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Article

Contribution to the Pachylaelapidae (Acari: Mesostigmata) fauna in some parts of Guilan province of Iran

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ABSTRACT

A faunistic study on the family Pachylaelapidae in forest and garden habitats from some regions in Guilan province, northern Iran, was carried out during 2015–2016. The samples were taken from soil, decaying organic matter, especially humus, rotten wood, moss and plant remains. A total of 10 species, belonging to three genera, were collected and identified, among them, *Onchodellus squamosus* Koroleva is newly recorded from Iran. *Onchodellus* and *Pachylaelaps grandis* Koroleva were considered as the most specious genus and the most frequent species, respectively. Some morphological characters and distributions of the species in Iran are discussed herein.

KEY WORDS: Edaphic mites; Eviphidoidea; fauna; forest; Gamasina.

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INTRODUCTION

Mites of the family Pachylaelapidae Berlese, 1913 (Mesostigmata: Eviphidoidea) are relatively poorly known in comparison with other groups of Mesostigmata (Maśán and Halliday 2014a). Members of this group are found in all kinds of decomposing organic matter, especially soil, humus, leaf-litter, moss, dead-wood and plant debris, as well as the nests of mammals, birds and social insects (Maśán 2007). They include a cosmopolitan group of predatory mites with considerable ecological and behavioral diversity (Maśán and Halliday 2014b). They feed on a range of micro-invertebrates and often have common habitat with the family Macrochelidae (Lindquist *et al.* 2009). Many species are associated with coprophilous insects, especially scarabaeid dung beetles, while some genera appear to be exclusively myrmecophilous (Maśán 2007).

Fauna of the family Pachylaelapidae Berlese, 1913 is poorly known in Iran (Ahadiyat *et al.* 2014). Kazemi and Rajaei (2013) listed five genera and 18 species from different provinces of the country, among them some species have been currently transferred into another genus and even another family. Recently, one new record, *Pachylaelaps (Longipachylaelaps) vicarius* Maśán, 2007, and three new species, including *Pachyseius masanisimilis* Ahadiyat & Ghasemi Moghadam, 2016, *P. persicus* Babaeian & Maśán, 2016, and *P. angustoides* Babaeian & Maśán, 2016, have been reported and described from Iran (Ahadiyat *et al.* 2014, 2016; Babaeian *et al.* 2016 a, b). Fauna of pachylaelapid mites in Guilan province, as one of the northern provinces of Iran with various microhabitats, is still

unknown. Nejadghanbar *et al.* (2010) reported an unidentified species of *Pachyseius* Berlese, 1910 from eastern Guilan, and Nazari-Tajani *et al.* (2012) found four species of three genera, including *Olopachys compositus* Koroleva, 1976, *Onchodellus procerus* Mašán, 2003, *Pachylaelaps pectinifer* (G. Canestrini, 1881) and *P. resinae* Karg, 1971 in citrus orchards from Guilan province. The aim of this research is to represent mite species of the Pachylaelapidae in some regions of Guilan province and discuss about their national and worldwide distribution.

MATERIALS AND METHODS

Mite specimens were collected by the senior author (SM) from soil under the broad- and needle-leaved forests and fruit orchards, decaying organic matter especially humus, rotten wood, moss and plant remains from seven regions in Guilan province, including pine forest of Guilan University (37° 19' N, 49° 63' E, altitude: 29 m a.s.l.), forests of Saravan (37° 06' N, 49° 66' E, altitude: 72 m a.s.l.), Imamzadeh Hashem (37° 02' N, 49° 62' E, altitude: 113 m a.s.l.) in Rasht, Astaneh-Ashrafieh Safrabasteh (37° 34' N, 49° 97' E, altitude: -18 m a.s.l.), Shaft Chubar (37° 17' N, 49° 40' E, altitude: 40 m a.s.l.), Rezvanshahr-Talesh Gisoum (37° 67' N, 49° 02' E, altitude: -10 m a.s.l.) and citrus orchards in east of the province from June 2015 to August 2016. They were extracted using Berlese-Tullgren funnels, preserved in 75% ethanol, cleared in Nesbitt's fluid and then mounted on microscope slides using Hoyer's medium in the Acarology Laboratory of Plant Protection Department of Guilan University. The slides were placed in an oven at 45°C for two weeks. Specimens were identified by the relevant taxonomic keys and papers presented by Koroleva (1977b) and Mašán (2007). Precise observation of morphological details and measurements were made using compound microscope equipped with differential interference contrast and phase contrast optical system, and a drawing tube. Measurements are given in micrometres (µm). Lengths of dorsal, sternal, genitiventral, and genitiventral shields were measured from the anterior to posterior margins along their midlines. Maximum widths of dorsal, ventrianal, anal, and genitiventral shields were taken at their widest points. Width of sternal shield was measured at the mid-level of coxae II. Lengths of dorsal setae J1-5 were measured from their bases of their insertions to their tips. Photos were taken by a Leica DM1000 light microscopy equipped with a Canon Camera DS126311. More than one photo were taken for some of the species and selected photos were merged together and arranged into a single photo using Photoshop (version CS6) [computer software]. The specimens examined are partly deposited in the Acarology Collection at the Department of Plant Protection, Faculty of Agricultural Sciences, University of Guilan, Rasht, Iran, and partly deposited in the Acarology Collection of the Department of Entomology, College of Agriculture and Natural Resources, Science and Research Branch, Islamic Azad University, Tehran, Iran.

RESULTS

A total of 10 species, belonging to three genera, were collected and identified, among them eight species are reported for the first time from Guilan province and one species is new for Iran mites fauna. Table 1 shows a list of the species, their habitats, the total number of collected specimens, the collected localities of each species in Guilan province, and their altitudinal ranges (m.s.l.). The list of identified species with some morphological characteristics is as follow:

Pachylaelapidae Berlese, 1913 **Genus *Olopachys* Berlese, 1910**

Pachylaelaps (Olopachys) Berlese, 1910: 256.

Type species: *Pachylaelaps (Olopachys) scutatus* Berlese, 1910, by original designation.

Diagnosis

Dorsal idiosoma with 30 pairs of setae. Setae *J5* usually minute as microsetae or rarely normal in length. Posterolateral margins of dorsal idiosoma with one or two pairs of hypertrophied and slot-like gland pores. Ventral shields well-reticulated. Sternal shield fused to metasternal platelets and endopodal elements, bearing four pairs of setae. Peritrematal shields fused to exopodal elements II–IV, and developed posteriorly. Genitiventrianal shield oval or tongue-like bearing 3–5 pairs of pre-anal and three circumanal setae. Soft integument usually with 10–13 pairs of setae. Hypostomal corniculi long and sword-like. Palp apotele three-tined. Sperm access systems associated with coxae IV. Spermathecal tubes variably formed and sclerotized. Genu I with 13 setae (2-6/3-2). Tarsus II with 1–2 spur-like distal setae (*pl1* ± *pl2*).

Olopachys caucasicus Koroleva, 1976 (Fig. 1)

Diagnosis

Female with dorsal shield 680–800 long, 440–528 wide (length/width ratio: 1.51–1.54). Dorsal shield setae *J1* 84–100, *J2*–3 100–112, *J4* 53–64, *J5* reduced, 16–18 (*J4/J5* ratio: 3.31–3.55). Sternal shield 220–240 long, 120–140 wide (length/width ratio: 1.71–1.83). Genitiventrianal shield 344–416 long, 308–360 wide (length/width ratio: 1.11–1.15). Two pairs of close slit-shaped gland pores on posterolateral margins of dorsal shield. Soft lateral and opisthogastric integument bearing 13 pairs of smooth setae, containing seven and six pairs of opisthogastric and marginal setae, respectively. Tarsus II with two spur-like distal setae. Sperm access system with a short, slightly curved tube.

Material examined – 3 females, Saravan forest, from soil under pine trees, 11 July 2015; 1 female, Rezvanshahr-Talesh Gisoum forest, from moss of oak tree, 24 November 2015; 1 female, Guilan University pine forest, from soil under pine tree, 25 November 2015; 1 female, Saravan forest, from soil under pine tree, 14 June 2016.

Distribution and habitats in Iran – This species was previously found in soil, leaf-litter and decaying trunk of trees in Mazandaran (Nowshahr and Ecology Garden of Nowshahr) and East Azerbaijan (Arasbaran forests) provinces (Ahangaran *et al.* 2010; Mohammad-Dustar-Sharaf *et al.* 2016a, b; Saberi *et al.* 2016).

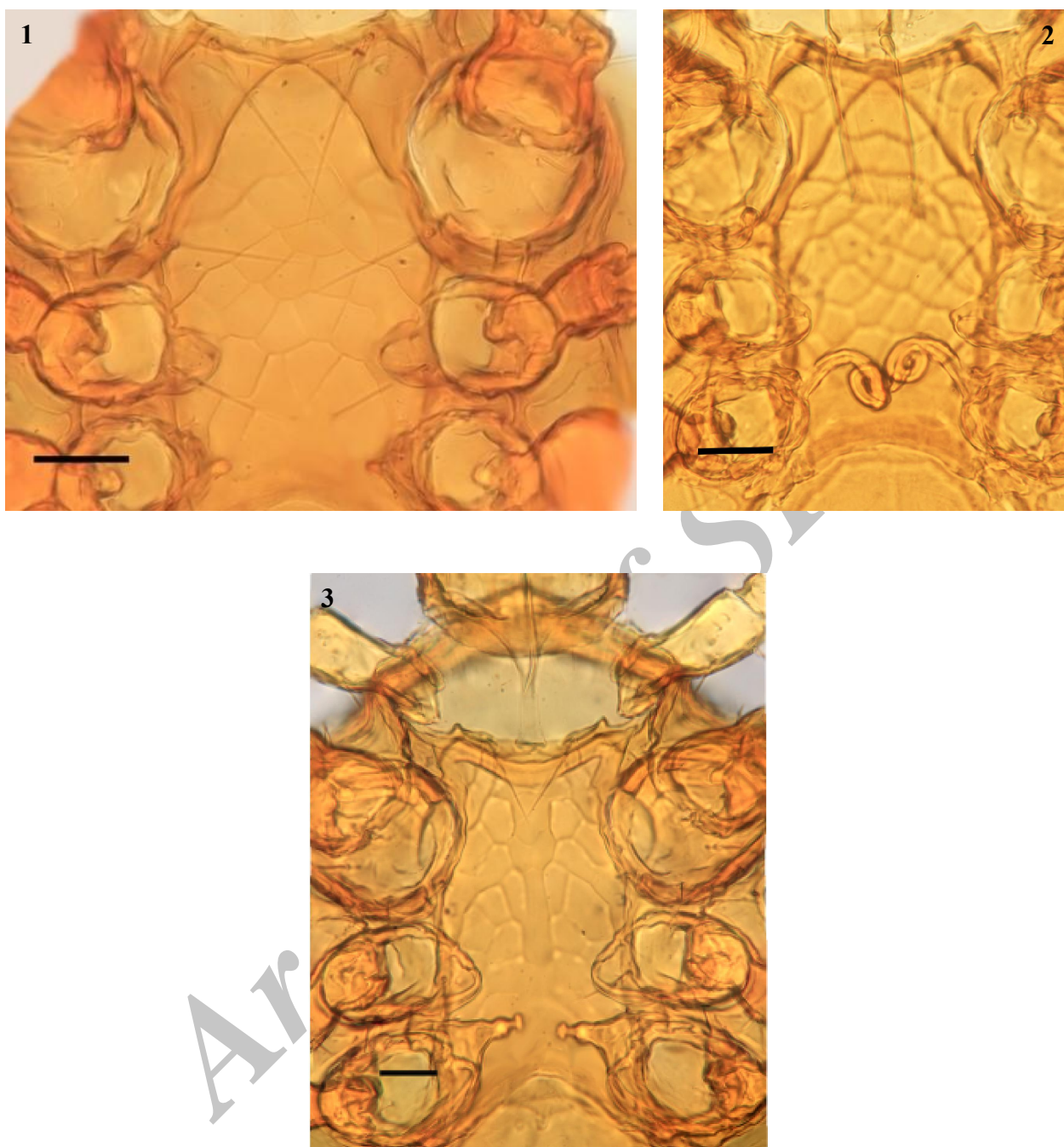
World distribution – Armenia and Georgia (Koroleva 1976, 1977b).

Notes – This is the first record of this species in Guilan province. According to the original description of the species provided by Koroleva (1976) studying an individual female, the length and width of dorsal shield were considered as 690 and 450, respectively, while here we measured six specimens, most of which were longer and wider than the Koroleva's specimen.

Olopachys compositus Koroleva, 1976 (Fig. 2)

Diagnosis

Female with dorsal shield 696–776 long, 496–512 wide (length/width ratio: 1.40–1.51). Dorsal shield setae *J1* 100–116, *J2* 104–120, *J3* 108–128, *J4* 120–136, *J5* reduced 15–16 (*J4/J5* ratio: 8–8.50). Sternal shield 200–240 long, 104–120 wide (length/width ratio: 1.92–2). Genitiventrianal shield 360–408 long, 330–368 wide (length/width ratio: 1.09–1.10). Two pairs of adjacent gland pores *gdZ1* and *gdS4* on posterolateral margins of dorsal shield. Soft lateral and opisthogastric integument bearing 13 pairs of smooth setae, containing seven and six pairs of opisthogastric and marginal setae, respectively. Tarsus II with two spur-like distal setae. Sperm access system with a long, well-developed tube with several bends.



Figures 1–3. Sternal shields in females – 1. *Olopachys caucasicus*; 2. *Olopachys compositus* with tubes of the sperm access systems; 3. *Pachylaelaps pectinifer* with tubes of the sperm access systems. Scale bars = 50 μm .

Material examined – 2 females, Saravan forest, from soil under pine and oak trees, 11 July 2015; 1 female, Saravan forest, from soil under pine and oak trees, 14 June 2016; 4 females, forest areas of the Imamzadeh Hashem, from soil under poplar trees, 17 June 2016.

Distribution and habitats in Iran – This species was found in soil, leaf-litter, plant debris, floor weeds and sheep manure from Golestan (e.g. Minudasht), Guilan (Region not mentioned), Mazandaran (Ecology Garden of Nowshahr, Namak Darreh of Ramsar, Konse Forest of Tonekabon) and Tehran (Rudbar-e Qasran of Shemiranat) provinces (Kazemi and Ahangaran 2011; Ahadiyat and Cheraghali 2012; Kazemi *et al.* 2012; Nazari-Tajani *et al.* 2012; Zakeri *et al.* 2012; Kazemi and Rajaei

2013). It was also found in the nest of an ant, *Tapinoma* sp. (Formicidae), in North Khorasan province (Rezaie *et al.* 2016).

World distribution – Georgia (Koroleva 1976, 1977b)

Genus *Onchodellus* Berlese, 1904

Pachylaelaps (*Onchodellus*) Berlese, 1904: 452.

Type species: *Pachylaelaps* (*Onchodellus*) *reticulatus* Berlese, 1904, by monotypy.

Diagnosis

Dorsal shield with 30 pairs of setae. Setae *J5* normally developed, needle-like. Posterolateral margins of dorsal idiosoma with one or two pairs of gland pores. Sternal shield fused to metasternal platelets and endopodal elements, bearing four pairs of setae. Peritrematal shields fused to exopodal elements, and developed posteriorly. Genitiventral shield enlarged, closely adjacent to subtriangular anal shield. Soft integument with 10–15 pairs of setae. Hypostomal corniculi short and horn-like. Palp apotele three-tined. Sperm access systems associated with coxae III with long and fine spermathecal tubes. Genu I with 12 setae (2-5/3-2). Female tarsus II with one spur-like distal seta (*pl1*). Genu IV and tibia IV each with seven setae (1-4/1-1 and 1-3/2-1, respectively).

***Onchodellus alpinus* (Willmann, 1953)**

Diagnosis

Female with dorsal shield middle-sized, 580 long, 420 wide (length/width ratio: 1.38), oval, well-reticulated. Dorsal shield setae *J1*–2 65, *J3*–4 68, *J5* 33 long (*J4/J5* ratio: 2.06). Posterolateral margins of dorsal shield with one pair of slit-shaped gland pores (*gdS4*) close to seta *S4*, glands *gdZ1* circular. Sternal shield 164 long, 100 wide (length/width ratio: 1.64), well reticulated. Genitiventral shield 200 long, 216 wide (length/width ratio: 0.92), reticulate-lineate. Anal shield subtriangular, smooth, 64 long, 100 wide (length/width ratio: 0.64). Soft lateral and opisthogastric integument bearing 12 pairs of smooth setae. Tarsus II with one spur-like distal seta. Sperm access system with a spermathecal tube long and sac-like basally.

Material examined – 1 female, Saravan forest, from soil under pine tree, 14 June 2016.

Distribution and habitats in Iran – This species was firstly recorded in honey bee hives from Tehran province (Region not mentioned) (Rahmani *et al.* 2006).

World distribution – European countries (e.g. Central Europe, Alps area, Austria, Finland and Slovakia) (Karg 1993; Mašán 2007; Mašán and Mihál 2009; Mašán and Halliday 2014a; Huhta 2016).

Note – This is the first record of this species in Guilan province.

***Onchodellus hispani* (Berlese, 1908)**

Diagnosis

Female with dorsal shield oval, middle-sized, 568 long, 368 wide (length/width ratio: 1.54), marginal section reticulate and median section lineate. Dorsal shield setae *J1* 40, *J2*–3 76, *J4*, *J5* long (*J4* 72, *J5* 44) and slightly differing in length (*J4/J5* ratio: 1.63). Sternal shield 200 long, 100 wide (length/width ratio: 2), lateral and median surfaces reticulate and smooth, respectively. Genitiventral shield 208 long, 224 wide, (length/width ratio: 0.92), median section with no reticulation. Anal shield subtriangular and smooth, 64 long, 120 wide, (length/width ratio: 0.53). Soft lateral and opisthogastric integument with 15 pairs of smooth setae. Tarsus II with one spur-like distal seta.

Material examined – 1 female, Saravan forest, from soil and humus under pine tree, 11 July 2015.

Distribution and habitats in Iran – This species was found in soil from Kerman province (Region not mentioned) (Ahmadi 2002).

World distribution – European countries (e.g. Bulgaria, Italy, Poland and Slovakia) (Karg 1993; Mašán 2007; Mašán and Halliday 2009, 2014a; Mašán and Mihál 2009).

Note – This is the first record of this species in Guilan province.

***Onchodellus siculus* (Berlese, 1892)**

Diagnosis

Male with dorsal shield 576–630 long, 408–440 wide (length/width ratio: 1.41–1.43). Dorsal shield setae *J4* 72–75, *J5* 51–55 (*J4/J5* ratio: 1.36–1.41). Sternogenital and ventrianal regions each bearing five pairs of setae. Opistogastric and lateral idiosoma with 6–7 pairs of setae. Sternogenital region reticulated. Ventrianal region lineate medially. Cheliceral spermatodactyl elongated, about twice as long as cheliceral movable digit, increasingly tapered distally; sperm ducts positioned symmetrically in all sections of spermatodactyle. Terminal part of tarsus II with one spur-like seta *pl1*.

Material examined – 1 male, forest areas of the Imamzadeh Hashem, from soil under poplar tree, 18 January 2016; 1 male, Astaneh-Ashrafieh Safrabasteh forest, from soil under oak tree, 14 June 2016.

Distribution and habitats in Iran – This species was found in soil, foliage, and in association with a scarabaeid beetle, *Pentodon* sp., from Chaharmahal and Bakhtiari (Shahrekord), Hamedan (Region not mentioned), Kerman (Region not mentioned), West Azerbaijan (Miandoab Plain) provinces (Ahmadi 2002; Haddad Irani-Nejad *et al.* 2003; Rostami *et al.* 2010; Babaeian and Kazemi 2011).

World distribution – Finland, Germany, Hungary, Korea, Latvia and Slovakia (Karg 1993; Salmane 2001; Salmane and Kontschán 2005; Mašán 2007; Huhta 2016; Keum *et al.* 2016).

Note – This is the first record of this species in Guilan province.

***Onchodellus squamosus* (Koroleva, 1977) (Fig. 4)**

Diagnosis

Female with dorsal shield 576 long, 379 wide, (length/width ratio: 1.51). Dorsal shield setae *J1*, *J3–4* 80, *J2* 86, *J5* 52 (*J4/J5* ratio: 1.53). Sternal shield 200 long, 120 wide (length/width ratio: 1.66). Genitiventral shield 200 long, 216 wide (length/width ratio: 0.92). Anal shield 76 long, 120 wide (length/width ratio: 0.63). All idiosomal shields well reticulated. Soft lateral and opisthogastric integument with 14 pairs of smooth setae. Tarsus II with one spur-like distal seta *pl1*, 35 long. Sperm access system with a long and thin spermathecal tube which widened distally, basal section of the sperm access system indistinct in the specimen examined.

Material examined – 1 female, forest areas of the Imamzadeh Hashem, from soil under poplar tree, 17 June 2016.

World distribution – Georgia and Taiwan (Koroleva 1977a, b; Ma *et al.* 2008; Mašán and Halliday 2014a).

Note – This is the first record of this species in Iran.

***Onchodellus strigifer* (Berlese, 1892)**

Diagnosis

Female with dorsal shield 568 long, 340 wide (length/width ratio: 1.67), reticulate posteriorly. Setae *J1–2* 39, *J3* 40, *J4* 52, *J5* 24 (*J4/J5* ratio: 2.16). Sternal shield 164 long, 81 wide (length/width

ratio: 2.02). Genitiventral shield 208 long, 204 wide (length/width ratio: 1.01). Anal shield 76 long, 120 wide (length/width ratio: 0.63). Two pairs of slightly adjacent slit-shaped gland pores (*gdZ1*, *gdS4*) on posterolateral margins of dorsal shield. Peritreme extending anteriorly to the level between setae *z1* and *z2*. Soft lateral and opisthogastric integument bearing 11 pairs of smooth setae. Tarsus II with one spur-like distal seta.

Material examined – 1 female, Saravan forest, from soil under oak tree, 11 July 2015.

Distribution and habitats in Iran – This species was found in soil, leaf-litter, plant debris, orchards, green spaces and parks from Tehran province (e.g. Rudbar-e Qasran of Shemiranat) (Ahadiyat and Cheraghali 2012; Baroozeh and Ahadiyat 2012).

World distribution – European countries (e.g. Italy) (Karg 1993; Mašán 2007; Mašán and Halliday 2014a).

Note – This is the first record of this species in Guilan province.

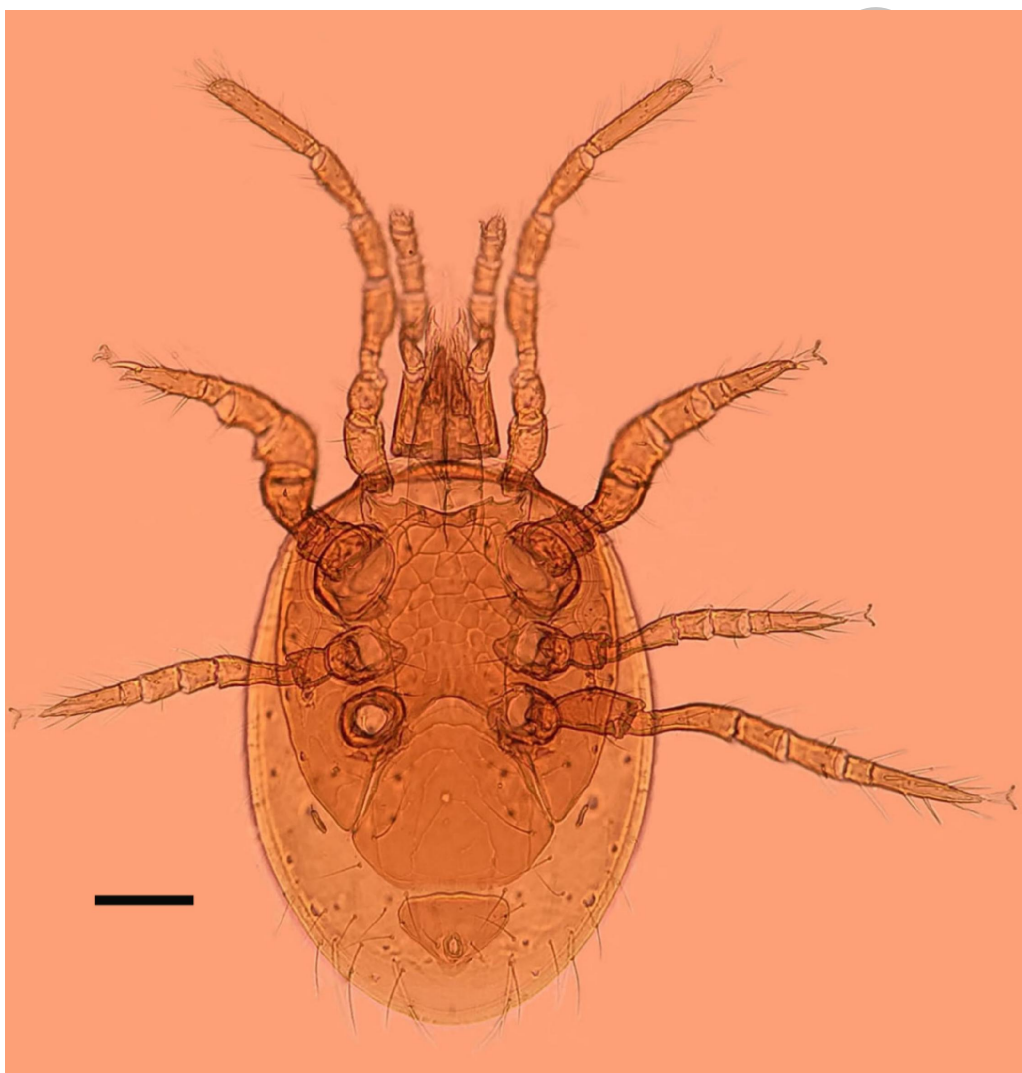


Figure 4. Ventral idiosoma of *Onchodellus squamosus* (female). Scale bar = 100 μ m.

Genus *Pachylaelaps* Berlese, 1888

Pachylaelaps Berlese, 1888: 196.

Type species: *Gamasus pectinifer* G. Canestrini, 1881, by subsequent designation (Berlese 1904).

Diagnosis

Dorsal shield with 30 pairs of setae. Setae *J5* minute as microsetae or normal in length. Posterolateral margins of dorsal idiosoma with one or two pairs of hypertrophied slit-shaped gland pores. Sternal shield fused to metasternal platelets and endopodal elements, bearing four pairs of setae. Peritrematal shields fused to exopodal elements, and developed posteriorly. Genitiventral shield enlarged, closely adjacent to subtriangular anal shield. Soft integument usually with 14–16 pairs of setae. Hypostomal corniculi long and sword-like. Palp apotele three-tined. Sperm access systems associated with coxae IV with variably formed spermathecal tubes. Femur I and genu I each with 13 setae (2-5/4-2 and 2-6/3-2, respectively). Tibia I with 12 setae (2-5/3-2). Female tarsus II with two spur-like distal seta (*pl1* and *pl2*). Genu III with seven setae (1-4/1-1).

Pachylaelaps grandis* Koroleva, 1977Diagnosis*

Female with dorsal shield 920–1040 long, 632–704 wide (length/width ratio: 1.45–1.47). Most of dorsal idiosomal setae long, extending well behind the insertion of next setae. Sternal shield 256–304 long, 128–160 wide (length/width ratio: 1.90–2), reticulated almost in two third anterior half, smooth posteriorly. Genitoventral shield wider than long, 320–360 long, 384–456 wide (length/width ratio: 0.78–0.83), posterior margin straight. Anal shield 96–152 long, 232–256 wide (length/width ratio: 0.41–0.59). Two pairs of adjacent slit-shaped gland pores (*gdZ1*, *gdS4*) on posterolateral margins of dorsal shield. Soft lateral and opisthogastric integument bearing 15 pairs of smooth setae, containing eight and seven pairs of opisthogastric and marginal setae, respectively. Tarsus II with two spur-like distal setae.

Material examined – 3 females, Shaft Chubar forest, from soil under pine and poplar trees, 18 June 2015; 2 females, Astaneh-Ashrafieh Safrabasteh forest, from soil under oak trees, 2 July 2015; 7 females, Saravan forest, from soil under ironwood (*Parrotia persica*, Hamamelidaceae), oak and pine trees, 11 July 2015; 3 females, Shaft Chubar forest, from soil under pine and oak trees, 11 July 2015; 2 females, Rezvanshahr-Talesh Gisoum forest, from soil and moss under pine trees, 24 November 2015; 2 females, Guilan University pine forest, from soil under pine trees, 25 November 2015; 4 females, Shaft Chubar forest, from soil under poplar trees, 9 June 2016; 3 females, Saravan forest, from soil under hawthorn trees, 14 June 2016.

Distribution and habitats in Iran – This species was found in soil, leaf-litter and plant debris in Golestan (Kalale, Minudasht), Mazandaran (Ecology Garden of Nowshahr) and Tehran (Rudbar-e Qasran of Shemiranat) provinces (Ahadiyat and Cheraghali 2012; Zakeri *et al.* 2012; Saberi *et al.* 2016).

World distribution – Armenia, Georgia and Russia (Koroleva 1977a, b; Mařán and Halliday 2014a).

Note – This is the first record of this species in Guilan province.

Pachylaelaps imitans* Berlese, 1920Diagnosis*

Male with dorsal shield 880 long, 608 wide (length/width ratio: 1.44). Two pairs of closely adjacent slit-shaped gland pores on posterolateral margins of dorsal shield. Tarsus II with two spur-like distal setae. Palptibia with two outgrowths, one of which with needle-like apex. Cheliceral spermatodactyl with one small and lobe-like projection.

Material examined – 1 male, Saravan forest, from soil under ironwood, 15 June, 2015.

Distribution and habitats in Iran – This species was found from soil in Kerman province (Region not mentioned) (Ahmadi 2002).

World distribution – Georgia, Israel, Italy, Latvia, Russia, Ukraine and Western Europe (Koroleva 1977b; Salmane 2001; Mašán 2007; Mašán and Halliday 2014a).

Note – This is the first record of this species in Guilan province.

***Pachylaelaps pectinifer* (G. Canestrini, 1881) (Fig. 3)**

Diagnosis

Female with dorsal shield oval, middle-sized, 800–816 long, 496–512 wide (length/width ratio: 1.59–1.61). Dorsal shield simple, needle-like. Setae *J1* 57–60, *J2* 77–80, *J3* 80–83, *J4* 85–88, *J5* 17–18 (*J4/J5* ratio: 4.88–5). Sternal shield 240–272 long, 120–128 wide (length/width ratio: 2–2.12). Genitiventral shield 248–280 long, 280–296 wide (length/width 0.88–0.94). Anal shield subtriangular, 80–96 long, 152–168 wide (length/width ratio: 0.52–0.57). All ventral shields well reticulated. Two pairs of almost adjacent slit-shaped gland pores on posterolateral margins of dorsal shield. Soft lateral and opisthogastric integument bearing 14 pairs of smooth setae, containing six and eight pairs of marginal and opisthogastric setae, respectively. Tarsus II with two spur-like distal setae. Epistome with a distally serrated projection with long, narrow neck. Sperm access system with a well sclerotized Y-shaped tube.

Male with dorsal shield 680–696 long, 400–472 wide (length/width ratio: 1.47–1.70). Dorsal shield setae *J1* 55–60, *J2* 80–88, *J3* 77–80, *J4* 82–84, *J5* 7–8 (*J4/J5* ratio: 10.50–11.71). Palptibia with no outgrowth. Tarsus II with two spur-like setae *pl1* and *pl2*. Cheliceral spermatodactyle elongate, about 1.5 x as long as movable digit.

Material examined – 4 females and 1 male, Astaneh-Ashrafieh Safrabasteh forest, from soil under oak trees, 2 July 2015; 1 male, Shaft Chubar forest, from soil under pine tree, 9 June 2016; 1 female, Astaneh-Ashrafieh Safrabasteh forest, from soil under oak trees, 14 June 2016.

Distribution and habitats in Iran – This species is widely distributed in Iran. It was found in soil, leaf-litter, plant debris, and in association with a scarabaeid beetle, *Copris hispanus* (Linnaeus, 1764), in Chaharmahal and Bakhtiari (Saman, Shahrekord), Fars (Northwestern area), Golestan (Marzankalateh), Guilan (Region not mentioned), Isfahan (Najaf Abad, Mobarake, Kashan), Kerman (Baft, Jiroft), Lorestan (Khorramabad), Mazandaran (Nowshahr), Tehran (e.g. Rudbaar-Qasran of Shemiranat), West Azerbaijan (Miandoab, Urmia) provinces (Jalaeian *et al.* 2004; Ahangaran *et al.* 2010; Babaeian and Kazemi 2011; Bahrami *et al.* 2011; Rajaei *et al.* 2011; Rezaie *et al.* 2011; Sekonji *et al.* 2011; Ahadiyat and Cheraghali 2012; Balooch Shahryari *et al.* 2012; Ghasemi Moghadam and Ahadiyat 2012; Nazari-Tajani *et al.* 2012; Hasanvand *et al.* 2014; Zarei and Kazemi 2014; Abolghasemi and Kazemi 2016; Abutaleb Kermani *et al.* 2017; Shariati *et al.* 2017).

World distribution – Azerbaijan, Croatia, East Russia, France, Georgia, Great Britain, Hungary, Iceland, Israel, Italy, Latvia, Moldova, North Africa, Russia, Slovakia, Ukraine and the USA (Koroleva 1977b; Salmane 2001; Salmane and Kontschán 2005, 2006; Mašán 2007; Kaczmarek *et al.* 2009; Mašán and Halliday 2009, 2014a).

DISCUSSION

Before the present study, only two publications reported four pachylaelapid species (namely *Olopachys compositus*, *Onchodellus procerus*, *Pachylaelaps pectinifer* and *P. resinae*) and one unidentified species of *Pachyseius* from Guilan province (Nejadghanbar *et al.* 2010; Nazari-Tajani *et al.* 2012), while this research shows that soil-inhabiting fauna of the family is relatively highly diversified with 10 species reported. Therefore, this research increases the number of the species of Pachylaelapidae in Guilan to 12 (*Olopachys* with two, *Onchodellus* with six and *Pachylaelaps* with four species). Since the family is widely distributed in many provinces in Iran (e.g. Ahmadi 2002;

Jalaeian *et al.* 2004; Ahangaran *et al.* 2010; Babaeian and Kazemi 2011; Ahadiyat and Cheraghali 2012; Baroozeh and Ahadiyat 2012), Guilan can be considered as one of the most diverse region in the species of Pachylaelapidae in soil microhabitats. The results showed that *Onchodellus* was considered as the most specious genus (five species), and *Pachylaelaps grandis*, as the most frequent species, was widely distributed in Guilan province (in five regions) with the greatest numbers (26 specimens) comparing the other species (Table 1). Saberi *et al.* (2016) found it as one of the most frequent species among the mesostigmatic mites in the same climatic area in the Ecology Garden of Nowshahr, north of Iran. This species is originally collected and described from Georgia, Armenia and Russia (Koroleva 1977a, b; Mašán and Halliday 2014a), which are almost close to the northern regions of Iran. Our study shows that it is distributed in very lowland areas in Guilan province (at the altitudes of -18–72 m a.s.l.) and sounds to prefer to be distributed in north provinces of Iran, containing Golestan, Guilan, Mazandaran and Tehran.

Table 1. Distribution of the pachylaelapid mites collected from various habitats in Guilan province.

Species	Habitat	Number of collected specimens	Collected areas in Guilan province	Altitudinal ranges (m a.s.l.)
<i>Olopachys caucasicus</i>	Moss of oak tree, soil under pine tree	6 ♀	Rezvanshahr- Talesh Gisoum forest, Guilan University pine forest, Saravan forest	-10–72
<i>Ol. compositus</i>	Soil under poplar tree, soil under pine and oak tree	7 ♀	Forest areas of the Imamzadeh Hashem, Saravan forest	72–113
<i>Onchodellus alpinus</i>	Soil under pine tree	1 ♀	Saravan forest	72
<i>On. hispani</i>	Soil and humus under pine tree	1 ♀	Saravan forest	72
<i>On. siculus</i>	Soil under oak tree, soil under poplar tree	2 ♂	Astaneh-Ashrafieh Safrabasteh forest, forest areas of the Imamzadeh Hashem	-18–113
<i>On. squamosus</i>	Soil under poplar tree	1 ♀	Forest areas of the Imamzadeh Hashem	113
<i>On. strigifer</i>	Soil under oak tree	1 ♀	Saravan forest	72
<i>Pachylaelaps grandis</i>	Soil under ironwood, hawthorn, oak and pine tree, soil under pine, oak and poplar tree, soil under pine trees and moss of pine tree	26 ♀	Saravan forest, Shaft Chubar forest, Guilan University pine forest, Rezvanshahr-Talesh Gisoum forest, Astaneh-Ashrafieh Safrabasteh forest	-18–72
<i>P. imitans</i>	Soil under iron tree	1 ♂	Saravan forest	72
<i>P. pectinifer</i>	Soil under pine tree, soil under oak tree	2 ♂, 5 ♀	Shaft Chubar forest, Astaneh-Ashrafieh Safrabasteh forest	-18–40

Olopachys caucasicus was previously recorded in two north and northwest provinces of Iran. Here, Guilan province is considered as the third province for its dispersion. It was originally found in Armenia and Georgia (Koroleva 1976, 1977b), which are located close to the northwestern borders of Iran. The altitudinal distribution of this species is 61–1675 m a.s.l. in Nowshahr County, Mazandaran province (Ahangaran *et al.* 2012), while it was found in very lowland areas at the altitudes of -10–72 m a.s.l. in this research. It is concluded that this species sounds to live in wide ranges of altitudes from low to midland areas. Regarding *Olopachys compositus*, it was originally described from Georgia (Koroleva 1976, 1977b), and reported from five north and northeast provinces of Iran. The species prefers to live in lowland areas at the altitudes of 64–156 m a.s.l. (Ahangaran *et al.* 2012) and 72–113 m a.s.l. (this study), although Koroleva (1976) found an individual specimen at the altitude around 2000 m a.s.l.

Only one individual specimen of *Onchodellus alpinus* was found during the current research (altitude: 72 m a.s.l.). It was distributed in lowland (mostly) to mid or highland areas of Slovakia at the altitudes of 100–1100 m a.s.l. (Mašán 2007; Mašán and Mihál 2009). Ahangaran *et al.* (2012) found some specimens of *On. alpinus*¹ at the altitude of 1410 m a.s.l. in Nowshahr County, Mazandaran province. It seems that this species can live in low to midland areas. This species is a euryhygrophilous edaphic detriticole mite with wide ecological plasticity (Mašán 2007). Although the habitats of *Onchodellus hispani* is only associated with adults and subterranean nests of coprophagous beetles of the genus *Copris* (Mašán 2007; Mašán and Halliday 2009), an individual specimen of this species was here found in soil and humans in a pine forest. The microhabitat of this species was not clearly determined in the forest, but it may be randomly observed in that environment. This species occurs on warm lowland pastures at the altitudes of 170–250 m a.s.l. in Slovakia (Mašán 2007; Mašán and Mihál 2009). The individual specimen of this species was here found at the altitude of 72 m a.s.l. *Onchodellus siculus* is found in different microhabitats, containing compost, moss (Karg 1993), horse excrement, tussock of grass plants, nests of small mammals (Mašán 2007), meadows (Salmane 2001), soil (Rostami *et al.* 2010), seabird nests, seashores, meadows (Huhta 2016), and in association with two scarabaeid species: *Pentodon* sp. (Babaeian and Kazemi 2011) and *Copris ochus* Motschulsky, 1860 (Keum *et al.* 2016). It is distributed in lowland areas at the altitudes of 170–895 m a.s.l. (Mašán 2007), while it was here found in very lowland areas at the altitudes of –18–113 m a.s.l. in Guilan province. Up to now, it has been recorded from five provinces of Iran. *Onchodellus squamosus* was found in soil substrates of forests and different plants (Koroleva 1977a, b; Ma *et al.* 2008). Here, the species was collected from soil under a poplar tree. *Onchodellus strigifer*, which is found in agricultural soils and in high lime content substrates (Karg 1993), was only found in soil in Tehran province (Ahadiyat and Cheraghali 2012; Baroozeh and Ahadiyat 2012). Here, Guilan is considered as the second province for its dispersal.

Pachylaelaps imitans was firstly collected by Ahmadi (2002) from Iran with no additional information on its collection sites. Here, it was collected from soil in a forest. The localities, in which it has been previously found, are soil, compost, moss, forest litter and rodents' nests (Koroleva 1977b; Karg 1993; Salmane 2001). *Pachylaelaps pectinifer* is a hygrophilous edaphic species (Mašán 2007) with almost worldwide distribution. This species is found in woodland and non-woodland areas (Mašán 2007). It prefers open wet substrates (Karg 1993; Mašán 2007; Mašán and Mihál 2009), and occurs in various microhabitats, in 10 provinces of Iran (The names of the provinces and the related references are presented under the name of the species in the section "Distribution and habitats in Iran"). In the current research, it was found in very lowland areas at the altitudes of –18–40 m a.s.l. According to Mašán (2007) and Mašán and Mihál (2009), it is mostly distributed in lowland areas at the altitudes of 120–850 m a.s.l., while Abutaleb Kermani *et al.* (2017) found it at the altitude 1581 m a.s.l. It shows that this species occurs in a wide range of altitudes.

Concerning a widespread pachylaelapid species, *Onchodellus karawaiewi* (Berlese, 1920), which is widely distributed in the Palaearctic region (Koroleva 1977b; Karg 1993; Salmane 2001; Mašán 2007; Mašán and Halliday 2014a), surprisingly no specimens were found during the current research. It has been previously recorded from 16 provinces of Iran (e.g. Kamali *et al.* 2001; Ahmadi 2002; Khademi *et al.* 2006; Seifori *et al.* 2006; Babakfard *et al.* 2008; Babaeian and Kazemi 2011; Rezaie *et al.* 2011; Salarzahi *et al.* 2011; Ahadiyat and Cheraghali 2012; Ahangaran *et al.* 2012; Mahpikaran *et al.* 2012; Zakeri *et al.* 2012; Hasanvand *et al.* 2014; Abutaleb Kermani *et al.* 2017). Although this species can be found in lowland areas in dark and peat soils with high capacity of humus (Karg 1993; Mašán 2007), we could not find it in such similar localities in Guilan province. Moreover, the

¹ According to the description presented in Ahangaran *et al.* (2012), the specimens recorded in that paper as *Onchodellus* cf. *alpinus* was absolutely similar in all morphological characters to *On. alpinus*. Since the authors did not consider any difference between their species with *On. alpinus* there, we here considered it as *On. alpinus*.

previous study carried out by Nazari-Tajani *et al.* (2012) did not record this species in this province. Some factors may be involved in this case. This mite is considered as a euryhygrophilous species growing in humid conditions (Mašán 2007), but during the present study, the soil substrates, in which the pachylaelapid specimens were collected, had been dry in some areas during the spring and summer. In addition, in this study, mite samples were collected only from forest areas, while *On. karawaiewi* is not only found in hard-wood flood-plain forests, but also in non-woodland area (Mašán 2007).

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شرحی بر کنه‌های *Pachylaelapidae* (Acari: Mesostigmata) در برخی از مناطق استان گیلان، ایران

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چکیده

بررسی فون کنه‌های خانواده *Pachylaelapidae* در زیستگاه‌های جنگلی و باغی برخی نواحی استان گیلان، شمال ایران، در طی سال‌های ۱۳۹۴-۱۳۹۵ انجام شد. در این بررسی، نمونه‌ها از خاک، مواد آلی پوسیده، به‌ویژه گیاهخاک، چوب پوسیده، خزه و بقایای گیاهی جمع‌آوری شدند. در مجموع ۱۰ گونه متعلق به سه جنس جمع‌آوری و شناسایی شدند که در بین آنها گونه *Onchodellus squamosus* Koroleva برای نخستین بار از ایران گزارش می‌شود. در بین جنس‌های گزارش شده، *Onchodellus* دارای بیشترین گونه و در بین گونه‌های موجود، *Pachylaelaps grandis* Koroleva به عنوان فراوان‌ترین گونه در نظر گرفته شدند. برخی از ویژگی‌های ریخت‌شناسی و انتشار گونه‌ها در ایران در این مقاله مورد بحث قرار گرفته است.

واژگان کلیدی: کنه‌های خاکزی؛ Eviphidoidea؛ فون؛ جنگل؛ Gamasina.

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