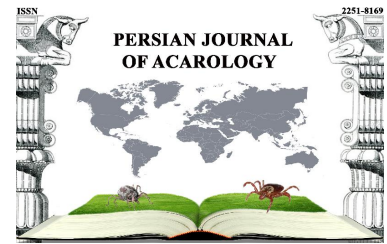




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Article

New records of Bdelloidea (Acari: Trombidiformes: Prostigmata) from Iran with a re-description of *Spinibdella tadjikistanica* Kuznetsov

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ABSTRACT

Spinibdella tadjikistanica Kuznetsov, 1984 and *Cunaxoides paracroceus* Sionti and Papadoulis, 2003 are reported for the first time from Iran. An additional description is provided for *Spinibdella tadjikistanica* based on male collected from East Azerbaijan Province, northwest of Iran.

KEY WORDS: Bdellidae, Cunaxidae, *Cunaxoides*, predatory mites, systematics.

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INTRODUCTION

The Bdelloidea comprises a moderately large assemblage of predatory species grouped in two cosmopolitan families: the Bdellidae and the Cunaxidae. Members of this superfamily are active predators of small arthropods and have high potential as biological control agents in agricultural ecosystems (Walter *et al.* 2009). Bdelloids are associated with a variety of habitats such as leaves, plant aerial parts, bark of trees, weeds and soil (Walter *et al.* 2009).

In the latest classification, the Bdellidae includes 11 genera and five subfamilies. About 280 world species have been considered to belong to this family, of which 37 species have been assigned to *Spinibdella* Thor, 1930 (Paktinat-Saeij *et al.* 2015b; Hernandez *et al.* 2016).

The classification system of the Cunaxidae was mainly established by Den Heyer (1980a, 1981a). Now, about 375 cunaxid species are presently arranged in five subfamilies, six tribes and 27 genera (Skvarla *et al.* 2014).

This work is a part of the prostigmatic mite fauna of Miyaneh county (East Azerbaijan, Iran) and includes data on the superfamily Bdelloidea (Acari, Prostigmata). During taxonomic identification, we found 20 species, two of which is new records for Iran, belonging to the genus *Spinibdella* Thor and *Cunaxoides* Baker and Hoffmann. The main goal of the paper is to re-describe and re-illustrate *Spinibdella tadjikistanica* and to present data on findings of other Bdelloid taxa.

MATERIALS AND METHODS

Soil and rotten leaves under apple trees were taken from Miyaneh region, East Azerbaijan Province. Mites were extracted using a Berlese-Tullgren funnel and put into AGA solution (Smiley 1992). Specimens were cleared in Nesbitt's fluid, mounted in Hoyer's medium (Walter and Krantz 2009), and were examined under a phase contrast microscope (Olympus BX41). Initial illustrations were made using a drawing tube attached to the phase contrast microscope, scanned, and cleaned up using Adobe Illustrator CS6. Body length was measured from the apex of subcapitulum to posterior margin of idiosoma and body width at the level of setae c_2 ; setae were measured from their insertion to their tips; and legs were measured from the ventral insertion of coxae to the base of pretarsi. The setal nomenclature of Kethley (1990) is followed for idiosoma except for the propodosomal setae, which follows the notation given by Fisher *et al.* (2011) and legs follows that Den Heyer (1981b). All measurements are given in micrometers (μm). Variations of leg setal numbers in paranthesis. Prodorsal setae: anterior trichobothria (*at*), posterior trichobothria (*pt*), lateral proterosomal setae (*lps*), median proterosomal setae (*m_{ps}*). Hysterosomal setae: internal humerals (*c₁*), external humerals (*c₂*), internal dorsals (*d₁*), internal lumbals (*e₁*), internal sacrals (*f₁*), external sacrals (*f₂*), internal clunals (*h₁*), external clunals (*h₂*). Anal region: postanals (*ps*), anal setae (*ad* and *an*); Genital region: aggenital setae (*ag*), genital setae (*g*). Ventral hypostomal setae (*vh₁₋₂*), dorsal hypostomal setae (*DHS*). Leg setae: attenuate (sharply) solenidion (*asl*), blunt-pointed rod-like solenidion (*bsl*), peg-like seta (*pe*), trichobothria (*T*), simple tactile seta (*sts*), macroseta (*ms*), duplex setae (*dxs*). Palp setae: solenidion (*s*), dorsal end seta (*DES*), and ventral end seta (*VES*). All specimens are deposited in the Acarological Collection, Department of Plant Protection, Faculty of Agriculture, University of Maragheh, Maragheh, Iran.

RESULTS

Family Bdellidae Dugès, 1834

Subfamily Spinibdellinae Grandjean, 1938

Genus *Spinibdella* Thor, 1930

Type species: *Spinibdella reducta* Thor, 1930, by original designation.

Spinibdella tadjikistanica Kuznetsov, 1984 (Figs. 1–12)

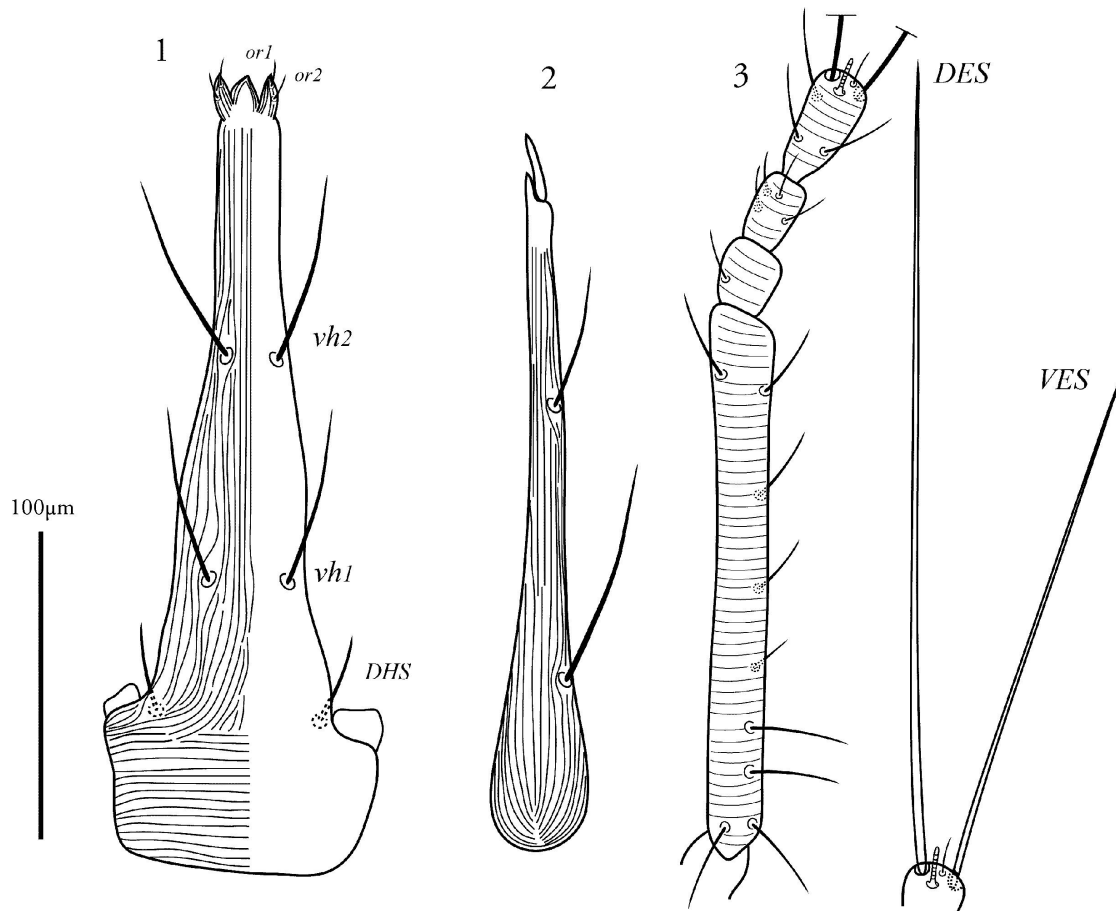
Diagnosis

Setae DHS present; chelicera with two normal setae; palp basifemur with nine setae; two pairs of lateral eyes and one median eye present; center of propodosoma with continuous to sparsely broken transverse striations; *lps* closer to *pt* than to *at*; genua I–III with one duplex setae; tarsi I–II without solenidion.

Male ($n = 4$) – Length of body (including gnathosoma) 896–990; width of body 318–366, length of gnathosoma 268–291; length of chelicera 234–254; leg lengths: I 473–492, II 460–466, III 508–532, IV 536–637; length of tarsi I–IV: 107–123; 114–130; 126–146; 133–152; *VES* 173–186, *DES* 270–283, *DHS* 24–26; palpomers I–V: 12–14, 151–175, 28–30, 23–25, 40–45; *at* 158–162, *lps* 54–62, *pt* 178–180, *m_{ps}* 50–60, *c₁* 61–67, *c₂* 70–73, *d₁* 64–67, *e₁* 63–68, *f₁* 70–76, *f₂* 67–69, *h₁* 85–95, *h₂* 83–85; distance: *at-at* 48–62, *pt-pt* 123–143, *at-lps* 73–82, *pt-lps* 43–47, *c_{1-c1}* 98–120, *c_{1-c2}* 70–78, *c_{1-d1}* 95–96.

Gnathosoma (Figs. 1–3) – Two pairs of ventral hypostomal setae longitudinally aligned (*vh₁₋₂*), *vh₁* 68–74, *vh₂* 66–70 (Fig. 1); hypostome ending in two lateral lips, bearing two adoral setae *or₁₋₂* and with sparsely longitudinal striations, which are transverse at base. Chelicera (Fig. 2) with longitudinal striae and with two setae, proximal seta 88–94 longer than distal seta 66–75, distance

between setae 93–102; movable digit smooth, fixed digit straight, smooth and slightly shorter than movable digit. Palp (Fig. 3) chaetotaxy: trochanter 0, basifemur 9 sts, telofemur 1 sts, genu 4 sts, tibiotarsus 4 sts, 1s, 2 long end setae (*VES*, *DES*).



Figures 1–3. *Spinibdella tadjikistanica* Kuznetsov, 1984 (male) – 1. Subcapitulum; 2. Chelicera; 3. Palp.

Dorsum (Figs. 4–5) – Center of propodosoma with continuous to sparsely broken transverse striations and lateral margins longitudinally striated (Fig. 4); *at* and *pt* slender and nude (Fig. 4). Two pairs of eyes posterolateral to *pt* with transverse striae between each pair between each pair and one median eye present (Fig. 4). Setae *lps* closer to *pt* than to *at*. Dorsal striae of hysterosoma with continuous to sparsely broken striae; dorsal setae minutely barbed (Fig. 5).

Venter (Figs. 6–8) – Ventral setae nude; genital plates each with 14–15 setae longitudinally; 19–20 aggenital setae present (Fig. 7); anal valves with three pairs of pseudanal setae (*ps1–ps3*), *ps1* 62–75, *ps2* 46–66, *ps3* 36–44; one pair of setae, one pair of setae (*vi*) present between coxae III. Setal formula on periphery of amphiod sclerites (Fig. 8) 5-3-2.

Legs (Figs. 9–12). Leg chaetotaxy: coxae I–IV 10/11-8-7/6-6 sts; trochantera I–IV 1-1-2-1 sts; basifemora I–IV 11-8/10-8-3 sts; telofemora I–IV 9 sts-8 sts-4/5 sts, 1 ms- 5 sts, 1 ms; genua I–IV 1duplex (*dxs*), 6 sts- 1duplex, 6 sts- 1duplex, 6 sts- 7 sts; tibiae I–IV 1asl, 1bsl, 1pe, 15 sts, 1T- 1bsl, 13 sts- 1asl, 14 sts- 13 sts, 1T; tarsi I–IV 1asl, 2bsl, 1pe, 30 sts- 2bsl, 1pe, 29 sts- 31 sts, 1T- 27/26 sts, 1T.

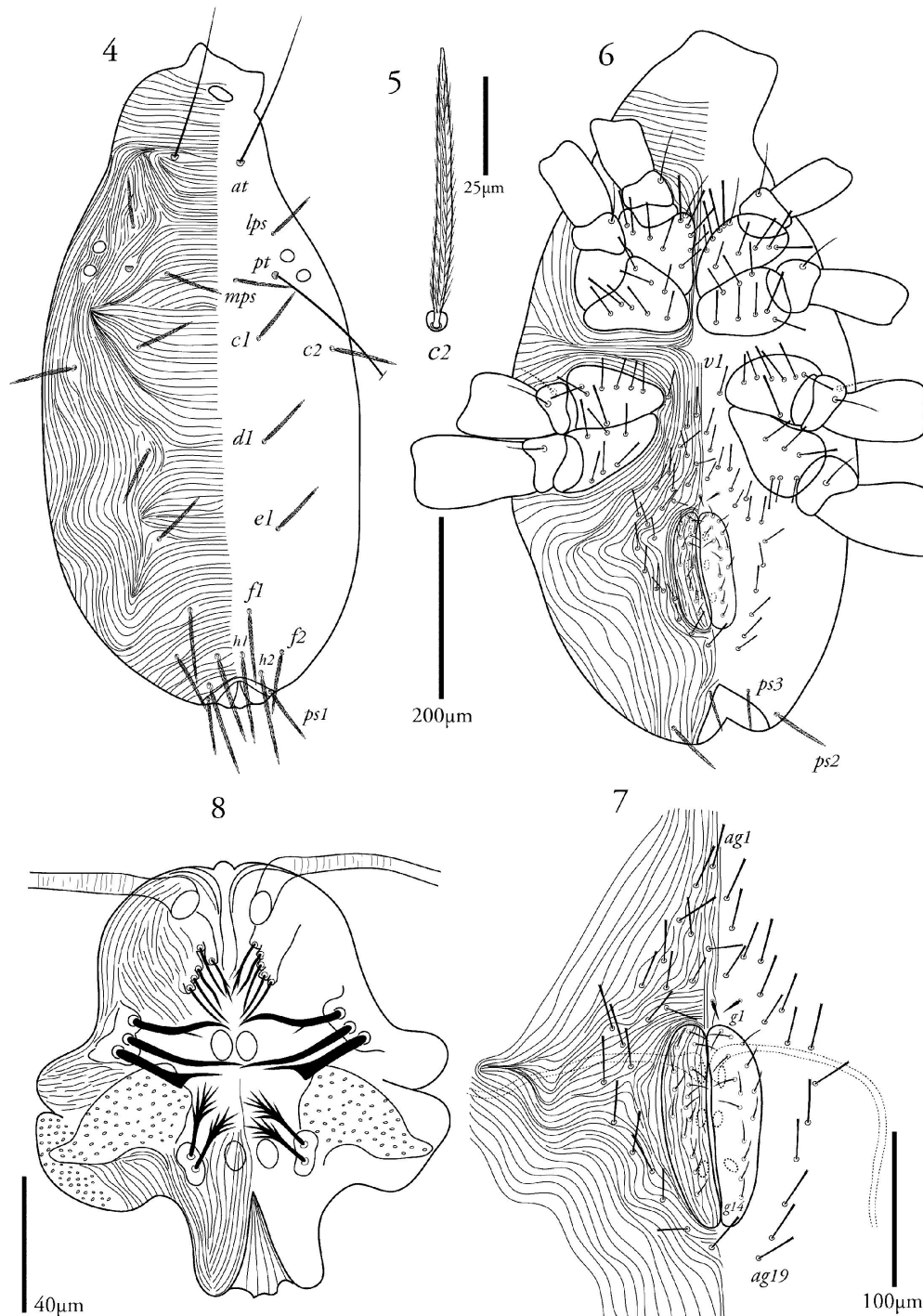
Remarks

Until now, *Spinibdella tadjikistanica* has previously been reported from Tadjikistan (Kuznetsov 1984). The original description provided based on female and male. The present Iranian specimens

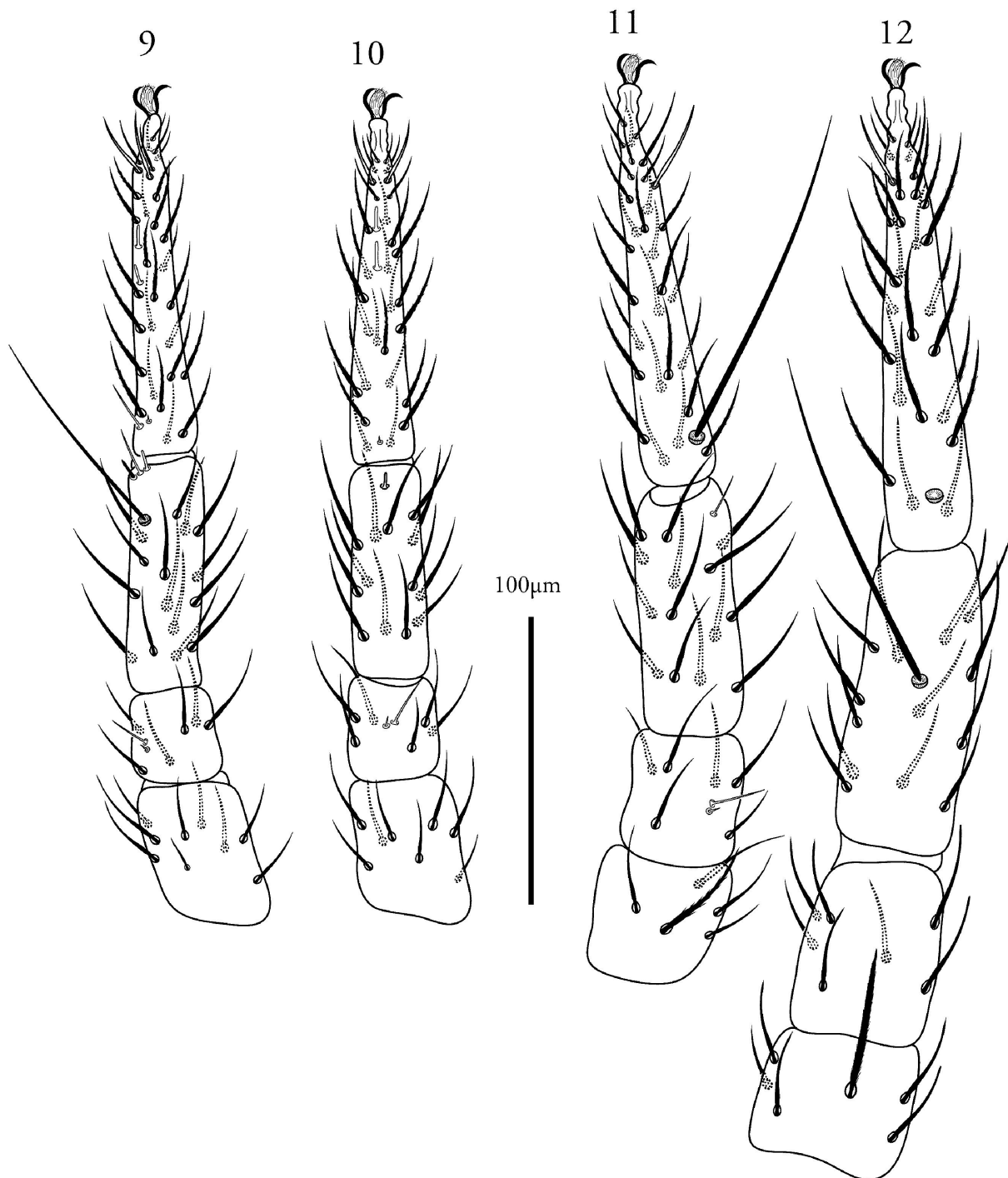
of *Spinibdella tadjikistanica* are morphologically and in general appearance similar to the Tadjik specimens (see the original description of Kuznetsov (1984), in Russian), but there are slight differences as well; i.e. Iranian specimens with 14–15 genital setae vs. 17 setae in the Tadjik specimens and telofemur III with 5/6 setae in Iranian specimens vs. 4 setae in the Tadjik specimens.

Material examined

Three males and one female from bark of the apple tree and rotten leaves of apple tree, Seyyedlar village, 11 December 2015; one male from bark of the apple tree, Sowmaeh-ye Kabudin, 19 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.



Figures 4–8. *Spinibdella tadjikistanica* Kuznetsov, 1984 (male): 4. Dorsal view of idiosoma; 5. Dorsal body seta *c*₂; 6. Ventral view of idiosoma; 7. Genital valve; 8. Amphiodid sclerites.



Figures 9–12. *Spinibdella tadjikistanica* Kuznetsov, 1984 (male): 9. Leg I; 10. Leg II; 11. Leg III; 12. Leg IV.

***Spinibdella cronini* (Baker and Balock, 1944)**

Bdella cronini Baker and Balock, 1944: 178.

Distribution: Cosmopolitan (Hernandes *et al.* 2016).

Previous provincial records from Iran: Alborz, Isfahan, Tehran (Ostovan and Kamali 1995), East Azerbaijan, Hamedan (Kamali *et al.* 2001), Fars (Abbaszadeh *et al.* 2010), Razavi Khorasan

(Paktinat-Saej *et al.* 2012), Mazandaran (Paktinat-Saej *et al.* 2014a), Kermanshah, Kurdistan, West Azerbaijan (Eghbalian *et al.* 2014).

Material examined: Two females and two nymphs from soil, Gundogdu village, 16 November 2015; four females, six males and two nymphs from soil under apple tree, Zarnagh village, 19 December 2015; two males and two nymphs from soil under apple tree, Cheran village, 11 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Spinibdella tabarii Paktinat-Saej & Bagheri, 2015

Spinibdella tabarii Paktinat-Saej and Bagheri, 2015b: 696.

Distribution: Iran (Paktinat-Saej *et al.* 2015b).

Previous provincial records from Iran: Mazandaran (Paktinat-Saej *et al.* 2015b).

Material examined: Two females and one nymph from soil and rotten leaves under apple tree, Chetab village, 18 December 2015; one female from soil under apple tree, Zarnagh village, 26 January 2016, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Genus *Bdella* Latreille, 1795

Bdella muscorum Ewing, 1909

Bdella muscorum Ewing, 1909: 124.

Distribution: Cosmopolitan (Hernandes *et al.* 2016).

Previous provincial records from Iran: Alborz (Ueckermann *et al.* 2007), Razavi Khorasan (Paktinat-Saej *et al.* 2012), East Azerbaijan (Navaei-Bonab *et al.* 2013), Tehran (Cheraghali *et al.* 2013), Mazandaran (Paktinat-Saej *et al.* 2016b).

Material examined: 10 females and two males from rotten leaves under apple tree, Hafez village, 1 November 2016; 15 females and three males from soil and rotten leaves under apple tree, Turkman Chay village, 11 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Biscirus Thor, 1913

Biscirus iranensis Paktinat-Saej & Bagheri, 2015

Biscirus iranensis Paktinat-Saej and Bagheri, 2015a: 520.

Distribution: Iran (Paktinat-Saej *et al.* 2015a).

Previous provincial records from Iran: Mazandaran, East Azerbaijan (Paktinat-Saej *et al.* 2015a).

Material examined: Two males from rotten leaves under apple tree, Gundogdu village, 16 November 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Genus *Cyta* von Heyden, 1826

Cyta latirostris (Hermann, 1804)

Scirus latirostris Hermann, 1804: 62.

Distribution: Cosmopolitan (Hernandes *et al.* 2016).

Previous provincial records from Iran: Razavi Khorasan, Fars (Ostovan and Kamali 1995), Mazandaran, Tehran, West Azerbaijan (Kamali *et al.* 2001), Alborz, (Ueckermann *et al.* 2007), East Azerbaijan (Navaei-Bonab *et al.* 2013).

Material examined: One female and two males from rotten leaves under apple tree, Mahiabad village, 19 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Genus *Hexabdella* Van der Schyff, Theron & Ueckermann, 2004

***Hexabdella persiaensis* Paktinat-Saeij & Bagheri, 2014**

Hexabdella persiaensis Paktinat-Saeij and Bagheri, 2014: 3.

Distribution: Iran (Paktinat-Saeij *et al.* 2014b).

Previous provincial records from Iran: Mazandaran (Paktinat-Saeij *et al.* 2014b).

Material examined: Two females from rotten leaves under apple tree, Chetab village, 18 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Genus *Odontoscirus* Thor, 1913

***Odontoscirus lapidaria* (Kramer, 1881)**

Bdella lapidaria Kramer, 1881: 444.

Distribution: Cosmopolitan (Hernandes *et al.* 2016).

Previous provincial records from Iran: Fars (Ostovan and Kamali 1995), Chahar Mahal and Bakhtiari, Khuzestan (Kamali *et al.* 2001).

Material examined: Two females from rotten leaves under apple tree and four nymphs from soil, Balesin village, 26 January 2016; one female from rotten leaves under apple tree, Seyyedlar village, 11 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

***Odontoscirus meridionalis* Thor, 1931**

Biscirus (Biscirus) meridionalis Thor, 1931: 74.

Distribution: Cosmopolitan (Hernandes *et al.* 2016).

Previous provincial records from Iran: Alborz (Ueckermann *et al.* 2007), East Azerbaijan (Bagheri and Paktinat-Saeij 2016), Mazandaran (Paktinat-Saeij *et al.* 2016b).

Material examined: Two females from soil under apple tree, Chetab village, 11 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Family Cunaxidae Genus *Coleoscirus* Berlese, 1916

***Coleoscirus buartsus* Den Heyer, 1980**

Coleoscirus buartsus Den Heyer, 1980c: 106.

Distribution: China, South Africa (Skvarla *et al.* 2014), Iran (Den Heyer *et al.* 2011a).

Previous provincial records from Iran: Kurdistan (Den Heyer *et al.* 2011a), East Azerbaijan (Ghorbani *et al.* 2012), Mazandaran (Paktinat-Saeij *et al.* 2016a).

Material examined: Two females from soil under apple tree, Cheshmeh Kesh village, 20 November 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Genus *Cunaxa* Von Heyden, 1826

***Cunaxa capreolus* (Berlese, 1887)**

Scirus capreolus Berlese, 1887: 63.

Distribution: Cosmopolitan (Smiley 1992).

Previous provincial records from Iran: ChaharMahal and Bakhtiari, Khuzestan, Hamedan (Den Heyer *et al.* 2011b), Fars (Majidi and Akrami 2011), East Azerbaijan (Ghorbani *et al.* 2012), Razavi Khorasan (Khaleghabadian *et al.* 2013), Mazandaran (Paktinat-Saeij *et al.* 2016b).

Material examined: Five females from rotten leaves under apple tree, Gundogdu village, 16 November 2015; two females from soil under apple tree, Avin village, 26 January 2016, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

***Cunaxa grobleri* Den Heyer, 1979**

Cunaxa grobleri Den Heyer, 1979: 37.

Distribution: South Africa (Den Heyer 1979), Iran (Den Heyer *et al.* 2011b).

Previous provincial records from Iran: Fars, Hamedan, Tehran (Den Heyer *et al.* 2011b), East Azerbaijan (Ghorbani *et al.* 2012).

Material examined: One female from soil under apple tree, Mahiabad village, 19 December 2015; one female from soil under apple tree, Chanaq Bulaq village, 11 November 2016, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

***Cunaxa setirostris* (Hermann, 1804)**

Scirus setirostris Hermann, 1804: 62.

Distribution: Cosmopolitan (Smiley 1992).

Previous provincial records from Iran: Ardabil, East Azerbaijan, Guilan, Mazandaran, West Azerbaijan (Kamali *et al.* 2001), Fars, Isfahan, Kurdistan, Tehran (Den Heyer *et al.* 2011b), Razavi Khorasan (Paktinat-Saeij *et al.* 2012).

Material examined: Four females from soil under apple tree, Mahiabad village, 19 December 2015; 22 females from soil and rotten leaves under apple tree, 11 October 2015; 13 females from rotten leaves under apple tree, SevinjSofla village, 11 November 2016, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Genus *Cunaxoides* Baker and Hoffmann, 1948

***Cunaxoides paracroceus* Sionti & Papadoulis, 2003**

Cunaxoides paracroceus Sionti and Papadoulis, 2003: 317.

Distribution: Greece (Sionti and Papadoulis 2003).

Remarks: Until now, *C. paracroceus* was reported only from Greece (Sionti and Papadoulis 2003). The characteristics of the specimens collected are very similar to those of the original description of Sionti and Papadoulis (2003). This is the first record of this species from Iran.

Material examined: Four females from rotten leaves under apple tree, Balesin village, 26 January 2016, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Cunaxoides croceus Koch, 1838

Eupalus croceus Koch, 1838: 20.

Distribution: Europe (Smiley 1992), Iran (Kamali *et al.* 2001).

Previous provincial records from Iran: Hamedan, Mazandaran (Kamali *et al.* 2001), East Azerbaijan (Akbari *et al.* 2010), Razavi Khorasan (Paktinat-Saeij *et al.* 2012), Tehran (Cheraghali *et al.* 2013).

Material examined: Two females from soil under apple tree, Mahiabad village, 19 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Cunaxoides shahriari Bagheri, Paktinat- Saeij and Castro, 2016

Cunaxoides shahriari Bagheri, Paktinat- Saeij and Castro, 2016: 2.

Distribution: Iran (Bagheri *et al.* 2016).

Previous provincial records from Iran: Mazandaran, East Azerbaijan (Bagheri *et al.* 2016).

Material examined: Two females from rotten leaves under apple tree, Onliq village, 25 October 2015; one nymph from soil under apple tree, Charan village, 11 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Genus *Lupaeus* Castro & Den Heyer, 2009

Lupaeus iranensis Den Heyer, 2013

Lupaeus iranensis Den Heyer, 2013: 2061.

Distribution: Iran (Den Heyer *et al.* 2013).

Previous provincial records from Iran: Isfahan, Kurdistan (Den Heyer *et al.* 2013).

Material examined: Eight females from soil and rotten leaves under apple tree, Gundogdu village, 16 November 2015; two females from soil under apple tree, Sowmaeh-ye Kabudin village, 19 December 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Lupaeus sativae Den Heyer, 2013

Lupaeus sativae Den Heyer, 2013: 2063.

Distribution: Iran (Den Heyer *et al.* 2013).

Previous provincial records from Iran: East Azerbaijan, Khuzestan (Den Heyer *et al.* 2013).

Material examined: One female from rotten leaves under apple tree, Maman village, 16 November 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Lupaeus valentinae Sergeyenko, 2011

Lupaeus valentinae Sergeyenko, 2011: 66.

Distribution: Ukraine (Sergeyenko 2011), Iran (Den Heyer *et al.* 2013).

Previous provincial records from Iran: Hamedan (Den Heyer *et al.* 2013), East Azerbaijan (Bagheri and Paktinat-Saeij 2016), Mazandaran (Paktinat-Saeij *et al.* 2016b).

Material examined: One female from soil under apple tree, Achachi village, 26 January 2016, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

Genus *Pulaeus* Den Heyer, 1980

***Pulaeus krama* (Chaudhri, 1977)**

Neocunaxoides krama Chaudhri, 1977: 50.

Distribution: Cosmopolitan (Smiley 1992).

Previous provincial records from Iran: East Azerbaijan (Ghorbani *et al.* 2012), Tehran (Den Heyer *et al.* 2013), Mazandaran (Paktinat-Saeij *et al.* 2016b).

Material examined: Three females and six males from bark of the apple tree, Noghabad village, 27 November 2015; six females and one male from bark of the apple tree, Achachi village, 26 January 2016; six females and one male from soil and bark of the apple tree, Seyyedlar village, 11 December 2015; three females and three males from bark of the apple tree, Gundogdu village, 16 November 2015, Miyaneh city, East Azerbaijan province, Iran were collected by Aylar Rostami.

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گزارش‌های جدیدی از بالاخانواده *Bdelloidea* (Acari: Trombidiformes: Prostigmata) از ایران، همراه با بازتوصیف گونه *Spinibdella tadjikistanica* Kuznetsov

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چکیده

گونه‌های *Spinibdella tadjikistanica* Kuznetsov, 1984 و *Cunaxoides paracroceus* Sionti and Papadoulis, 2003 برای نخستین بار از ایران گزارش می‌شوند. هم‌چنین توصیفات اضافی برای گونه *Spinibdella tadjikistanica* Kuznetsov, 1984 بر اساس نمونه‌نر جمع‌آوری شده از استان آذربایجان شرقی، شمال‌غرب ایران ارائه شده است.

واژگان کلیدی: خانواده *Bdellidae*، خانواده *Cunaxidae*، *Cunaxoides*، کنه‌های شکارگر، رده‌بندی.

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