

Article

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A new species of the genus *Pachyseius* Berlese (Acari: Pachylaelapidae) from Iran, with remarks on the world fauna

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Abstract

A new pachylaelapid mite species, *Pachyseius angustoides* Babaeian & Mašán **sp. nov.**, is described and illustrated, based on adult females found in leaf litter habitat in southwestern part of Iran (Chaharmahal va Bakhtiari province). The new species is morphologically compared with the most closely related congeneric species, *Pachyseius angustus* Hyatt, 1956, and an updated list of the world fauna of the genus is provided.

Key words: Female; Mesostigmata; *Pachyseius angustoides*; Parasitiformes; taxonomy.

Introduction

Pachyseius Berlese, 1910 is a small group of edaphic predatory animals distributed mainly in the Palaearctic region and currently includes 26 valid species based on the type specimens from Europe (14 spp.) and Asia (12 spp.), excluding those which have been synonymized or incorrectly classified in the genus at some time (see Table 1). In the genus, altogether 10 newly described species were established and introduced in various taxonomic papers during the last three years: Mašán and Fend'a (2014) described one species from Romania, Özbek and Halliday (2014, 2015) described four species from Turkey, Marchenko (2015) described one species from Russia (South Siberia), Mašán and Özbek (2016) described two species from Bulgaria and Romania, respectively, and Babaeian *et al.* (2016) and Ahadiyat *et al.* (2016) each described one species from Iran. Our aim in this paper is to describe a new soil-inhabiting species of *Pachyseius*, compare it with other noticeably similar species *Pachyseius angustus* Hyatt, 1956 and provide an updated list of the world fauna of the genus.

Material and methods

Mites were extracted from soil and leaf litter using Berlese-Tullgren funnels and picked out under a stereomicroscope. After clearing in Nesbitt's fluid, specimens were mounted in Faure's medium on permanent microscope slides. Morphological observations, measurements, and illustrations were made using a BX51 phase contrast Olympus microscope equipped with a drawing tube and digital photo system. Our figures were performed with CorelDRAW Graphics Suite X7 software, based on the scanned line drawings. Measurements were made from slide-mounted specimens, and presented as ranges (minimum–maximum) in micrometers (μm). Lengths of shields and legs were

measured along their midlines, and widths at their widest point (if not otherwise specified in the description). Idiosomal and gnathosomal setae were measured from the bases of their insertions to their tips, legs I–IV with coxa but without pretarsal ambulacrum. The terminology of dorsal and ventral chaetotaxy follows Lindquist and Evans (1965). The setal nomenclature for the legs is that of Evans (1963). Identification of pore-like structures on the idiosomal integument is based on the morphological observations of Athias-Henriot (1969); notation for these structures, such as adenotaxy and poroidotaxy, follows Johnston and Moraza (1991).

***Pachyseius angustoides* Babaeian & Mašán sp. nov. (Figs. 1–9)**

Type material

Holotype (ARS-20161003-1a): female, Iran, Chaharmahal va Bakhtiari province, Shahrekord County, Saman region, Dashti village, 32° 32' N, 50° 51' E, altitude 1884 m a.s.l., 27 September 2010, E. Babaeian coll., in leaf litter. Paratype (ARS-20161003-1b): one female, the same data as holotype. The type specimens are deposited in the Acarological Collection, Jalal Afshar Zoological Museum, Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran.

Diagnosis (female)

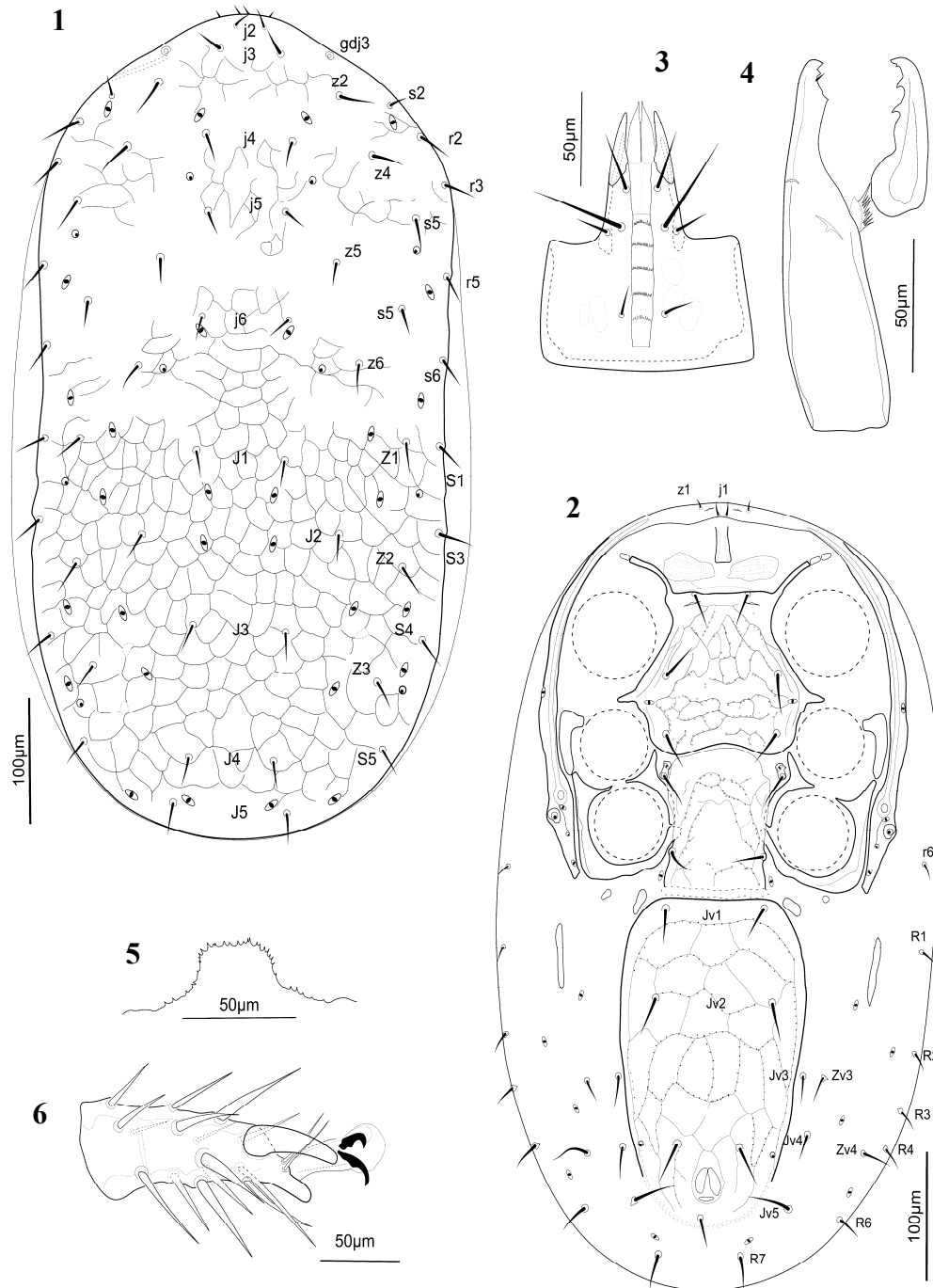
Dorsal shield with 30 pairs of needle-like setae and delicate punctate-reticulate pattern; gland pores *gdj3* modified and enlarged, cavity-like. Presternal shield weakly sclerotized and defined, transversely striated, and with fine micropunctuation on surface. Ventral shields with delicate punctate-reticulate pattern on entire surface. Metapodal shields well separate from anterolateral margins of ventrianal shield. Post-stigmatic section of peritrematal shields terminally truncates, reaching slightly beyond coxa IV, with one enlarged and cavity-like gland pore close to stigma. Ventrianal shield suboval, slightly widened in anteromedial portion, bearing only two pairs of preanal setae. Soft integument in parapodal regions with one pair of larger suboval platelets and one pair of smaller rounded platelets. Lateral and opisthogastric soft integument with 12 pairs of setae. Tarsus II with one enlarged and spur-like seta.

Description (female)

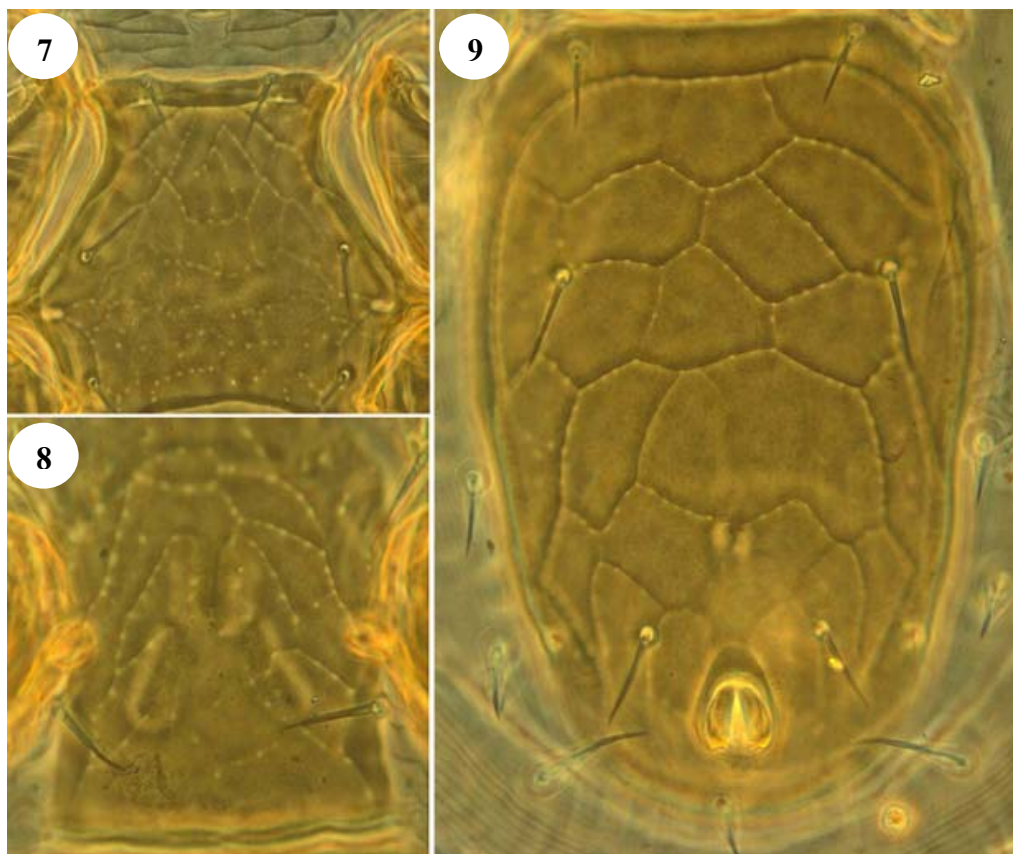
Dorsal idiosoma (Fig. 1) – Dorsal shield 614–624 long and 334–346 wide, suboval, with delicate punctate-reticulate pattern on entire surface, and a complement of 30 pairs of simple, smooth, short and subequal setae: 18 pairs (*j1–j6*, *z1*, *z2*, *z4–z6*, *s2*, *s4–s6*, *r2*, *r3*, *r5*) on podonotum and 12 pairs (*J1–J5*, *Z1–Z3*, *S1*, *S3–S5*) on opisthonotum, clunal setae *J5* 28–30 long. Dorsal shield with complement of 21 pairs of discernible pore-like structures (8 podonotal, 13 opisthonotal), of which 5 (3 podonotal, 2 opisthonotal) superficially appear secretory gland pores and 16 (5 podonotal, 11 opisthonotal) nonsecretory lyrifissures; gland pores *gdj3* modified and enlarged, cavity-like.

Ventral idiosoma (Fig. 2) – Tritosternal base narrow and long; laciniae long and densely pilose. Presternal shield weakly sclerotized, transversely lineate, and with fine micropunctuation on cell areas. Sternal shield 119–124 long and 101–104 wide (at the level of setae *st2*), with short anterolateral corners, straight or slightly concave anterior margin, well-developed mediolateral corners, moderately concave posterior margin, 3 pairs of sternal setae, and 2 pairs of lyrifissures. Metasternal shields small and suboval, each with a seta and a lyrifissure. Endopodal shields between coxae III and IV well-developed, subtriangular. Epigynal shield 120–124 long and 79–84 wide (at the level of genital

setae), oblong, subrectangular, and straight posteriorly; genital setae inserted close to lateral margins of the shield; genital pores situated on soft cuticle, outside the shield. Peritrematal shields normally developed, with anterior section fused to dorsal shield, bearing 2 gland pores and 3 lyrifissures (1 gland pore enlarged, cavity-like); posterior end of peritrematal shields free, obliquely truncated and reaching the posterior margin of exopodal shield III-IV.



Figures 1–6. *Pachyseius angustoides* Babaeian & Mašán **sp. nov.** (female) – 1. Dorsal view of idiosoma; 2. Ventral view of idiosoma; 3. Ventral view of gnathosoma; 4. Chelicera; 5. Epistome; 6. Tarsus II.



Figures 7–9. *Pachyseius angustoides* Babaeian & Mařán **sp. nov.** (female, sculpture of ventral shields) – 7. Presternal and sternal shield; 8. Epigynal shield; 9. Ventrianal shield. Not scaled.

Soft integument between parapodal portion of exopodals III-IV and anterolateral margins of ventrianal shield with two pairs of small, suboval to rounded platelets; the pair situated more closely to ventrianal shield obviously larger. Exopodal shields II-III and III-IV separate, free from peritrematal shields. Lateral and ventral soft integument with 12 pairs of setae and 5 pairs of lyrifissures. Ventrianal shield 236–248 long and 154–166 wide, tongue-shaped, almost straight anteriorly, moderately widened in anteromedial part, widely rounded posteriorly; bearing 2 pairs of preanal setae, and a pair of adanal gland pores close to posterolateral margins of the shield (at level of adanal setae); cribrum normally developed. All ventral shields with delicate punctate-reticulate pattern on entire surface (Figs. 7–9). Ventrally positioned setae similar in length and form to those on dorsum.

Gnathosoma (Figs. 3–5) – Hypostome and subcapitulum normal for the genus. Corniculi horn-like, with acute tip; hypostomal and palpcoxal setae simple, smooth and needle-like; deutosternal groove with five transverse rows of fine denticles; internal malae apically pointed, reaching beyond the corniculi (Fig. 3). Chelicera with bidentate digits; movable digit (57–59) nearly as long as fixed digit (60–62), with fringed hyaline arthrodistal process at its base; pilus dentilis setiform and minute (Fig. 4). Palptarsal apotele three-tined, basal tine slightly shorter. Epistome with well denticulate anterior margin and relatively flat apex (Fig. 5).

Legs – All legs with well-developed ambulacra and claws. Setation of legs I–IV normal for the genus; tarsus II with one spur-like seta (Fig. 6), tarsus IV with 18 setae.

Length of legs I 460–470, II 352–366, III 298–312, IV 418–426.

Male and immature stages – Unknown.

Etymology

The species name is derived from the epithet of the most similar congeneric species (*angustus*) and the Greek suffix *-oides* (resembling); similar to *Pachyseius angustus*.

Remarks

By having short dorsal setae, weakly sclerotized presternal shield, free post-stigmatic section of peritrematal shields with an enlarged cavity-like gland pore close to stigma, fragmented exopodals, 2 pairs of pre-anal setae and 12 pairs of setae on lateral and opisthogastric soft integument, *Pachyseius angustoides* Babaeian & Mašán **sp. nov.** is closely related to *P. angustus*, but the new species can be distinguished from it by a combination of the characters such as form of idiosoma (stouter and more widely suboval in *P. angustoides* Babaeian & Mašán **sp. nov.**, but relatively more elongated and narrower in *P. angustus*; with length/width of idiosoma \approx 1.65 in *P. angustoides* Babaeian & Mašán **sp. nov.** and 2.1 in *P. angustus*), sculpture pattern of sternal, epigynal and ventrianal shields (reticulation is present on entire surface of the shields in *P. angustoides* Babaeian & Mašán **sp. nov.**, but is faint and developed only on anterior portion of sternal shield in *P. angustus*; the ventrianal shield of *P. angustus* is having only three parallel, curved and transversely oriented striae), placement of genital pores (outside the epigynal shield in *P. angustoides* Babaeian & Mašán **sp. nov.**, but on posterolateral angles of the shield in *P. angustus*), posterior end of peritrematal shields (truncate in *P. angustoides* Babaeian & Mašán **sp. nov.**, but tapered in *P. angustus*), number of platelets between ventrianal shield and exopodals III-IV (2 pairs in *P. angustoides* Babaeian & Mašán **sp. nov.**, but 3 pairs, if not absent, in *P. angustus*), shape of epistome (with rounded anterolateral angles in *P. angustoides* Babaeian & Mašán **sp. nov.**, and small anterolateral cusps in *P. angustus*), and setation of tarsus II (with 1 spur-like seta in *P. angustoides* Babaeian & Mašán **sp. nov.**, but with 3 such setae in *P. angustus*).

Above mentioned comparison is based on the type specimen of *Pachyseius angustus* that has been recently revised by one of us (Mašán 2007, p. 211). He amended some complementary characters and metric data to the original description of Hyatt (1956), including the number of marginal and ventral setae on soft idiosomal integument (in *P. angustus*, there are setae r6 omitted in the original illustrations and description).

Remarks on the world fauna of *Pachyseius*

Berlese (1910) proposed *Pachyseius* as a monobasic genus, with *Pachyseius humeralis* Berlese, 1910 as its type species. It has sometimes been considered as a synonym of *Neoparasitus* Oudemans, 1901, or as a valid genus, in the family Neoparasitidae Oudemans, 1939 (Vitzthum 1942; Baker and Wharton 1952; Evans 1957). Later, Koroleva (1977) placed *Pachyseius* in the family Pachylaelapidae, but Karg (1971, 1993) classified the genus in the family Macrochelidae rather than the Pachylaelapidae. Although most other authors have placed *Pachyseius* in the family Pachylaelapidae (Evans and Till 1979; Mašán 2007), the systematic position of the genus in the family seems to be uncertain and provisional.

A world checklist of the genus (as a part of the checklist of the family Pachylaelapidae) was presented by Mašán and Halliday (2014). In their paper, the authors

provided a list of 17 valid *Pachyseius* species known to that time. Our own recent survey of the global *Pachyseius* fauna is presented in Table 1. The data on the individual species, presented in the table, include the names of all the species once classified in the genus, reference to their authorship, original generic placement (generic name under which the species has been originally described) together with the current generic position for each species, synonyms within the genus if any, references to important taxonomic works on the classification of the species, and short notes on geographic origin of the holotype specimens.

Table 1. Alphabetical list of the 36 species which are or have been included in the genus *Pachyseius* (in alphabetical order), with some additional data on taxonomic classification, bibliography and distribution of individual species (* – valid *Pachyseius* species).

Species included in <i>Pachyseius</i>	Reference to description	Original generic	Current generic position (if changed)	Reference to revision	Location of type locality (country)
<i>accedens</i> *	Mašán & Özbek (2016)	<i>Pachyseius</i>	—	—	Europe (Bulgaria)
<i>adeliensis</i>	Womersley (1937)	<i>Pachyseius</i>	unknown (dubious species)	Mašán & Halliday (2014)	Antarctica
<i>angustiventris</i> *	Willmann (1935)	<i>Pachyseius</i>	—	—	Europe (Belgium)
<i>angustus</i> *	Hyatt (1956)	<i>Pachyseius</i>	—	—	Europe (British Isles)
<i>anisimovi</i> *	Marchenko (2015)	<i>Pachyseius</i>	—	—	Asia (Russia, South Siberia)
<i>arrhenobasis</i> *	Mašán & Özbek (2016)	<i>Pachyseius</i>	—	—	Europe (Romania)
<i>cavernicolus</i> *	Ishikawa (1989)	<i>Pachyseius</i>	—	—	Asia (Japan)
<i>chenpengi</i> *	Ma & Yin (2000)	<i>Pachyseius</i>	—	—	Asia (China)
<i>cicaki</i> *	Mašán & Mihál (2007)	<i>Pachyseius</i>	—	—	Europa (Bulgaria)
<i>complanatus</i>	Kramer (1876)	<i>Gamasus</i>	unknown (Ologamasidae?)	Mašán & Halliday (2014) as <i>Pachyseius</i> : Oudemans (1939)	not stated
<i>crymophilus</i> *	Mašán & Fend'a (2014)	<i>Pachyseius</i>	—	—	Europa (Romania)
<i>destitutus</i> *	Özbek & Halliday (2015)	<i>Pachyseius</i>	—	—	Asia (Turkey)
<i>friedrichi</i> *	Mašán (2008)	<i>Pachyseius</i>	—	—	Europa (Germany)
<i>huanrenensis</i> *	Chen <i>et al.</i> (2009)	<i>Pachyseius</i>	—	—	Asia (China)
<i>humeralis</i> *	Berlese (1910)	<i>Pachyseius</i>	—	—	Europa (Italy)
<i>insculptus</i>	Keegan (1946)	<i>Pachyseius</i>	<i>Cheiroseius</i> (Blattisociidae)	Hennessey & Farrier (1988)	North America (USA)

Table 1. Continued.

Species included in <i>Pachyseius</i>	Reference to description	Original generic position	Current generic position (if changed) & synonymy	Reference to revision	Location of type locality (country)
<i>iraola</i> *	Moraza (1993)	<i>Pachyseius</i>	—	—	Europe (Spain)
<i>jacobsonianus</i>	Berlese (1911)	<i>Pachyseius</i>	<i>Neoparasitus</i> (Neoparasitidae)	Maśán & Halliday (2014)	Asia (Indonesia, Java)
<i>malimingi</i>	Bei <i>et al.</i> (2010)	<i>Pachyseius</i>	<i>Mirabulbus</i> (Pachylaelapidae)	Maśán & Halliday (2014)	Asia (China)
<i>masani</i> *	Özbek & Halliday (2014)	<i>Pachyseius</i>	—	—	Asia (Turkey)
<i>masanisimilis</i> *	Ahadiyat & Ghasemi Moghadam (2016)	<i>Pachyseius</i>	—	—	Asia (Iran)
<i>molossus</i>	Berlese (1923)	<i>Pachyseius</i>	<i>Neoparasitus</i> (Neoparasitidae)	Maśán & Halliday (2014)	Asia (Indonesia, Sumatra)
<i>morazae</i> *	Maśán & Mihál (2007)	<i>Pachyseius</i>	—	—	Europe (Bulgaria)
<i>morenoi</i>	Moraza (1993)	<i>Pachyseius</i>	= <i>angustiventris</i>	Maśán & Özbek (2016)	Europe (Spain)
<i>orientalis</i> *	Nikolsky (1982)	<i>Pachyseius</i>	—	—	Asia (Russia, Primorsky Region)
<i>orientalis</i>	Berlese (1910)	<i>Megalolaelaps</i>	<i>Neoparasitus</i> (Neoparasitidae)	Moraza & Johnston (2002) as <i>Pachyseius</i> : Berlese (1913)	Asia (Indonesia, Java)
<i>pachylaelapoides</i> *	Maśán & Mihál (2007)	<i>Pachyseius</i>	—	—	Europe (Bulgaria)
<i>persicus</i> *	Babaeian & Maśán (2016)	<i>Pachyseius</i>	—	—	Asia (Iran)
<i>quadrigeminus</i> *	Özbek & Halliday (2015)	<i>Pachyseius</i>	—	—	Asia (Turkey)
<i>quartus</i>	Vitzthum (1926)	<i>Pachyseius</i>	<i>Neoparasitus</i> (Neoparasitidae)	Vitzthum (1941)	Asia (Indonesia)
<i>sinicus</i> *	Yin <i>et al.</i> (1986)	<i>Pachyseius</i>	—	—	Asia (China)
<i>siranensis</i> *	Özbek & Halliday (2014)	<i>Pachyseius</i>	—	—	Asia (Turkey)
<i>slavicus</i> *	Maśán (2007)	<i>Pachyseius</i>	—	—	Europa (Slovakia)
<i>spectandus</i>	Castagnoli & Pegazzano (1985)	<i>Pachyseius</i>	unknown (<i>nomen nudum</i>)	—	Asia (Indonesia, Java)
<i>strandtmanni</i> *	Solomon (1982)	<i>Pachyseius</i>	—	—	Europe (Romania)
<i>wideventris</i> *	Afifi & Nasr (1984)	<i>Pachyseius</i>	—	—	Europe (Netherlands)

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گونه جدیدی از *Pachyseius Berlese* (Acari: *Pachylaelapidae*) از ایران،
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چکیده

گونه جدیدی از کنه‌های پاکی لاپید به نام *Pachyseius angustoides* Babaeian & Mašán sp. nov. بر اساس ماده‌های جمع‌آوری شده از خاک‌برگ از جنوب غرب ایران (استان چهارمحال و بختیاری)، توصیف و ترسیم می‌شود. گونه جدید از نظر ریخت‌شناسی با نزدیک‌ترین گونه، *Pachyseius angustus* Hyatt, 1956 مقایسه شده و فهرست به‌روز شده فون جنس مذکور ارائه می‌شود.

واژگان کلیدی: ماده؛ راسته میان‌استیگمایان؛ *Pachyseius angustoides*؛ Parasitiformes؛ آرایه‌شناسی.

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