. The specimens are stored in 70% ethanol and deposited in the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM) and the SNSB–Bavarian State Collection of Zoology, Munich, Germany (ZSM).

Abbreviations: *h* = hypostomal setae, *st* = sternal setae. All the measurements and the scales in the figures are given in micrometres (µm).

RESULTS

Taxonomy

Afrotrachytes Kontschán, 2006

Afrotrachytes Kontschán, 2006a: 2; Kontschán, 2006b: 53; Kontschán, 2009: 41.

Diagnosis. Color yellowish-brown. Idiosoma oval with long vertex. Legs as long as idiosoma. First legs without ambulacral claws. All legs bearing wide dorsal and ventral processes and wide phylliform setae. Inner margins of femur, genu, tibia and tarsus of leg I with long and rod-like setae. Dorsal and marginal shields fused anteriorly, pygidial shield present. Several long and phylliform caudal setae (three pairs or more) situated on ventral and dorsal idiosoma. One pair of horn-like anterior humps located on dorsal idiosoma at the level of coxae II. Genital shield of female oval, reticulate without anterior process.

Type species. *Afrotrachytes seticaudatus* Kontschán, 2006 by original designation.

Biology. We have very few information about the biology of the *Afrotrachytes* mites. Only N'Dri et al. (2018) presented that an unidentified species of the genus had been found in higher abundance in the native habitats (primary forests and savanna) in Cameroon in the rainy season. But the abundance had been elevated in the disturbed habitat (in a teak plantation) during the dry season contrary the natural habitats, where the number of specimens had been reduced (N'Dri et al., 2018).

Afrotrachytes peruensis **sp. nov.**

(Figures 1-11).

Diagnosis. Dorsal shield covered by oval pits, caudal setae long with narrow flag-like hyaline margin. Pygidial shield quadrangular. Sternal setae *st3*, *st4* and *st5* rod-like and apically forked. Genital shield of female with reticulate sculptural pattern.

Material examined. *Holotype.* Female. Peru, Dept. Huánuco, Rio Yuyapichis, ACP Panguana, 9°37'S, 74°56'W, 230-260m a.s.l., 23.IV.2016-09.V.2016., leg. S. Friedrich, F. Wachtel & D. Hauth (in MUSM). *Paratypes.* Three females,

collection data as in holotype (one paratype deposited in the MUSM, two paratypes deposited in the ZSM).

Description

Female (n=4).

Description. Length of idiosoma 775–820, width 575–605. Shape pentagonal, posterior margin rounded.

Dorsal idiosoma (Fig. 1). Dorsal and marginal shields fused close to anterior margin. Dorsal shield covered by oval pits (ca 8–10×7–11), except on smooth central area. Eight pairs of setae on dorsal shield bulbiform and ca 24–36 long. Marginal shield reduced posteriorly, bearing flag-like (ca 40–68) setae. Some oval pits situated on posterior part of marginal shield. Two pairs of long (ca 155–160) and narrow flag-like setae situated on small platelets (ca 30–34×18–20) and one pair of short (ca 65–70) and wider setae situated on membranous cuticle on caudal part of dorsal idiosoma. Pygidial shield quadrangular (80–85 long and 260–270 wide), covered by oval pits and bearing one pair of long and narrow setae (ca 120–135).

Ventral idiosoma (Fig. 2). Sternal and ventral shields with oval pits. Sternal setae *st1* and *st2* short (ca 21–23) leaf-like, situated at level of coxae II. Setae *st3*, *st4* and *st5* short (ca 20–28), rod-like, apically forked into 3–5 short branches. Setae *st3* situated close to anterior margin of genital shied, *st4* at level of central area of coxae III, *st5* close to posterior margin of genital shield. Three pairs of short (ca 26–40) and leaf-like ventral setae situated between coxae IV and level of anal opening. Two pairs of long (ca 100–120) and leaf-like setae placed at level of anal opening on marginal area of ventral idiosoma. Anal opening small, with one pair of shorter (ca 23–25) and one pair of longer (ca 38–41) adanal setae, postanal setae ca 37–42 long. All setae around anal opening leaf-like (Fig. 3). Ventral shield covered by oval pits (ca 7–11×8–13). Stigmata situated between coxae II and III. Poststigmatid part of peritremes short and straight, prestigmatid part with three bends (Fig. 4). Genital shield suboval (180–192 long and 154–160 wide) and its surface covered by reticulate sculptural pattern. Tritosternum with wide, quadrangular basis; laciniae subdivided into five smooth branches (Fig. 5).

Gnathosoma. Corniculi horn-like, internal malae smooth and longer than corniculi. Hypostomal setae *h1* smooth and ca 30–33 long, *h2*, *h3* and *h4* trifurcated and ca 14–17 long. Palp trochanter with two marginally serrate setae. Epistome basally serrate, apically smooth (Fig. 7). Chelicera with one tooth on fixed digit, one big tooth and some (6–7) small teeth on movable digit, internal sclerotized node absent, fixed digit longer than movable digit (Fig. 6).

Legs (Figs 8–11). Claws and ambulacrum absent in leg I. Leg I with wide flap-like prolongation and inner margin of femur, genu, tibia and tarsus with long and rod-like setae. Smaller flap-like prolongation situated on trochanters, femora, genua and tibiae on other legs. Setae on legs bulbiform or flag-like, needle-like setae situated only on tarsi I-IV. Length of legs: leg I 710–725, leg II 645–660, leg III 590–600, leg IV 695–710.

Etymology. The name of the new species refers to the country where it was collected.

Remarks. The new species differs from the other Neotropical species (*Afrotrachytes bercziki*) in several character states. The surface of female genital shield is smooth in *A. bercziki* and it is ornamented by reticulate sculptural pattern in the new one. The dorsal shield of known species is covered by irregular pits on central area, contrary with the new one, where the dorsal shield is smooth or bears oval pits on central area. *A. bercziki* has spatuliform postanal seta, apically serrate first ventral setae and needle like *st3* and *st4* setae, but the new species has leaf-like postanal seta, first ventral setae leaf-like, and apically forked st*3* and st*4* setae.

Key to the females of known *Afrotrachytes*

1. Dorsal shield with irregular and rectangular pits, anal area with two postanal setae..... 2

- Dorsal shield without irregular and rectangular pits, anal area with one postanal seta 3

2. Postanal seta leaf-like, setae on pygidialshield more than two times longer than the length of pygidial shield ....*A. seticaudatus*

- Postanal seta spatulate, setae on pygidial shield almost as long as the length of pygidial shield .....*A. bercziki*

3. Surface of female genital shield smooth .....*A. mirabilis*

- Surface of female genital shield with reticulate sculptural pattern 4

4. Sternal setae *st3*, *st4* and *st5* smooth and needle-like, setae on marginal shield serrate.....*A. longicaudatus*

- Sternal setae *st3*, *st4* and *st5* rod-like and apically forked, setae on marginal shield smooth and leaf-like..... .....*A. peruensis* **sp. nov.**

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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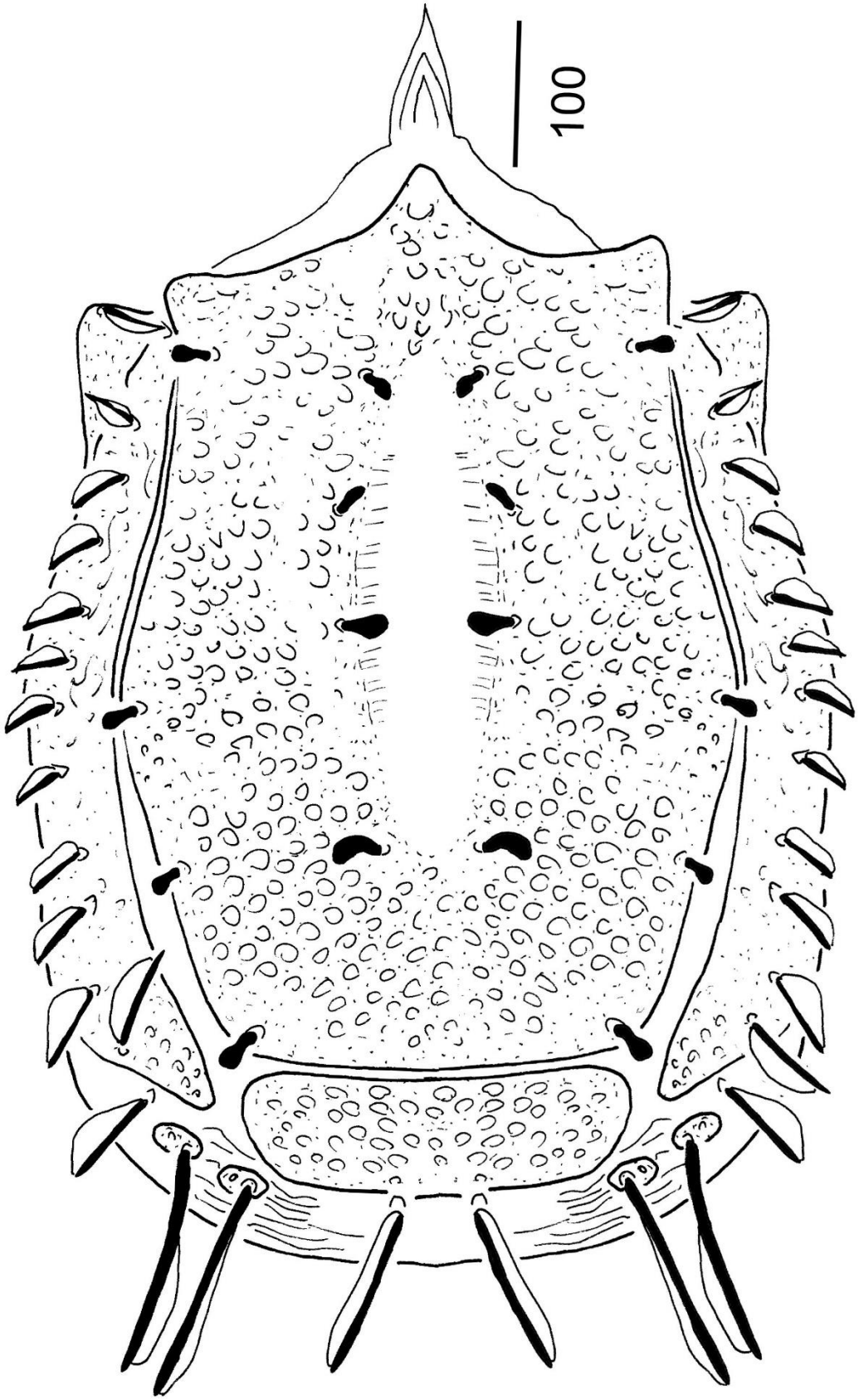


Figure 1. Dorsal view of *Afrotrachytes peruensis* **sp. nov.** (female), holotype.

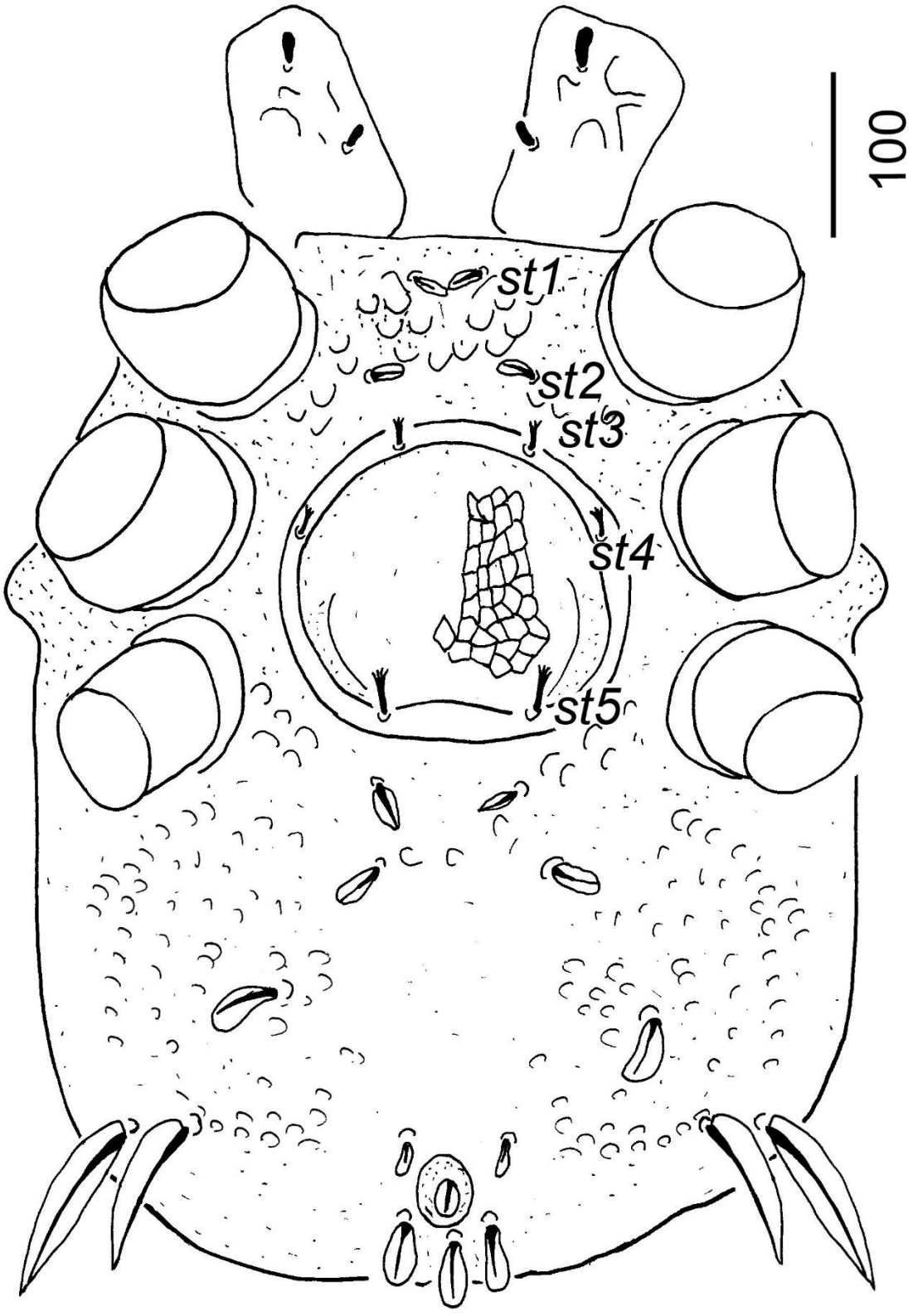
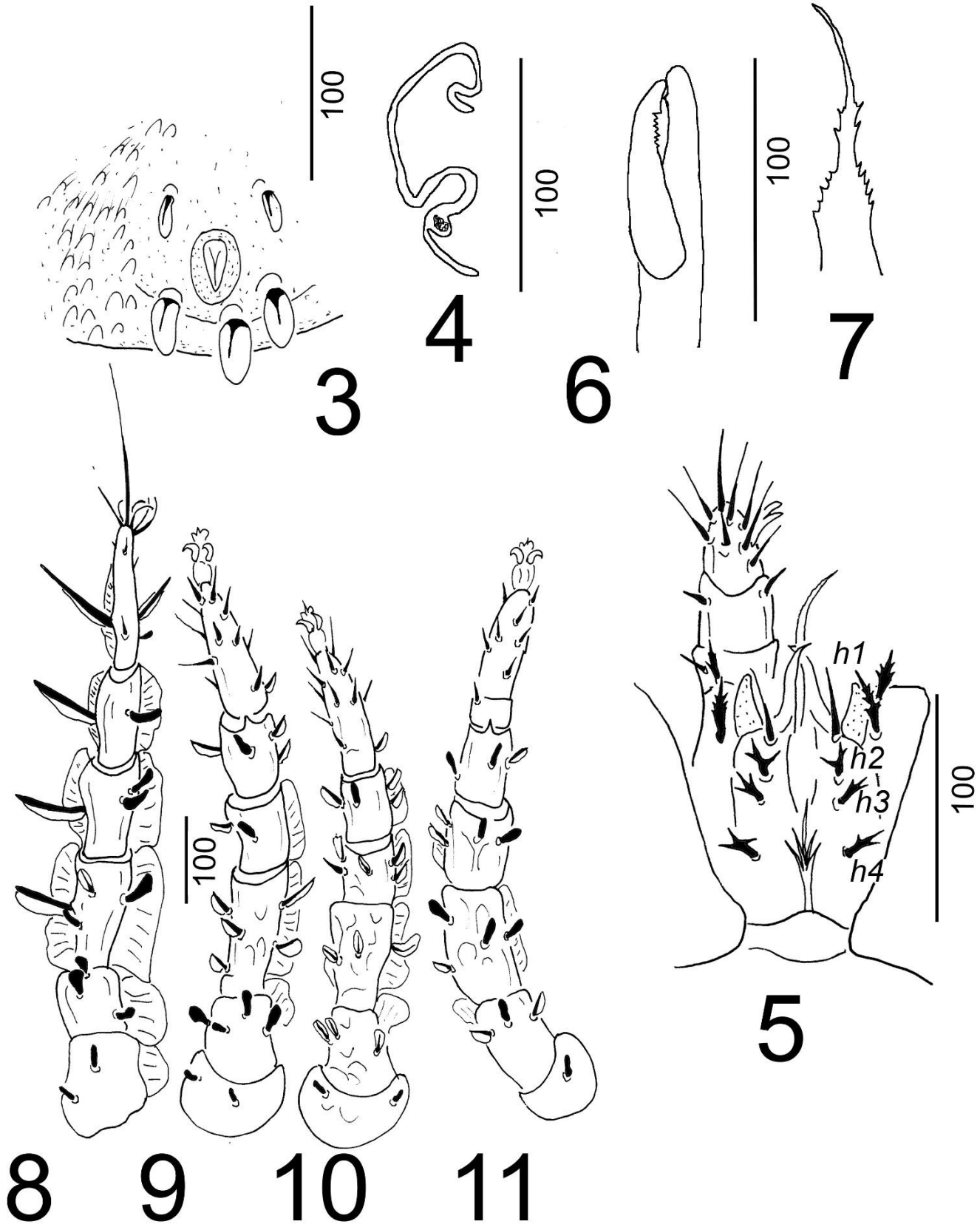


Figure 2. Ventral view of *Afrotrachytes peruensis* **sp. nov.** (female), holotype.



Figures 3–11. *Afrotrachytes peruensis* **sp. nov.** (female), holotype. **3.** Anal region, **4.** Peritreme, **5.** Ventral view of tritosternum, gnathosoma and palp, **6.** Lateral view of chelicera, **7.** Epistome, **8.** Leg I. in ventral view, **9.** Leg II in ventral view, **10.** Leg III in ventral view, **11.** Leg IV in ventral view.

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RESEARCH ARTICLE

Diversity and distribution of phytophagous and predatory mites on rosehip (*Rosa canina* L.) (Rosaceae) in Ankara, Turkey

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ABSTRACT: The study was carried out to detect phytophagous and predatory mites on rosehip (*Rosa canina* L.) (Rosaceae) in Ankara, Turkey. The samples were collected monthly from Ayaş, Çubuk, Gölbaşı, Haymana, Kahramankazan and Kızılcahamam districts of Ankara province from March to November between 2012 and 2014. As a result, a total of 12 mite species were identified namely; *Amphitetranychus viennensis* (Zacher), *Bryobia kissophila* Eyndhoven, *Eotetranychus populi* (Koch), *Tetranychus urticae* Koch (Acari: Tetranychidae), *Cenopalpus pulcher* (Canestrini and Fanzago) (Acari: Tenuipalpidae), *Tarsonemus smithi* Ewing (Acari: Tarsonemidae) as phytophagous mites, and *Euseius finlandicus* (Oudemans), *Kampimodromus aberrans* (Oudemans), *Paraseiulus triporus* (Chant and Yoshida-Shaul), *Typhlodromus* (*Anthoseius*) *bagdasarjani* Wainstein and Arutunjan, *T.* (*A.*) *psyllakisi* (Swirski and Ragusa) (Acari: Phytoseiidae) and *Zetzellia mali* (Ewing) (Acari: Stigmaeidae) as predatory mites. *Tetranychus urticae* and *K. aberrans* are the most common phytophagous and predatory mites, respectively. *Tarsonemus smithi* is a new record for the Turkish fauna.

Keywords: Acari, mites, Phytoseiidae, Rosaceae, rosehip, Turkey
Zoobank: http://zoobank.org/E4047CC2-63A4-47E4-B00D-33BF30CD22A9

INTRODUCTION

Rosehip (*Rosa canina* L.) (Rosaceae) is a perennial, bush-formed plant belonging to the family of Rosaceae. Rosehip is important for human health via regulation cholesterol and blood pressure. It has positive effect to decrease cancer disease, reduce the risk of getting diabetes. It is known it is beneficial at joint inflammation, increases blood pressure, protects skin and stomach health, and prevents kidney diseases. It is good for respiratory diseases (Anonymous, 2014). At the same time, for naturel rosehip is also grown as erosion preventive plants and as resource pollens of beekeeping. Rosehip, which is widely found in naturally in various regions of Turkey is a very rich plant group due to its minerals and vitamins.

There have been very few studies on arthropod pests of rosehip in Turkey (Karaca, 1956; Özbek et al., 1996; Bayram et al., 1998). Bayram et al. (1998) detected *Diplolepis mayri* Schlecht, *D. rosae* L. *D. eglanteriae* Htg. (Hymenoptera: Cynipidae) and *Perrisia rosarum* Hardy (Diptera: Cecidomyiidae) as pest species on the rosehip in Ankara (Center, Çamlıdere, Gölbaşı). Nine parasitoid species belonging to Braconidae, Chalcididae, Eulophidae, Eurytomidae, Pteromalidae and Torymidae families were also found in association with the above-mentioned pests in Turkey (Bayram et al., 1998). The mite species on rosehip have not been studied in Ankara province, so far. Therefore, the aim of this study was to determine diversity and distribution of phytophagous and predatory mites on rosehip (*Rosa canina* L.) (Rosaceae) in Ankara, Turkey.

MATERIALS AND METHODS

Samples were collected at monthly intervals from different districts of Ankara (Ayaş (GPS: 40.063466, 32.489552), Çubuk (GPS: 40.388507, 32.946036), Gölbaşı (GPS: 39.822684, 32.827995), Haymana (GPS: 39.616573, 32.692048), Kahramankazan (GPS: 40.184415, 32.666811) and Kızılcahamam (GPS: 40.459057, 32.624257)) during the period of March to November in 2012-2014 (Fig. 1). A total of 125 samples were collected from six districts in Ankara province during two years (14 samples from Ayaş, 33 samples from Çubuk, 16 samples from Gölbaşı, 15 samples from Haymana, 17 samples from Kahramankazan and 29 samples from Kızılcahamam). The plant samples were transferred to the laboratory and they were examined under stereomicroscope. Berlese funnels are also used to extract mites. The mites were cleared in lactophenol solution and then mounted in Hoyer's medium (Düzgüneş, 1980).

Species identifications were made by Prof. Sultan Çobanoğlu according to Pritchard and Baker (1955), Tuttle and Baker (1968), Jeppson et al. (1975), Meyer (1987) and Papadoulis et al. (2009). The identified specimens are deposited in the mite collection of senior author (University of Ankara, Department of Plant Protection, Ankara, Turkey).

RESULTS AND DISCUSSION

A total of 12 mite species belonging to five families were identified from rosehip in Ankara: *Amphitetranychus viennensis* (Zacher), *Bryobia kissophila* Eyndhoven, *Eotetranychus populi* (Koch), *Tetranychus urticae* Koch (Acari: Tetranychidae), *Cenopalpus pulcher* (Canestrini and Fanzago) (Acari: Tenuipalpidae), *Tarsonemus smithi* Ewing (Acari: Tarsonemidae) as phytophagous mites, and *Euseius finlandicus* (Oudemans), *Kampimodromus aberrans* (Oudemans), *Paraseiulus triporus* (Chant and Yoshida-Shaul), *Typhlodromus* (*Anthoseius*) *bagdasarjani*

Wainstein and Arutunjan, *T.* (*A.*) *psyllakisi* (Swirski and Ragusa) (Acari: Phytoseiidae) and *Zetzellia mali* (Ewing) (Acari: Stigmaeidae) as predatory mites (Table 1).

Table 1. Phytophagous and predatory mites on Rosehip in Ankara

	Family	Species
Predatory mites	Phytoseiidae	*Kampimodromus aberrans* (Oudemans, 1930)
		Euseius finlandicus (Oudemans, 1915)
		Typhlodromus (*Anthoseius*) *bagdasarjani* Wainstein and Arutunjan, 1967
		Typhlodromus (Anthoseius) psyllakisi (Swirski and Ragusa, 1976)
	Stigmaeidae	*Zetzellia mali* (Ewing, 1917)
Phytophagous mites	Tarsonemidae	*Tarsonemus smithi* Ewing, 1939*
	Tetranychidae	*Amphitetranychus viennensis* (Zacher, 1920)
		Tetranychus urticae Koch, 1836
		Eotetranychus populi (Koch, 1838)
		Bryobia kissophila Eyndhoven, 1955

*New record for the Turkish fauna

A total of 1173 specimens, of which 897 specimens belongs to phytophagous mites, were identified. The six species are predators while the other six species are phytophagous mites (Table 1).

Figure 1. Ankara province (★: Sampling areas).

Phytophagous mites

Family: Tetranychidae

Amphitetranychus viennensis (Zacher, 1920)

Material examined: Çubuk, 02. VI. 2013 (1♀); Gölbaşı, 02. XI. 2013 (1♂); Haymana, 09. IX. 2012 (2♀♀); Kızılcahamam, 15. IV. 2012 (1♀), 26. V. 2013 (2♀♀).

Distribution: It is mostly seen in Asian and European countries (Migeon et al., 2011).

Tetranychus urticae Koch, 1836

Material examined: Ayaş, 29. X. 2012 (4♀♀, 1♂), 02. XII. 2012 (1♂), 24. VIII. 2013 (5♀♀, 5♂♂), 27. X. 2013 (1♂); Çubuk, 22. IX. 2012 (19♀♀, 2♂♂), 21. X. 2012 (7♀♀, 3♂♂), 25. XI. 2012 (7♀♀, 8♂♂), 29. VI. 2013 (9♀♀, 1♂), 25. VII. 2013 (2♀♀, 2♂♂), 21. VIII. 2013 (10♀♀, 4♂♂), 16. IX. 2013 (1♀, 7♂♂), 13. X. 2013 (1♂); Gölbaşı, 04. XI. 2012 (5♀♀, 1♂), 15. VI. 2013 (1♀), 07. IX. 2013 (2♂♂), 28. IX. 2013 (1♀); Haymana, 06. I. 2012 (1♂), 13. VI. 2013 (2♀♀); Kahramankazan, 18. XI. 2012 (2♂♂), 14. IX. 2013 (2♂♂); Kızılcahamam, 06. IX. 2012 (6♀♀, 6♂♂), 14. X. 2012 (7♀♀, 3♂♂), 18. XI. 2012 (1♀), 23. VI. 2013 (1♀), 17. VIII. 2013 (6♀♀, 3♂♂), 10. XI. 2013 (1♂).

Distribution: *T. urticae* is widespread throughout the world except for some African and European countries and Asia (Migeon et al., 2011).

Remarks: *T. urticae* is more common in Çubuk, Kızılcahamam and Ayaş districts (Fig. 1).

Eotetranychus populi (Koch, 1838)

Material examined: Gölbaşı, 06 January 2012 (1♂).

Distribution: Armenia, Azerbaijan, China, France, Germany, Greece, Gruziya (Georgia), Hungary, India, Iran, Italy, Kazakhstan, Korea, the Netherlands, Poland, Russia (Eastern), Tajikistan, Turkey, Ukraine, UK, USA, Uzbekistan, Yugoslavia (Migeon et al., 2011).

Bryobia kissophila Eyndhoven, 1955

Material examined: Çubuk, 01. V. 2012 (1♀).

Distribution: Belgium, Bulgaria, Chile, Denmark, France, Germany, Greece, Gruziya (Georgia), Hungary, Italy, the

Netherlands, Poland, Portugal, Serbia-Montenegro, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Tasmania (Australia), Turkey, Ukraine, UK, USA (Düzgüneş, 1963; Migeon et al., 2011).

Family: Tenuipalpidae

Cenopalpus pulcher (Canestrini and Fanzago, 1876)

Material examined: Ayaş, 06. VIII. 2012 (1♀), 21. IX. 2013 (1♀); Çubuk, 26. VIII. 2012 (1♀), 22. IX. 2012 (1♀), 25. XI. 2012 (1♀), 28. IV. 2013 (1♀), 29. VI. 2013 (1♀); Gölbaşı, 06. I. 2012 (3♀♀, 1♂), 06. X. 2012 (4♀♀), 04. XI. 2012 (1♀); Haymana, 17. VI. 2012 (1♀), 26. IX. 2013 (3♀♀); Kahramankazan, 16. XII. 2011(2♀♀); Kızılcahamam, 16. XII. 2011(2♀♀).

Distribution: Afghanistan, Algeria, Austria, Britain, Bulgaria, Crimea, Cyprus, Denmark, Egypt, Georgia, Germany, Greece, Iranian, Iraq, Israel, Italy, Lebanon, Libya, the Netherlands, Portugal, Russia, Sicily, Syria, Turkey, Ukraine (Pritchard and Baker, 1958; Düzgüneş, 1965; Jeppson et al., 1975; Anonymous, 2007; Çobanoğlu et al., 2016).

Remarks: *C. pulcher* is frequently found in Gölbaşı, Çubuk and Haymana districts (Fig. 1).

Family: Tarsonemidae

Tarsonemus smithi Ewing, 1939

Material examined: Gölbaşı, 06. I. 2012 (1♀).

Distribution: The species is widespread and known in North America, Japan, Germany, Israel, Poland, Crimea, Taiwan, Italy, Libya, China (Anonymous, 2016).

Remarks: *Tarsonemus smithi* is a new record for Turkish mite fauna.

Predatory mites

Family: Phytoseiidae

Kampimodromus aberrans (Oudemans, 1930)

Material examined: Ayaş, 13. V. 2012 (1♀), 08. VII. 2012 (2♂♂), 19. V. 2013 (1♀), 27. VII. 2013 (3♀♀), 21. IX. 2013 (1♀), 27. X. 2013 (3♀♀); Çubuk, 03. VI. 2012 (2♀♀), 01. VII. 2012 (1♀, 1♂), 26. VIII. 2012 (5♀♀), 22. IX. 2012 (6♀♀, 1♂), 21. X. 2012 (3♀♀), 25. XI. 2012 (2♀♀), 25. VII. 2013 (1♀, 3♂♂), 21.VIII. 2013 (2♀♀); Gölbaşı, 20. V. 2012 (9♀♀), 06. X. 2012 (1♀), 04. XI. 2012 (1♀); Haymana, 20. V. 2012 (1♀), 01. V. 2013 (1♀), 13. VI. 2013 (1♀), 26. IX. 2013 (3♀♀); Kahramankazan, 27. V. 2012 (5♀♀), 23. VI. 2012 (8♀♀, 2♂♂), 13. VIII. 2012 (1♀), 06. IX. 2012 (3♀♀, 2♂♂), 14. X. 2012 (3♀♀), 14. IV. 2013 (3♀♀), 26. V. 2013 (1♀), 21. VII. 2013 (6♀♀); Kızılcahamam, 27. V. 2012 (1♀), 06. IX. 2012 (1♀), 14. X. 2012 (2♀♀), 21. VII. 2013 (2♀♀).

Distribution: Albania, Algeria, Armenia, Austria, Azerbaijan, Belarus, Bulgaria, Canada-British, Columbia, Ontario, Caucasus Region, Croatia, Czech Republic, England, France, Georgia, Germany, Greece, Hungary, Iran, Israel, Italy, Moldova, Montenegro, Morocco, the Netherlands, Norway, Poland, Portugal, Russia-Krasnodar Region, Moscow, Serbia, Slovakia, Slovenia, Spain, Switzerland, Tunisia, Turkey, Ukraine, USA (Faraji et al., 2011; Demite, 2014).

Euseius finlandicus (Oudemans, 1915)

Material examined: Ayaş, 02. XII. 2012 (1♀), 21. IX. 2013 (1♀); Çubuk, 28. IV. 2013 (1♀), 02. VI. 2013 (1♀), 21. VIII. 2013 (1♀), 16. IX. 2013 (3♀♀), 13. X. 2013 (2♀♀); Gölbaşı, 14. VIII. 2013 (6♀♀); Haymana, 10. VIII. 2012 (2♀♀), 13. VI. 2013 (1♀); Kahramankazan, 14. X. 2012 (1♀), 18. XI. 2012 (2♀♀); Kızılcahamam, 13.VIII. 2012 (1♀), 14. X. 2012 (16♀♀), 17. VIII. 2013 (1♀), 05. X. 2013 (1♀), 10. XI. 2013 (2♀♀).

Distribution: Albania, Algeria, Angola, Argentina, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, British Columbia, New Brunswick, Nova Scotia, Ontario, Caucasus Region, China, Croatia, Cyprus, Czech Republic, Denmark, England, Finland, France, Georgia, Germany, Greece, Hungary, India, Indonesia, Iran, Italy, Japan, Kazakhstan, Latvia, Lithuania, Mexico, Moldova, Montenegro, the Netherlands, Nicaragua, North Macedonia, Norway, Poland, Portugal, Russia, Scandinavia, Serbia, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, Ukraine, USA (Faraji et al., 2011; Demite, 2014).

Typhlodromus (*Anthoseius*) *bagdasarjani* Wainstein and Arutunjan, 1967

Material examined: Gölbaşı, 10. VIII. 2012 (2♀♀).

Distribution: Armenia, Azerbaijan, Iran, Turkey, Turkmenistan (Faraji et al., 2011; Demite, 2014).

Typhlodromus (*Anthoseius*) *psyllakisi* (Swirski and Ragusa, 1976)

Material examined: Ayaş, 06. VIII. 2012 (2♀♀); Haymana, 10. VIII. 2012 (1♀); Kahramankazan, 13. VIII. 2012 (1♀).

Distribution: Greece, Turkey (Demite, 2014; Ersin and Madanlar, 2016; Gökçe et al., 2020).

Paraseiulus triporus (Chant and Yoshida-Shaul, 1982)

Material examined: Çubuk, 01. V. 2012 (1♀).

Distribution: Czech Republic, Denmark, Finland, France, Georgia, Germany, Greece, Hungary, Iran, Italy, Kazakhstan, Moldova, Morocco, the Netherlands, Poland, Portugal, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Syria, Turkey, Ukraine, USA (Demite, 2014).

Family: Stigmaeidae

Zetzellia mali (Ewing, 1917)

Material examined: Çubuk, 21. X. 2012 (1♀); Kızılcahamam, 14. X. 2012 (1♀).

Distribution: Argentina, Austria, Bulgaria, Canada, China, Czech, France, Germany, Hungary, India; Iran, Italy, Lebanon, Lithuanian, Moldavia, Netherlands, Poland, Serbia, Slovenia, Spain, Switzerland, Tunisia, Turkey, UK, USA, former USSR, former Yugoslavia (Dönel and Doğan, 2013; Fan et al., 2016).

CONCLUSION

In this study, the diversity and distribution of phytophagous and predatory mites on rosehip plants in Ankara were determined. A total of 125 samples were collected from six districts during two years. A total of 1173 specimens of which 897 specimens belongs to plant feeding mites and the rest was predatory mites. A total of 12 mite species were determined in this study. The six phytophagous mite species were determined to be members of Tetranychidae (*A. viennensis, T. urticae, B. kissophila* and *E. populi*), Tenuipalpidae (*C. pulcher*) and Tarsonemidae (*T. smithi*) families. *T. urticae* is the most common and important phytophagous mite species in Ankara. *T. smithi* is the first record for the Turkish fauna. Six predatory mite species were identified from 276 predatory mite samples examined. Among them five species (*K. aberrans, E. finlandicus, T.* (*A.*) *bagdasarjani, T.* (*A.*) *psyllakisi* and *P. triporus*) were belonging to family Phytoseiidae and one species (*Z. mali*) belonging to family Stigmaeidae.

Although chemical control is the most widely used method in Çubuk among the districts sampled in this study, the highest number of phytophagous mites was determined in this district. However, the number of predatory mites was relatively low when compared to phytophagous mites in Çubuk. The fauna of Gölbaşı is different from other districts, probably due to high humidity. Therefore, it harbors various species such as *Eotetranychus populi* and *Tarsonemus smithi*. As a result, predatory mites (especially phytoseiid species) were intensively observed in this study. For this reason, they can be used in the pest management programs that are targeting at control of phytophagous mites. Thus, it would also help to reduce total pesticide applications.

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Conflict of interest

I declare that there are no conflicts of interest among the authors.

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RESEARCH ARTICLE

A new species of the genus *Neophyllobius* Berlese (Acari: Camerobiidae) from Denizli province, Turkey

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ABSTRACT: A new species viz. *Neophyllobius denizliensis* **sp. nov.,** collected from soil and litter under *Verbascum* sp., is described and illustrated based on adult female, protonymph and larva. An updated key to all known species of genus *Neophyllobius* of Turkey is provided.

Keywords: Acari, Raphignathoidea, *Neophyllobius*, new species, Turkey.
Zoobank: http://zoobank.org/42CE1610-ACBF-4430-8651-C13145F530B3

INTRODUCTION

Camerobiidae is the second largest family of the superfamily Raphignathoidea. Members of the family Camerobiidae (Acari: Raphignathoidea) are freeliving predatory mites that feed on small arthropods and commonly found in soil and plant litter (Meyer, 1962; Bolland, 1986, 1991; Gerson and Smiley, 1990; Fan and Zhang, 2005; Khanjani et al., 2010, 2014; Fan and Walter, 2011). This family contains seven genera, with more than 160 species, of which *Neophyllobius* Berlese is the largest genus (Khaustov and Abramov, 2017; Akyol, 2018; Zmudzinski, 2020). Up till now, 23 species of *Neophyllobius* have been reported from Turkey (Koç and Ayyıldız, 1996; Koç, 1999, 2001; Koç and Madanlar, 2002; Doğan and Ayyıldız, 2003; Akyol and Koç, 2006a-c; Akyol, 2013, 2018; Uluçay and Koç, 2014; Çobanoğlu and Yeşilayer, 2016; Doğan, 2019). In this paper, a new species, *Neophyllobius denizliensis* **sp. nov.**, is described and illustrated based on the adult female, protonymph and larva from Denizli province (Turkey). Also, a key to all known species of genus *Neophyllobius* of Turkey is partly modified and updated.

MATERIALS AND METHODS

The mite specimens were collected from soil and litter under *Verbascum* sp. (Scrophulariaceae), in Denizli province (Turkey), and brought to the laboratory in plastic bags and extracted by Berlese-Tullgren funnels for seven days. Mites were collected in 70% ethanol and then mounted on slides in modified Hoyer's medium. The mite figures were drawn and measured by means of a research microscope (Nikon Eclipse E 400). The setal nomenclature follows those of Kethley (1990) and Grandjean (1944). All measurements were given in micrometres (µm). Measurements of legs were taken from base of femur to tips of tarsal claws. The specimens mounted on slide are deposited in the (CBZM), Manisa, Turkey.

RESULTS AND DISCUSSION

Family: Camerobiidae Southcott, 1957

Genus: *Neophyllobius* Berlese, 1886

Type species: *Neophyllobius elegans* Berlese, 1886.

Diagnosis: Idiosoma with 15 (excluding *pdx* with 14) pairs of lanceolate setae. One pair of peritremes arising from middle of forepart of stylophore and loop along edges. Counts of setae and solenidia from palptrochanter to palptarsus: 0, 2, 1, 3 + 1 claw, 2 setae + 1-2 eupathidia + 1 solenidion. Genital shields with one pair of setae, anal shields with three pairs of pseudanal setae. Solenidion ω on basal halves of tarsi I and II. Tarsi I-II each with 2 medio-ventral setae in a longitudinal line and III-IV each with 1-2 medio-ventral setae. Counts of setae and solenidia of legs I-IV: coxae (excluding 1*a*, 3*a* and 4*a*) 2 + 1elcp, 1, 2, 2; trochanters 1, 1, 1, 1; femora 3-4, 2-4, 1-3, 1-3; genua 1 + 1κ, 1 + 1κ, 1, 1; tibiae 9 + 1φ, 8 + 1φ, 8 + 1φ, 7 + 1φ; tarsi 9-10 + 1ω, 9-10 + 1ω, 7-8 + 0-1ω, 7-8 (Fan and Zhang, 2005).

Neophyllobius denizliensis **sp. nov.**

Female (n=1) (Figure 1)

Body ovoid, length (excluding gnathosoma) 333, width 268.

Gnathosoma (Fig. 1B). Length of gnathosoma 104. Infracapitulum with one pair of subcapitular setae (*m* 21) and two pairs of adoral setae (or_{1-2}). Cheliceral stylets retracted, invisible. Palpus five segmented: Tarsus with two setae, one small solenidion and two eupathidia; tibia with three setae and one bladelike seta; genu with one serrated seta; femur with two serrated setae and trochanter without setae (Fig 1G).

Dorsum of idiosoma (Fig. 1A) Almost ovoid; integument striated; two pairs of eyes between *sci* and *sce* setae present; fifteen pairs of dorsal setae set on tubercles, *pdx* present, dorsal body setae with denticles. Lengths of setae: *vi* 62, *ve* 52, *sci* 52, *sce* 57, c_1 52, c_2 78, d_1 133, d_2 52, e_1 104, e_2 55, f_1 73, f_2 39, h_1 29, h_2 26, *pdx* 44. Setae d_1 and e_1 longer than others.

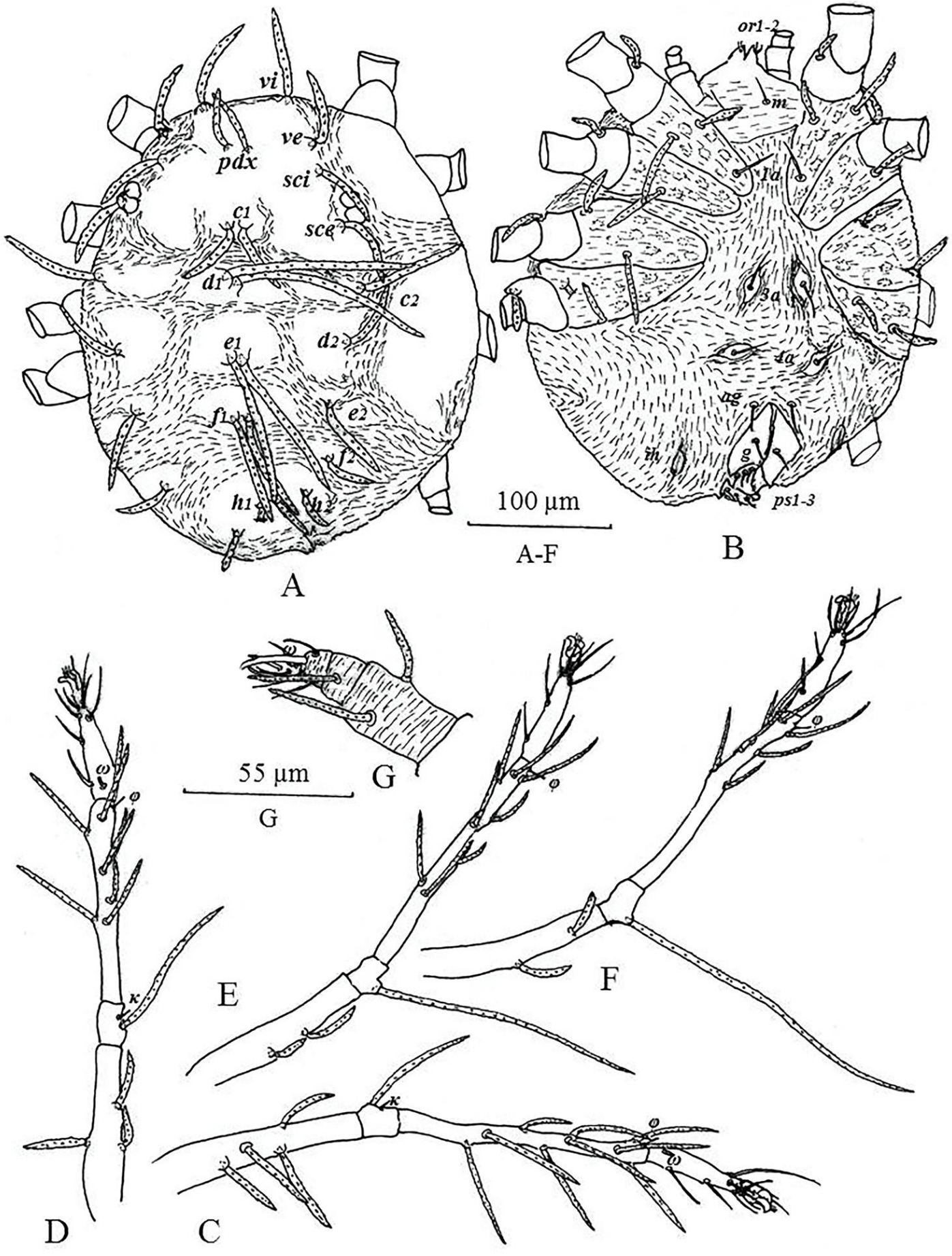

Figure 1. *Neophyllobius denizliensis* **sp. nov.** (Female) – **A.** Dorsal view of idiosoma, **B.** Ventral view of idiosoma, **C.** Leg I, **D.** Leg II, **E.** Leg III, **F.** Leg IV, **G.** Palp.

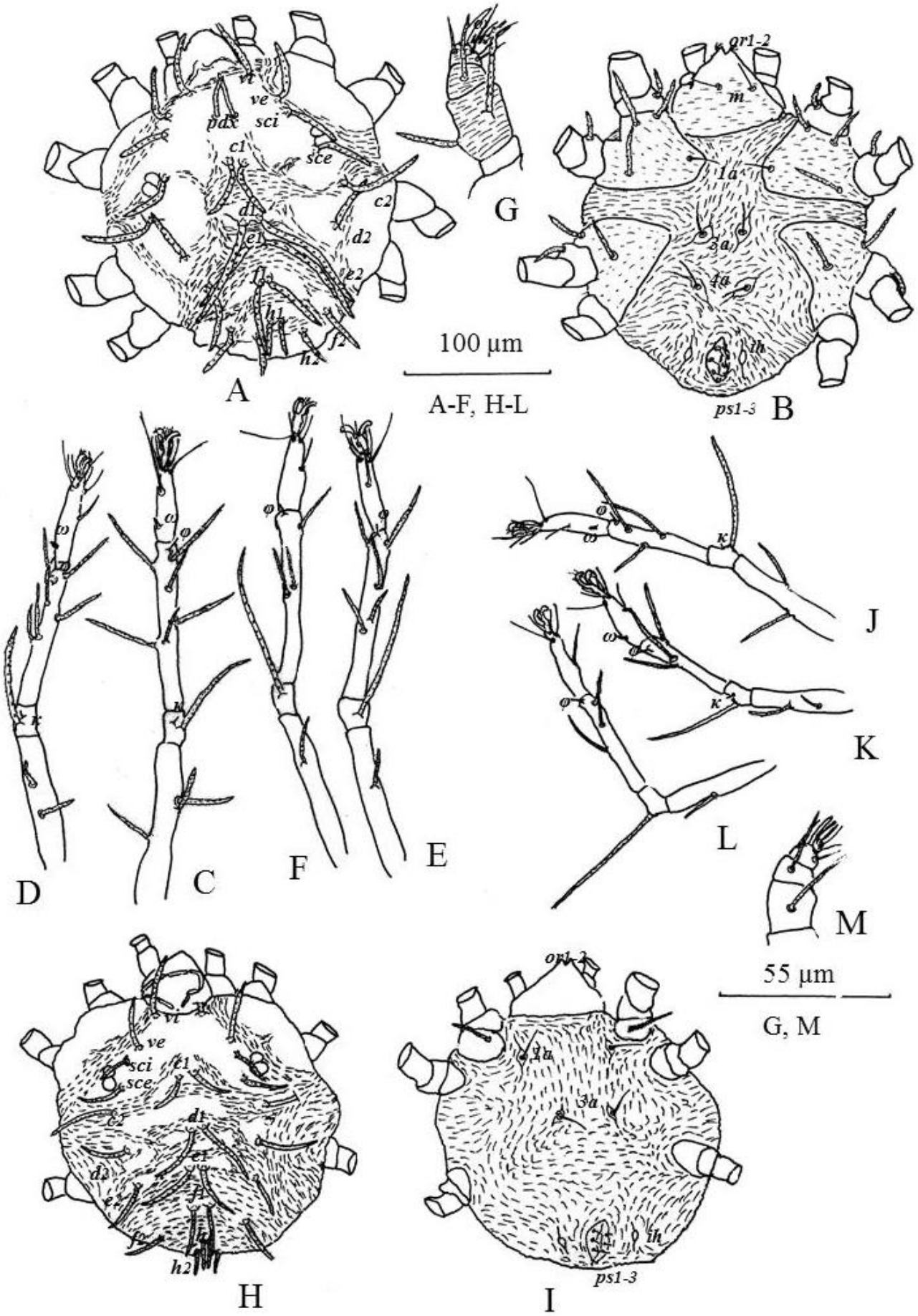

Figure 2. *Neophyllobius denizliensis* **sp. nov.**, Protonymph (A-G) and Larva (H-M) – **A.** Dorsal view of idiosoma, **B.** Ventral view of idiosoma, **C.** Leg I, **D.** Leg II, **E.** Leg III, **F.** Leg IV, **G.** Palp, **H.** Dorsal view of idiosoma, **I.** Ventral view of idiosoma, **J.** Leg I, **K.** Leg II, **L.** Leg III, **M.** Palp.

Venter of idiosoma (Fig. 1B). All ventral surface striated. All coxal area with sligtly striated and reticulated. Venter with three pairs of smooth setae (1*a* 21, 3*a* 29, 4*a* 16). Endopodal shields absent. Anogenital area with one pair of aggenital setae (*ag* 10), one pair of genital setae (*g* 10) and three pairs of pseudanal setae (ps_{1-3}). Cupules *ih* situated laterally to anal opening.

Legs (Figs 1C-F). Length of legs: leg I 442, leg II 382, leg III 421, leg IV 424. Setal formula of leg segments (solenidia in parentheses) as follows: coxae 3-1-2-2, trochantera 1-1-1-1, femora 4-3-2-2, genua 1(+κ)-1(+κ)-1-1, tibiae 9(+φ)-8(+φ)-8(+φ)-7(+φ), tarsi 10(+ω)-10(+ω)-8-8. Tarsi I-IV with two midventral setae. All genual setae whip-like.

Protonymph (n= 3) (Figures 2A-G)

Length of body (excluding gnathosoma) (minimum and maximum measurements): 182-216, width 169-203.

Gnathosoma (Fig. 2B). Length of gnathosoma 65. Infracapitulum with one pair of setae medioventrally (*m* 10-13) and two pairs of adoral setae (or_{1-2}). Cheliceral stylets retracted, invisible. Palpus five segmented: Tarsus with two setae, one small solenidion and two eupathidia; tibia with three setae and one bladelike seta; genu with one serrated seta; femur with two serrated setae and trochanter without setae (Fig 2G).

Dorsum of idiosoma (Fig. 2A). Dorsum as in female. Lengths of setae (minimum and maximum measurements): *vi* 39-47, *ve* 34-39, *sci* 31-34, *sce* 34-39, c_1 34-39, c_2 47-57, d_1 60-78, d_2 31-39, e_1 39-52, e_2 31-34, f_1 34-42, f_2 26-31, h_1 21-23, h_2 18-23.

Venter of idiosoma (Fig. 2B). With three pairs of setae (1*a* 16-18, 3*a* 16-18, 4*a* 10-13) and three pairs of pseudanal setae (ps_{1-3}). Aggenital and genital setae absent. Cupules *ih* situated laterally to anal opening.

Legs. (Figs 2C-F). Length of legs (minimum and maximum measurements): leg I 299-343, leg II 268-299, leg III 281-315, leg IV 273–325. Setal formula of leg segments (solenidia in parentheses) as follows: coxae 3-1-2-0, trochanters 1-1-1-0, femora 3-2-1-1, genua 1(+κ)-1(+κ)-1-1, tibiae 6(+φ)-6(+φ)-5(+φ)-3(+φ), tarsi 8(+ω)-8(+ω)-7-5.

Larva (n= 1) (Figures 2H-M)

Length of body (excluding gnathosoma) 190, width 203.

Gnathosoma (Figs 2I, M). Length of gnathosoma 65. Infracapitulum with two pairs of adoral setae (or_{1-2}), and without setae *m*. Cheliceral stylets retracted, invisible. Palpus five segmented: Tarsus with two setae and two eupathidia; tibia with three setae and one bladelike seta; genu with one serrated seta; femur with one serrated setae and trochanter without setae. Palpal solenidion absent (Fig. 2M).

Dorsum of idiosoma (Fig. 2H). As in protonymph except fourteen pairs of dorsal setae set on small tubercles, *pdx* absent, dorsal body setae with minute denticles. Length of setae: *vi* 29, *ve* 29, *sci* 21, *sce* 34, c_1 29, c_2 42, d_1 47, d_2 34, e_1 39, e_2 29, f_1 34, f_2 26, h_1 16, h_2 13.

Venter of idiosoma (Fig. 2I). Venter with two pairs of setae (1*a* 16, 3*a* 16), three pairs of pseudanal setae (ps_{1-3}). Setae 4*a*, aggenital and genital setae absent. Cupules *ih* situated laterally to anal opening.

Legs (Figs 2J-L). Lengths of legs: leg I 260, leg II 221, leg III 247. Setal formula of leg segments (solenidia in parentheses) as follows: coxae 1-0-0, trochanters 0-0-0, femora 2-2-1, genua 1(+κ)-1(+κ)-1, tibiae 3(+φ)-3(+φ)-3(+φ), tarsi 7(+ω)-7(+ω)-5. All tarsi with one midventral setae.

Male and Deutonymph. Unknown.

Etymology. This species is named after the locality, Denizli, where it was found.

Material examined. Holotype female, three female protonymphs and one larva from litter and soil under *Verbascum* sp., 37°22'38"N 29°25'56"E, 1084 m a.s.l., 14 July 2019, Acıpayam district, Denizli province, Turkey, coll. M. Akyol.

Remarks. *Neophyllobius denizliensis* **sp. nov.** is similar to *N. hispanicus* Bolland in that setae e_1 do not reach the margin of dorsum, c_1 reach the base of d_1, *pdx* do not reach the base of d_1, and same the legs chaetotaxy (Bolland, 1991). However, it differs from *N. hispanicus* by the following combination of characters: (1) almost dorsocentral setae longer (*pdx* 44, c_1 52, d_1 133, e_1 104, f_1 73) in the new species versus (*pdx* 40, c_1 40, d_1 85, e_1 80, f_1 60 in *N. hispanicus*); (2) third seta on femur I the longest seta in the new species, whereas shortest in *N. hispanicus*; (3) first and second setae on femur II same in length in the new species oppose to second setae the longest in *N. hispanicus*; (4) palp tarsus with ω in the new species, versus without in *N. hispanicus*; (5) ratio d_1/h_1 4.58 in the new species (2.83 in *N. hispanicus*).

Key to *Neophyllobius* species of Turkey

This key is partly modified and updated from Akyol (2013) and Bolland (1991).

1. Tarsus IV with one midventral seta ……..…….. 2

- Tarsus IV with two midventral setae ……..…….. 4

2. Femur IV with two setae ……. 3

- Femur IV with one setae ..... *N. orhani* Doğan and Ayyıldız

3. Tarsus II with 10(+ω) setae .. *N. fani* Doğan and Ayyıldız

- Tarsus II with 9(+ω) setae ……... *N. yunusi* Akyol and Koç

4. Femur II with three setae ……..…….. 5

- Femur II with four setae ….. *N. sultanensis* Akyol and Koç

5. Distal end of the tibia I with one solenidion ……..…….. 6

- Distal end of tibia I with two solenidion .... *N. karabagiensis* Akyol and Koç

6. Setae c_1 just reaching, or shorter than the distance to bases of e_1 11

- Setae c_1 long, passes at least bases of e_1 7

7. Setae e_1 as long as or shorter than c_1 9

- Setae e_1 longer than c_1 8

8. d_1 longest setae, tarsi II with 9(+ω) setae .... *N. izmirensis* Akyol

- e_1 longest setae, tarsi II with 10(+ω) setae .... *N. podocarpi* Bolland

9. Setae e_1 shorter than c_1 10

- Setae e_1 as long as c_1 ..... *N. pathenocissi* Bolland

10. d_1 longest setae ..... *N. afyonensis* Akyol and Koç

- c_1 longest setae ..... *N. turcicus* Koç and Ayyıldız

11. Setae d_1 do not reach at all the bases of f_1 18

- Setae d_1 reach or pass bases of f_1 12

12. Setae e_1 do not reach margin of the dorsum 13

- Setae e_1 reach margin of the dorsum 17

13. Setae e_1 do not pass bases of h_1 14

- Setae e_1 pass bases of h_1 ..... *N. populus* Akyol and Koç

14. Setae c_1 pass easily bases of d_1 16

- Setae c_1 just reach bases of d_1 15

15. First seta on femur I is the shortest .... *N. demirsoyi* Akyol and Koç

- Setae on femur I equal in length except for distal setae .... *N. persiaensis* Khanjani and Ueckermann

16. Setae c_1, d_1, e_1 and f_1 almost subequal length .... *N. bolvadinensis* Akyol and Koç

- Setae c_1, d_1, e_1 and f_1 not subequal length .... *N. denizliensis* **sp. nov.**

17. Most distal seta on femur I longer than the third one .... *N. lachishensis* Bolland

- Most distal seta on femur I shorter than the third one .... *N. communis* Bolland

18. The third seta on femur I longer than 1/2 the length of the fourth 20

- The third seta on femur I shorter than 1/2 the length of the fourth 19

19. Setae *pdx* reaching the marginal side of the dorsum .... *N. lamimani* Bolland

- Setae *pdx* not reaching the marginal side of the dorsum ... . *N. olurensis* Doğan and Ayyıldız

20. Some dorsacentral setae reach the bases of the next dorsacentral setae and longer than the other dorsacentral setae, i.e. e_1 and f_1, tarsi II with 9(+ω) setae ..... *N. ayvalikensis* Akyol

- All dorsacentral setae bases of the next dorsacentral setae 21

21. Genu I setae not reaching second row of tibia setae .... *N. atriplicis* Bolland

- Genu I setae reaching or longer than distance to second row of tibia setae..... 22

22. Genu II setae not whip-like .... *N. ayyildizi* Koç and Madanlar

- Genu II setae whip-like 23

23. Setae *pdx* shorter than c_1 .... *N. askalensis* Doğan and Ayyıldız

- Setae *pdx* equal in length with c_1 .... *N. quercus* Uluçay and Koç

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RESEARCH ARTICLE

Türkiye faunası için yeni stigmaeid akarlar (Acariformes: Raphignathoidea: Stigmaeidae)

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ÖZET: Pülümür Vadisi'nden (Türkiye) toplanan akarlar içerisinden Stigmaeidae familyasına ait örnekler incelenmiştir. İncelenen örneklerden toplam altı stigmaeid akar türü bu çalışmada değerlendirilmiştir. Bunlardan; *Eustigmaeus capitatus* Stathakis, Kapaxidi & Papadoulis, *Eustigmaeus nahidae* Gheblealivand & Bagheri ile *Mediolata aegyptiaca* (Zaher & Soliman) Türkiye faunası için yeni olarak tespit edilmiştir. Ayrıca *Eustigmaeus dogani* Khanjani, Fayaz, Mirmoayedi & Ghaedi, *Stigmaeus glabrisetus* Summers'ın dötonimf evreleri ile *Villersia sudetica* Willmann'ın larvası ilk defa bu çalışmada tanımlanmıştır. Tespit edilen bu türler Pülümür Vadisi'nden ilk kez kaydedilmiştir. Türlerin ölçümleri yapılarak tanımları toplanan örnekler üzerinden gözden geçirilmiş ve fotoğraflarına yer verilmiştir.

Anahtar Kelimeler: Akar, tanım, yeni kayıt, Pülümür Vadisi, Türkiye.

Zoobank: http://zoobank.org/CD4D64E8-D8F5-4B4C-8DB6-359482388272

Newly recorded stigmaeid mites (Acariformes: Raphignathoidea: Stigmaeidae) for the fauna of Turkey

ABSTRACT: The specimens belonging to the family Stigmaeidae among mite specimens collected from Pülümür Valley (Turkey) have been examined. A total of six stigmaeid mite species from the examined specimens have been identified. Of these, *Eustigmaeus capitatus* Stathakis, Kapaxidi & Papadoulis, *Eustigmaeus nahidae* Gheblealivand & Bagheri and *Mediolata aegyptiaca* (Zaher & Soliman) have been determined as new records for the fauna of Turkey. Also, the deutonymph stages of *Eustigmaeus dogani* Khanjani, Fayaz, Mirmoayedi & Ghaedi and *Stigmaeus glabrisetus* Summers, and the larva of *Villersia sudetica* Willmann are described for the first time in this study. All identified species are reported for the first time from Pülümür Valley. The species are measured, they are re-described based on the collected specimens and their photos are included.

Keywords: Mite, description, new record, Pülümür Valley, Turkey.

GİRİŞ

Stigmaeidae, rafignatoidlerin (Raphignathoidea) en kalabalık ve en çeşitli familyası olup oldukça geniş bir dağılıma sahiptir. Türlerinin çoğu Palearktik, Oryantal, Nearktik, Afrotropikal ve Avustralya bölgelerinden kaydedilmiştir (Fan ve Zhang, 2005; Dilkaraoğlu vd., 2016). Stigmaeid akarlar günümüzde 33 cins ve 600'den fazla türle temsil edilmektedir (Dilkaraoğlu vd., 2016; Fan vd., 2019; Doğan ve Doğan, 2020a).

Türkiye'den şu ana kadar bu familyanın 11 cinsi tespit edilmiş olup; *Agistemus*'tan 3, *Cheylostigmaeus*'tan 7, *Eryngiopus*'tan 4, *Eustigmaeus*'tan 26, *Ledermuelleriopsis*'ten 12, *Mediolata*'dan 8, *Prostigmaeus*'tan 1, *Stigmaeus*'tan 48, *Storchia*'dan 5, *Villersia*'dan 1 ve *Zetzellia*'dan 5 tür olmak üzere toplamda 120 stigmaeid akar türünün kaydı verilmiştir (Doğan, 2019; Doğan ve Doğan, 2020a,b). Bu çalışma ile Pülümür Vadisi'nden tespit edilen, *Eustigmaeus* cinsinden iki türün, *E. capitatus* Stathakis, Kapaxidi & Papadoulis, *E. nahidae* Gheblealivand & Bagheri, *Mediolata*'dan bir türün, *M. aegyptiaca* (Zaher & Soliman) ilavesi ile toplam sayı 123'e yükselmiştir. Ayrıca *Eustigmaeus dogani* Khanjani, Fayaz, Mirmoayedi & Ghaedi ve *Stigmaeus glabrisetus* Summers'ın dötonimf evreleri ile *Villersia sudetica* Willmann türünün larva evresine ilk defa bu çalışmada rastlanmıştır.

MATERYAL VE YÖNTEM

Pülümür Vadisi'nden (Tunceli) Ekim 2018 – Eylül 2019 tarihleri arasında toplanan akarlar içerisinden Stigmaeidae familyasına ait örnekler incelenmiştir. T.C. Tarım ve Orman Bakanlığı, Tarımsal Araştırmalar ve Politikalar Genel Müdürlüğü (50411936-604.02-E.2200901) ve Doğa Koruma ve Milli Parklar Genel Müdürlüğü'nden (72784983-488.04-44455) yasal izinler alınarak örnekleme çalışmaları gerçekleştirilmiştir. Çalışma alanından toplanan toprak, döküntü, yosun, çimen örnekleri laboratuvara getirilmiş ve Berlese düzeneğine yerleştirilmiştir. Akar örneklerinin ayıklanması, ağartılması, preparasyonu, ölçümü ve görüntüleme işlemleri Fan ve Zhang (2005), Walter ve Krantz (2009) ile Doğan vd. (2016) tarafından belirtildiği şekilde gerçekleştirilmiştir. Teşhis işlemleri yazarlar tarafından literatüre dayalı olarak gerçekleştirilmiştir. Ölçümlerde ilk verilen değer ortalamayı, parantez içerisinde verilen değerler ise değişim aralığını göstermektedir. Çalışmada, vücut kısımları ile vücut ve

bacak kıllarının isimlendirilmesinde Grandjean (1944) ve Kethley (1990) tarafından önerilen terminoloji tercih edilmiştir. Örnekler Erzincan Binali Yıldırım Üniversitesi, Akaroloji Laboratuvarında (EBYU) muhafaza edilmektedir.

BULGULAR VE TARTIŞMA

Familya: Stigmaeidae Oudemans

Cins: *Eustigmaeus* (Berlese)

Eustigmaeus capitatus Stathakis, Kapaxidi & Papadoulis

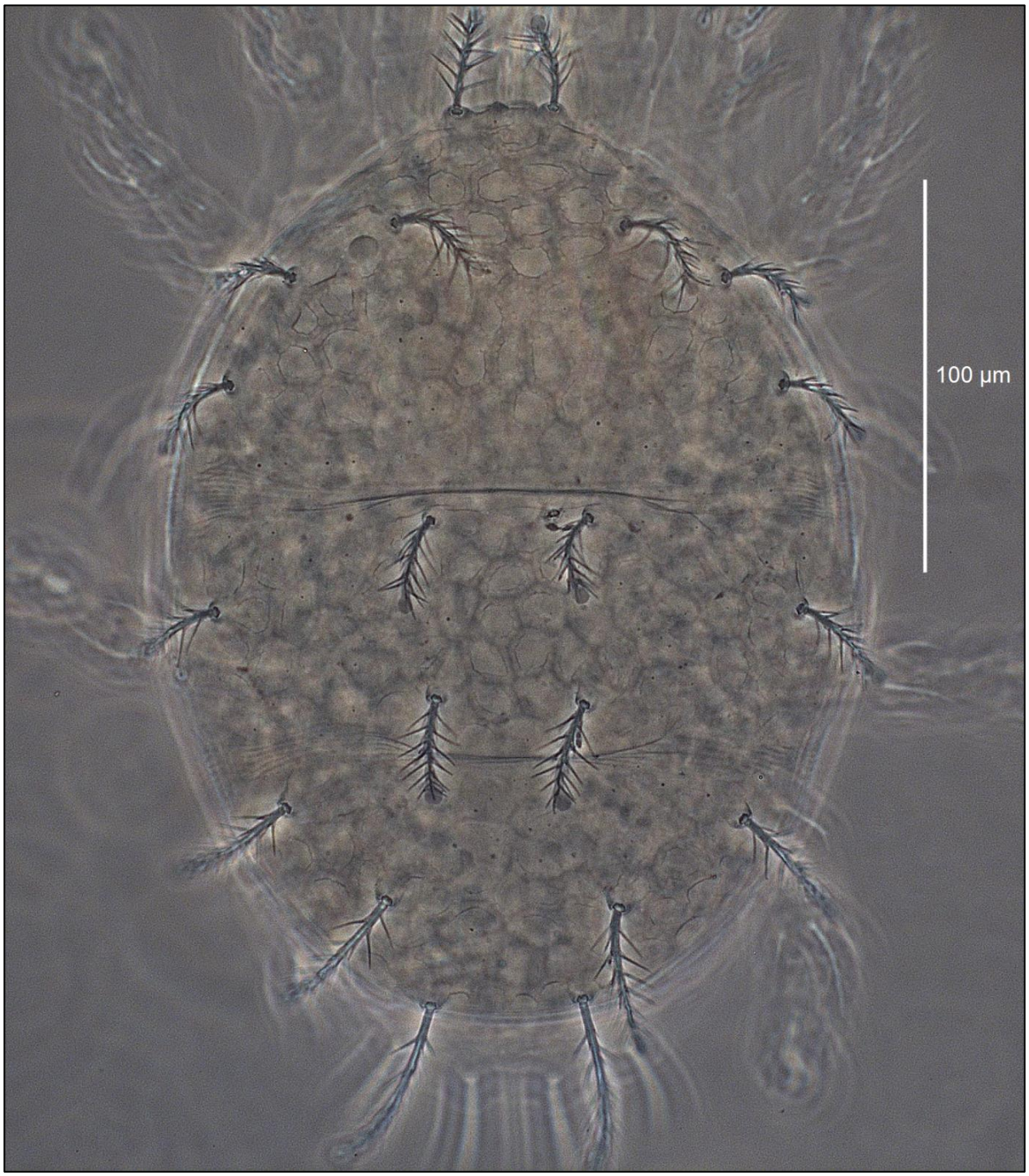
DİŞİ (Şekil 1)

Vücut 317 (298-342) µm uzunluğunda, 228 (199-263) µm genişliğindedir.

Şekil 1. *Eustigmaeus capitatus* (Dişi). Üstten görünüm.

Gnatozoma 62 (53-67), keliser 76 (65-81), palp 98 (88-103) µm uzunluğundadır. Subkapitulum kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; *m* 11 (10-12), *n* 8 (7-8), *m*–*m* 18 (15-20), *n*–*n* 21 (19-22), *m*–*n* 12 (10-13) µm.

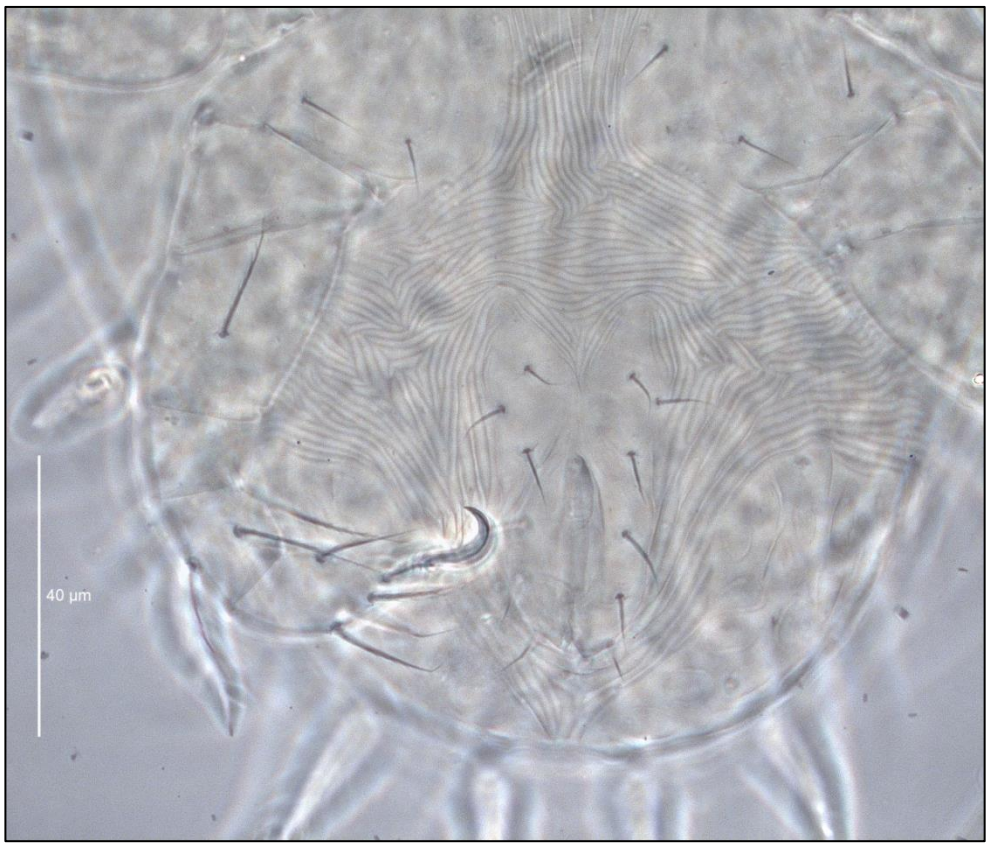
Propodozoma plağı üzerinde 9 (9-10) µm çapında bir çift göz bulunmaktadır. Propodozoma ve histerozoma plakları üzeri noktalı çokgensi şekillerden oluşan desenlere sahiptir. Propodozoma plağı dört çift, histerozoma plağı altı çift, suranal plak ise iki çift kıl taşır. Kıllar çalımsı formda ve uçları tomurcuk şeklinde hiyalin kılıflıdır (Şekil 1). Sırt kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; *vi* 27 (23-31), *ve* 30 (29-33), *sci* 28 (23-33), *sce* 26 (25-28), c_1 26 (24-29), c_2 39 (30-43), d_1 27 (26-29), d_2 26 (25-27), e_1 32 (30-34), e_2 27 (26-29), f_1 47 (41-50), h_1 35 (29-40), h_2 34 (30-36), *vi*–*vi* 37 (33-41), *ve*–*ve* 80 (64-94), *vi*–*ve* 35 (31-43), *sci*–*sci* 142 (122-159), *ve*–*sci* 34 (32-40), *sce*–*sce* 173 (151-192), *sci*–*sce* 35 (33-40), c_1–c_1 50 (38-59), d_2–d_2 185 (167-202), c_1–d_1 48 (45-50), c_1–d_2 70 (55-81), d_1–d_1 56 (48-61), d_2–d_1 66 (59-71), e_2–e_2 157 (137-169), d_2–e_2 56 (53-62), d_1–e_1 69 (60-77), d_1–e_2 59 (50-66), e_1–e_1 88 (75-93), e_2–e_1 46 (42-51), f_1–f_1 60 (54-66), e_1–f_1 33 (30-36), e_2–f_1 81 (70-89), h_1–h_1 23 (19-29), h_2–h_2 75 (70-86), h_1–h_2 23 (22-25) µm.



Şekil 2. *Eustigmaeus dogani* (Dötonimf). Üstten görünüm.

Humeral plaklar, sırt plaklarıyla aynı desene sahip ve taşıdığı c_2 kılları sırt kıllarına benzer şekildedir fakat hiyalin kılıf yoktur. Noktalı ve ağsı desene sahip koksisternal plaklar tamamen kaynaşmıştır. 1*a*, 3*a* ve 4*a* kılları bu plaklar üzerinde yer almaktadır. Bu kılların uzunlukları ve aralarındaki mesafeler sırasıyla; 1*a* 11 (8-14), 3*a* 11 (8-13), 4*a* 9 (8-10), 1*a*–1*a* 26 (25-27), 3*a*–3*a* 33 (31-35), 4*a*–4*a* 21 (20-24) µm. Aggenital plak üç çift aggenital (ag_{1-3}) kıl, anogenital plak üç çift pseudanal (ps_{1-3}) kıl taşımaktadır. Bu kılların uzunlukları şöyledir; ag_1 8 (8-9), ag_2 7 (6-9), ag_3 10 (8-11), ps_1 12 (11-14), ps_2 11 (10-12), ps_3 10 (9-11) µm.

Bacak uzunlukları sırasıyla; I.B 157 (135-167), II.B 133 (111-143), III.B 142 (119-155), IV.B 148 (130-160) µm'dir. Bacak parçaları üzerindeki kılların dağılımı ise şöyledir; koksa: 2–2–2–2, trokanter: 1–1–2–1, femur: 6–5–3–2, genu: 3(+1κ)–3(+1κ)–1–1, tibiya: 5(+1φ+1φρ)–5(+1φρ)–5(+1φρ)–5(+1φρ), tarsus: 13(+1ω)–9(+1ω)–7(+1ω)–7.



Şekil 3. *Eustigmaeus dogani* (Dötonimf). Anogenital bölge.

İncelenen Örnekler: 2♀♀, meşe (*Quercus* sp.) altından döküntü ve toprak, 39°29'52,4''K 39°51'27,6''D, 1610 m, 27.10.2018; 1♀, kaya kovuğundan toprak, 39°11'29,2''K 39°42'50,3''D, 1009 m, 27.10.2018; 2♀♀, meşe altından döküntü, 39°27'17,3''K 39°54'27,6''D, 1579 m, 27.04.2019; 1♀, meşe altından döküntü ve toprak, 39°30'24,0''K 39°52'24,8''D, 1660 m, 09.06.2019; 1♀, meşe altından döküntü ve toprak, 39°31'43,3''K 39°54'21,7''D, 1719 m, 22.06.2019; 1♀, çürümüş meşe gövdesi ve üzeri yosun, 39°23'51,4''K 39°46'50,3''D, 1508 m, 22.06.2019; Pülümür Vadisi, Tunceli, Türkiye.

Yayılışı: Yunanistan (Stathakis vd., 2016; Fan vd., 2019).

Tartışma: Şu ana kadar sadece tip yeri olan Yunanistan'dan bilinen tür, bu çalışma kapsamında Pülümür Vadisi'nden de kaydedilmiştir. İncelenen örnekler genel itibariyle tip örneklerine benzemektedir. Farklı olarak, Pülümür örneklerinde vücut biraz daha küçüktür ve d_1–e_1'in c_1–d_1'e oranı 1,4 iken bu oran tip örneklerinde 1,2'dir. Tip örneklerinin c_2 ve h_2 kıllarında hiyalin kılıf yoktur. Pülümür örneklerinde de c_2 kıllarında hiyalin kılıf bulunmaz ancak örneklerin bazılarında h_2 kıllarının uç kesimlerinde küçük ve zayıf yapılı hiyalin kılıf ayırt edilebilmektedir.

Eustigmaeus dogani Khanjani, Fayaz, Mirmoayedi & Ghaedi

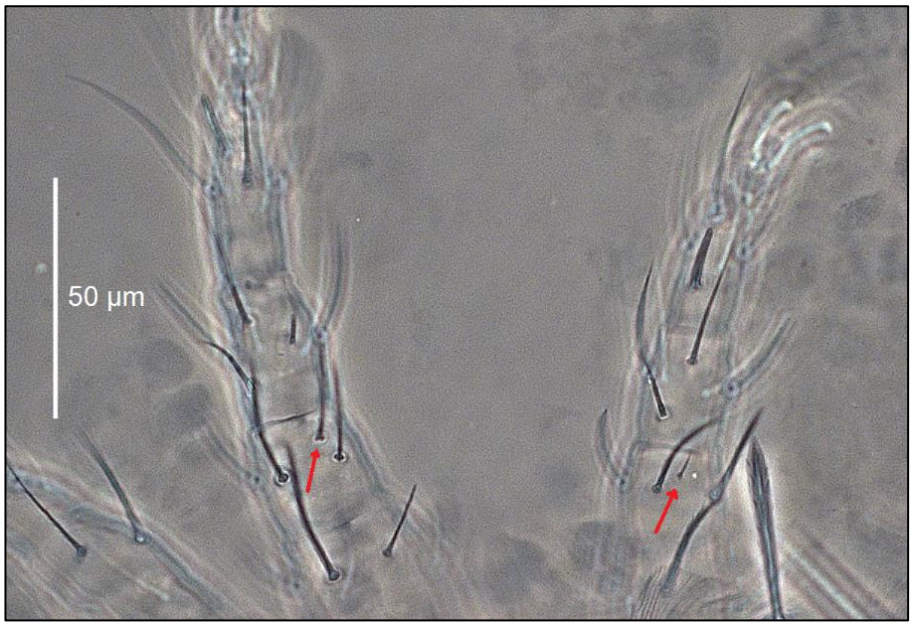
Çalışma kapsamında türün dişi ve nimf bireyleri elde edilmiştir. Daha önce ergin evreleri bilinen türün dötonimf evresine ilk defa bu çalışmada rastlanmıştır.

DÖTONİMF (Şekil 2, 3)

Vücut 247-259 µm uzunluğunda, 176-188 µm genişliğindedir.

Gnatozoma 46-47, keliser 63-72, palp 76-79 µm uzunluğundadır. Kılların palp parçaları üzerindeki dağılımı palp trokanterinden palp tarsusuna doğru şu şekildedir: 0, 3, 2, 2+1 yardımcı tırnak+1 güçlü tırnak, 4+1ω+1 düz yapılı subterminal öpatidiyum+1 üççatallı öpatidiyum. Subkapitulum kıllarının uzunlukları ve aralarındaki mesafeler; *m* 9-10, *n* 9-10, *m*–*m* 11-12, *n*–*n* 15-16, *m*–*n* 11-11 µm'dir.

Şekil 4. *Eustigmaeus nahidae* (Dişi). Palp tarsusu üzerindeki üççatallı öpatidiyum.



Şekil 5. *Eustigmaeus nahidae* (Dişi). I. ve II. bacak genuları üzerindeki κ solenediyumları.

Sırt plakları çukurluklu ve noktalı desene sahiptir. Nokta desenler, çukurlukların periferal kesimlerinde rahatlıkla ayırt edilebilirken, merkezdekilerinin ayrımı zordur. Histerozoma plağı d_1 kıllarının gerisinde enine bölünmüştür.

Tüberküller üzerinden çıkan sırt kılları uzun dikenli yapıda olup uçlarında yuvarlak hiyalin kılıf taşır (Şekil 2). Sırt kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; *vi* 25-26, *ve* 29-30, *sci* 26-26, *sce* 26-26, c_1 23-25, c_2 32-32, d_1 28-28, d_2 29-29, e_1 38-39, e_2 35-37, f_1 48-49, h_1 30-31, h_2 28-29, *vi–vi* 23-24, *ve–ve* 57-61, *vi–ve* 31-33, *sci–sci* 109-110, *ve–sci* 25-28, *sce–sce* 140-141, *sci–sce* 29-30, c_1–c_1 37-39, c_2–c_2 166-168, d_2–d_2 148-150, c_1–d_1 42-43, c_1–d_2 57-60, d_1–d_1 34-36, d_1–d_2 57-58, e_2–e_2 114-114, e_1–e_1 54-58, e_1–e_2 32-32, f_1–f_1 39-39, e_1–f_1 22-26, e_2–f_1 53-60, h_1–h_1 18-19, h_2–h_2 54-56, h_1–h_2 17-17 µm.

Koksisternal plaklar dişiden farklı olarak bölünmüş durumdadır. 1*a*, 3*a* ve 4*a* kılları bu plaklar üzerinde yer almaktadır. Aggenital plak desensiz yapıda ve boyuna bölünmüş olup üç çift kıl ($ag_{1\text{-}3}$) taşır (Şekil 3). Anogenital plaklar üzerinde benzer yapılı üç çift pseudanal kıl ($ps_{1\text{-}3}$) bulunur.

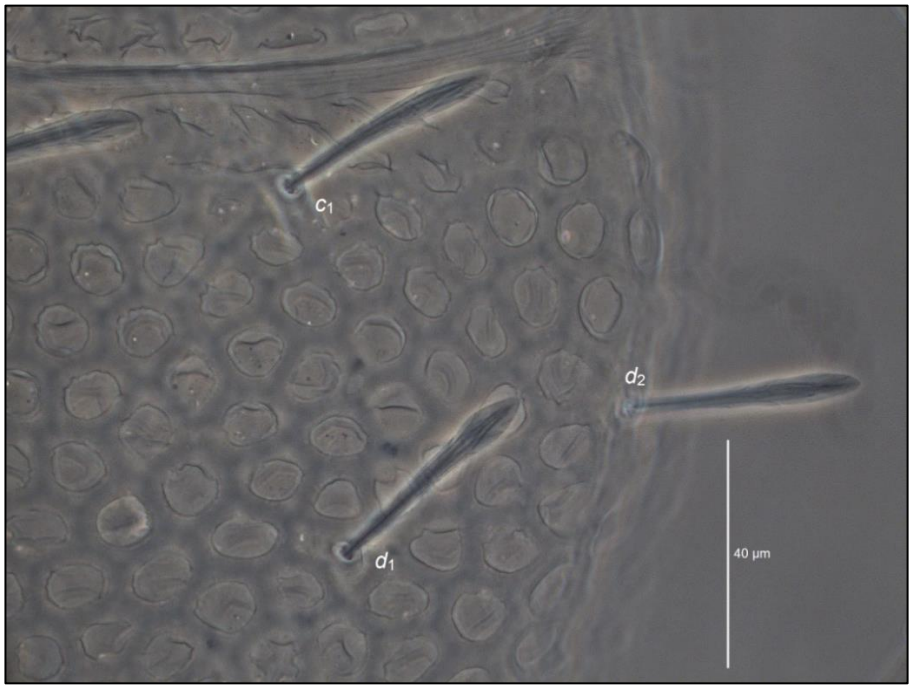
Bacak uzunlukları sırasıyla; I.B 113-116, II.B 100-110, III.B 97-101, IV.B 109-113 µm'dir. Bacak parçaları üzerindeki kılların dağılımı ise şöyledir; koksa: 2–2–2–2, trokanter: 1–1–2–0, femur: 6–4–3–2, genu: 3(+1κ)–2(+1κ)–0–0, tibiya: 5(+1φρ+1φ)–5(+1φρ)–5(+1φρ)–5(+1φρ), tarsus: 13(+1ω)–9(+1ω)–7(+1ω)–7.

Şekil 6. *Eustigmaeus nahidae* (Dişi). Üstten görünüm.

İncelenen Örnekler: 7♀♀, geven (*Astragalus* sp.) altından döküntü ve toprak, 39°24'30,4''K 39°51'56,4''D, 1712 m, 13.10.2018; 1♀, meşe ve ardıç (*Juniperus* sp.) altından karışık döküntü ve toprak, 39°09'28,3''K 39°40'20,5''D, 1060 m, 13.10.2018; 1♀, taş altından toprak, 39°31'24,1''K 39°50'57,5''D, 1928 m, 27.10.2018; 1♀, meşelik alandan taş altı ve kovuğundan toprak, 39°15'33,6''K 39°46'00,3''D, 1076 m, 10.11.2018; 1♀, kurumuş yosun ve toprak, 39°14'52,3''K 39°45'46,8''D, 1058 m, 10.11.2018; 1♀, meşelik alandan toprak üzeri yosun, 39°11'26,5''K 39°42'19,0''D, 988 m, 10.11.2018; 1♀, ardıç ve meşe altından karışık döküntü, toprak ve mantar, 39°08'27,3''K 39°37'29,5''D, 1020 m, 10.11.2018; 1♀, toprak üzeri yosun ve liken, 39°35'04,3''K 39°52'42,2''D, 1310 m, 24.11.2018; 3♀♀, yosunlu ve çimenli toprak, 39°11'26,5''K 39°42'19,0''D, 988 m, 24.11.2018; 3♀♀, geven altından çimenli ve yosunlu toprak, 39°35'16,7''K 39°51'19,8''D, 1451 m, 08.12.2018; 1♀, köstebek yuvasından toprak, 39°11'26,5''K 39°42'19,0''D, 988 m, 08.12.2018; 1♀, ardıç altından döküntü ve yosunlu toprak, 39°36'04,00''K 39°47'20,93''D, 1386 m, 30.01.2019; 3♀♀, ardıç ve meşe altı döküntü, 39°32'57,0''K 39°52'42,0''D, 1881 m, 22.03.2019; 1♀, meşelik alanda döküntü, 39°32'57,0''K 39°52'42,0''D, 1881 m, 22.03.2019; 2♀♀, taş altından toprak, 39°30'09,1''K 39°52'11,5''D, 1681 m, 13.04.2019; 1♀, geven altından döküntü ve toprak, 39°24'23,3''K 39°50'37,4''D, 1434 m, 13.04.2019; 1♀, tanımlanamayan bir bitki ve altından toprak, 39°24'23,3''K 39°50'37,4''D, 1434 m, 13.04.2019;

Şekil 7. *Eustigmaeus nahidae* (Dişi). Alttan görünüm.

39°27'17,3''K 39°54'27,6''D, 1579 m, 27.04.2019; 1♀, ardıç, huş (*Betula* sp.) ve meşe altından karışık döküntü, 39°34'51,8''K 39°48'03,8''D, 1622 m, 11.05.2019; 1♀, toprak üzeri yosun, 39°34'51,8''K 39°48'03,8''D, 1622 m, 11.05.2019; 1♀, kesik meşe gövdesi içinden toprak (karıncalı), 39°34'51,8''K 39°48'03,8''D, 1622 m, 11.05.2019; 1♀, köstebek yuvasından toprak, 39°34'51,8''K 39°48'03,8''D, 1622 m, 11.05.2019; 2♀♀, geven altından döküntü ve toprak, 39°33'18,1''K 39°54'34,6''D, 1877 m, 11.05.2019; 2♀♀, gevenlik ve ardıçlık altından toprak üzeri yosun, 39°33'18,1''K 39°54'34,6''D, 1877 m, 11.05.2019; 3♀♀, 1 dötonimf, meşe ve ardıçlı taşlık alandan karışık döküntü ve çimenli toprak, 39°10'38,9''K 39°40'57,4''D, 982 m, 27.05.2019; 3♀♀, 1 dötonimf, meşelik alandan döküntü ve çimenli toprak, 39°05'54,6''K 39°37'41,0''D, 1012 m, 27.05.2019; 1♀, dere kenarı, ılgın (*Tamarix* sp.) ve altından toprak, 39°30'50,5''K 39°51'54,3''D, 1800 m, 09.06.2019; 1♀, dere kenarından nemli yosun, 39°31'43,3''K 39°54'21,7''D, 1719 m, 22.06.2019; 5♀♀, sürünür ardıç ve çam altından karışık döküntü ve toprak, 39°31'44,0''K 39°53'13,1''D, 1913 m, 18.08.2019; Pülümür Vadisi, Tunceli, Türkiye.



Şekil 8. *Eustigmaeus nahidae* (Dişi). c_1, d_1 ve d_2 kılları.

Şekil 9. *Eustigmaeus nahidae* (Dişi). f_1, h_1 ve h_2 kılları.

Yayılışı: İran, Türkiye ve Yunanistan'dan bilinmektedir (Khanjani vd., 2011; Stathakis vd., 2016; Fan vd., 2016, 2019; Doğan, 2019).

Tartışma: Daha önce ergin evreleri bilinen türün dötonimf evresine ilk defa bu çalışmada rastlanmıştır. Dişiden farklı olarak, dötonimfin histerozoma plağı ile koksisternal plakları bölünmüş haldedir. Bunun dışında, aggenital plak da boyuna bölünmüştür. Erginde ise bu plaklar tamdır. Diğer taraftan, bacak parçalarından IV. trokanter, II. femur, II.-IV. genularda birer kıl eksiktir.

Eustigmaeus nahidae Gheblealivand & Bagheri

DİŞİ (Şekil 4-9)

Vücut 303 (295-311) µm uzunluğunda, 223 (218-230) µm genişliğindedir.

Şekil 10. *Mediolata aegyptiaca* (Dişi). Üstten görünüm.

Gnatozoma 81 (79-83), keliser 104 (104-104), palp 98 (95-100) µm uzunluğundadır. Palp beş segmentlidir. Palp trokanterinden palp tarsusuna doğru kılların sayısı şu şekildedir: 0, 3, 2, 2+1 gelişmiş tırnak+1 diken şeklinde yardımcı tırnak, 5+1ω+1 kaidede kaynaşmış uçta üççatallı öpatidiyum (Şekil 4). Subkapitulum kıllarının uzunlukları

ve aralarındaki mesafeler şöyledir; *m* 20 (20-20), *n* 13 (13-14), *m*–*m* 19 (19-19), *n*–*n* 18 (17-19), *m*–*n* 14 (13-15) µm.

Sırt plakları çokgensi ve çukurluklu hücrelerden oluşan desene sahiptir (Şekil 6). Propodozoma plağı üzerinde bir çift göz bulunmaktadır. Propodozoma plağı dört çift (*vi*, *ve*, *sci*, *sce*), histerozoma plağı altı çift kıl (c_1, d_1, d_2, e_1, e_2, f_1) taşır. Suranal plak vücudun alt kısmına kaymış olup iki çift kıllıdır (h_1, h_2). Sırt kılları çentikli, hiyalin kılıflı, uca doğru genişleyen yapıda ve spatülü andıran bir görünümdedir (Şekil 8, 9). h_1 ve h_2 kılları diğer sırt kıllarına göre daha belirgin çentiklidir.

Şekil 11. *Stigmaeus glabrisetus* (Dişi). Üstten görünüm.

Sırt kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; *vi* 44 (43-46), *ve* 47 (45-50), *sci* 40 (38-42), *sce* 43 (41-44), c_1 43 (42-44), c_2 40 (39-42), d_1 42 (42-43), d_2 41 (39-41), e_1 43 (42-44), e_2 42 (42-43), f_1 47 (46-50), h_1 41 (41-42), h_2 32 (31-32), *vi–vi* 23 (20-25), *ve–ve* 67 (63-69), *vi–ve* 44 (43-45), *sci–sci* 119 (112-122), *ve–sci* 34 (31-36), *sce–sce* 159 (156-162), *sci–sce* 30 (28-32), c_1–c_1 63 (60-67), c_2–c_2 182 (178-184), d_1–d_1 82 (79-83), d_2–d_2 186 (181-191), c_1–d_1 60 (58-61), c_1–d_2 72 (70-75), d_2–d_1 55 (51-59), e_2–e_2 152 (150-157), d_2–e_2 64 (62-65), d_1–e_1 66 (61-68), d_1–e_2 55 (51-60), e_1–e_1 66 (66-66), e_2–e_1 46 (43-49), f_1–f_1 69 (66-72), e_1–f_1 42 (38-46), e_2–f_1 73 (71-76), h_1–h_1 31 (30-33), h_2–h_2 64 (59-68), h_1–h_2 21 (20-22) µm. *ve* ile f_1, vücudun en uzun kıllarıdır.

Şekil 12. *Stigmaeus glabrisetus* (Dişi). Alttan görünüm.

Vücudun alt yan tarafında humeral plaklar yer almakta ve c_2 kıllarını taşımaktadır. c_2 kılları sırt kıllarına benzemektedir. Koksisternal plaklar bölünmüş ve üzerinde 1*a*, 3*a* ve 4*a* kıllarını taşımaktadır (Şekil 7). Bu kılların uzunlukları ve aralarındaki mesafeler şöyledir; 1*a* 16 (15-17), 3*a* 15 (13-16), 4*a* 15 (14-16), 1*a*–1*a* 16 (14-17), 3*a*–3*a* 26 (22-29), 4*a*–4*a* 12 (11-13) µm. Aggenital plak üzerinde iki çift kıl vardır. Anogenital plaklar üç çift pseudanal kıl taşır. Bu kılların uzunlukları şöyledir; ag_1 12 (10-13), ag_2 10 (10-11), ps_1 12 (11-12), ps_2 16 (15-16), ps_3 19 (19-20) µm.

Şekil 13. *Stigmaeus glabrisetus* (Erkek). Üstten görünüm.

Bacak uzunlukları sırasıyla; I.B 174 (172-174), II.B 150 (147-153), III.B 149 (145-154), IV.B 186 (183-188) µm'dir. Bacak parçaları üzerindeki kılların dağılımı ise şöyledir; koksa: 2–2–2–2, trokanter: 1–1–2–1, femur: 6–5–3–2, genu: 3(+1κ)–3(+1κ)–1–1, tibiya: 5(+1φ+1φρ)–5(+1φρ)–5(+1φρ)–5(+1φρ), tarsus: 13(+1ω)–9(+1ω)–7(+1ω)–7. I. genudaki κ solenidiyumu normal kıl şeklinde, II. genudaki ise küçük diken şeklindedir (Şekil 5). Iω 14 (14-14), IIω 13 (13-14), IIIω 6 (5-7) µm uzunluğundadır. IV. tarsusta ω solenidiyumu bulunmaz.

Şekil 14. *Stigmaeus glabrisetus* (Erkek). Alttan görünüm.

İncelenen Örnekler: 4♀♀, cevizlik alandaki söğüt (*Salix* sp.) kovuğundan çürümüş gövde ve toprak, 39°24'28,7''K 39°51'15,7''D, 1491 m, 13.10.2018; Pülümür Vadisi, Tunceli, Türkiye.

Yayılışı: İran (Gheblealivand vd., 2012; Fan vd., 2016; Stathakis vd., 2016).

Tartışma: Bu tür, ülkemizden ilk defa kaydedilmiştir. Örneklerimiz genel olarak tip örnekleri ile benzerlik göstermektedir; farklı olarak, II. tarsusta bir kıl fazladır (9+1ω) ayrıca h_2 kılı da diğer sırt kılları gibi hiyalin kılıflıdır (Şekil 9). Tip örneklerinde ise II. tarsus 8+1ω kıllı olup, h_2 kılının hiyalin kılıf taşımadığı belirtilmektedir (Gheblealivand vd., 2012).

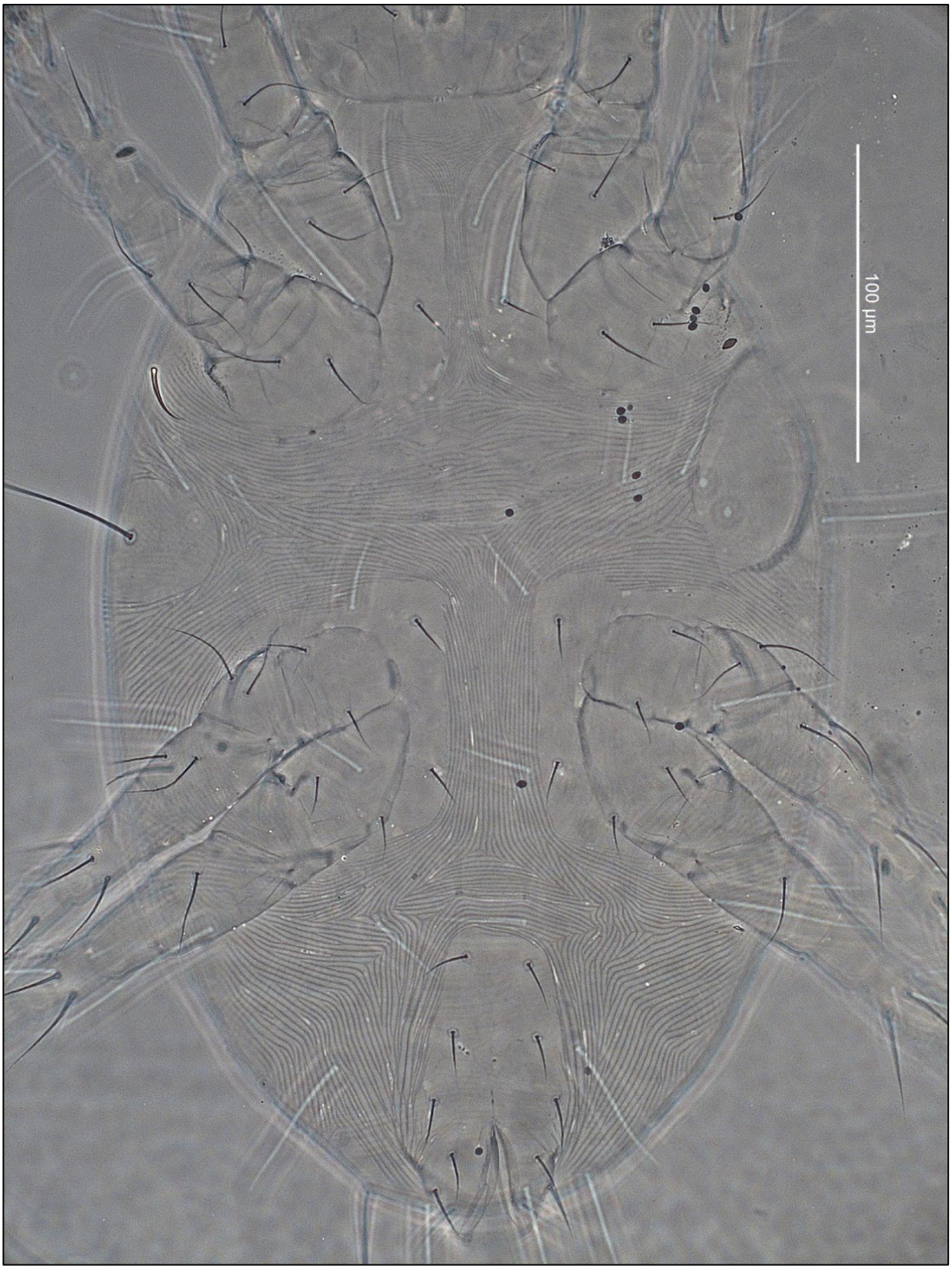
Şekil 15. *Stigmaeus glabrisetus* (Dötonimf). Üstten görünüm.

Cins: *Mediolata* Canestrini

Mediolata aegyptiaca (Zaher & Soliman)

DİŞİ (Şekil 10)

Vücut 274 µm uzunluğunda, 181 µm genişliğindedir. Gnatozoma 69, keliser 79 µm uzunluğundadır. Subkapitulum kılı (*m*) 29 µm uzunluğunda olup aralarındaki mesafe (*m*–*m*) 16 µm'dir. Palpin uzunluğu 111 µm'dir. Kılların palp parçaları üzerindeki dağılımı trokanterden tarsusa doğru şu şekildedir; 0, 2, 2, 2+1 tırnak, 5+1ω+1 öpatidiyum.



Şekil 16. *Stigmaeus glabrisetus* (Dötonimf). Alttan görünüm.

Sırt plakları nokta desenlidir (Şekil 10). Propodozoma plağı üzerinde *vi*, *ve*, *sci*, *sce* kılları ve bir çift göz ve gözardı cisim bulunmaktadır. Göz 10, gözardı cisim 16 µm çapındadır. Metapodozoma plağında c_1, d_1, d_2 kılları bulunmaktadır. Opistozoma plağı ikiye bölünmüş e_1, e_2, f_1 kılları yer almaktadır. Suranal plak bütün halde ve h_1 ile h_2 kıllarını taşır. Sırt kılları zayıf çentikli bir yapıya sahiptir. Sırt kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; *vi* 24, *ve* 34, *sci* 20, *sce* 36, c_1 25, d_1 29, d_2 25, e_1 30, e_2 35, f_1 42, h_1 33, h_2 28, *vi*–*vi* 16, *ve*–*ve* 54, *vi*–*ve* 25, *sci*–*sci* 95, *ve*–*sci* 26, *sce*–*sce* 134, *sci*–*sce* 32, c_1–c_1 ? (preparasyondan kaynaklı ölçüm alınamadı), d_2–d_2 110, c_1–d_1 48, c_1–d_2 49, d_1–d_1 46, d_2–d_1 28, e_2–e_2 89, e_1–e_1 34, e_2–e_1 31, f_1–f_1 51, f_1–h_1 37, f_1–h_2 31, h_1–h_1 21, h_2–h_2 65, h_1–h_2 20 µm.

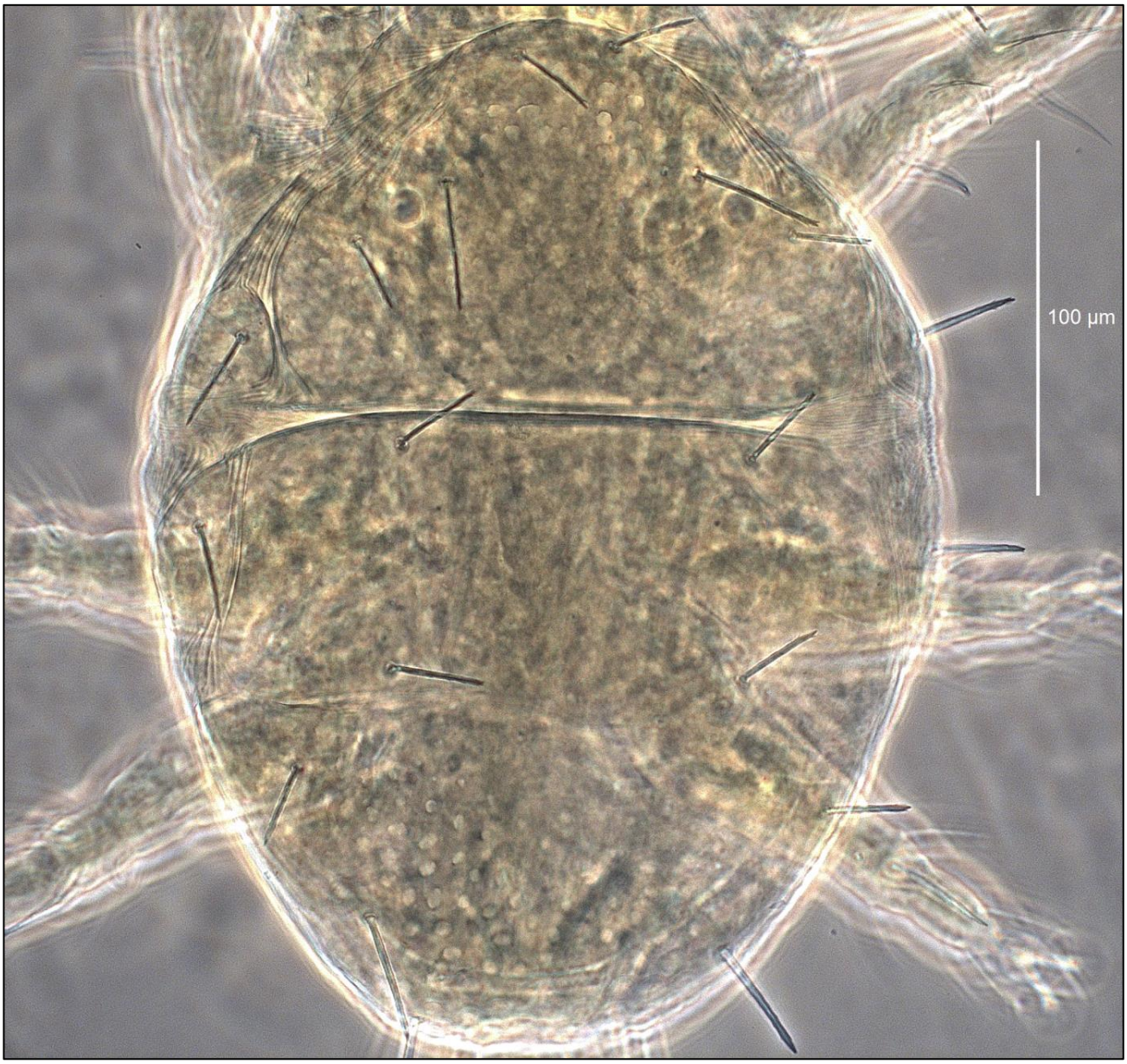
Koksisternal ve humeral plaklar yoktur. 1*a* I. ve II. koksalar arasında, 3*a* ve 4*a* kılları ise III. ve IV. koksalar arasındaki çizgili integüment üzerinde yer almaktadır. Aggenital plak yoktur, çizgili integüment üzerinde üç çift aggenital kıl bulunmaktadır. Anogenital plak üzerinde bir çift genital ve üç çift pseudanal kıl vardır. ps_3, diğer pseudanal kıllara göre daha zayıf yapılıdır. Bu kılların uzunlukları ve aralarındaki mesafeler şöyledir; 1*a* 36, 3*a* 29, 4*a* 28, 1*a*–1*a* 30, 3*a*–3*a* 34, 4*a*–4*a* 26, ag_1 13, ag_2 9, ag_3 13, ps_1 16, ps_2 14, ps_3 13 µm.

Bacak uzunlukları sırasıyla; I.B 180, II.B 158, III.B 147, IV.B 164 µm'dir. Bacak parçaları üzerindeki kılların dağılımı ise şöyledir; koksa: 2–1–2–2, trokanter: 1–1–1–0, femur: 5–5–2–1, genu: 3–3–1–1, tibiya: 5(+1φρ)–5(+1φρ)–5(+1φρ)–5(+1φρ), tarsus: 11(+1ω)–9(+1ω)–7(+1ω)–7(+1ω).

ERKEK

Vücut 252 µm uzunluğunda, 137 µm genişliğindedir.

Gnatozoma 63, keliser 70, palp 82 µm uzunluğundadır. Palpin kıl dağılımı dişideki gibidir. Subkapitulum kıllının uzunluğu; *m* 23 µm'dir.



Şekil 17. *Villersia sudetica* (Dişi). Üstten görünüm.

Sırt plaklarının belli sınırlarla birbirinden ayrılmış olması, deseni ve sırt kıllarının yapısı dişi bireylerde olduğu gibidir. Gözardı cisim 16 µm çapındadır. Sırt kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; *vi* 16, *ve* 22, *sci* 27, *sce* 34, c_1 21, d_1 18, d_2 22, e_1 16, e_2 22, f_1 27, h_1 19, h_2 29, *vi–vi* 19, *ve–ve* 46, *vi–ve* 24, *sci–sci* 65, *ve–sci* 20, *sce–sce* 112, *sci–sce* 25, c_1–c_1 42, d_2–d_2 86, c_1–d_1 45, c_1–d_2 42, d_1–d_1 45, d_2–d_1 18, e_2–e_2 71, e_1–e_1 34, e_2–e_1 19, f_1–f_1 62, f_1–h_1 17, f_1–h_2 18, h_1–h_1 31, h_2–h_2 50, h_1–h_2 9 µm.

Karın kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; 1*a* 27, 3*a* 26, 4*a* 16, 1*a*–1*a* 22, 3*a*–3*a* 34, 4*a*–4*a* 15 µm. Aggenital bölgede iki çift aggenital kıl vardır. Anogenital plak vücudun arka ucunda olup üç çift pseudanal kıl taşır. Aggenital ve pseudanal kılların uzunlukları sırasıyla; ag_1 15, ag_2 19, ps_1 3, ps_2 4, ps_3 6 µm'dir.

Bacak uzunlukları sırasıyla; I.B 168, II.B 145, III.B 137, IV.B 143 µm'dir. Bacak parçaları üzerindeki kılların dağılımı ise şöyledir koksa: 2–1–2–2, trokanter: 1–1–1–0, femur: 5–5–2–1, genu: 3–3–1–1, tibiya: 5(+1φρ)–5(+1φρ)–5(+1φρ)–5(+1φρ), tarsus: 11(+1ω+1ω♂)–9(+1ω+1ω♂)–7(+1ω♂)–7(+1ω♂).

İncelenen Örnekler: 1♀, meşe altından döküntü ve toprak, 39°35'18,72''K 39°51'09,35''D, 1459 m, 30.01.2019; 1♂, çürümüş meşe gövdesi ve üzeri yosun ve liken, 39°22'49,9''K 39°49'42,4''D, 1471 m, 14.09.2019; Pülümür Vadisi, Tunceli, Türkiye.

Yayılışı: Mısır'dan bilinmektedir (Zaher ve Soliman, 1966; Zaher ve Gomaa, 1978, Fan vd. 2016).

Tartışma: *Mediolata aegyptiaca* türü ilk olarak Zaher ve Soliman (1966) tarafından Mısır'dan verilmiş, daha sonra Zaher ve Gomaa (1978) tarafından ilave örneklerle yeniden tanımlanmıştır. Bunun yanında, Wafa vd. (1967), Yousef ve Shehata (1971), Rasmy vd. (1972) ve El-Halawany vd. (1986) tarafından da bu türe değinilmiştir (Aktaran: Fan vd., 2016). Türkiye'den ilk defa bu çalışma ile kaydedilen türün bir dişi ve bir erkek bireyine rastlanmıştır. Örneklerimiz genel olarak türün daha önce verilen örneklerine morfolojik açıdan benzerlik göstermektedir.

Şekil 18. *Villersia sudetica* (Dişi). Alttan görünüm.

Cins: *Stigmaeus* Koch

Stigmaeus glabrisetus Summers

(Şekil 11-16)

Çalışma sahasından türün dişi (Şekil 11, 12), erkek (Şekil 13, 14) ve dötonimf bireyleri (Şekil 15, 16) elde edilmiştir. Daha önce ergin dişi ve erkekleri bilinen türün dötonimf evresine ilk defa bu çalışmada rastlanmıştır.

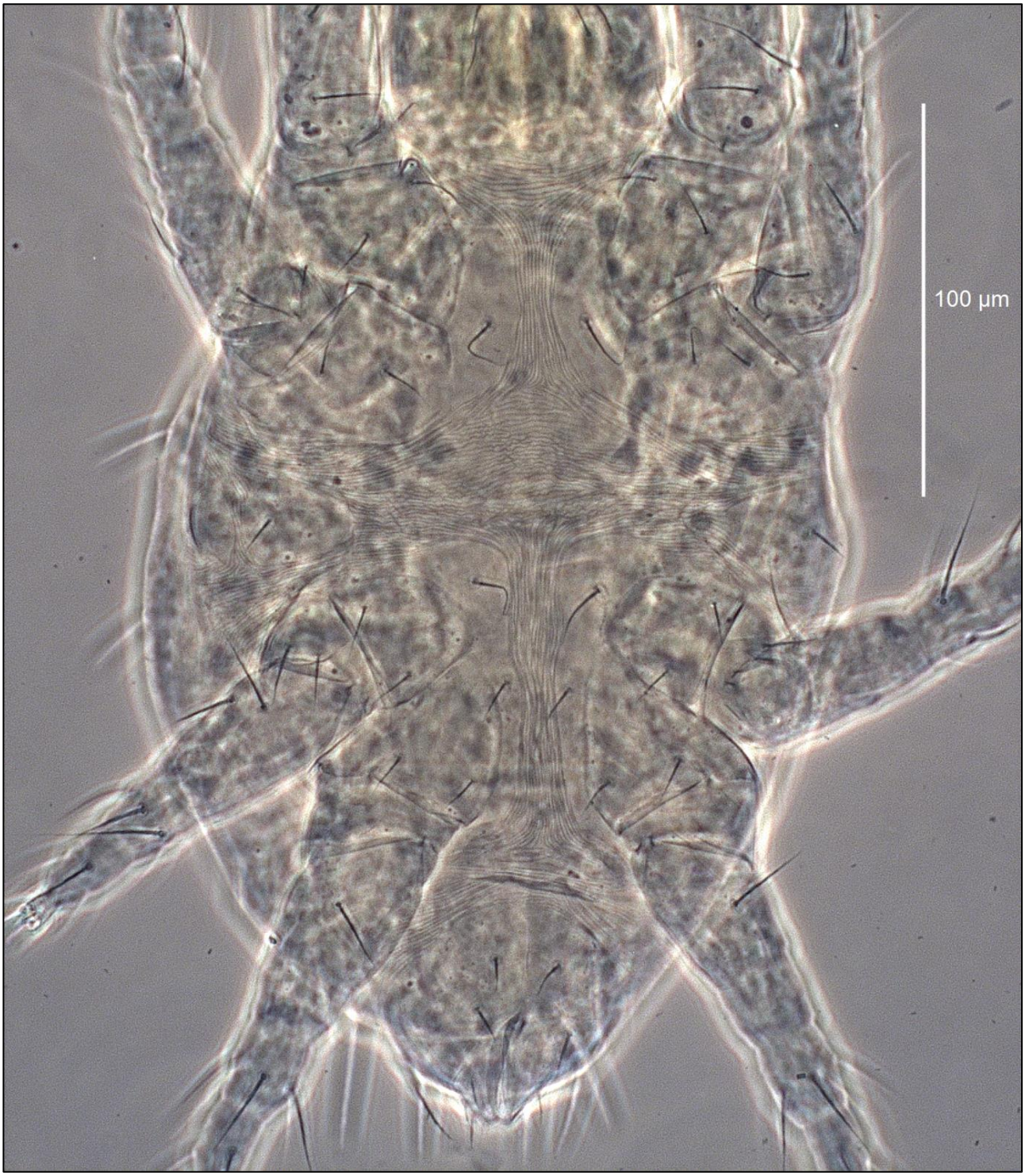
DÖTONİMF (Şekil 15, 16)

Vücut 297-329 µm uzunluğunda, 182-229 µm genişliğindedir.

Gnatozoma 69-73, keliser 87-89, palp 90-94 µm uzunluğundadır. Palp trokanterinden palp tarsusuna doğru kılların dağılımı şu şekildedir: 0, 3, 2, 2+1 tırnak+1 yardımcı tırnak, 4+1ω+1 diken şeklinde subterminal öpatidiyum+1 üççatallı kaidede kaynaşmış terminal öpatidiyum. Subkapitulum kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; *m* 15-18, *n* 15-17, *m*–*m* 25-27, *n*–*n* 18-19, *m*–*n* 9-10 µm.

Şekil 19. *Villersia sudetica* (Dötonimf). Üstten görünüm.

İntegüment sırt plakları arasında çizgili yapıdadır (Şekil 15). Plaklar zayıf ağsı desenlidir. Propodozoma plağında üç çift kıl (*vi*, *ve*, *sci*), bir çift gözardı cisim vardır. Gözardı cismin çapı 70-71 µm'dir. Apodemal işaret vardır. *sce* kılları bir çift küçük plak üzerinde yer almaktadır. Merkezi plak iki çift (c_1, d_1) kıl taşımaktadır. d_2 kılları yanal plaklar üzerinde, e_2 kılları lateral zonal plaklar üzerinde, e_1 kılları median zonal plaklar üzerinde bulunmaktadır. Çift haldeki interkalar plaklar üzerinde f_1 kılları yer almaktadır. Suranal plak bütün halde ve iki çift suranal kıl (h_1, h_2) taşımaktadır. Sırt kıllarından *ve*, c_2, e_2 sivri uçlu ve düzdür. Diğer kıllar ise özellikle uca doğru çentikli yapıdadır. Sırt kıllarının uzunlukları ve aralarındaki mesafeler şöyledir; *vi* 36-36, *ve* 88-91, *sci* 21-23, *sce* 33-34, c_1 25-27, c_2 75-76, d_1 26-28, d_2 36-41, e_1 28-28, e_2 68-71, f_1 47-49, h_1 42-43, h_2 38-41, *vi–vi* 21-22, *ve–ve* 43-44, *vi–ve* 24-28, *sci–sci* 122-122, *ve–sci* 63-66, *sce–sce* 143-155, *sci–sce* 10-17, c_1–c_1 53-60, c_2–c_2 175-217, d_2–d_2 142-169, c_1–d_1 54-56, c_1–d_2 55-68, d_1–d_1 51-55, d_1–d_2 45-61, e_2–e_2 119-157, d_2–e_2 51-59, d_1–e_1 42-46, d_1–e_2 44-69, e_1–e_1 39-44, e_1–e_2 42-58, f_1–f_1 65-74, e_1–f_1 29-40, e_2–f_1 48-61, f_1–h_1 34-44, f_1–h_2 25-37, h_1–h_1 29-32, h_2–h_2 65-66, h_1–h_2 15-18 µm. Vücudun en uzun kılı *ve*'dir. e_2 kılı, d_2 ve f_1 kıllarından daha uzundur.



Şekil 20. *Villersia sudetica* (Dötonimf). Alttan görünüm.

Vücudun alt yan tarafında humeral plaklar yer almakta ve c_2 kıllarını taşımaktadır. c_2 kılları uzun ve sivri uçludur. Koksisternal plaklar bölünmüş ve üzerinde 1*a*, 3*a* ve 4*a* kıllarını taşımaktadır (Şekil 16). Bu kılların uzunlukları ve aralarındaki mesafeler şöyledir; 1*a* 16-16, 3*a* 15-17, 4*a* 13-18, 1*a*–1*a* 22-25, 3*a*–3*a* 26-43, 4*a*–4*a* 17-37 µm. Aggenital plak üzerinde üç çift kıl ($ag_{1\text{-}3}$) vardır. ag_1 15-16, ag_2 15-17, ag_3 17-18, µm uzunluğundadır. Genital kıllar yoktur. Pseudanal kıllar üç çifttir ($ps_{1\text{-}3}$).

Bacak uzunlukları sırasıyla; I.B 175-177, II.B 149-152, III.B 140-145, IV.B 153-167 µm'dir. Bacak parçaları üzerindeki kılların dağılımı ise şöyledir; koksa: 2–2–2–2, trokanter: 1–1–2–0, femur: 6–4–3–2, genu: 3(+1κ)–3(+1κ)–0–0, tibiya: 5(+1φ+1φρ)–5(+1φρ)–5(+1φρ)–5(+1φρ), tarsus: 13(+1ω)–9(+1ω)–7(+1ω)–7(+1ω). I. genu üzerindeki κ solenidiyumu kıl şeklindedir.

İncelenen Örnekler: 2♀♀, çürümüş huş ağacı kovuğu, kabuğu ve üzeri yosun ve liken, 39°34'35,6''K 39°48'45,3''D, 1612 m, 27.10.2018; 1♀, ardıç altından döküntü ve çimenli toprak, 39°31'44,0''K 39°53'13,1''D, 1913 m, 24.11.2018; 15♀♀, çürümüş söğüt kovuğundan döküntü ve toprak, 39°23'38,3''K 39°48'03,1''D, 1400 m, 24.11.2018; 3♀♀, çürümüş ceviz kütüğünün kovuğundan döküntü ve toprak, 39°23'38,3''K 39°48'03,1''D, 1400 m, 24.11.2018; 2♀♀, söğüt ağacının kabuğu ve üzeri yosun, 39°11'27,8''K 39°41'28,1''D, 972 m, 24.11.2018; 1♀, söğüt ağacının kovuğundan döküntü, 39°35'20,9''K 39°48'31,3''D, 1467 m, 11.05.2019; 2♀♀, 2 dötonimf, çürümüş meşe gövdesi ve üzeri yosun, 39°31'43,3''K 39°54'21,7''D, 1719 m, 22.06.2019; 1♀, 1♂, çürümüş meşe gövdesi ve altından döküntü ve toprak, 39°22'53,5''K 39°47'23,0''D, 1498 m, 17.07.2019; Pülümür Vadisi, Tunceli, Türkiye.

Şekil 21. *Villersia sudetica* (Protonimf). Üstten görünüm.

Yayılışı: ABD, Kanada, Polonya ve Türkiye'den bilinmektedir (Summers, 1962; Dönel ve Doğan, 2011; Doğan vd., 2014; Fan vd., 2016; Doğan, 2019).

Tartışma: Dişi bireylerin bazılarında simetrik ve asimetrik varyasyonlar vardır: Üç dişi bireyde e_2 kılları küt uçlu ve çentikli; bir dişide sağ d_2 küt uçlu ve çentikli, sol d_2 sivri uçlu; bir dişide sol d_2 küt uçlu ve çentikli, sağ d_2 sivri uçlu; bir dişide sağ e_2 küt uçlu ve çentikli, sol e_2 sivri uçludur.

Örneklerimiz morfolojik olarak türün tipik karakterlerini yansıtmaktadır. Daha önce Dönel ve Doğan (2011) tarafından Türkiye'den verilen örneklerde propodozoma plağında apodemal işaretin ayırt edilemediği belirtilmektedir. İncelenen örneklerde bu karakter tip örneklerinde olduğu gibi (Summers, 1962) belirgindir.

Cins: *Villersia* Oudemans

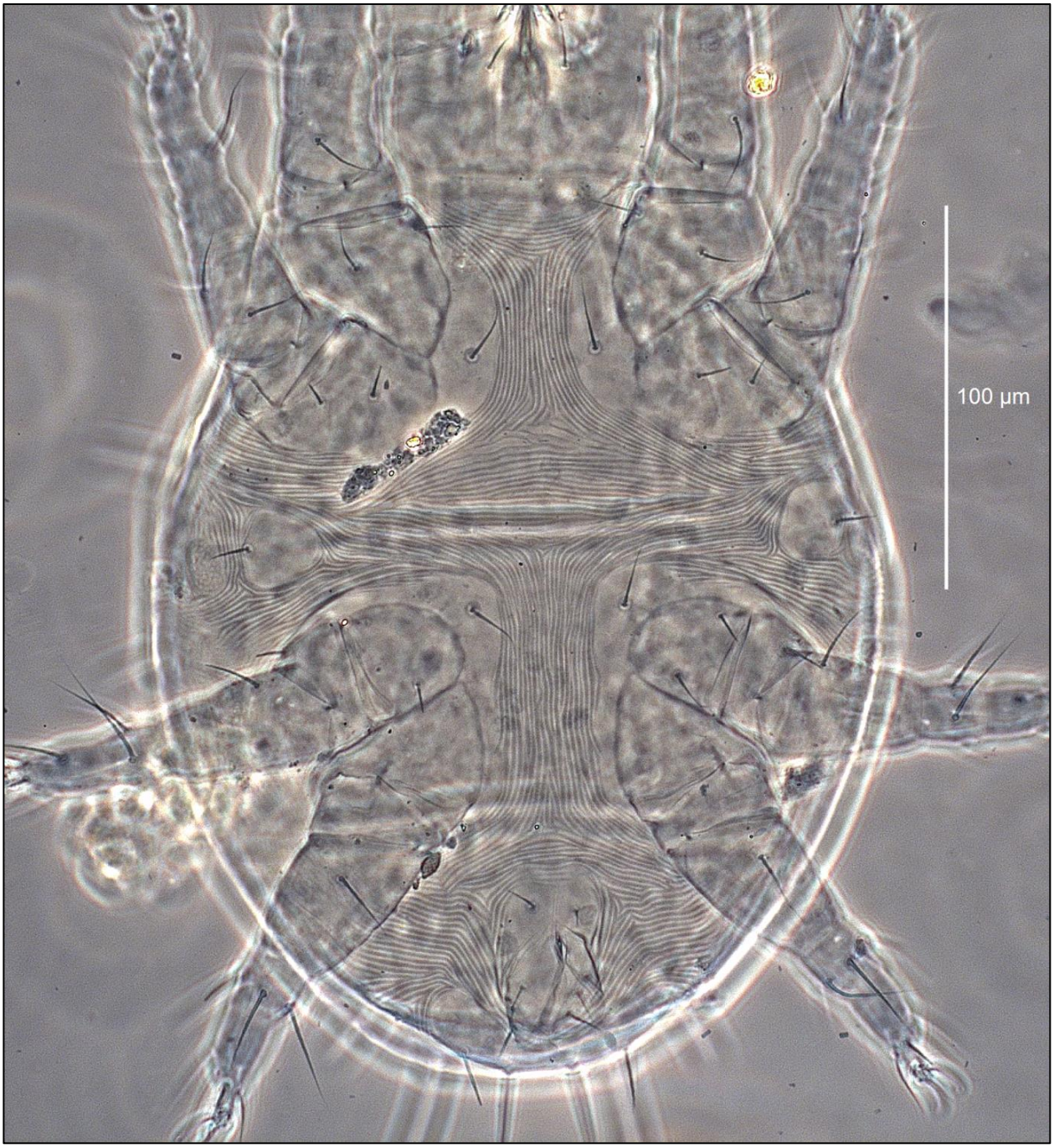
Villersia sudetica Willmann

(Şekil 17-25)

Çalışma sahasından türün tüm yaşam evreleri (ergin erkek hariç) (Şekil 17-25) elde edilmiştir. Daha önce nimf ve ergin evreleri bilinen türün larva evresine (Şekil 23-25) ilk defa bu çalışmada rastlanmıştır.

LARVA (Şekil 23-25)

Vücut oval, 172 µm uzunluğunda ve 150 µm genişliğindedir. Gnatozoma 51, keliser 57, palp 73 µm uzunluğundadır. Subkapitulum kılları bulunmamaktadır.



Şekil 22. *Villersia sudetica* (Protonimf). Alttan görünüm.

Propodozoma plağı üzerinde üç çift kıl (*vi*, *ve*, *sci*) ve bir çift göz bulunmaktadır. *sce* kılları ayrı plaklar üzerindedir. Histerozoma plağı bölünmüştür. Merkezi plak üzerinde iki çift (c_1, d_1), yanal plaklarda birer çift (d_2), zonal plakta iki çift (e_1, e_2), interkalar plak üzerinde bir çift (f_1), suranal plak üzerinde iki çift (h_1, h_2) kıl bulunmaktadır (Şekil 23, 24). Suranal plaklar karın tarafına kaymıştır. Sırt kılları çentikli yapıda olup, bu kılların uzunlukları ve aralarındaki mesafeler şöyledir; *vi* 20, *ve* 29, *sci* 13, *sce* 18, c_1 16, c_2 8, d_1 16, d_2 15, e_1 22, e_2 15, f_1 25, h_1 30, h_2 14, *vi–vi* 20, *ve–ve* 47, *vi–ve* 22, *sci–sci* 80, *ve–sci* 16, c_1–c_1 47, c_1–d_1 33, d_1–d_1 47, e_2–e_2 80, e_1–e_1 42, e_2–e_1 21, f_1–f_1 39, h_1–h_1 13, h_2–h_2 22, h_1–h_2 14 µm.

Vücudun alt yan tarafında humeral plaklar yer almakta ve c_2 kıllarını taşımaktadır. Bir çift kallosit ayırt edilebilmektedir. Koksisternal plaklar tamamen bölünmüş, üzerinde 1*a* ve 3*a* kılları bulunmaktadır. Bu kılların uzunlukları ve aralarındaki mesafeler; 1*a* 18, 3*a* 20, 1*a*–1*a* 35, 3*a*–3*a* 44 µm'dir. 4*a* kılı yoktur. Aggenital plak ve aggenital kıllar yoktur. Anogenital plaklar üzerinde üç çift pseudanal kıl ($ps_{1\text{-}3}$) bulunmaktadır (Şekil 25).

Bacak uzunlukları sırasıyla; I.B 118, II.B 94, III.B 87 µm'dir. Bacak parçaları üzerindeki kılların dağılımı ise şöyledir; koksa: 1–0–0, trokanter: 0–0–0, femur: 4–4–3, genu: 2(+1κ)–2(+1κ)–0, tibiya: 5(+1φ+1φρ)–5(+1φρ)–5(+1φρ), tarsus: 12(+1ω)–8(+1ω)–7(+1ω).

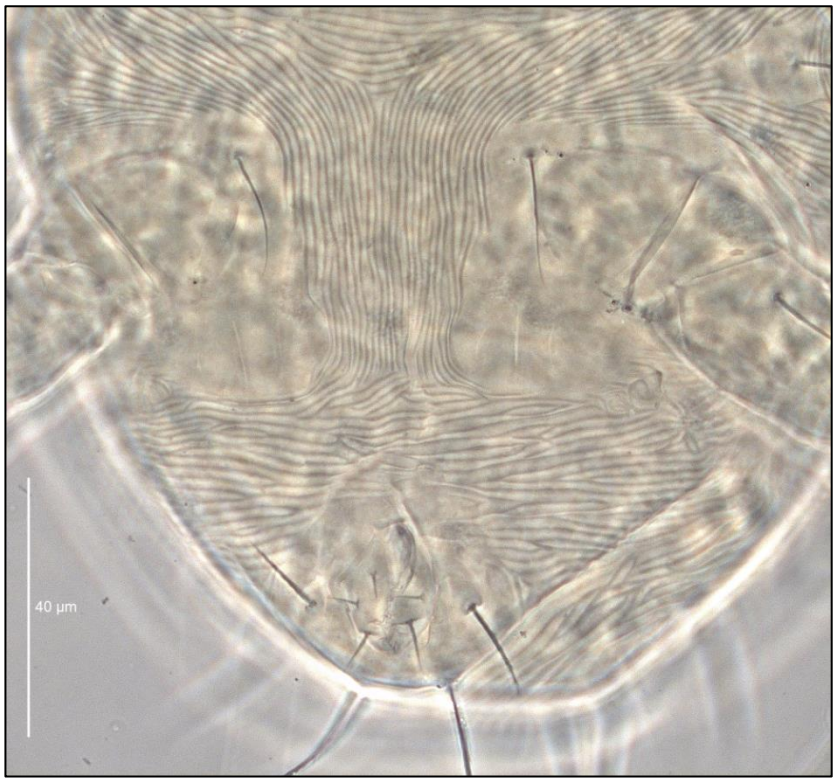
Şekil 23. *Villersia sudetica* (Larva). Üstten görünüm.

İncelenen Örnekler: 1 protonimf, dere kenarından nemli yosun, 1 protonimf, çimenli toprak, 39°30'50,5''K 39°51'54,3''D, 1800 m, 09.06.2019; 4♀♀, 4 dötonimf, 2 protonimf, 1 larva, dere kenarından nemli yosun, 39°31'08,6''K 39°51'31,1''D, 1914 m, 22.06.2019; Pülümür Vadisi, Tunceli, Türkiye.

Yayılışı: Çek Cumhuriyeti, Polonya ve Türkiye'den bilinmektedir (Willmann, 1956; Koç ve Ayyıldız, 1997; Doğan, 2007, 2019; Fan vd., 2016).

Tartışma: Daha önce nimf ve ergin evreleri bilinen türün larva evresine ilk defa bu çalışmada rastlanmıştır. Larva ve nimflerde histerozomal plak bölünmüştür. Erginde ise bu plak ya kısmen bölünmüş veya tamdır. Diğer taraftan; dişi üç çift, dötonimf iki çift, protonimf bir çift aggenital kıl taşır. Larvada ise aggenital kıl yoktur.

Şekil 24. *Villersia sudetica* (Larva). Üstten görünüm.



Şekil 25. *Villersia sudetica* (Larva). Anogenital bölge.

Fon sağlayıcılar

Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) tarafından 118Z469 numaralı proje ile finanse edilmiştir.

Çıkar ilişkisi

Yazarlar, çalışma kapsamında herhangi bir kişisel çıkar çatışması veya çakışmasının olmadığını bildirmektedir.

Teşekkür

Çalışmanın materyalini, Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) tarafından desteklenen 118Z469 numaralı projeden elde edilen akar örnekleri oluşturmaktadır. Desteklerinden dolayı TÜBİTAK'a teşekkür ederiz. Arazi çalışmalarının yürütülmesine yasal olarak izin veren T.C. Tarım ve Orman Bakanlığı Doğa Koruma ve Milli Parklar Genel Müdürlüğü ile Tarımsal Araştırmalar ve Politikalar Genel Müdürlüğü'ne teşekkürlerimizi sunarız.

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RESEARCH ARTICLE

The first record of *Valgothrombium* (Acari: Microtrombidiidae) from Iran with description of a new species

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ABSTRACT: A new species *Valgothrombium takhtii* Saberi-Riseh & Saboori **n. sp.** (Acari: Microtrombidiidae: Valgothrombiinae) is described and illustrated based on larvae collected from soil, i.e. off their host from Riseh village, Shahre Babak city, Kerman province, Iran. This is the first record of *Valgothrombium* for Iranian mite fauna and 15th species of the genus based on the larva. In Asia, the genus *Valgothrombium* is reported from China, Bhutan, Yemen from larval form, and Japan and Malaysia from post-larval forms.

Keywords: Larva, new record, Prostigmata, taxonomy, Trombidiformes.
Zoobank: http://zoobank.org/D1CB1E99-1715-4A42-873C-3F3EFC4E42ED

INTRODUCTION

One of the largest family in group of Parasitengona is Microtrombidiidae with about 450 species in 126 genera, all of which are parasites of arthropods as larvae (Mąkol and Wohltmann, 2012; Masoumi et al., 2016; Mąkol et al., 2017). Valgothrombiinae is a subfamily of Microtrombidiidae that comprises 12 genera. *Valgothrombium* comprises 31 species, of them, 17 species are known exclusively from post-larval forms, 11 from larvae, whereas only three from both larval and post-larval forms (Mąkol and Wohltmann, 2012; Buğa and Sevsay 2020). It is reported from China, Bhutan, Yemen in Asia from larval form, and Japan and Malaysia from post-larval forms. It is the first report of *Valgothrombium* from Iran.

In this paper, we describe a new species, *Valgothrombium takhtii* Saberi-Riseh & Saboori **n. sp.** based on larva and collected from soil in Riseh village, Shahre Babak city, Kerman province, Iran.

MATERIALS AND METHODS

Three specimens were collected in Riseh Village (30° 19′ 00″ N, 55° 24′ 33″ E, 2498 m a.s.l), Shahre Babak city, Kerman province, southern Iran. They were extracted from soil using a Berlese funnel and separated under a stereomicroscope. The specimens were cleared in Nesbitt's fluid and mounted on glass microscope slides using Faure's medium (Walter and Krantz, 2009). Figures were drawn and measurements (given in micrometers) were made using a BX 51 phase contrast Olympus microscope equipped with a drawing tube. The terminology and abbreviations are adapted from Makol and Łaydanowicz (2010).

RESULTS

Microtrombidiinae Thor, 1935

Subfamily Valgothrombiinae Gabryś, 1999

Genus *Valgothrombium* Willmann, 1940

Type species: *Ottonia valga* George, 1909

Valgothrombium takhtii Saberi-Riseh & Saboori **n. sp.**

Diagnosis

Larva with following features: Dorsum of idiosoma with two shields; median ridge present on posterior part of the scutum. Scutum punctate and rectangle, and scutellum punctate; palp femur and palp genu without setae; fD = 4(+2)-6-6-6-4 = 26(+2); fV = 2-2u = 4; fnGe = 4-2-2; IP = 490–503.

Description (n = 3)

Colour in life red. Idiosoma oval, Metric data given in Table 1.

Dorsal idiosoma (Fig. 1) with a scutum, a scutellum; hysterosoma with 28 barbed setae, each placed on a large sclerite except c_1 on scutellum and terminal setae. Setal sclerites (largest bearing setae c_2 and d_1) sparsely punctated. Dorsal setae arranged in five rows (c_{1-3}, d_{1-3}, e_{1-3}, f_{1-3}, h_{1-2}) (Fig. 1). Setae f_3 and h_1-h_2 are seen on the ventral side of idiosoma. Scutum rectangular in outline and distinctly longer than wide, with slight antero-medial protrusion and rounded anterolateral angles. Scutum with a posteriorly protruding ridge along its median axis (Fig. 1); scutum with bearing 3 pairs of normal setae (AM, AL and PL) and 1 pair of trichobothria (S). AM and AL with setules and PL slightly thicker than AM and barbed. S filiform

and smooth. Paired eyes at the level of posterior part of scutum, each pair composed of anterior and posterior lens (anterior 6–7 in diameter, posterior: 4–5), situated on a smooth oval sclerite. Scutellum wider than long, bearing one pair of barbed c_1 setae. Antero- and postero-median parts of scutellum with distinct concavity, other parts of scutellum convex.

Ventral idiosoma (Fig. 2) with smooth cuticle. Claparéde's organs laterally between coxae I and II. Coxa I with *1a* and *1b* setae with one setula. Coxa II with antero-lateral seta *2b* with one setula. Coxa III with single antero-lateral seta *3b*, with one setula. *fCx* formula = BB-B-B. Idiosoma without intercoxal setae (*3a*) between coxae III, 2 pairs of ventral setae with distinct barbs and a uropore. Anal opening without sclerite. *f*V formula = 2u-2. NDV = 28 (+ 2) + 4 = 30 (+ 2).

Gnathosoma (Fig. 3) with hypostomal setae (*bs*) short, small spine-like, a pair of nude adoral setae (*or*). Chelicer-al blade slightly curved, with small denticle in distal part of its inner edge. Palpal femur and genu without setae. Palp tibia with one long smooth seta and two shorter, thorn-like setae. Palpal tibial claw bifid. Palpal tarsus with one solenidion, one eupathidium, one very long nude setae and 3 very short nude setae. fPp =0-0-0-NNN$_2$-NNNNωζ.

Leg segmentation formula: 6-6-6. Leg setal formula (Figs 4-12): Leg I: Tr (1n) - Fe (6n) - Ge (4n, 2σ, 1κ) - Ti (6n, 2φ, 1κ) - Ta (17n, 2ζ, 1ω, 1ε). Leg II: Tr (1n) - Fe (5n) - Ge (2n, 1σ) - Ti (5n, 2φ) - Ta (14–15n, 1ζ, 1ω, 1ε). Leg III: Tr (1n) - Fe (4n) - Ge (2n, 1σ) - Ti (5n) - Ta (13n). Fe I with two and Fe II & III with one nude setae. Ta I & II with two falciform claws; Ta III with two falciform claws and a slender claw-like empodium. Each claw has a subterminal spur on each side (Figs 6, 9, 12). Measurements given in Table 1.

Type material

The holotype (ARS-20200528-1a) and two paratypes (ARS-20200528-1b, 1c) were collected by Nasir Saberi-Riseh, 22 June 2018. Larvae were collected from soil under walnut tree, Riseh village (30° 19′ 00″ N, 55° 24′ 33″ E, 2498 m a.s.l), Shahre Babak city, Kerman Province, southern Iran. The holotype (ARS-20200611-1a) and one paratype (ARS-20200611-1b) are deposited in the Acarological Collection, Jalal Afshar Zoological Museum (JAZM), Faculty of Agriculture, University of Tehran, Karaj, Iran. Other paratype (ARS-20200611-1c) are deposited in the Acarological Collection, Acarological Society of Iran, Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran

Etymology

This species is named in memory of Gholamreza Takhti (August 27, 1930 – January 7, 1968) was an Iranian Olympic Gold-Medalist wrestler. Popularly nicknamed Jahān Pahlevān ("The World Champion") because of his chivalrous behavior and sportsmanship, he was the most popular athlete of Iran in the 20th century, although dozens of Iranian athletes have won more international medals than he did. Takhti is still a hero to many Iranians. He is listed in the FILA wrestling hall of fame.

Remarks

Valgothrombium takhtii Saberi-Riseh & Saboori **n. sp.** differs from other species of the genus in the shape of the scutum and scutellum, in *V. takhtii* Saberi-Riseh & Saboori **n. sp.** scutum is punctate and rectangle, and scutellum entirely punctate, whereas in other species of *Valgothrombium* scutum is pentagonal, oval or semi-circular, except for *V. melindae* Haitlinger, 2008, *V. valgum* George, 1909, *V. tarnavense* Feider, 1950 and *V. andreae* Saboori, Ueckermann & van Harten, 2007, where the general shape of the scutum and scutellum is similar to *V. takhtii*. *Valgothrombium takhtii* **n. sp.** differs from *V. melindae* in shorter AL (27–28 vs. 35 in *V. melindae*), PL (40–41 vs. 62), IP (490–503 vs. 532) and longer L/W (1.58–1.64 vs. 1.39), median ridge on scutum originated between sensillary and PL setal bases (median ridge on scutum originated from bases of sensillary setae in *V. melindae*), setae c_1 placed in the mid-line of scutellum (vs. placed in the posterior half of scutellum); from *V. valgum* by fD (28 vs. 26 in *V. valgum*), WS (47–50 vs. 55), HS (48–49 vs. 55), IP (490–503 vs. 535–561), shorter S (27–29 vs. 32), median ridge on scutum originated between sensillary and PL setal bases (vs. median ridge on scutum originated between base of sensillary setae), scutum longer than scutellum (vs. scutum and scutellum with the same length), anterior border of scutum convex (vs. anterior border of scutum straight); from *V. tarnavense*, two claws and an empodium are present on all tarsi and scuttelum seems larger than scuttum, number of setae on Fe II (5 vs. 4), on Fe III (4 vs. 3), on Ge I-III (4-2-2 vs. 3-3-3) and longer HS (48–49 vs. 81), from *V. andreae* with median ridge on scutum originated between sensillary and PL setal bases (median ridge on scutum originated prior to the base of sensillary setae in *V. andreae*), without mushroom-like projections on dorsal idiosoma (vs. with mushroom-like projections on dorsal idiosoma), posterolateral part of coxae II normal (vs. posterolateral part of coxae II with protrusion), coxal setae with unequal branches (vs. with equal branches), IP (490–503 vs. 419–460), AL (27–28 vs. 17–22) and PL (40–41 vs. 30–35).

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Conflict of interest

No potential conflict of interest was reported by the authors.

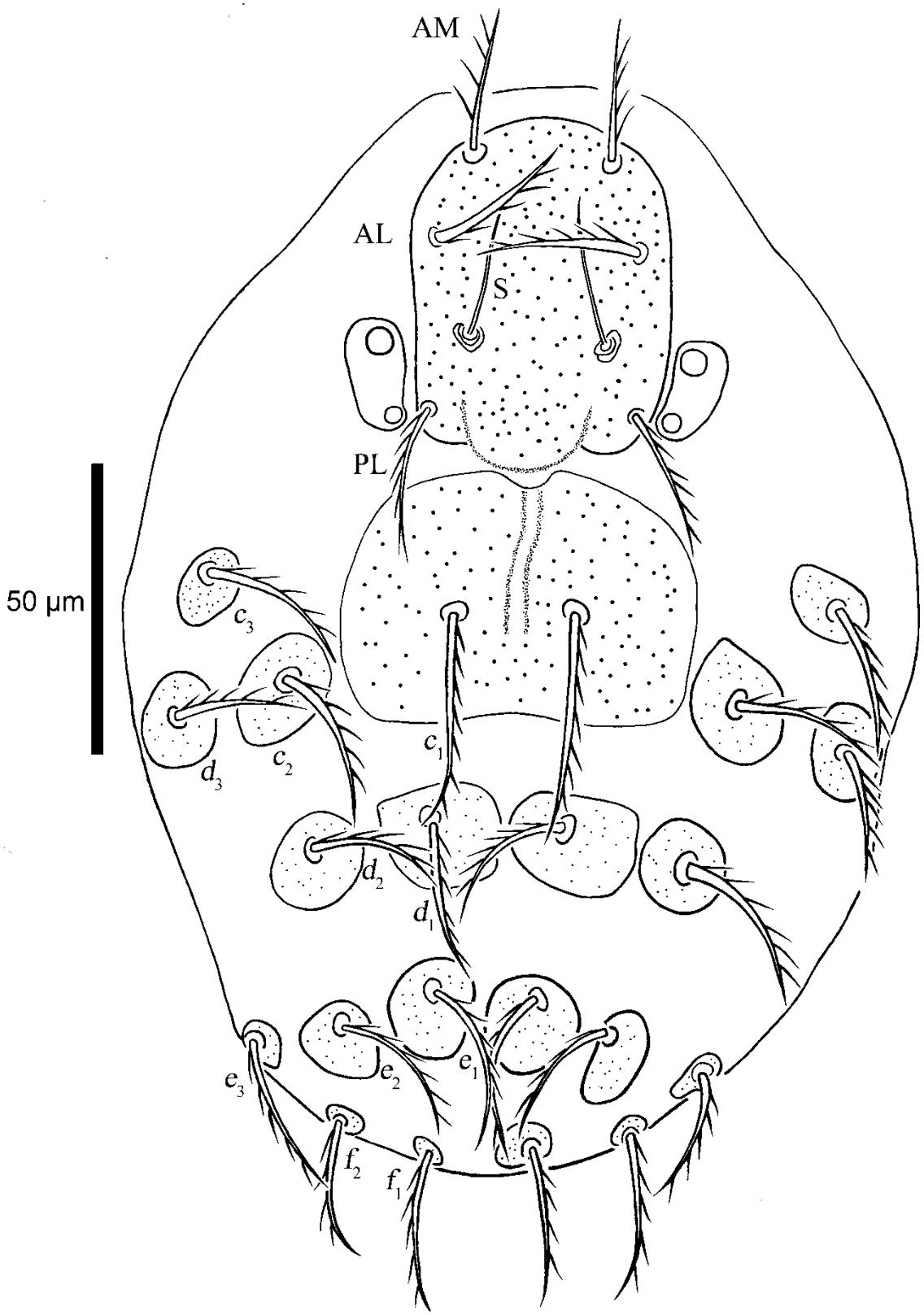


Figure 1. *Valgothrombium takhtii* Saberi-Riseh & Saboori **n. sp.** (larva) - Dorsal view of idiosoma (AM = Anteromedian seta, AL = Anterolateral seta, PL = Posterolateral seta, S = Sensillary seta).

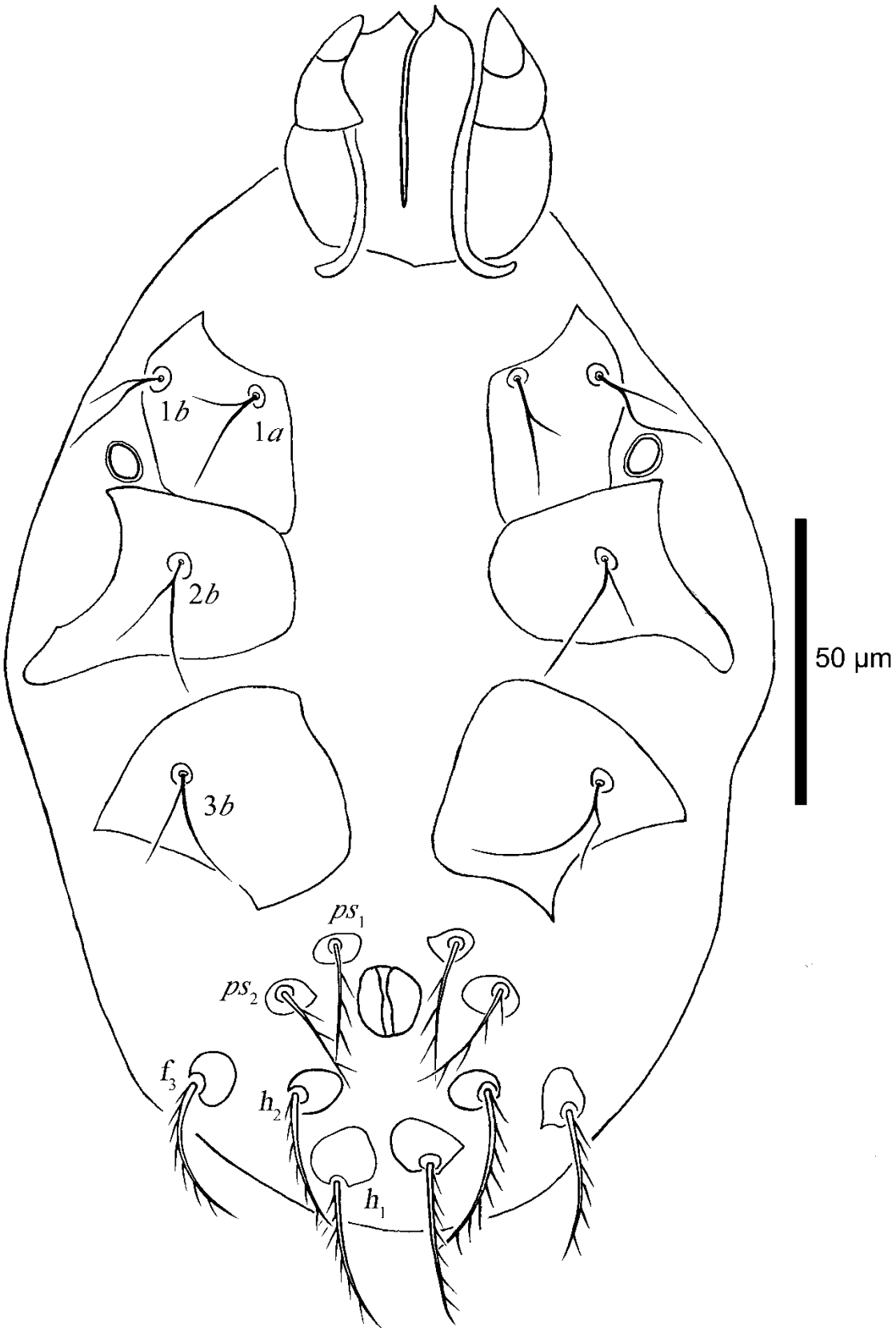


Figure 2. *Valgothrombium takhtii* Saberi-Riseh & Saboori **n. sp.** (larva) - Ventral view of idiosoma.

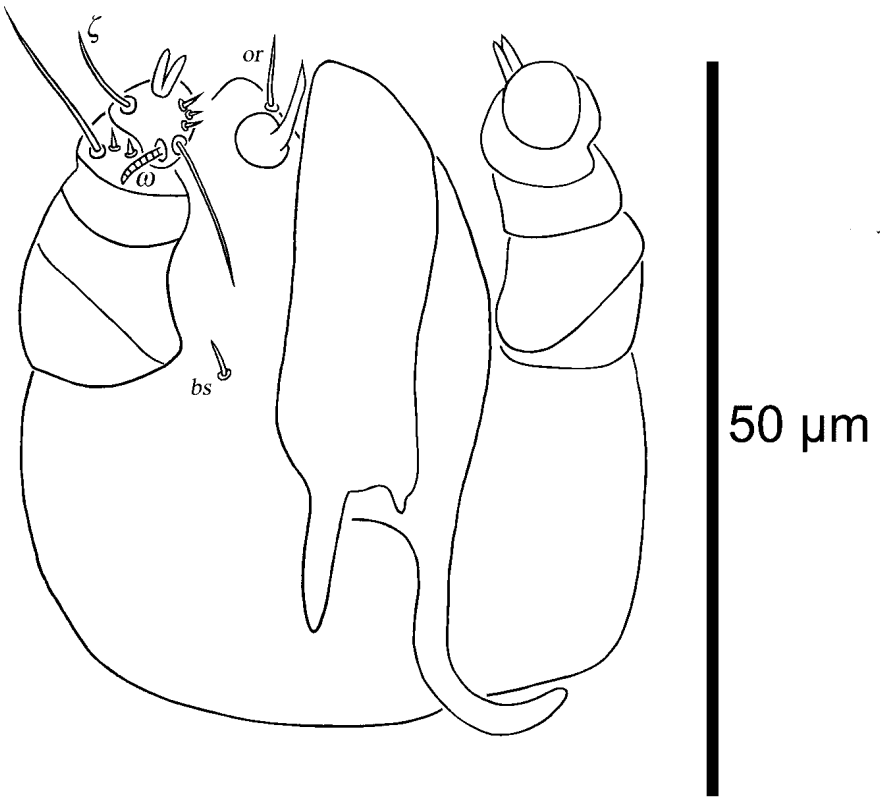
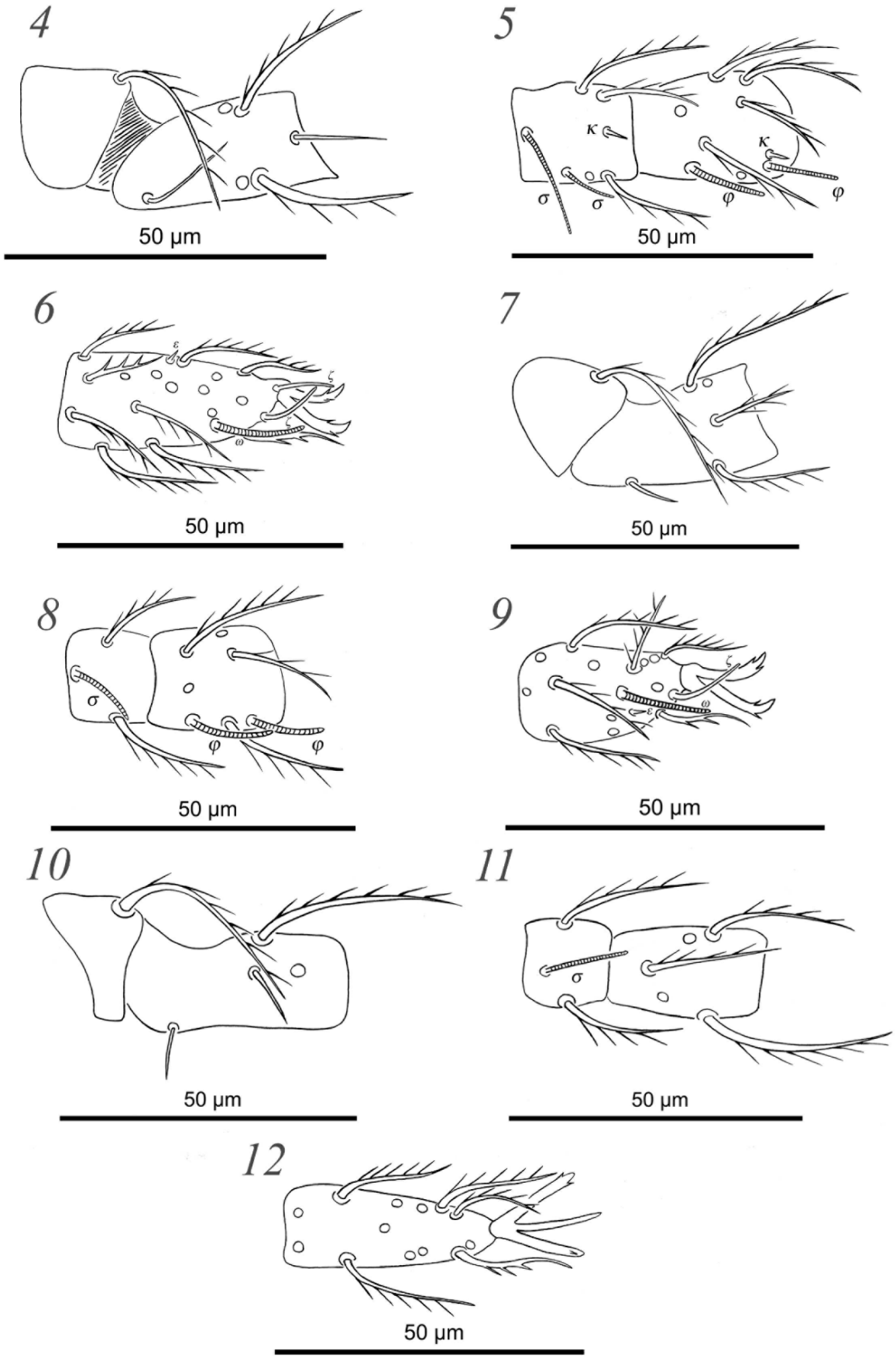


Figure 3. *Valgothrombium takhtii* Saberi-Riseh & Saboori **n. sp.** (larva) - Dorsal view (right) and ventral view (left) of gnathosoma.

Table 1. Metric data for larvae of *Valgothrombium takhtii* Sabori-Riseh & Saboori **n. sp.** (1a, holotype; 1b-1c, paratypes).

Character	1a	1b	1c	Character	1a	1b	1c
LB	213	186	200	Ta I (L)	35	34	34
WB	134	113	125	Ta I (W)	18	20	19
LB/WB	1.58	1.64	1.60	Ti I	26	24	26
AW	36	35	35	Ge I	17	16	17
PW	38	40	39	Fe I	37	37	36
AA	24	18	20	Tr I	24	23	24
SB	24	26	25	Cx I	40	38	40
ASB	38	34	36	Leg I	179	172	177
PSB	19	24	21	Ta II (L)	28	27	28
LS	57	58	57	Ta II (W)	16	17	16
WS	47	50	48	Ti II	22	20	21
AP	29	30	30	Ge II	15	15	16
MA	16	15	16	Fe II	35	32	33
AL	28	27	28	Tr II	24	21	22
PL	41	41	40	Cx II	37	40	38
AM	30	31	30	Leg II	161	155	158
S	27	29	28	Ta III (L)	32	30	32
SL	43	47	44	Ta III (W)	14	15	15
SS	22	21	22	Ti III	20	21	20
HS	48	49	49	Ge III	15	13	15
LSS	64	66	65	Fe III	31	34	34
PDS	31	29	30	Tr III	25	25	24
DS	27–32	27–35	27–33	Cx III	41	40	39
or	6	-	7	Leg III	163	163	164
bs	4	4	5	IP	503	490	499



Figures 4–12. *Valgothrombium takhtii* Saberi-Riseh & Saboori **n. sp.** (larva) – **4.** Trochanter and femur I, **5.** Genu and tibia I, **6.** Tarsus I, **7.** Trochanter and femur II, **8.** Genu and tibia II, **9.** Tarsus II, **10.** Trochanter and femur III, **11.** Genu and tibia III, **12.** Tarsus III.

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SHORT NOTE

A contribution to the tick (Acari: Ixodidae) fauna of Turkey: The first record of *Ixodes inopinatus* Estrada-Peña, Nava & Petney

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ABSTRACT: Ticks are blood-sucking ectoparasites of terrestrial vertebrates. The genus *Ixodes* Latreille is the largest among hard ticks, and the members of the genus are spread around the world. In the present study, we reported presence of *Ixodes inopinatus* Estrada-Peña, Nava & Petney, 2014 in Turkey for the first time. The specimens of *I. inopinatus* (1 male, 6 females) were collected from cattle in Ordu province, Turkey.

Keywords: Hard ticks, host associations, vectors, Turkey.
Zoobank: http://zoobank.org/4C24E3D1-8E34-4B24-B331-D9CEAF27D089

Ticks are important ectoparasites, causing a variety of serious infectious diseases in humans and domestic animals. Turkey is a Eurasian country occupying 783,562 square kilometers including Anatolian peninsula and Thrace. The territory of Turkey lies between latitudes 35° - 43° North and longitudes 25° - 45° East and is divided into seven geographic regions. Each region has specific climate, vegetation and wild life allowing a suitable habitat for various tick species.

Turkish tick fauna is currently composed of 51 species; 43 species from family Ixodidae and 8 species from family Argasidae (Bursali et al., 2012; Kar et al., 2017; Keskin et al., 2014; Orkun and Karaer, 2018; Keskin and Erciyas-Yavuz, 2019). The genus *Ixodes* Latreille is the largest among ixodid ticks; and the members of the genus is spread around the world. To date, approximately 261 species of the genus *Ixodes* are known worldwide (Guglielmone et al., 2014, 2020; Onofrio et al., 2020), but this number are increasing with the new studies. In Turkey, to date, a total of 13 species of the genus *Ixodes* are identified: *Ixodes acuminatus* Neumann, *Ixodes arboricola* Schulze & Schlottke, *Ixodes crenulatus* Koch, *Ixodes eldaricus* Djaparidze, *Ixodes festai* Tonelli-Rondelli, *Ixodes frontalis* (Panzer), *Ixodes gibbosus* Nuttall, *Ixodes hexagonus* Leach, *Ixodes laguri* Olenev, *Ixodes redikorzevi* Olenev, *Ixodes ricinus* (L)., *Ixodes simplex* Neumann, and *Ixodes vespertilionis* Koch (Bursali et al., 2012; Keskin et al., 2014; Kar et al., 2017; Orkun and Karaer, 2018; Keskin and Erciyas-Yavuz, 2019).

During our parasitological survey on ticks in the Black Sea Region of Turkey, we collected a number of *Ixodes* ticks (12 males, 49 females, 5 nymphs) on domestic cattle in 2006 from Ordu Province. This province is located the coastal strip of the Black Sea Region of Turkey. It has a temperate and humid climate. The mean annual precipitation is 1152 mm, and the precipitation regime is the Black Sea Rainfall Type. The mean annual temperature is 13.8 ^{0}C. On average, 143 days of the year are rainy. The average relative humidity is 74.7% (Karaman et al., 2012). All of them were placed into labeled small plastic tubes containing 70% ethanol and sent to Acarology Laboratory, Department of Biology, Tokat Gaziosmanpaşa University, Tokat, Turkey. Using of descriptions and identification keys given by Filippova (1977) and Estrada-Peña et al. (2017), ticks were identified as *I. ricinus* (11 males, 43 females, 5 nymphs), and *Ixodes inopinatus* Estrada-Peña, Nava, and Petney (1 male and 6 females). This is the first report of *I. inopinatus* in Turkey.

Ixodes inopinatus has been described among the specimens of *I. ricinus* specimens (Estrada-Peña et al., 2014). It is share some morphological features with other Palearctic *Ixodes* species; therefore *I. inopinatus* might have been historically confused with and erroneously reported as Palearctic *Ixodes* species, especially *I. ricinus* (Estrada-Peña et al., 2014; Chitimia-Dobler et al., 2018). Presence of *I. inopinatus* has been documented from Austria, Portugal, Romania, Spain, and Tunisia.

Adults of *I. inopinatus* can be separated from the most related species, *I. ricinus*, by the combination of following characters. Punctations on the dorsal scutum are larger and conscutal setae are longer in the male of *I. inopinatus* than in *I. ricinus*. In addition, the pre-genital and median plates in *I. inopinatus* are with larger and deeper punctuation than in *I. ricinus*. Male of *I. inopinatus* has only one row of lateral conscutal setae (the second row can be observed only in the central part of idiosoma) between the lateral margin of the idiosoma and the marginal groove (Figs 1A, B), whereas there are several rows of lateral conscutal setae in *I. ricinus* (Figs 2A, B). The females of *I. inopinatus* have deep and large punctations in the central field of the scutum, which

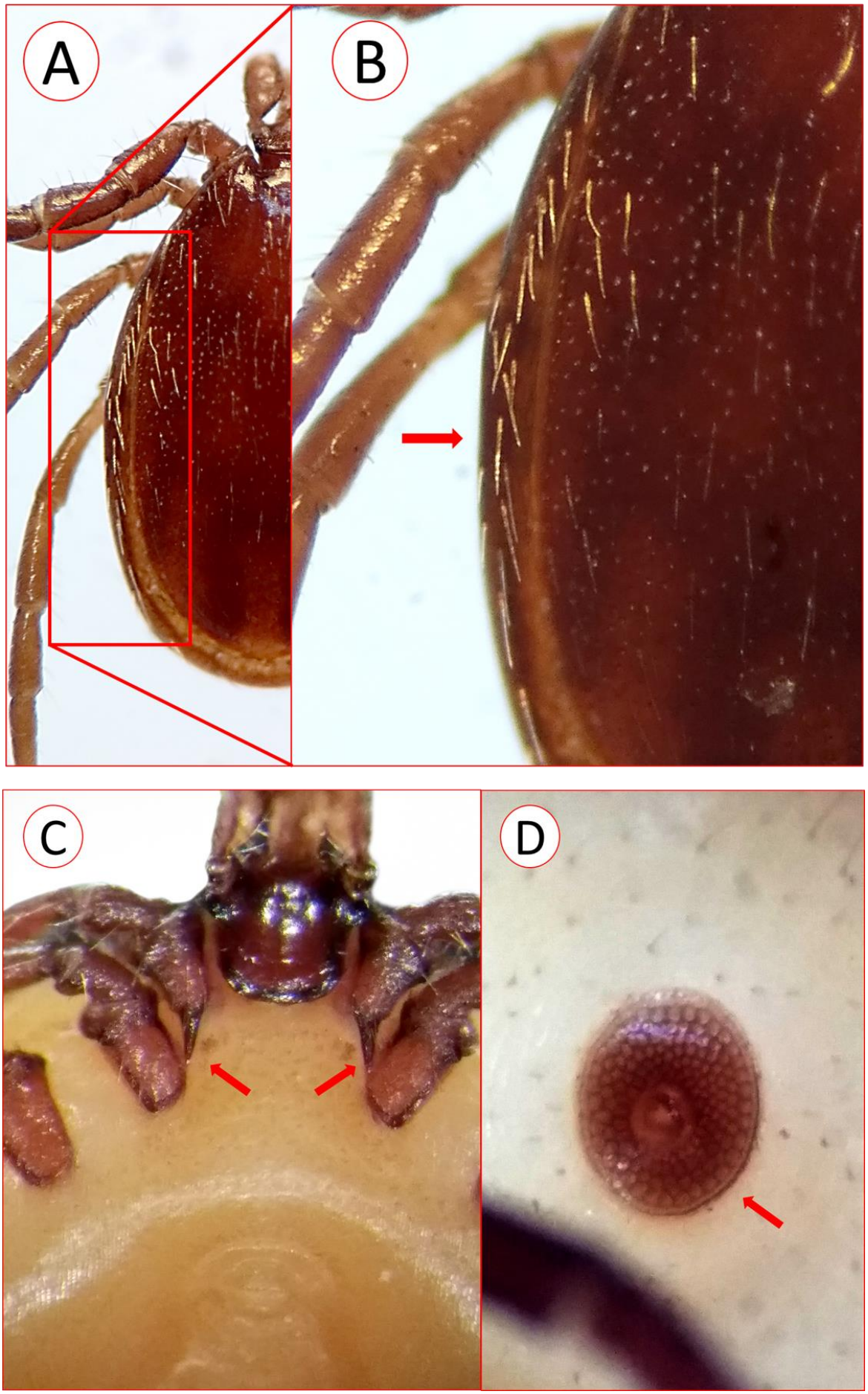

Figure 1. *Ixodes inopinatus* **A.** Dorsal view of male, **B.** One row of seta in the lateral margin of the conscutum of male, **C.** Internal spurs of coxa I of female, **D.** Spiracular plate with four concentric rows goblets of female.

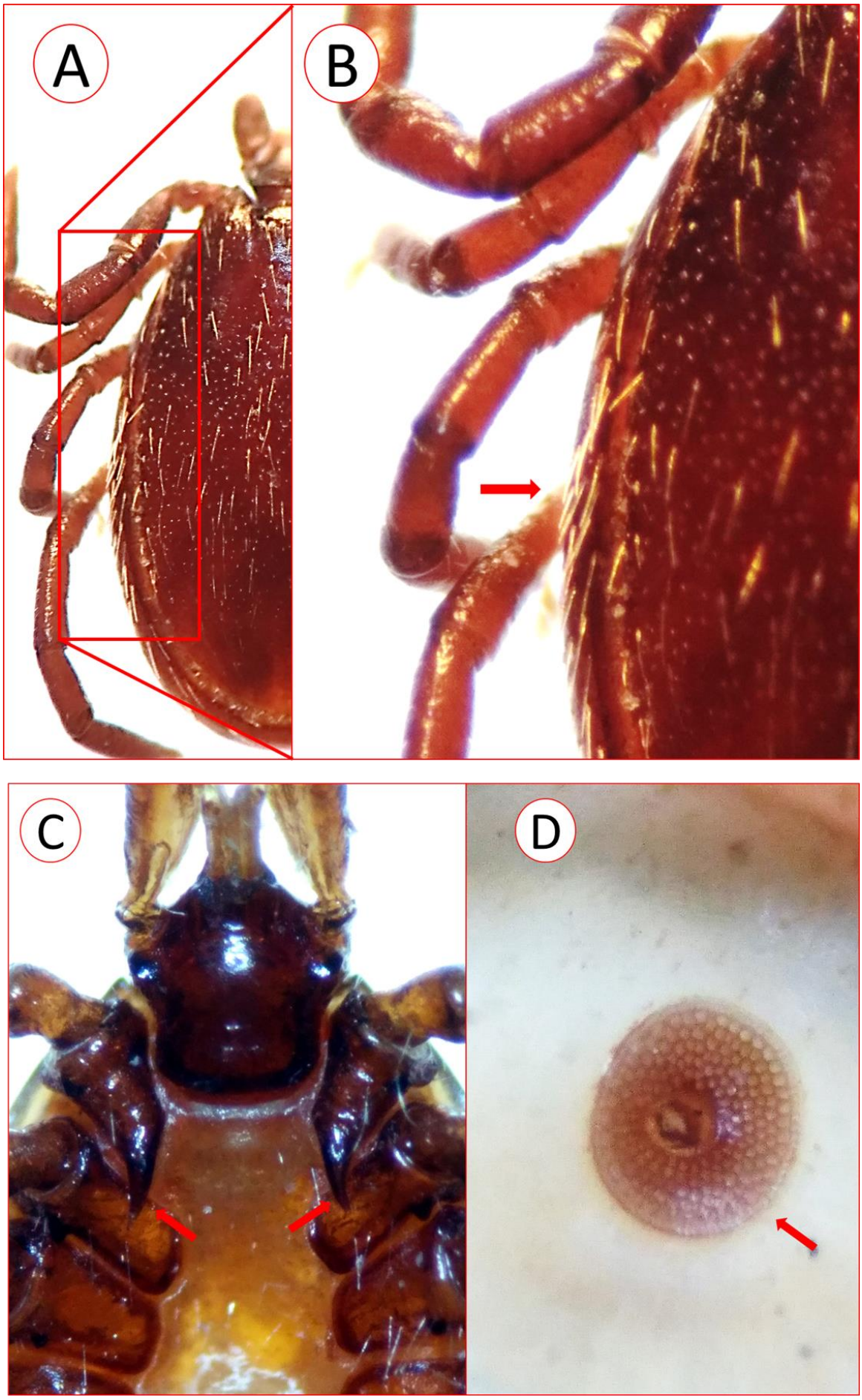

Figure 2. *Ixodes ricinus* **A.** Dorsal view of male, **B.** Several rows of setae in the lateral margin of the conscutum of male, **C.** Internal spurs of coxa I of female, **D.** Spiracular plate with concentric five rows goblets of female.

are less numerous and almost inconspicuous in *I. ricinus*. The internal spur on coxa I has a long tapering pointed internal spur reaching coxa II in *I. inopinatus* (Fig. 1C), but is longer, curved and touching coxa II in *I. ricinus* (Fig. 2C) (the internal spur of coxa I only in females is a feature of diagnostic importance). In the female of *I. inopinatus*, there are four concentric rows of goblets in the spiracular plate (Fig. 1D), while there are (5 or 6 rows) in the female of *I. ricinus* (Fig. 2D). The more detailed morphological comparison of *I. ricinus* and *I. inopinatus* has been given by Estrada-Peña et al. (2014) and Chitimia-Dobler et al. (2018).

As previously reported, *I. inopinatus* is a species that replaces *I. ricinus* in drier areas, but a recent study shown that both species can be found sympatric in the humid areas (Younsi et al., 2020). In the present study, *I. inopinatus* and *I. ricinus* were collected from Ordu province. This province has a humid climate in nearly whole year. Therefore, this study supports the hypotheses of Younsi et al. (2020) about the sympatric distribution of *I. inopinatus* and *I. ricinus* ticks in the humid areas. In previous reports, specimens of *I. inopinatus* have been mainly collected by flagging from the vegetation and from some host animals, such as lizards, foxes and sheep (Estrada-Peña et al., 2014; Chitimia-Dobler et al., 2018; Hauck et al., 2019). To the best of our knowledge, *I. inopinatus* was collected from cattle, for the first time, from Turkey.

We strongly suggest that tick specimens identified as *I. ricinus* in tick collections should be re-examined based on the current taxonomic concepts. The medical importance of *I. inopinatus* is also currently unknown; therefore, new studies should be aimed at the presence and prevalence of tick-borne pathogens in *I. inopinatus*.

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Conflict of interest

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