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Article

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Pachyseius masanisimilis (Mesostigmata: Eviphidoidea: Pachylaelapidae), a new species of edaphic mite from Iran

Ali Ahadiyat[1]*, Sahebeh Ghasemi Moghadam[1] and Zahra Cheraghali[2]

1. Department of Entomology, Science and Research Branch, Islamic Azad University, Tehran, Iran; E-mails: a.ahadiyat@srbiau.ac.ir & ali.ahadiyat@hotmail.com, sahebe.moghadam@gmail.com
2. Young Researchers Club, Garmsar Branch, Islamic Azad University, Garmsar, Iran; E-mail: z_cheraghali2005@yahoo.com

* Corresponding author

Abstract

Pachyseius masanisimilis Ahadiyat and Ghasemi Moghadam **sp. nov.** is described based on female specimens collected from soil, leaf litter and humus of fruit trees in highland areas of north part of Tehran Province of Iran.

Key words: Female; Gamasina; leaf litter; soil; taxonomy; Tehran.

Introduction

Species of the genus *Pachyseius* Berlese, 1910 are free-living mites inhabiting the temperate zone of the northern hemisphere (Mašán 2008). They live in various microhabitats, including litter, soil, moss, caves, nests of birds and mammals, but mostly in litter and soil substrates (Koroleva 1977; Mašán 2007). This genus comprises 24 species (Özbek and Halliday 2015; Babaeian *et al*. 2016) which is mostly distributed in Palaearctic region, recorded from Belgium, British Isles, Bulgaria, China, Germany, Iran, Italy, Japan, the Netherlands, Romania, Russia, Siberia, Slovakia, Spain, Turkey (Hyatt 1956; Afifi and Nasr 1984; Moraza 1993; Mašán 2007, 2008; Mašán and Mihál 2007; Ahadiyat and Cheraghali 2012; Mašán and Fenďa 2014; Mašán and Halliday 2014; Özbek and Halliday 2014, 2015; Marchenko 2015; Babaeian *et al*. 2016). Furthermore, it has been observed in Australia (New South Wales) (Halliday 2001) and Canada (Ontario) (Broadbent and Tomlin 1979).

Literature reviews show that only a few unidentified and misidentified species of *Pachyseius* have been reported from Iran. Babaeian and Kazemi (2011) and Gholami and Ostovan (2013) respectively reported *P. angustus* Hyatt, 1956 (from sandy riverbank in Shahrekord region, Chaharmahal and Bakhtiari Province) and *P. humeralis* Berlese, 1910 (from soil samples in Eghlid region, Fars Province), although Babaeian *et al*. (2016) considered both as misidentified species based on some differential morphological characteristics. They also described a new species, namely *P. persicus* Babaeian and Mašán, from Mazandaran Province of Iran. Other researchers recorded some unidentified species of the genus from soil samples of several provinces of Iran, including Farshiani *et al*. (2010) (from Fars, Golestan, Guilan, Khuzestan, and Mazandaran provinces), Nejadghanbar *et al*. (2010) (from Guilan Province), Rahmani and Zare (2011) (from

Zanjan Province), Ahadiyat and Cheraghali (2012) (from Tehran Province), and Bigdeli *et al*. (2014) (from Zanjan Province).

The aim of this paper is to describe a new species of *Pachyseius* based on the female specimens collected from Tehran Province at the north of the central plateau of Iran. This species had been previously considered as a new one in Ahadiyat and Cheraghali (2012).

Material and Methods

Sampling areas were considered in Rudbār-e Qasrān District, Shemirānāt County, Tehran Province. The specimens were collected using Berlese-Tullgren funnel from soil, leaf-litter, humus and debris of trees and ground covering plants of orchards during spring till fall 2011. Mites were preserved in 70–75% ethanol, then cleared in lactophenol, finally mounted on microscope slides using Hoyer's medium. All measurements are given in micrometers (µm) and presented as ranges of minimum to maximum. Lengths of all dorsal and ventral setae were measured from the bases of their insertions to their distal ends. For the distances between setae, the intervals between their central insertions were considered. Lengths of shields were measured along their midlines from the anterior to posterior margins, and widths were measured from the dorsal area at the level of setae *z6* (mid-level of coxae IV) for the dorsal shield, and in two points for genital shield: from the widest point (posterior margin of the shield) and at the mid-level of coxae IV. For the widths of sternal shield, three sections were considered: at the widest point (between coxae II and III), at the narrowest point (posterior level of setae *st1*), and at the level of setae *st2*. Palp length was measured ventromedially from the base of trochanter to the apex of tarsus, and lengths of its segments were taken dorsomedially, excluding intersegment membranes. For the tritosternum, lengths of its base and lacinia, and widths of its base and apex were measured. Length of peritreme was measured from anterior section of stigmata to its anterior end. Terminology for dorsal and ventral idiosomal chaetotaxy used in this paper follows that of Lindquist and Evans (1965). Idiosomal notation of glands and lyrifissures follows those of Johnston and Moraza (1991) and Moraza and Peña (2005), and the notation of pore-like structures on the peritrematal shield region follows that of Lindquist and Moraza (2014). Individuals of the species are partially deposited in the Acarology Collection of the Department of Entomology (ACDE), College of Agriculture and Natural Resources, Science and Research Branch, Islamic Azad University, Tehran, Iran, as well as the junior author's collection (ZC).

Pachyseius masanisimilis Ahadiyat and Ghasemi Moghadam sp. nov. (Figs. 1–10)

Diagnosis

Dorsal shield weakly reticulated especially on podonotum, bearing 30 pairs of setae, vertex bent downward so that *j1*, *j2* and *z1* and one pair of poroids *idj1* are visible ventrally. Presternal region with no distinct platelets. Sternal shield weakly reticulated with linear ornamentation anteriorly. Genital shield weakly linearly ornamented and micropunctated. Ventrianal shield with micropunctation and linear ornamentation entirely. Metapodal shields well-separated from anterolateral margins of ventrianal shield. Peritrematal shield completely free from exopodal shields III and IV, anteriorly located almost at the level with the gland pore *gdj3*. End of poststigmatic region of peritrematal shield distinctly truncate. Areas between peritrematal shield and antrolateral corners of ventrianal shield with three platelets. Lateral and opisthogastric cuticle with

six pairs of setae. Fixed and movable cheliceral digits tri- and bi-dentate, respectively. Spermathecal tubes fine, long. Tarsus II with one enlarged, spur-like distal seta *pl1*.

Description (female, n = 5)

Dorsal idiosoma (Fig.1) – Dorsal shield 555–600 long, 297–327 wide, oval (length/width: 1.83–1.94). Weakly reticulated, bearing 30 pairs of homologous, simple, smooth and needle-like setae and 19 pairs of pore-like structures. Podonotum smooth, with no distinct ornamentation, with 18 pairs of setae, and eight pore-like structures (*idj1*, *gdj3*, *idj4*, *ids2*, *ids4 or gds4?*, *idj6 or gdz6?*, *ids6*, *idz6*), vertex bent downward so that *j1*, *j2* and *z1* and one pair of poroids *idj1* are visible ventrally (Figs. 9, 10). Opisthonotum with defined polygonal reticulation entirely, with 12 pairs of setae and 11 pairs of pore-like structures (*idJ1*, *idS1*, *idJ2*, *idS3*, *gdZ1*, *idZ2*, *idZ3*, *idS4*, *gdS4*, *idS5*, *idJ4*).

Ventral idiosoma (Fig. 2) – Tritosternum with a columnar basal section, 28 long, 14–15 wide at base, 9 wide at apex, and a pair of pilose laciniae, 73–82 long (Fig. 3). Presternal region with linear ornamentation, but no distinct platelets. Sternal shield 116–125 long, widths at the widest point 170–183, at the narrowest point 90–95, and 125–133 at the level of setae *st2* (length/width at the widest point: 0.64–0.70, length/width at the narrowest point: 1.24–1.33, and length/width at the level of setae *st2*: 0.89–0.96). The shield truncate anteriorly, linearly ornamented in anterior section, and weakly reticulated with polygonal punctations in other areas. Posterior margin slightly concave medially. Bearing three pairs of setae and two pairs of poroids (*iv1–2*). Metasternal shield small, oval, with one pair of setae *st4* and one pair of poroids (*iv3*). Genital shield 121–123 long from the anterior hyaline margin, 87–98 long from the sclerotized portion of the shield, 76–84 wide at the widest point, 74–80 wide at the mid-level of coxae IV (maximum length/width at the widest point: 1.46–1.60, and maximum length/width at the mid-level of coxae IV: 1.54–1.66). Weakly linearly ornamented and micropunctate. Anterior hyaline margin convex and poorly sclerotized, posterior margin truncate. Bearing one pair of setae *st5*. Poroids *iv5* positioned outside at the posterolateral margins of the shield. Posterior margin of the shield abutting the anterior margin of ventrianal shield with 2–4 narrowed platelets. Ventrianal shield 215–240 long, 136–160 wide (length/width: 1.43–1.58). Micropunctate and linearly ornamented entirely. Anterior margin slightly concave medially. Bearing three pairs of preanal setae *JV1–3*, three circumanal setae, and one pair of glands (*gv3*) which inserted on posterolateral margins of the shield almost at the level of adanal setae. Adanal setae inserted away from and before the anterior margin of anus. Postanal seta the largest seta on the shield. Anus 23 long, 19 wide. Cribrum well developed, with two rows of denticles. Metapodal shields 45–61 long, 6–8 wide, crescent, longitudinally elongated, well-separated from anterolateral margins of ventrianal shield. Peritreme 248–271 long, micropunctate entirely, curved almost at the anterior portion of coxa II, extending beyond the coxa II on ventral idiosoma and anteriorly mostly reaching to or rarely slightly extending beyond the level of the gland pore *gdj3* on dorsal shield, with one gland pore (*gp1*) located at the posterior level of coxa II. Peritrematal shield contiguous with exopodal shields III and IV, but completely free from them, with narrow width in whole length, anteriorly extending to the anterior portion of coxa II, almost located at the level with the gland pore *gdj3*. The shield bearing four poroids (*ip1–4*) and two gland pores (*gp2–3*). The gland pore *gp2* enlarged, slightly larger than stigmata, rounded with two holes. End of poststigmatic region of peritrematal shield distinctly truncate, almost located at the level with posterior margin of coxa IV. Areas between peritrematal shield and antrolateral corners of ventrianal shield with three platelets, two

of which suboval or subcircular and the other one almost quadrate and larger which located close to the anterolateral margin of ventrianal shield. Lateral and opisthogastric cuticle with six pairs of setae and five pairs of poroids (*ivo1–3*, *ivp*, *idR*?). All ventral setae located on shields and soft cuticle smooth, simple and needle-like.

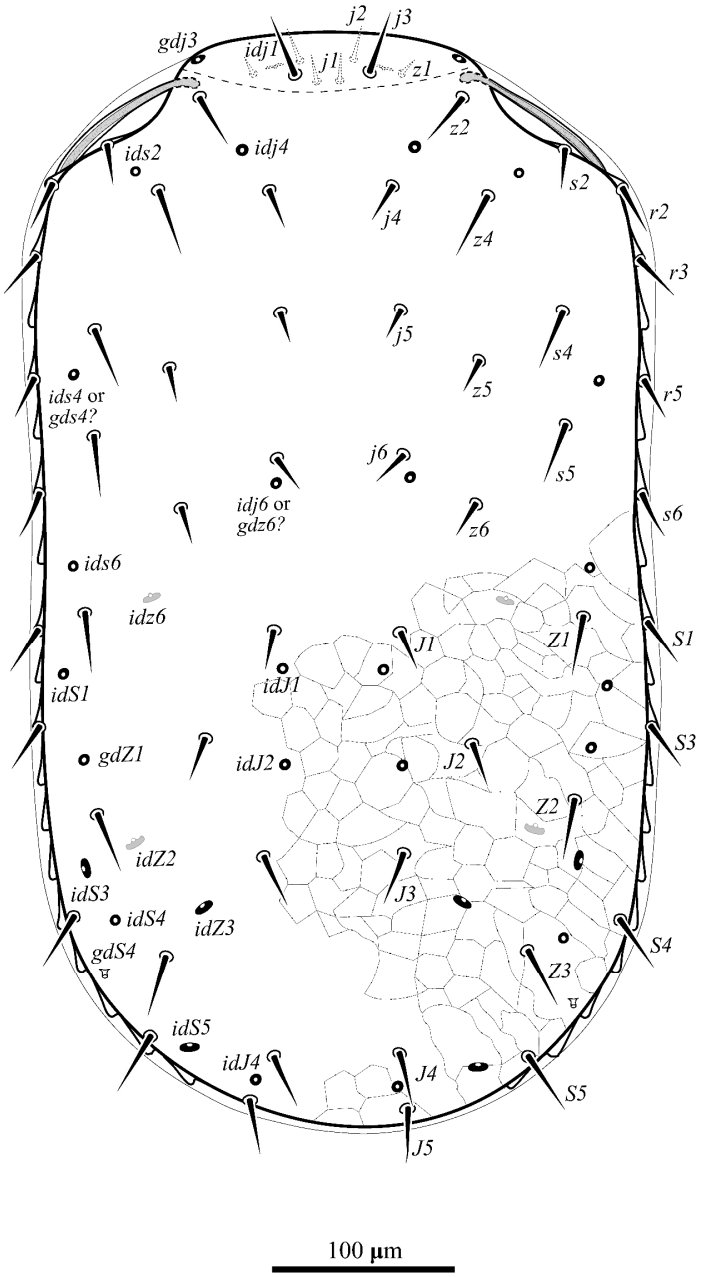


Figure 1. *Pachyseius masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.** (female) – Idiosoma, dorsal aspect with notation of setae and pore-like structures.

Gnathosoma – Epistome denticulated mostly at the middle portion (Fig. 4). Curniculi well separated, short, straight and horn-like, 27–28 long (Fig. 5). Hypostomal setae simple, smooth, and needle-like, *h3* (35–42) > *h1* (29–30) > *h2* = *pc* (18–20). Setae *h3* inserted near the first (anterior) deutosternal row, *pc* located at the level between the fifth and sixth deutosternal grooves in the posterior section. Deutosternum with seven rows,

five of which multi-denticulated. The anterior and posterior rows smooth, with no denticles. Numbers of teeth in other rows from the anterior (2nd) to posterior (6th) ones, respectively: 9–15, 14–17, 13–19, 10–15, 6–11. Denticles of the sixth row greater (Fig. 5). First (basal) and second cheliceral segments 50–56 and 77–80 long, respectively. Fixed digit 41–43 long, tridentate, including one minute tuber-like tooth followed by a large and distinct tooth at the middle portion and a minute tubercle. Pilus dentilis located on one third terminal section of the fixed digit. Movable digit 53 long, bidentate (medial teeth). Arthrodial brush long and plumose. Dorsal cheliceral seta short and setiform (Fig. 6). Palp 196–203 long. Palp apotele three-tined. Lengths of palp segments: trochanter 48–54, femur 48, genu 39–41, tibia 38–40. Palp trochanter, femur, genu and tibia with 2, 5, 6 and 14 setae, respectively. All palp setae smooth and needle-like, except setae *av*? on femur and *av*? on genu both spatulated.

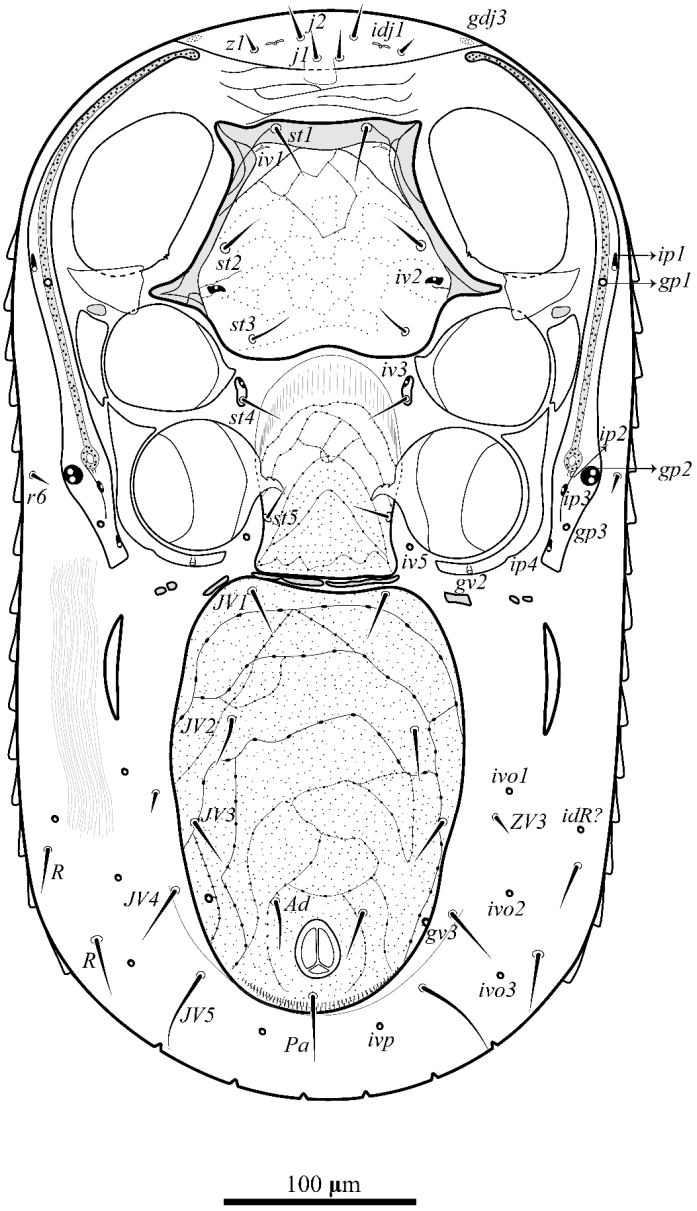
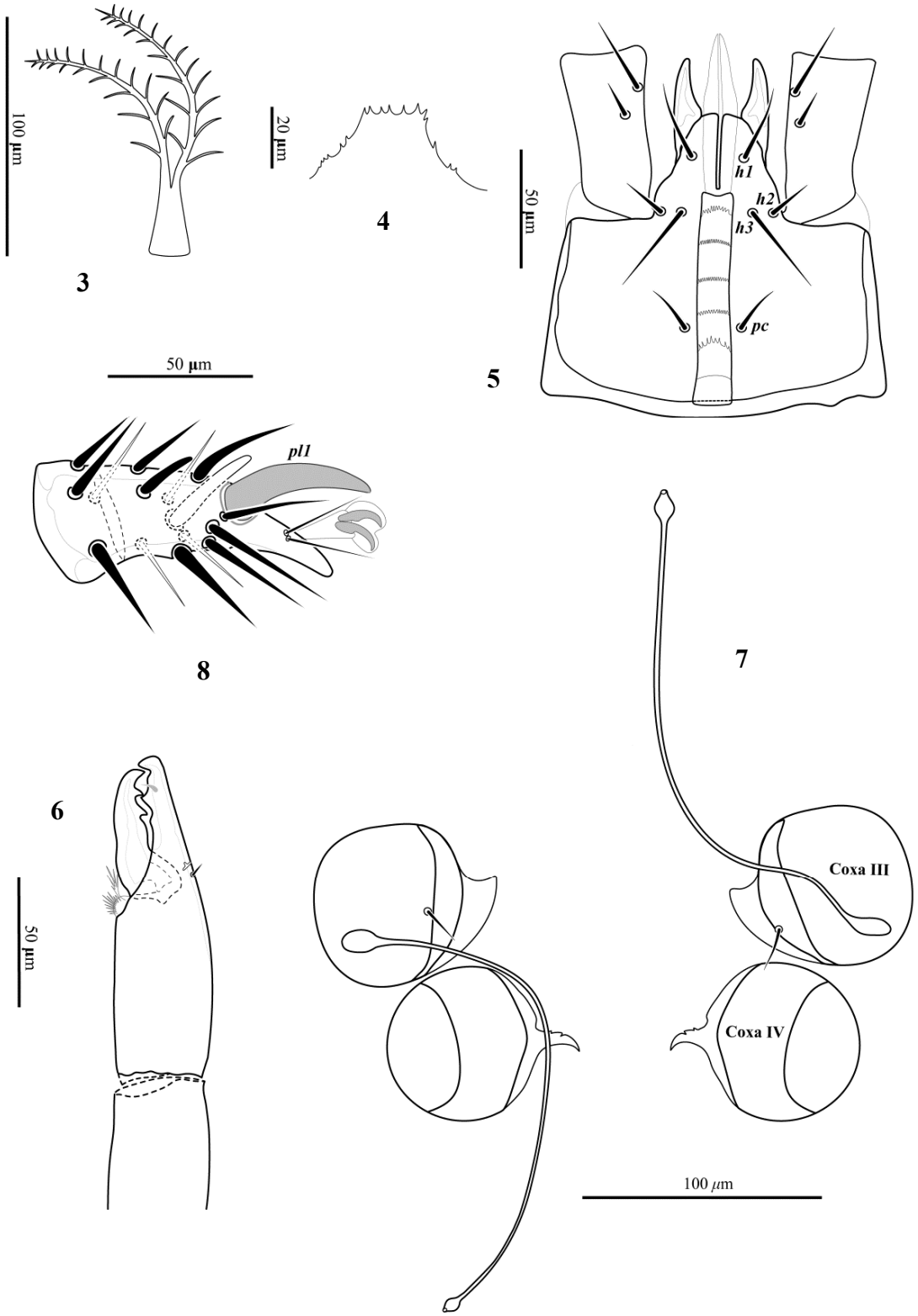


Figure 2. *Pachyseius masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.** (female) – Idiosoma, ventral aspect with notation of setae and pore-like structures.



Figures 3–8. *Pachyseius masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.** (female) – 3. Tritosternum; 4. Epistome; 5. Hypostome; 6. Chelicera; 7. Spermathecal apparatus; 8. Tarsus II.

Spermathecal apparatus – Spermathecal tubes fine, long (144–207) and associated with the posterior section of coxae III. The proximal and distal portions of spermathecal apparatus sack-like, 16 and 11 long, respectively (Fig. 7).

Legs – Because of the bad positions of legs in all the examined specimens, only the chaetotaxy of a few segments is provided herein: leg II: coxa 0 0/2 0, trochanter 1 0/3 1; leg III: coxa 0 0/2 0, femur 1 3/1 1, genu 2 4/1 1, tibia 1 3/2 1, tarsus 3 7/5 2; leg IV: coxa 0 0/1 0. Numbers of setae on legs I–IV: coxae 2, 2, 2, 1; trochanters 6, 5, 5, 5; femora 13, 11, 6, 6; genua 12, 11, 8, 8; tibiae 12, 10, 7, 7; tarsi II–IV: 18, 17, 16. Tarsus II with one enlarged, bent and spur-like distal seta *pl1*, 42–50 long (Fig. 8).

Lengths of idiosomal setae and their distances are presented in Tables 1 and 2.

Male – Unknown.

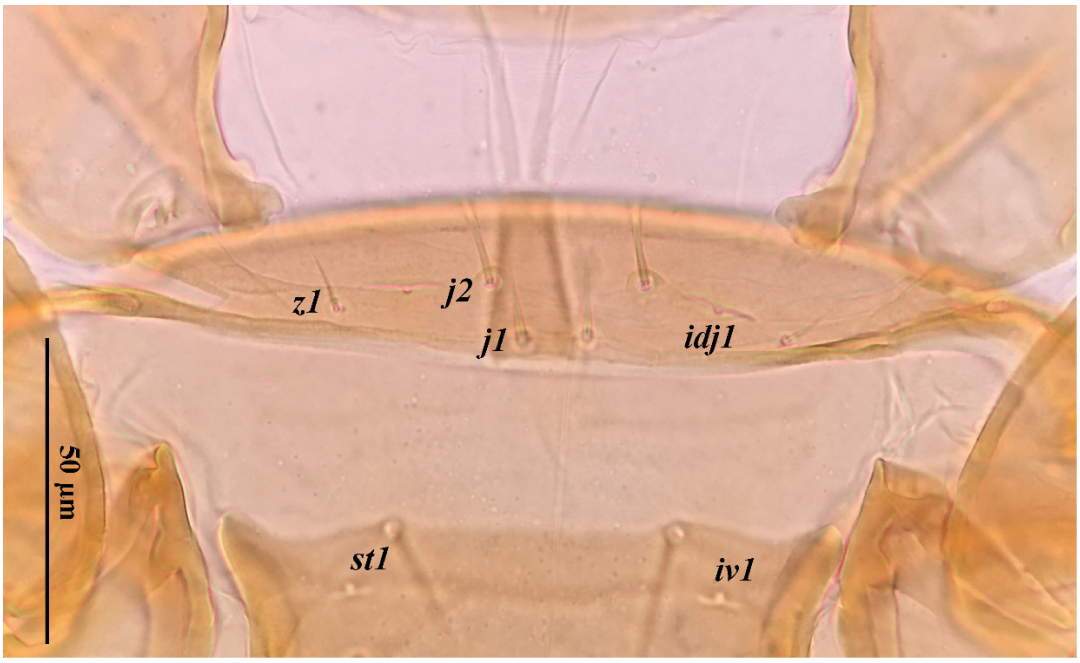


Figure 9. *Pachyseius masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.** (female) – Anterior section of ventral idiosoma.

Type material

Holotype. Female: slide No. 24, Iran, Tehran Province, Shemirānāt County, Rudbār-e Qasrān District, Fasham City, 35° 55′ N, 51° 31′ E, altitude: 2025 m a.s.l., soil of cherry tree, April 13, 2011. **Paratypes.** 1♀: slide No. 20, as the same data as in holotype. 1♀: slide No. 21, Iran, Tehran Province, Shemirānāt County, Rudbār-e Qasrān District, Shemshak City, 36° 00' N, 51° 29' E, altitude: 2455 m a.s.l., soil and leaf litter of cherry tree, April 19, 2011. 1♀: slide No. 26, Iran, Tehran Province, Shemirānāt County, Rudbār-e Qasrān District, Fasham City, 35° 55′ N, 51° 31′ E, altitude: 2025 m a.s.l., humus of walnut tree, November 29, 2011. 1♀: slide No. 38, Iran, Tehran Province, Shemirānāt County, Rudbār-e Qasrān District, Rudbār-e Qasrān Rural District, Garmābdar Village, 35° 59′ N, 51° 37′ E, altitude: 2410 m a.s.l., soil of weeds in an orchard, September 29, 2011. All collected by Z. Cheraghali.

Etymology

The name of this new species is derived from the species *Pachyseius masani* Özbek and Halliday, 2014, due to have similar morphological characteristics with this species

("Similis" in Latin means similar).

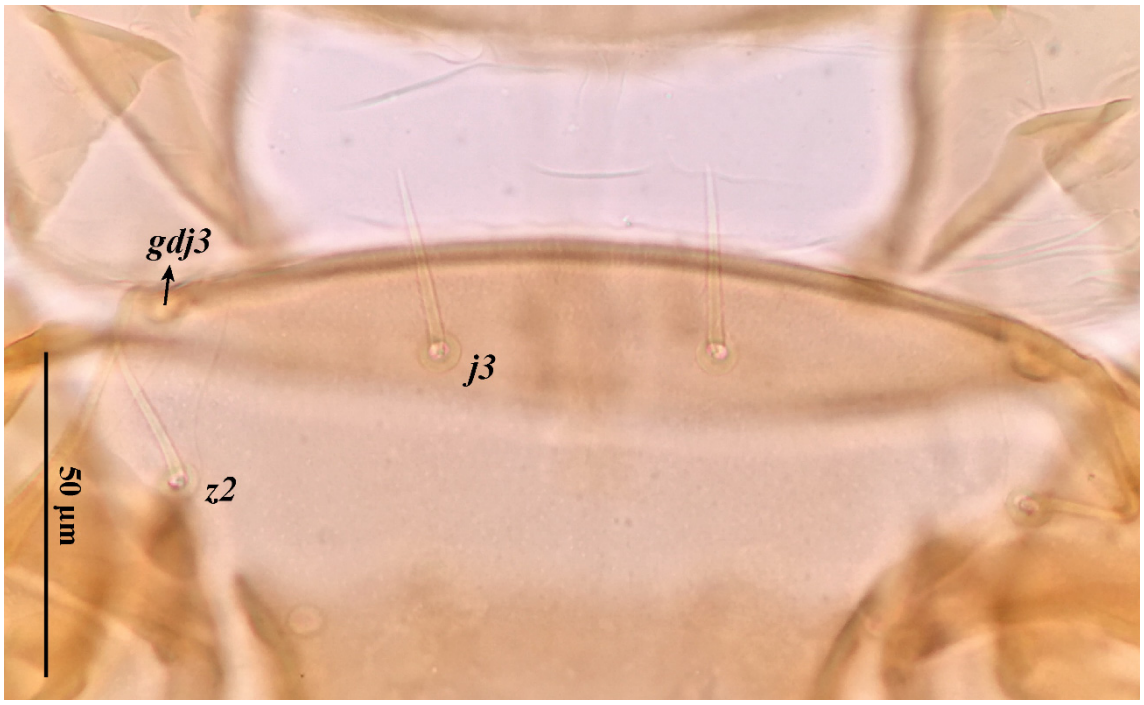


Figure 10. *Pachyseius masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.** (female) – Anterior section of dorsal idiosoma.

Table 1. Metric data of idiosomal setae of *Pachyseius masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.**

Character	Range	Character	Range	Character	Range	Character	Range
j1	15–19	*z1*	10–14	*S1*	21–25	*st5*	23–25
j2	13–20	*z2*	30–32	*S3*	25–29	*JV1*	20–26
j3	28–35	*z4*	38–43	*S4*	29–35	*JV2*	29–33
j4	24–28	*z5*	18–22	*S5*	27–36	*JV3*	23–29
j5	17–20	*z6*	24	*r2*	30–34	*JV4*	28–36
j6	22–24	*Z1*	35–38	*r3*	30–37	*JV5*	45–52
J1	21–24	*Z2*	33–38	*r5*	25–31	*ZV3*	16–19
J2	24–27	*Z3*	35–40	*r6*	12	Adanal	27–32
J3	25–27	*s2*	20–24	*st1*	28–33	setae	
J4	26–30	*s4*	31–39	*st2*	28–34	Postanal	41–46
J5	28–35	*s5*	31–38	*st3*	25–30	setae	
J4/J5	0.85–1	*s6*	21–30	*st4*	22–27		

Remarks

Pachyseius masanisimilis Ahadiyat and Ghasemi Moghadam **sp. nov.** was found in semi-arid and sub-humid climates and in the highland areas at the altitudes between 2025–2455 m a.s.l. It seems that it is distributed in highland areas with different humidity. This species is very similar to *P. masani* Özbek and Halliday, 2014 in many characteristics, e.g. length and width of dorsal and ventrianal shields, lengths of many idiosomal setae, numbers of lateral and opisthogastric setae, chaetotaxy of tarsi III and IV. Some minor and unreliable differences are found between these two species. For instances, lengths of dorsal setae *j5* and *z5* in *P. masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.** are shorter (17–20 and 18–22, respectively) than those in *P. masani* (22–26 in both setae).

Also, the fixed cheliceral digit bears one single tooth with bidentate terminal hook in *P. masani*, while it has three teeth in the new species, including one distinct medial tooth and two minute tubercles besides that. *Pachyseius masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.** differs from *P. masani* in the following characters: 1) Podonotum in the new species is smooth, with no distinct reticulation, but it is clearly reticulated in *P. masani* based on the Figure 7 in Özbek and Halliday (2014); 2) Anterior end of peritreme in the new species mostly reaches to or rarely slightly extends beyond the level of gland pores *gdj3*, while it clearly extends beyond *gdj3* in *P. masani*; 3) Posterior end of peritrematal shield in the new species is distinctly truncate, while it is tapered in *P. masani*; 4) Vertex of dorsal shield is bent downward so that *j1*, *j2* and *z1* and one pair of poroids *idj1* are visible ventrally in the new species, while they are located in the normal dorsal position in *P. masani*. The last difference is the most important and distinguishable character for identifying *P. masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.**

Table 2. Distances between dorsal and ventral idiosomal setae of *Pachyseius masanisimilis* Ahadiyat and Ghasemi Moghadam **sp. nov.**

Setae	Distance	Setae	Distance	Setae	Distance
j1–j1	9	*z1–z1*	66	*st1–st1*	46–52
j2–j2	24	*z2–z2*	138	*st2–st2*	99–112
j3–j3	33	*z4–z4*	190	*st3–st3*	83–93
j4–j4	68	*z5–z5*	143	*st4–st4*	97–106
j5–j5	68	*z6–z6*	180	*st5–st5*	66–77
j6–j6	68	*Z1–Z1*	265	*JV1–JV1*	45–52
J1–J1	50	*Z2–Z2*	265	*JV2–JV2*	63–72
J2–J2	138	*Z3–Z3*	208	*JV3–JV3*	94–99
J3–J3	70	*s2–s2*	200	*JV4–JV4*	122–146
J4–J4	58	*s4–s4*	278	*JV5–JV5*	138–154
J5–J5	73	*S5–S5*	203	*ZV3–ZV3*	175–182

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Pachyseius masanisimilis **(Mesostigmata: Eviphidoidea: Pachylaelapidae)**
گونهٔ جدید کنهٔ خاکزی از ایران

علی احدیت[1]*، صاحبه قاسمی مقدم[1] و زهرا چراغعلی[2]

۱. گروه حشره شناسی، واحد علوم و تحقیقات تهران، دانشگاه آزاد اسلامی، تهران، ایران؛ رایانامه‌ها:
a.ahadiyat@srbiau.ac.ir و ali.ahadiyat@hotmail.com ، sahebe.moghadam@gmail.com

۲. باشگاه پژوهشگران جوان، واحد گرمسار، دانشگاه آزاد اسلامی ، گرمسار، ایران؛ رایانامه:
z_cheraghali2005@yahoo.com

* نویسنده مسئول

چکیده

گونهٔ *Pachyseius masanisimilis* **sp. nov.** براساس نمونه‌های کنه‌های مادهٔ جمع‌آوری شده از خاک، خاک‌برگ و هوموس درختان میوه در مناطق مرتفع بخش شمالی استان تهران (ایران) توصیف می‌شود.

واژگان کلیدی: ماده؛ گامازینا؛ خاک‌برگ؛ خاک؛ آرایه‌شناسی؛ تهران.

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