

Article

Additional description of *Hypochthoniella minutissima* (Acari: Oribarida) with a checklist and a key to the enarthronotic oribatid mites of Guilan Province, Iran

Shabnam Mortazavi^{1*}, Jalil Hajizadeh¹ and Mohammad Ali Akrami²

1. Department of Plant Protection, Faculty of Agricultural Science, University of Guilan, Rasht, Iran; E-mails: shmortazavi@msc.guilan.ac.ir; hajizadeh@guilan.ac.ir

2. Department of Plant Protection, College of Agriculture, Shiraz University, Shiraz, Iran; E-mail: akrami@shirazu.ac.ir

* Corresponding author

Abstract

Hypochthoniella minutissima (Berlese, 1904) is newly reported from Guilan Province, Iran. After comparison with the original description and redescrptions, we here provide an expanded description, including illustrations of the adult, based on material collected from Guilan Province, Iran. A checklist and an identification key to the 20 species of enarthronotic oribatid mites of Guilan Province are provided. The genus and subgenus *Eohypochthonius* (*Eohypochthonius*) Jacot, and the species *Eohypochthonius* (*Eohypochthonius*) *magnus* Aoki, *E. (E.) crassisetiger* Aoki, *Cosmochthonius* (*Cosmochthonius*) *plumatus* Berlese, *Brachychthonius impressus* Moritz and *B. hungaricus* (Balogh) are new records for the Iran mite fauna.

Key words: Additional description; Enarthronota; *Hypochthonius minutissimus*; identification key; new record.

Introduction

Oribatid mites are primarily terrestrial species, most of which inhabit soil, litter, bark and foliage. Certain oribatid taxa have also managed to conquer the marine environment but are restricted to littoral zones (Procheş and Marshall 2001). They are actively involved in decomposition of organic matter, in nutrient cycling and in soil formation (Behan-Pelletier 1997). These mites are probably the most numerous of the soil-living mites, with about 10,695 species and subspecies being listed in the latest version of the world oribatid mites catalogue (Subías 2004, updated 2015). According to Akrami (2015) 380 species of oribatid mites have been reported from Iran.

Hypochthoniella minutissima was poorly described by Berlese (1904) as '*Hypochthonius minutissimus*' from Boboli Gardens in Florence (Italy), but there have been some nomenclatural problems for years. Berlese (1910) proposed *Hypochthoniella* as a subgenus of *Hypochthonius* Koch that was subsequently elevated to genus rank by Sellnick (1928). Some authors used the name *Hypochthoniella pallidula* (Koch) for this species (e.g. Sellnick 1928 and Willmann 1931). Van der Hammen (1959) recombined it to *Eniochthonius minutissimus* (Berlese) and placed *E. pallidulus* (Michael) and *E. grandjeani* van der Hammen in synonymy with this species. Marshall (1968) applied

the name *Hypochothoniella minutissimus* for it. Pérez -Íñigo (1969) first used the combination *Hypochothoniella minutissima* that was later used by some authors (e.g. Balogh and Mahunka 1983; Subías 2004, updated 2015). Morphology of the anogenital region of the larva and nymphs of *E. minutissimus* was investigated by Grandjean (1933, 1934) as '*E. pallidulus*'. Norton and Behan-Pelletier (2007) described the ontogeny of *E. mahunkai* and compared leg setation and larval morphology of this species and Nearctic specimens of *E. minutissimus*. Seniczak *et al.* (2009) re-described and illustrated the morphology of all juvenile stages of *Eniochthonius minutissimus*, and compared the ontogeny of it with *Hypochothonius rufulus* Koch. There are some differences between our specimens and those previously described and re-described. So we decided to compose an additional description of the adult of this species based on material collected from Guilan Province Iran.

Enarthronota Grandjean is one of the five supercohorts of the suborder Oribatida. This supercohort contains two cohorts (Euarthronota Balogh and Mahunka and Arthroptyctima, Grandjean). Euarthronota contains five superfamilies (Brachychthonioidea Thor, Cosmochthonioidea Grandjean, Atopochthonioidea Grandjean, Hypochothonioidea Berlese and Lohmannioidea Berlese) and 12 families. The notogaster in these mites is subdivided by one to three furrows. Arthroptyctima contains two superfamilies of ptyctimous mites (Protoplophoroidea Ewing and Mesoplophoroidea Ewing) and two families which have distinct ventral plates on the ventral side showing genital and anal openings well separated by brachypily (Balogh and Mahunka 1983; Subías 2004, updated 2015).

According to Subías (2004, updated 2015), the supercohort Enarthronota contains 68 genera, 12 subgenera, 597 species and 19 subspecies. Studies on enarthronotic oribatid mite fauna in Iran are scarce. The first enarthronotic oribatid mite (*Cosmochthonius ponticus* Gordeeva), reported from Iran was from Urmia, northwest of Iran (Mirfakhraii 1994). Until now, 48 species and two subspecies belonging to six superfamilies, nine families and 22 genera have been reported from Iran (Akrami 2015). Among them only one species, '*Protoplophora iranica* Akrami and Behmanesh', was reported and described as a new taxon for science from Shiraz, Arjan plain (Akrami and Behmanesh 2012).

In the course of this survey, the fauna of enarthronotic oribatid mites (Acari: Oribatida: Macropylina) of Guilan Province was studied. An additional description of *Hypochothoniella minutissima* (Berlese) is provided, because there are some morphological differences between our specimens from Guilan Province and previous descriptions.

Materials and methods

All specimens were collected during 2013–2014 from soil and litter in three areas of Guilan Province, 'Rasht County, Saravan Forest (37° 08.097' N, 049° 39.926' E, 118.3 m), Shaft County, Chubar Forest (37° 06.289' N, 049° 23.843' E, 38.4 m) and Rostamabad City, Salansar (36° 54.121' N, 049° 27.519' E, 546.5 m)'. Samples were taken from different habitats. Each sample contains about two kg soil taken from the surface to a depth of 15 cm. Mites were extracted by Berlese-Tullgren funnel, cleared in Nesbitt's fluid and permanently mounted on slides using Hoyer's medium. The mites were examined under an Olympus BX51 (Olympus Optical Co., LTD., Japan) microscope. The drawings were prepared from slide mounted mites. The unit of measurement is micrometer (µm). All specimens were collected by the senior author.

The voucher specimens of each species are preserved as slide-mounted specimens in the Acarology Laboratory, Department of Plant Protection, Faculty of Agricultural Science at University of Guilan, Rasht, Iran. The systematic and nomenclature used here follows the work of Subías (2004, updated 2015).

Results

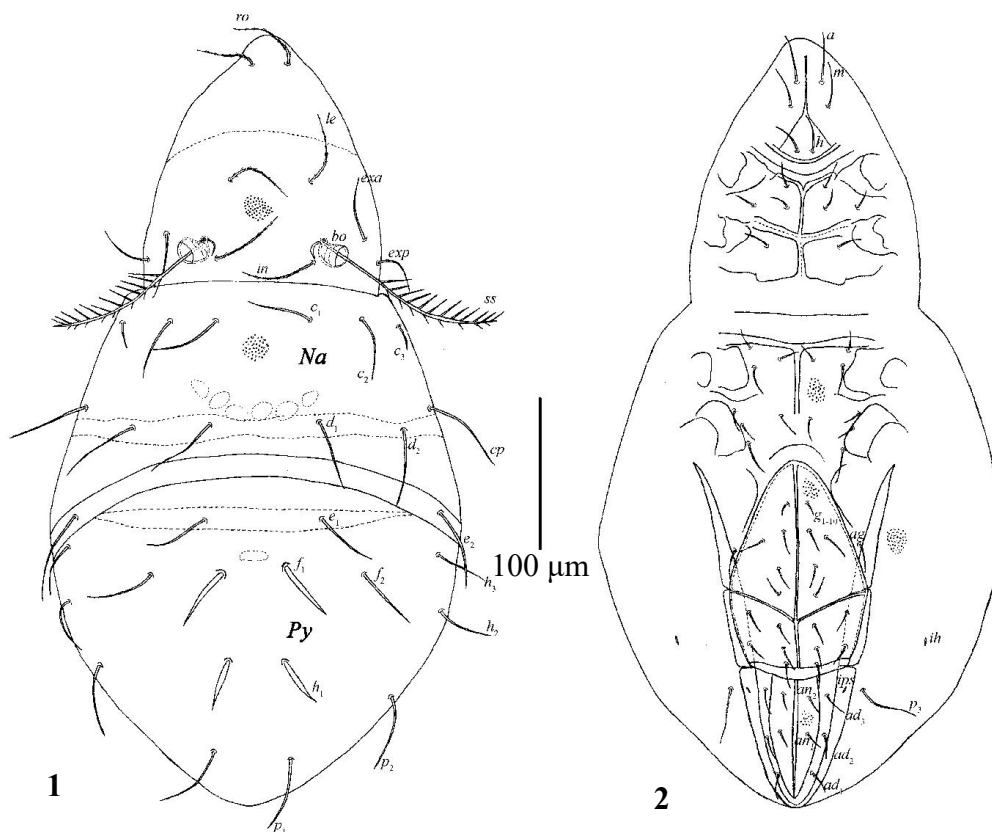
Hypochthoniella minutissima (Berlese) (Figs. 1–8)

Additional description

Measurements – Body length 376–396, width 200–228 (n= 5).

Integument – Body yellowish brown in color; integumental surface densely pitted.

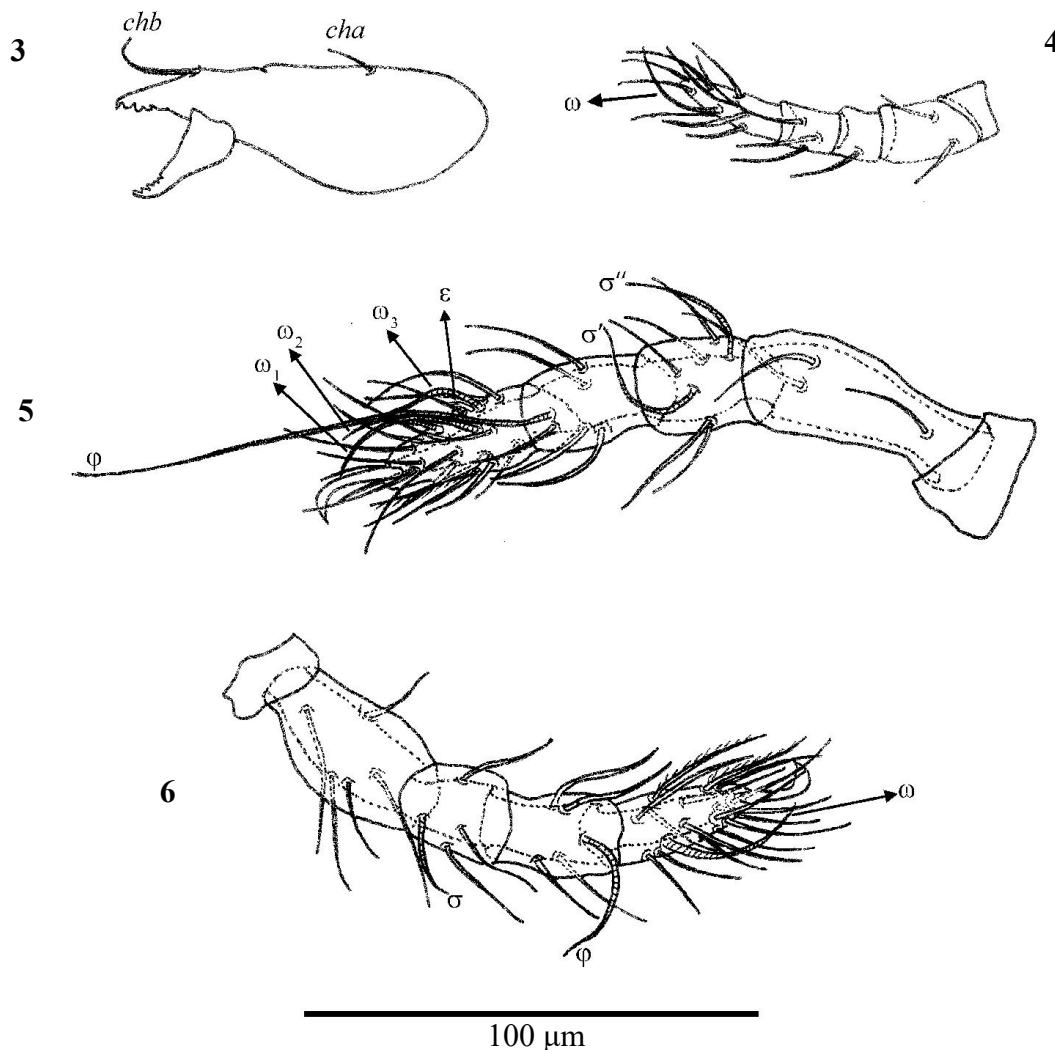
Prodorsum (Fig. 1): Rostrum rounded; all prodorsal setae setiform, rostral ($ro = 46$), lamellar ($le = 46$) and interlamellar ($in = 47$) setae about equal in length, all sparsely barbed, exobothridial setae smooth, anterior setae ($exa = 38$) longer than posterior ones ($exp = 33$); bothridium (bo) completely distinguished with round opening, sensillus ($ss = 103$) long, setiform and asymmetrical with 10–13 long barbs on one side and some short barbs on the other.



Figures 1–2. *Hypochthoniella minutissima* (Berlese, 1904), adult – 1. Dorsal view of body; 2. Ventral view of body.

Notogaster (Fig. 1) – Oval shape in dorsal aspect, widest in row of setae e ; with 16 pairs of smooth medium sized setae, all setiform, except f_1 and h_1 which are fusiform, setae c_3 shortest, c_1 (38), c_2 (38), c_3 (15), cp (46), d_1 (42), d_2 (49), e_1 (38), e_2 (49), f_1 (38), f_2 (40), h_1 (32), h_2 (32), h_3 (32), p_1 (44), p_2 (44), p_3 (30); an incomplete transverse

thickening present at level of setal row *d*, and a distinct posterior furrow between setae of *d* and *f* series; shield *Na* displaying some lighter spots.



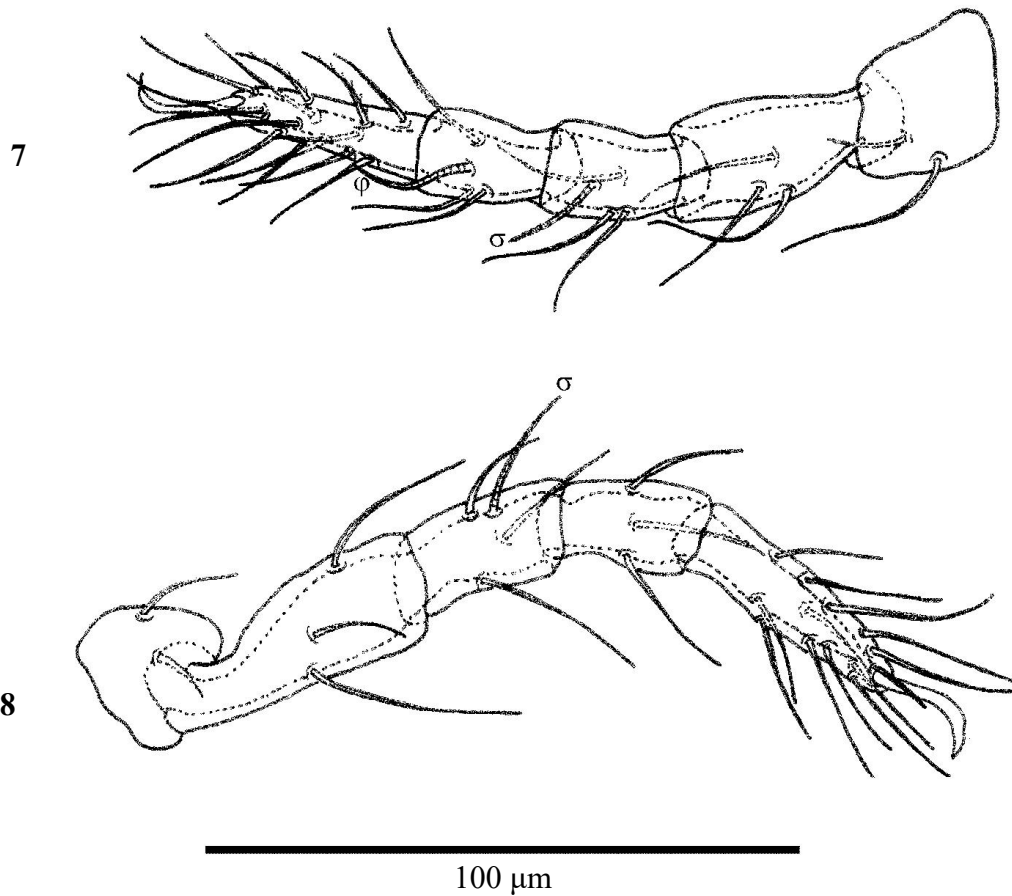
Figures 3–6. *Hypochthoniella minutissima* (Berlese, 1904), adult – 3. Chelicera, left, paraxial view; 4. Palp, right, paraxial view; 5. Leg I; 6. Leg II, all left, paraxial view.

Gnathosoma (Figs. 2–4) – Anterior infracapitular ($a = 30$), median infracapitular ($m = 27$) and mental ($h = 23$) setae setiform, smooth, medium sized, anterior infracapitular setae longest and thickest; chelicerae chelate-dentate, fixed digit with four teeth, movable digit with five teeth, setae *chb* (23) thicker and more than two times longer than *cha* (10), both smooth; palps with five segments, setation formulae: 0-2-1-3-8(1), all setae smooth.

Epimeral region (Fig. 2) – Epimeral setal formula: 3-1-3-4, all setae setiform, smooth and almost equal in length (13).

Anogenital region (Fig. 2) – Genital opening length (123) and anal opening (76), genital and aggenital plates subdivided by an obsolete transverse suture, 10 pairs of genital setae (*g*) grouped in 5+5, one pair of aggenital setae (*ag*), two pairs of anal setae

(*an*) and three pairs of adanal setae (*ad*), all these setae setiform, smooth and almost equal in length (12); lyrifissures *ih* and *ips* distinct.



Figures 7–8. *Hypochthoniella minutissima* (Berlese, 1904), adult 7. Leg III; 8. Leg IV, both left, paraxial view.

Legs (Figs. 5–8) Formulae of leg setae (solenidia): I: 0-3-5(2)-5(1)-18(3), II: 0-5-3(1)-4(1)-16(1), III: 2-3-3(1)-3(1)-14, IV: 2-3-3(1)-3-13, some setae sparsely barbed, tarsus of leg I with one forked famulus; all tarsi monodactyle.

Remarks

The present specimens are morphologically similar to specimens of previous descriptions, but there are some differences as well. For example, integumental surface of these specimens is densely pitted but in Seniczak *et al.* (2009) and Balogh and Mahunka (1983) is described as smooth; prodorsal setae are different, setae *ro*, *le*, *in* and *exa* are almost the same length versus different lengths in Seniczak *et al.* (2009) and Balogh and Mahunka (1983); sensillus with 10–13 long barbs versus 14–15 in Balogh and Mahunka (1983); notogastral setae are much longer than in Seniczak *et al.* (2009); setae *f*₁ and *h*₁ are obviously wider than in Balogh and Mahunka (1983) and Seniczak *et al.* (2009); further, the genital opening is much longer than in Seniczak *et al.* (2009). Measurement comparison of some characters of *Hypochthoniella minutissima* in related references is given in Table 1.

Table 1. Measurement comparison (in μm) of some characters of *Hypochthoniella minutissima* in related references.

Characters*	Berlese (1904) Original description	Seniczak <i>et al.</i> (2009)	Balogh and Mahunka (1983)	This study
Body length	360	378	370–380	376–396
Body width	?	210	180–195	200–228
<i>le</i>	?	12	?	46
<i>in</i>	?	21	?	47
<i>c</i> ₁	?	25	?	38
<i>d</i> ₁	?	20	?	42
<i>f</i> ₁	?	25	?	38
Genital opening	?	65	?	123
Anal opening	?	60	?	76

* Other characters are not given in the literatures, but measurements of all characters of our specimens from Guilan Province are included in the text.

These differences are regarded as insufficient to establish this material as a new species or even subspecies, so we just added an additional description of these specimens to show the variation in *H. minutissima*.

Checklist of Guilan Province enarthronotic oribatid mites

In this survey, a total of 20 enarthronotic oribatid mites species belonging to 12 genera and six families were collected and identified from Guilan Province (Northern Iran). Among them, one genus and subgenus and five species were new records for the mite fauna of Iran, and three families, seven genera, two subgenera and nine species were new records for the mite fauna of Guilan Province, that are marked with one and two asterisks respectively.

Family Hypochthoniidae Berlese

Genus *Hypochthonius* Koch

Hypochthonius luteus Oudemans

Syn.: *Hypochthonius luteus rectosetosus* Krivolutsky

Measurements – Body length 664–720, width 376–384 (n = 5).

Material examined

19 specimens, Saravan Forest, 1 June 2013 and 18 May 2014, soil under raspberry, *Rubus* spp. (Rosaceae) and 16 October 2013, soil under ironwood, *Parrotia persica* (DC.) C.A. Mey (Hamamelidaceae); Chubar Forest, 16 October 2013 and 10 January 2014, soil under pine, *Pinus sylvestris* L. (Pinaceae).

Distribution – Holarctic, Northeast of Oriental region and New Zealand (Subías 2004, updated 2015), including Iran (Bayartogtokh and Akrami 2000; Khanjani and Kamali 2000; Hajian *et al.* 2007; Mortazavi *et al.* 2010; Behmanesh and Akrami 2012; Rajabi *et al.* 2014; Keshavarz Jamshidian *et al.* 2015).

Hypochthonius rufulus Koch

Syn.: *Hypochthonius rufulus brevisetosus* Krivolutsky
Hypochthonius pallidulus Koch

Measurements: Body length 720–760, width 400–448 (n = 5).

Material examined

27 specimens, Saravan Forest, 10 January 2014, soil under walnut, *Juglans regia* L. (Juglandaceae) and 18 May 2014, soil under ironwood; Chubar Forest, 3 January 2013 and 18 June 2013, soil under black alder, *Alnus glutinosa* (L.) (Betulaceae), 11 June and 15 September 2013, soil under loblolly pine, *pinus taeda* L. (Pinaceae).

Distribution: Semicosmopolitan: Holarctic, Oriental (Southeast China and India: West Bengal), Seychelles and Mexico (Subías 2004, updated 2015), including Iran (Akrami and Saboori 2004; Mohammadzadeh 2004; Akrami 2006; Bastan *et al.* 2007; Mortazavi *et al.* 2010).

Genus *Eohypochthonius (*Eohypochthonius*)* Jacot**

***Eohypochthonius* (*Eohypochthonius*) *magnus** Aoki**

Measurements: Body length 376, width 184 (n = 1).

Material examined

1 specimen, Chubar Forest, 3 January 2013, soil under black alder.

Distribution: Holarctic (eastern Palearctic region and USA: Minnesota), China (Subías 2004, updated 2015) and Iran (this study).

***Eohypochthonius* (*E.*) *crassisetiger** Aoki**

Measurements: Body length 376–388, width 184–192 (n= 5).

Material examined

5 specimens, Chubar Forest, 18 June 2013, soil under black alder; Saravan Forest, 10 January 2014, soil under walnut.

Distribution: Southern Palaeartic region: Caucasus and Palaeartic oriental (except in the north), eastern Australia (Subías 2004, updated 2015) and Iran (this study).

Family Eniochthoniidae Grandjean**

Genus *Hypochthoniella* Berlese**

Hypochthoniella minutissima (Berlese)**

Syn.: *Eniochthonius grandjeani* van der Hammen

Measurements: Body length 376–396, width 200–228 (n = 5).

Material examined

5 specimens, Chubar Forest, 18 June 2013, soil under black alder; Saravan Forest, 10 January 2014, soil under walnut and raspberry and 18 May 2014, soil under

ironwood; Salansar, 8 June 2013, soil under pomegranate, *Punica granatum* L. (Punicaceae).

Distribution: Cosmopolitan (except Antarctica) (Subías 2004, updated 2015) and Iran (Akrami 2015).

Family Sphaerochthoniidae Grandjean

Genus *Sphaerochthonius* Berlese

***Sphaerochthonius splendidus* (Berlese)**

Syn.: *Sphaerochthonius dilutus* Sergienko
Sphaerochthonius ovatus Sergienko

Measurements: Body length 240–320, width 136–232, (n = 5).

Material examined

64 specimens, Saravan Forest, 1 June 2013, soil under oak, *Quercus castaneifera* (Fagaceae) and ironwood, 8 June 2013, soil under plum, *Prunus cerasifera* (Rosaceae), 15 September 2013, soil under ironwood, 18 May 2014, soil under raspberry; Salansar, 2 January, 8 June 2013 and 10 January 2014, soil under pomegranate, 16 October 2013, soil under red bark cypress, *Cupressus arizonica* Greene (Cupressaceae) and pomegranate; Chubar Forest, 3 January 2013, soil under loblolly pine, 16 October 2013, soil under loblolly pine and black alder.

Distribution: Pantropical, Neotropical and Subtropical (Subías 2004, updated 2015), including Iran (Khanjani 1996; Bayartogtokh and Akrami 2000; Haddad Irani-Nejad 2003; Akrami 2006; Khademi and Saboori 2006; Bastan *et al.* 2007; Lotfollahi and Haddad Irani-Nejad 2010; Mortazavi *et al.* 2010; Mirzaie *et al.* 2011a; Behmanesh and Akrami 2012; Rahbar *et al.* 2014; Rajabi *et al.* 2014; Keshavarz Jamshidian *et al.* 2015).

Family Cosmochthoniidae Grandjean**

Genus *Cosmochthonius* (*Cosmochthonius*)** Berlese**

Cosmochthonius* (*Cosmochthonius*) *lanatus (Michael)**

Measurements: Body length 340–360, width 220–230 (n = 3).

Material examined

3 specimens, Saravan Forest, 15 September 2013, soil under pine; Salansar, 16 October 2013, soil under walnut and pomegranate.

Distribution: Cosmopolitan (except Australia and Antarctica) (Subías 2004, updated 2015), including Iran (Mirzaie *et al.* 2011a).

***Cosmochthonius* (*C.*) *plumatus** Berlese**

Measurements: Body length 320–328, width 176–180 (n = 2).

Material examined

2 specimens, Salansar, 8 June 2013 and 10 January 2014, soil under pomegranate.

Distribution: Tropical, Neotropical, Oriental (India), southern Holarctic region (Subías 2004, updated 2015), and Iran (this study).

Genus *Phyllozetes* Gordeeva*****Phyllozetes emmae*** (Berlese)**

Syn.: *Trichthonius heterotrichus* Sanyal and Bhaduri

Measurements: Body length 252–260, width 130–132 (n = 2).

Material examined

2 specimens, Salansar, 8 June 2013, soil under pomegranate.

Distribution: Pantropical (except Ethiopian) and Subtropical (Subías 2004, updated 2015), including Iran (Bayartogtokh and Akrami 2000; Haddad Irani-Nejad *et al.* 2004; Akrami 2006; Mirzaie *et al.* 2011b; Behmanesh and Akrami 2012; Khaleghabadian *et al.* 2013; Ramezani and Mossadegh 2014).

Phyllozetes tauricus Gordeeva**

Measurements: Body length 252, width 120 (n = 1).

Material examined

1 specimen, Salansar, 8 June 2013, soil under pomegranate.

Distribution: Southern Palaearctic (Mediterranean and west-central Asia) (Subías 2004, updated 2015), including Iran (Esmaeili *et al.* 2010; Majidi and Akrami 2013).

Family *Brachychthoniidae* Thor****Genus *Brachychthonius*** Berlese*****Brachychthonius impressus** Moritz**

Syn.: *Brachychochthonius subcricoides* Balogh and Mahunka

Measurements: Body length 200, width 116 (n = 1).

Material examined

1 specimens, Saravan Forest, 2 January 2013, soil under pine.

Distribution: Palaearctic (Subías 2004, updated 2015), including Iran (this study).

***Brachychthonius hungaricus** (Balogh)**

Syn.: *Sellnickochthonius rostratus hungaricus* (Balogh)

Measurements: Body length 170, width 98 (n= 1).

Material examined

1 specimens, Saravan Forest, 18 May 2014, soil under raspberry.

Distribution: Southern Palaearctic region and Southeast China (Subías 2004, updated 2015), including Iran (this study).

Genus *Eobrachychthonius* Jacot**

Eobrachychthonius similis Mahunka**

Measurements: Body length 260–288, width 172–208 (n= 3).

Material examined

3 specimens, Saravan Forest, 18 May 2014, soil under raspberry; Rostamabad City, Salansar, 10 January 2014, soil under pomegranate.

Distribution: Southern Europe (Subías 2004, updated 2015) and Iran (Mirzaie *et al.* 2011b).

Genus *Liochthonius* (*Liochthonius*)** van der Hammen**

Liochthonius (Liochthonius) sellnicki (Thor)**

Syn.: *Brachychthonius nodosus* Willmann
Brachychthonius scalaris Forsslund

Measurements: Body length 180–208, width 114–140 (n = 3).

Material examined

3 specimens, Saravan Forest, 18 May 2014, soil under ironwood.

Distribution: Holarctic and Southeast China (Subías 2004, updated 2015) and Iran (Mirzaie *et al.* 2011a).

Liochthonius (L.) strenzkei Forsslund**

Measurements: Body length 176–178, width 120–126 (n = 2).

Material examined

2 specimens, Saravan Forest, 15 September 2013 and 2 January 2014, soil under ironwood.

Distribution: Holarctic and Southeast China (Subías 2004, updated 2015) and Iran (Mirzaie *et al.* 2010b).

Genus *Sellnickochthonius* Krivolutsky**
Sellnickochthonius gracilis (Chinone)**

Measurements: Body length 180–190, width 98–112, (n= 4).

Material examined

4 specimens, Salansar, 8 June 2013 and 10 January 2014, soil under pomegranate; Saravan Forest, 2 January and 15 September 2013, soil under ironwood.

Distribution: Japan and Southeast China (Subías 2004, updated 2015) and Iran (Mirzaie *et al.* 2011b; Rajabi *et al.* 2014).

Family Lohmanniidae Berlese

Genus *Lohmannia* (*Lohmannia*) Michael

***Lohmannia* (*Lohmannia*) *turcmenica* Bulanova-Zachvatkina**

Syn.: *Lohmannia hispaniola* Pérez-Iñigo

Measurements: Body length 840–1040, width 464–544 (n = 5).

Material examined

7 specimens, Saravan Forest, 8 June 2013, soil under orange, *Citrus sinensis* (L.) (Rutaceae) and 16 October 2013, soil under rice, *Oryza sativa* L. (Poaceae).

Distribution: Southern Palaearctic region, Southeastern China and Argentina (Subías 2004, updated 2015), and Iran (Khanjani 1996; Haddad Irani-Nejad *et al.*, 2004; Akrami 2006; Bastan *et al.* 2007; Hajian *et al.* 2007; Lotfollahi and Haddad Irani-Nejad 2010; Mortazavi *et al.* 2010; Behmanesh and Akrami 2012; Majidi and Akrami 2013; Ramezani and Mossadegh 2014; Keshavarz Jamshidian *et al.* 2015).

Genus *Papillacarus* Kunst

***Papillacarus aciculatus* (Berlese)**

Measurements: Body length 600–624, width 320–340 (n = 5).

Material examined

15 specimens, Saravan Forest, 8 June 2013, soil under white poplar, *Populus alba* L. (Salicaceae) and fig, *Ficus carica* L. (Moraceae), and 10 January 2014, soil under raspberry and pomegranate; Salansar, 8 June 2013, soil under walnut and pomegranate.

Distribution: West central Palaearctic and Vietnam (Subías 2004, updated 2015) and Iran (Akrami and Saboori 2004; Mohammadi and Akrami 2007; Bastan *et al.* 2007; Mortazavi *et al.* 2010; Behmanesh and Akrami 2012; Daneshnia and Akrami 2013; Rajabi *et al.* 2014).

Papillacarus chamartinensis Perez-Inigo**

Measurements: Body length 536–560, width 252–260 (n = 5).

Material examined: (5 specimens), Salansar, 16 October 2013 and 10 January 2014, soil under pomegranate.

Distribution: Spain (Subías 2004, updated 2015) and Iran (Mirzaie *et al.* 2010a; Behmanesh and Akrami 2012; Mortazavi *et al.* 2014; Ramezani and Mossadegh 2014).

***Papillacarus hirsutus* (Aoki)**

Syn.: *Papillacarus arboriseta* Jeleva and Vû

Measurements: Body length 424–456, width 200–220 (n = 5).

Material examined

15 specimens, Saravan Forest, 2 and 18 January 2013, soil under ironwood, 19 February 2013, soil under Buttonwood, *Platanus orientalis* L. (Platanaceae), 18 May 2013, soil under raspberry and pine; Chubar Forest, 18 January and 11 June 2013 and 10 January 2014, soil under black alder; Salansar, 10 January 2014, soil under red bark cypress.

Distribution: Tropical (Ethiopian, Oriental and Polynesia) and south-eastern Palearctic region (Subías 2004, updated 2015) and Iran (Mortazavi and Hajizadeh 2011; Amirazodi and Ostovan 2012).

Key to families, genera and species of enarthronotic oribatid mites of Guilan Province, Northern Iran (adults) (see Balogh and Mahunka, 1983)

1. Body dichiod; all transverse articulations of notogaster fused; genital and anal openings large, meeting each other.....Lohmanniidae Berlese.....2
 - Either notogaster subdivided by 1–4 furrows, or ventral side with distinct ventral plates showing genital and anal openings well separated5
2. Preanal plate wide.....*Lohmannia* (*Lohmannia*) Michael.....*Lohmannia* (*L.*) *turcmenica* Bulanova-Zachvatkina
 - Preanal plate narrow, terminally furcated.....*Papillacarus* Kunst.....3
3. Pygidial setae divers in length, at least f_1 , h_1 and ps_1 of basic chaetom well distinguishable.....*Papillacarus aciculatus* (Berlese)
 - Setae equal in length, basic chaetom of pygidium not recognizable among neotrichial setae4
4. Setae c_1 , d_1 and e_1 smooth.....*Papillacarus chamartinensis* Pérez-Íñigo
 - Setae c_1 , d_1 and e_1 stellately ramifying, composed of 5–6 cilia equal in length.....*Papillacarus hirsutus* (Aoki)
5. Body ptychoid.....Mesoplophoridae Ewing.....*Mesoplophora* (*Mesoplophora*) Berlese.....*Mesoplophora* (*Mesoplophora*) *michaeliana* Berlese
 - Body not ptychoid.....6
6. Notogaster divided by a transverse furrow into two shields.....7
 - Notogaster subdivided by 2–4 furrows into three to five shields.....12

7. All notogastral setae arising on surface of shields, none in furrow.....Eniochthoniidae Grandjean.....
*Hypochthoniella* Berlese.....*Hypochthoniella minutissima* (Berlese)
- One or two pairs of notogastral setae recognizable only by their insertion points within furrow.....8
8. Furrow with insertion points of one pair of setae (*d*); notogaster with 15 pairs of setae.....Sphaerochthoniidae Grandjean.....
*Sphaerochthonius* Berlese.....*Sphaerochthonius splendidus* (Berlese)
- Furrow with insertion points of two pairs of setae (*e*); notogaster with 14 pairs of setae.....Hypochthoniidae Berlese.....9
9. Genital plate subdivided by a transverse suture into two parts; two pairs of anal setae present.....*Eohypochthonius* (*Eohypochthonius*) Jacot.....10
- Genital plate whole without a transverse suture; anal setae vestigial.....*Hypochthonius* Koch.....11
10. Notogastral setae slightly expanded, fusiform; interlamellar setae thick, with minute surface squamae.....*Eohypochthonius* (*E.*) *crassisetiger* Aoki
- Notogastral setae simpler, thin; interlamellar setae setiform.....
*Eohypochthonius* (*E.*) *magnus* Aoki
11. Notogastral setae smooth or finely ciliate; apex of seta *c*₁ considerably projecting beyond insertion point of seta *d*₁; sensillus with 6–8 long lateral branches.....
*Hypochthonius rufulus* Koch
- Notogastral setae serrate-dentate or ciliate on one side; seta *c*₁ extending at most to insertion point of seta *d*₁; sensillus with 13–15 lateral branches.....
*Hypochthonius luteus* Oudemans
12. Notogaster with two furrows; all setae arising on the shields....Brachychthoniidae Thor13
- Notogaster with 3–4 furrows; some notogastral setae arising in the transverse furrow
Cosmochthoniidae Grandjean.....18
13. Seta *d*₂ not in a marginal position, therefore originating considerably more medially from setae *cp-e*₂; suprapleural plates absent.....
*Liochthonius* (*Liochthonius*) van der Hammen14
- Seta *d*₂ in a marginal position, aligned with the longitudinal row of setae *cp-e*₂; 2–4 pairs of suprapleural plates present.....15
14. Sensillar head fusiform, very narrow, hardly expanding, with long, thin and densely arranged spines.....*Liochthonius* (*L.*) *sellnicki* (Thor)
- Sensillar head truncate, thus biapical, asymmetrical, margins of head approximately straight, dorsal margin with densely arranged spines.....
*Liochthonius* (*L.*) *strenzkei* Forsslund
15. Four pairs of suprapleural plates present; insertions of lateral setae on anterior notogastral sclerite separated by sculptural line
*Eobrachychthonius* Jacot.....*Eobrachychthonius similis* Mahunka
- Two or three pairs of suprapleural plates present; insertions of lateral setae on anterior notogastral sclerite not separated by sculptural line.....16
16. Two adanal setae (*ad*₂ and *ad*₃) dilated as blades; three pairs of suprapleural plates present.....*Sellnickochthonius* Krivolutsky.....*Sellnickochthonius gracilis* (Chinone)
- All three adanal setae thin, simple, setiform; two pairs of suprapleural plates present.....*Brachychthonius* Berlese.....17

17. Some median fields of shield *Na* bisected into two halves by a longitudinal line, fields subdivided by transverse lines.....*Brachychthonius impressus* Moritz
 - Midline of shield *Na* with heavily punctuate and usually nearly rounded fields, removed from each other, no transverse lines present.....
*Brachychthonius hungaricus* (Balogh)
18. Notogaster subdivided by four furrows into five shields; setae *e* and *f* widely phylliform; tarsi with claw formula 2-2-2-3.....*Phyllozetes* Gordeeva.....19
 - Notogaster subdivided by three furrows into four shields; setae *e* and *f* resembling palm-leaves; tarsi with claw formula 2-3-3-3.....
*Cosmochthonius* (*Cosmochthonius*) Berlese.....20
19. Setae *e* and *f* distally rapidly acute, apex proper obtuse, distally not filiform; transverse venation of blades well discernible, margins densely ciliate; setae *h* and *ps* widened densely ciliate.....*Phyllozetes emmae* (Berlese)
 - Setae *e* and *f* distally elongately filiform, finely attenuating; transverse venation of blades obsolete, margins with rough, nearly spiniform cilia; setae *h* and *ps* short, with spiniform cilia.....*Phyllozetes tauricus* Gordeeva
20. Seta *d* of notogaster arising in anterior furrow or on its rim, hence their bases connected by it.....*Cosmochthonius* (*C.*) *plumatus* Berlese
 - Bases of notogastral setae *d* not connected by furrow or its rim, arising considerably behind it.....*Cosmochthonius* (*C.*) *lanatus* (Michael)

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توصیف تکمیلی گونه *Hypochthoniella minutissima* (Acari: Oribarida) به همراه
فهرست و کلید شناسایی کنه‌های اریباتید آرترونوتیک استان گیلان، ایران

شبنم مرتضوی^{۱*}، جلیل حاجی‌زاده^۱ و محمدعلی اکرمی^۲

۱. گروه گیاه‌پزشکی، دانشکده علوم کشاورزی، دانشگاه گیلان، رشت، ایران؛ رایانامه‌ها:

hajizadeh@guilan.ac.ir *shmortazavi@msc.guilan.ac.ir*

۲. بخش گیاه‌پزشکی، دانشکده کشاورزی، دانشگاه شیراز، شیراز، ایران؛ رایانامه:

akrami@shirazu.ac.ir

* نویسنده مسئول

چکیده

گونه *Hypochthoniella minutissima* (Berlese, 1904) برای نخستین بار از استان گیلان، ایران گزارش می‌شود. توصیف جامعی به همراه ترسیم فرد بالغ این گونه بر اساس نمونه‌های جمع‌آوری شده از استان گیلان، ایران و در مقایسه با توصیف اصلی و بازتوصیف‌های موجود، ارائه می‌شود. همچنین فهرست و کلید شناسایی ۲۰ گونه از کنه‌های اریباتید آرترونوتیک استان گیلان فراهم شده است. جنس و زیرجنس *Eohypochthonius* (*Eohypochthonius*) Jacot و گونه‌های *E.(E.) crassisetiger* Aoki، *Eohypochthonius* (*Eohypochthonius*) *magnus* Aoki، *Brachychthonius impressus*، *Cosmochthonius* (*Cosmochthonius*) *plumatus* Berlese و *B. hungaricus* (Balogh) Moritz برای فون کنه‌های ایران جدیدند. واژگان کلیدی: توصیف تکمیلی، *Hypochthonius minutissimus*، *Enarthronota*، کلید شناسایی، گزارش جدید.

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