

A checklist of Collembola of Tehran, with some new records from Iran

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Abstract

The present faunal study of springtails (Collembola) was conducted in city of Tehran during 2013-2014. Samples of soil and leaf litters from parks, forests, gardens and green landscapes were collected using Berlese funnels. A total of 21 species of eight families were identified of which the species *Hypogastrura ripperi* (Gisin, 1952), *Mesaphorura macrochaeta* (Rusek, 1976) and *Friesea claviseta* (Axelson, 1900) are newly recorded from Iran and six species are recorded from Tehran for the first time. This study rises the number of known collembolan species from Tehran to 71 species.

Key words: Collembola, Entomobryomorpha, Poduromorpha, Tehran province, Iran.

چکیده

چک لیست پادمان تهران به همراه گزارش چند گونه جدید برای ایران

فهیمة قاضی و معصومه شایانمهر

در این تحقیق، فون پادمان در شهر تهران در طی سالهای ۱۳۹۲ تا ۱۳۹۳ مورد مطالعه قرار گرفت. بدین منظور، نمونه‌های پادمان از خاک و خاک‌برگ پارک‌ها، مناطق جنگلی، باغی و فضاهای سبز جمع‌آوری و پس از انتقال به آزمایشگاه، با استفاده از قیف برلیز استخراج شدند. از نمونه‌های موجود در الک، اسلایدهای میکروسکوپی با استفاده از چسب هویر تهیه و در نهایت نسبت به شناسایی آنها اقدام گردید. نتایج این تحقیق در مجموع شامل جمع‌آوری و شناسایی ۲۱ گونه متعلق به هشت خانواده مختلف از پادمان است که سه گونه *Hypogastrura ripperi* (Gisin, 1952)، *Mesaphorura macrochaeta* (Rusek, 1976) و *Friesea claviseta* (Axelson, 1900) برای فون پادمان ایران جدید بوده و شش گونه نیز برای اولین بار از استان تهران جمع‌آوری و گزارش می‌شوند. به این ترتیب، تعداد گونه‌های گزارش شده از استان تهران به ۷۱ گونه افزایش می‌یابد که چک لیست به‌روز شده آنها ارائه شده است.

واژگان کلیدی: ایران، انتوموبریومورفا، پادمان، پودورومورفا، تهران.

Introduction

Collembolans represent an abundant and widespread group of microarthropods (Hopkin, 1997) and play an important ecological role (Parkinson, 1988, Filser *et al.*, 2002, Chahartaghi, *et al.*, 2005). They are distributed throughout the globe but the species fauna in many parts of the world remains unknown (Hopkin, 1977). In Iran, the study of Collembola started in some parts of the country (Yahyapour & Shayanmehr, 2011; Kahrarian *et al.*, 2012; Smolis *et al.*, 2012; Yoosefi Lafooraki & Shayanmehr, 2013; Bakhshi *et al.*, 2014; Kahrarian *et al.*, 2014; Yoosefi Lafooraki & Shayanmehr, 2014; Mehrafrooz Mayvan *et al.*, 2015) but still many species are yet to be identified. The city of Tehran features a semi-arid climate and the climate is largely defined by its geographic location, with the Alborz Mountains to the north and the central desert to the south. The first comprehensive study of Collembola in Iran was carried out by Cox (1982) who collected 70 species of 30 genera and five families, without stating their exact localities. Cox (1982) reported 32 species from Central Iran including Tehran province. Later, Moravvej (2003) found 16 species from different regions & Shayanmehr *et al.* (2013) published a checklist of Iranian springtails as well as

Qazi *et al.*, (2014 & 2015) who discovered some new species from Tehran. In the present study, Collembolan fauna was studied in some other regions of capital Tehran. New species records and a checklist of Collembola of Tehran are presented.

Materials and methods

Study site

The study was conducted in Tehran and its vicinities during 2013-2014 (Fig. 1, Table 1). Tehran County borders Shemiranat County to the north, Damavand County to the east, Eslamshahr, Pakdasht, and Rey counties to the south, and Karaj and Shahriar counties to the west. The City of Tehran is divided into 22 municipal districts, each with its own administrative center.

The soil, leaf litter and moss from different habitats were carried to the laboratory and springtails were extracted by modified Berlese funnels. The specimens were preserved in 85% alcohol. The pigmented samples were cleared in KOH for 3-5 minutes and their important taxonomic structures were made visible. Then, the specimens were mounted on Hoyer's medium due to preparing microscopic slides (Qazi & Shayanmehr, 2014). Preliminary identification

was done using available keys such as Potapov, 2001; Fjellberg, 2007; Jordana, 2012. The identifications were completed and confirmed by different experts such as Dr. Jordana (Spain), Dr. Kaprus (Ukraine), Dr. Skarzynski (Poland) and Dr. Deharveng (France). In this paper, a complete list of families, genera and species of class of Collembola collected from Tehran province is provided. Also, some information on sampling sites and their distribution is presented. For

some species which are reported for the first time for Iranian fauna, in addition to collecting data and distribution, some notes on their description and also photos are provided. The collection of specimens including microscopic slides and alcohol preserved specimens are kept in Entomology Laboratory of Sari University of Agricultural Sciences and Natural Resources (SARU).

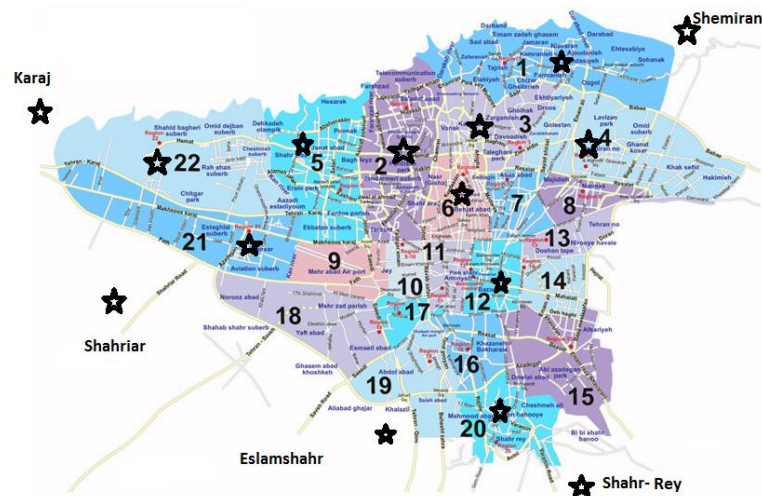


Fig. 1. Map of Tehran. Sampling sites are marked by asterisks.

Table 1. A checklist of Collembola from Tehran province.

Species	References
<i>Hypogastrura manubrialis</i> (Tullberg, 1869)	
<i>Hypogastrura vernalis</i> (Carl, 1901)	Qazi & Shayanmehr, 2013
<i>Ceratophysella stercoraria</i> (Stach, 1963)	
<i>Triacanthella intermedia</i> (Dunger & Zivadinovic, 1984)	
<i>Folsomides parvalus</i> (Stach, 1922)	
<i>Folsomia penicula</i> (Bagnall, 1939)	
<i>Pseudosinella octopunctata</i> (Borner, 1901)	
<i>Heteromurus major</i> (Moniez, 1889)	
<i>Cyphoderus albinus</i> (Nicolet, 1842)	
<i>Entomobrya lindbergi</i> (Stach, 1960)	Moravvej (2003); Qazi & Shayanmehr, 2013
<i>Entomobrya handschini</i> Stach, 1922	
<i>Folsomia similis</i> Bagnall, 1939	
<i>Parisotoma notabilis</i> (Schäffer, 1896)	Moravvej (2003)
<i>Entomobrya unostrigata</i> Stach, 1930	
<i>Orthonychiurus stachianus</i> (Bagnall, 1939)	
<i>Orthonychiurus folsomi</i> (Schäffer, 1900)	
<i>Heteraphorura cf. japonica</i> (Yosii, 1967)	Qazi & Shayanmehr, 2015
<i>Protaphorura fimata</i> (Gisin, 1952)	
<i>Thalassaphorura encarpata</i> (Denis, 1931)	

<i>Allonychiurus</i> sp.	
<i>Onychiuroides granulosis</i> (Stach, 1930)	Cox (1982)
<i>Onychiuroides pseudogranulosus</i> (Gisin, 1951)	
<i>Hymenaphorura sibirica</i> (Tullberg, 1876)	
<i>Protaphorura bicampata</i> (Gisin, 1956)	
<i>Protaphorura quadriocellata</i> (Gisin, 1947)	
<i>Metaphorura affinis</i> Börner, 1902	
<i>Paratullbergia callipygos</i> (Börner, 1902)	
<i>Pseudachorutes parvulus</i> Börner, 1901	
<i>Pseudachorutes subcrassus</i> Tullberg, 1871	
<i>Bilobella aurantiaca</i> (Caroli, 1912)	
<i>Willemia anophthalma</i> Börner, 1901	
<i>Orthonychiurus rectopapillatus</i> (Stach, 1933)	
<i>Folsomia candida</i> (Willem, 1902)	
<i>Folsomia fimetaria</i> (Linnaeus, 1758)	
<i>Folsomia quadrioculata</i> (Tullberg, 1871)	
<i>Hemisotoma orientalis</i> Stach, 1947	
<i>Hemisotoma thermophile</i> (Axelson, 1900)	
<i>Proisotoma minuta</i> (Tullberg, 1871)	
<i>Isotomurus palustris</i> (Muller, 1776)	
<i>Isotoma viridis</i> Bourlet, 1839	
<i>Entomobrya lanuginosa</i> (Nicolet, 1841)	
<i>Lepidocyrtus cyaneus</i> Tullberg, 1871	
<i>Lepidocyrtus lanuginosus</i> (Gmelin, 1788)	
<i>Lepidocyrtus ruber</i> Schött, 1902	
<i>Tomocerus minor</i> (Lubbock, 1862)	
<i>Tomocerus vulgaris</i> (Tullberg, 1871)	
<i>Neelus murinus</i> Folsom, 1896	
<i>Sphaeridia pumilis</i> (Krausbauer, 1898)	
<i>Sminthurides malmgreni</i> (Tullberg, 1876)	
<i>Podura aquatica</i> Linnaeus, 1758	

Results and Discussion

In sum, 21 species belonging to eight families of Collembola were collected and identified from Tehran city from the present study which adds to Tehran collembolan list. The information including sampling site, the distribution and diagnosis of identified species are represented. New taxa for province or to Iranian fauna are asterisked (*). Short description and illustrations are given for some species. At the end, the checklist of Collembolan species for Tehran province is given which include the species reported by Cox (1982), Moravvej (2003) and Qazi & Shayanmehr (2014 & 2015).

Family Hypogastruridae

This family belongs to the order of Poduromorpha which are characterized by, an elongated and segmented habitus, and first thorax being well developed with a row of dorsal setae (Thibaud *et al.*, 2004). This family includes 580 species in the world till 1997 (Hopkin, 1997), but today includes just 699 genera in the world (Bellinger *et al.*, 1996-2015). In Iran only 13 species have been recorded till 2013 (Shayanmehr, *et al.*, 2013).

***Hypogastrura cf. distincta* (Axelson, 1902)**

Material examined. Tehran, Velayat Park, Soil and leaf litter under acacia trees and box-tree, N 35° 41' E 51° 19' (3935 m.a.s.l.), March 19, 2014, F. Qazi.

Distribution. Afghanistan, Egypt, Yemen, United Arab Emirates, Holarctic (Thibaud *et al.*, 2004). More study is needed for identifying the species of the Iranian specimen.

Diagnosis. Body length up to 1.5 mm (Fig. 2). Color bluish grey, anterior nearly without color. Completely light specimens also occur. 8+8 ommatidia

with PAO (post antennal organ). Tegumentary granulation very fine. Antennal segment IV with simple apical bulb and 4 curved, long, thin sensilla. Antennal segment I with 7 setae. Tibiotarsi I-III with 3, 3, 4 knobbed tenant hairs. Claws with one inner tooth, no lateral tooth. Empodium with small, but distinct basal lamella. Dens only with 5 setae. Mucro minute, mostly with strong tooth on inner lamella. Anal spines relatively long, curved, on high papillae (Thibaud *et al.*, 2004).

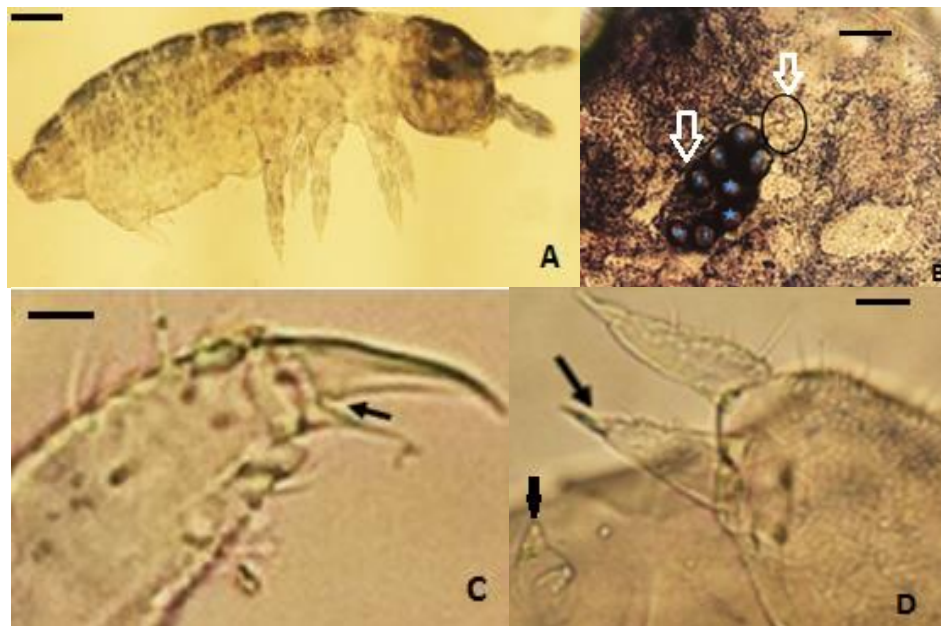


Fig. 2. *Hypogastrura cf. distincta* (Axelson): A: Body habitus (Scale bar: 1000 μ m), B: 8 ommatidia and PAO (Post antennal organ), C: Claws and empodium, D: Furca and retinaculum (Scale bar: 25 μ m) (Original).

***Hypogastrura ripperi* (Gisin, 1952)**

Material examined. Tehran, Jannat Abad, Soil and leaf litter under Quince tree, N 35° 44' E 51° 23' (4496 m.a.s.l.), July 31, 2013, F. Qazi.

Distribution. Holarctic: Austria, Hungary, Switzerland, France, Portugal, Iceland, Russia, Alaska, and USA (Thibaud *et al.*, 2004). This species is reported for the first time from Iran.

Diagnosis. Body length up to 0.9 mm (Fig. 3). Color bluish grey, sometimes nearly white. 8+8 ommatidia with PAO. Tegumentary granulation very

coarse, especially in the median regions of the last abdominal segments. Antennal segment IV with simple apical bulb and up to 10 normal long, curved, thickened sensilla. Antennal segment I with 8 setae. Tibiotarsi I-III each with one pointed tenant hair. Claws with a strong inner tooth, no lateral tooth. Empodium lance-shaped. Dens with 7 setae and some rows of coarse granules. Mucro hook-shaped, with broad inner lamella. Anal spines short, curved, on papillae, situated before the end of abdomen VI (Thibaud *et al.*, 2004).

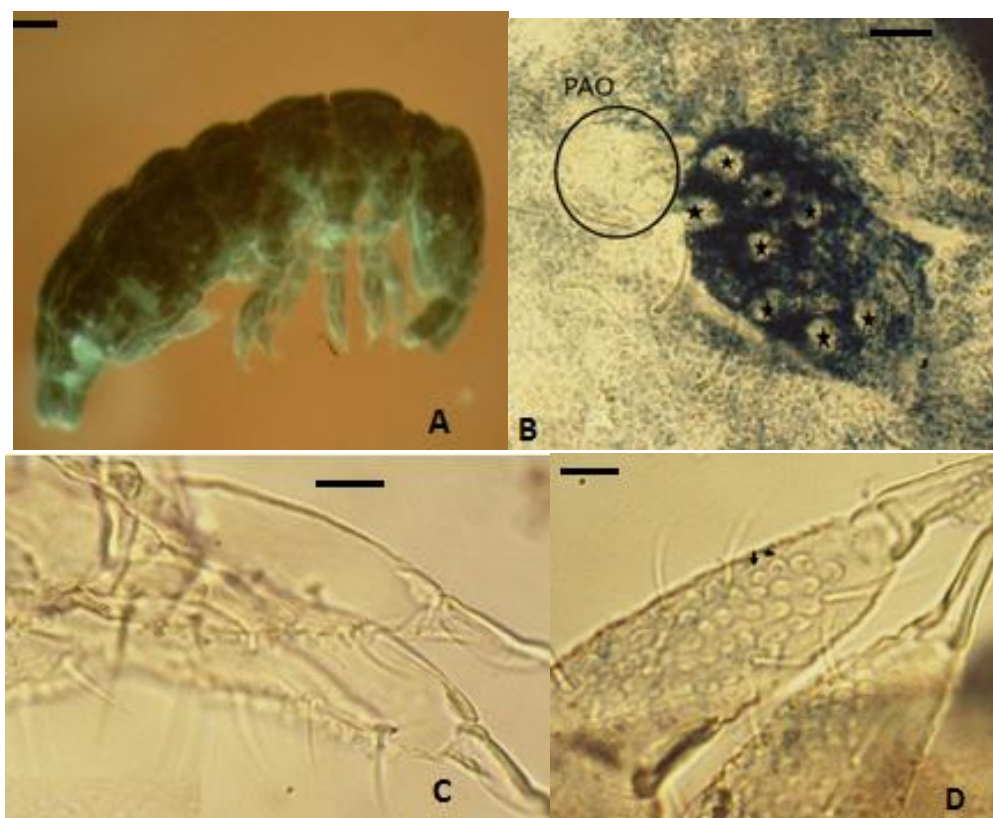


Fig. 3. *Hypogastrura ripperi* (Gisin): A: Body habitus (Scale bar: 1000 μ m), B: 8 ommatidia and PAO (Post antennal organ), C: Furca and retinaculum, D: Dens with tubercles (Scale bar: 25 μ m) (Original).

***Hypogastrura assimilis* (Krausbauer, 1898)**

Material examined. Tehran, Jannat Abad, Leaf litter and soil under Quince tree, N 35° 44', E 51° 23' (4496 m.a.s.l.), July 31, 2013, F. Qazi.

Distribution. Holarctic, Europe (Thibaud *et al.*, 2004). Kohgiluyeh and Boyer Ahmad, Charam (Falahati *et al.*, 2013). This species is recorded for the time from Tehran province.

Diagnosis. Body size 1.2-1.5 mm (Fig. 4). Color blue. With 8+8 ommatidia and PAO with 4 lobes. Mucro with distinct inner lamella. Anal spines short (Thibaud *et al.*, 2004).

***Hypogastrura purpurescens* (Lubbock, 1868)**

Material examined. Tehran, Niyavaran Park, Soil under pine trees, N 35° 48' E 51° 27' (5342 m.a.s.l.), February 1, 2014, F. Qazi.

Distribution. Cosmopolitan. Kermanshah (Kahrarian *et al.*, 2013). This species is recorded for the time from Tehran province.

Diagnosis. Body size up to 2 mm. Color brownish or grey-blue. Antennal segment 1 with 7 setae. Retinaculum with 3 teeth. Mucro straight with narrow outer lamella. Anal spines strong and curved on high papillae (Thibaud *et al.*, 2004; Kahrarian *et al.*, 2013).

***Hypogastrura cf. rangkuli* (Martynova, 1975)**

Material examined. Tehran, Shahrn, Soil and leaf litter under pine trees, N 35° 46' E 51° 18' (4906 m.a.s.l.), October 31, 2013, F. Qazi.

Distribution. Pamir, Taimir, Alaska (Thibaud *et al.*, 2004). More study is needed for identifying the species of the Iranian specimen.

Diagnosis. Body size up to 1.5 mm (Fig. 5-A). Color grey to violet. With 8+8 ommatidia and antennal segment 1 with 8 setae. Mucro strong with a broad inner lamella, curved. Anal spines short (Thibaud *et al.*, 2004).

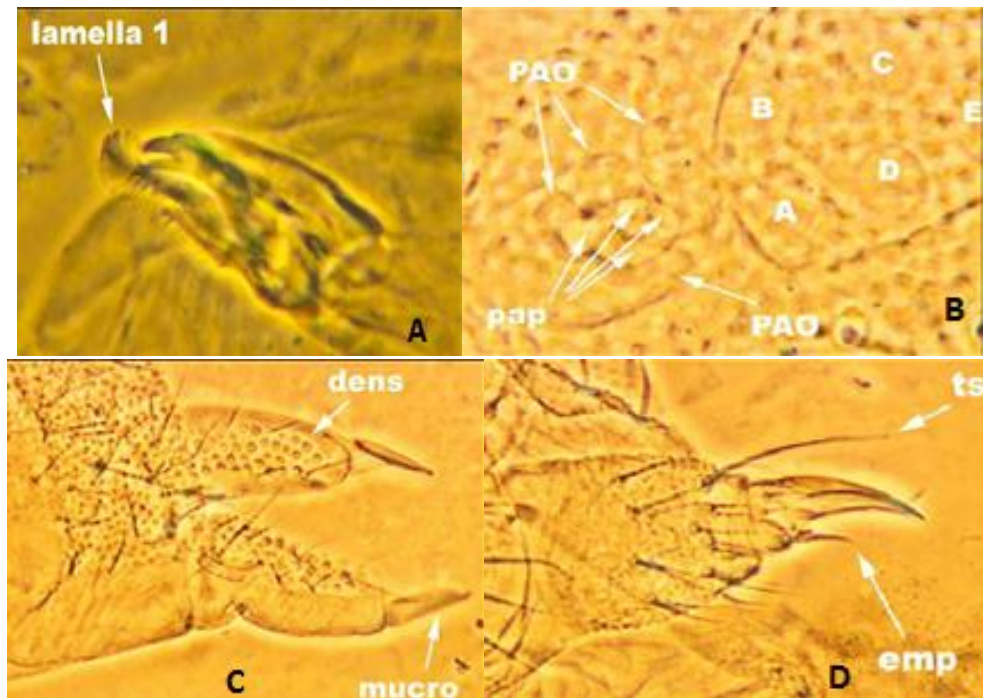


Fig. 4. *Hypogastrura assimilis* (Krausbauer): A: Maxilla, Lamella has only a single fringe of setae, B: 8 ommatidia and PAO (Post antennal organ), C: Furca, D: Tibiotarsi, Claws and empodium (from S.P. Hopkin, 2004).

***Ceratophysella cf. engadinensis* (Gisin, 1949)**

Material examined. Tehran, Sheikh Fazlollah, Leaf litter and soil under herb layer, N 35°4' E 51° 20' (4672 m.a.s.l.), April 5, 2013, F. Qazi.

Distribution. Cosmopolitan. More study is needed for identifying the species of the Iranian specimen.

Diagnosis: Body length up to 0.9-1.2 mm. Color blue. Tegumentary granulation typical for the genus. Antennal segment IV with a simple apical bulb. Claws with a small internal tooth and two lateral teeth. Dens with 7 setae. Anal spines about as long as the claws (Thibaud *et al.*, 2004). This specie is similar to *C. denticulata* but differ in the dorsal chaetotaxy of fifth abdominal segment (Fig. 5-B-C).

***Ceratophysella gibbosa* (Bagnall, 1940)**

Material examined. Tehran, Laleh Park, Soil and leaf litter under pine trees, N 35° 42' E 51° 23' (5213 m.a.s.l.), December 7, 2013; Tehran, Behesht Zahra, Soil and leaf litter under pine tree, N 35° 3' E 51° 22' (3341 m.a.s.l.), April 5, 2014; Tehran, Lavizan Park, leaf litter under pine trees, N 35° 46' E 51° 30' (5095 m.a.s.l.), April 15, 2014, F. Qazi.

Distribution. Cosmopolitan (Thibaud *et al.*, 2004). Tehran (Moravvej, 2003).

Diagnosis: Body length up to 1-1.5 mm (Fig. 6). Color blue-brown. Abdominal segment 4 with 2+2 medial microsetae. Abdominal 5 with a granulated, wart-hump between the p1 setae (Thibaud *et al.*, 2004).

Family Odontellidae

This family belongs to the order of Poduromorpha which included 100 world species (Hopkin, 1997). To date this family includes 135 genera in the world (Bellinger *et al.*, 1996-2015). Two species have been recorded from Iran (Shayanmehr, *et al.*, 2013).

***Axenylloides bayeri* (Kseneman, 1935)**

Material examined: Tehran, Shahrn. Soil and leaf litter under pine trees, N 35° 46' E 51° 18' (4906 m.a.s.l.), October 31, 2013, F. Qazi.

Distribution. Widely spread in Asia, Russia, Europe, North America (Bellinger *et al.*, 1996-2015). This species has been reported from province of Guilan and E. Azarbaijan (Cox, 1982). This species is recorded for the time from Tehran province.

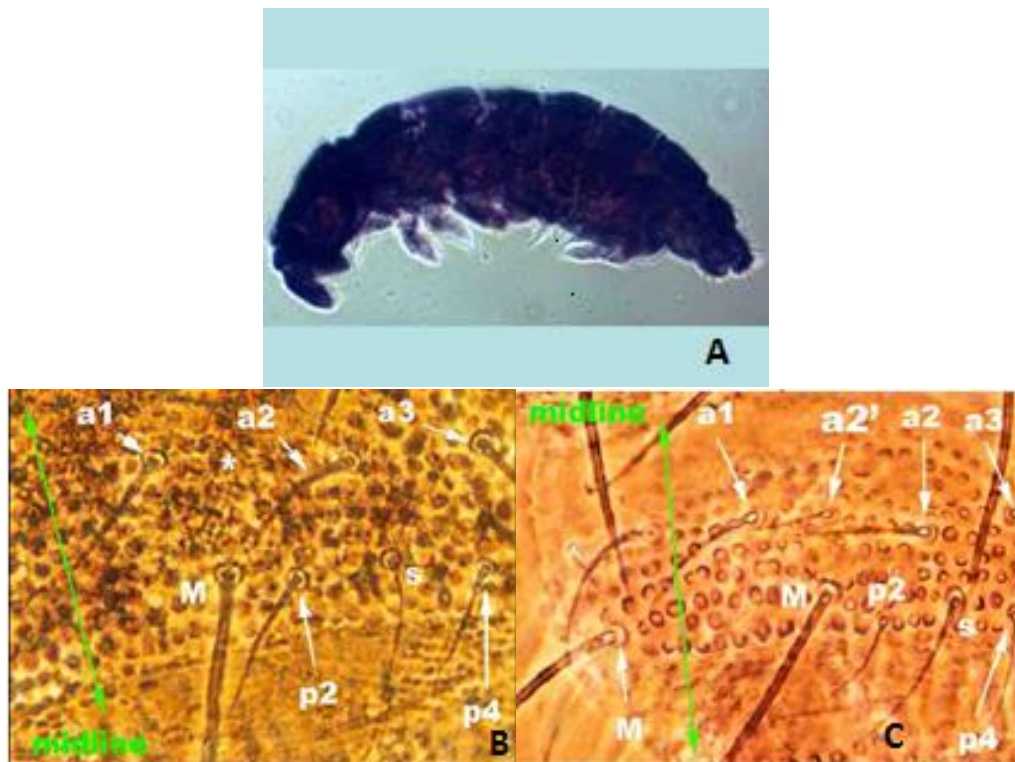


Fig. 5. A: *Hypogastrura rangkuli* from India by Mandal GP & Arbea JI, in 2014 (Bellinger *et al.*, 1996-2015), B: Dorsal chaetotaxy of fifth abdominal segment of *Ceratophysella engadinensis*. Note the absence (*) of seta a2' (present in *Ceratophysella denticulata*) (M (macroseta) = p1, s (sensilla) = p3), C: Dorsal chaetotaxy of fifth abdominal segment of *Ceratophysella denticulata*. Note the presence of seta a2' (absent in *Ceratophysella engadinensis*) (M (macroseta) = p1; s (sensilla) = p3). (From S.P. Hopkin, 2004).

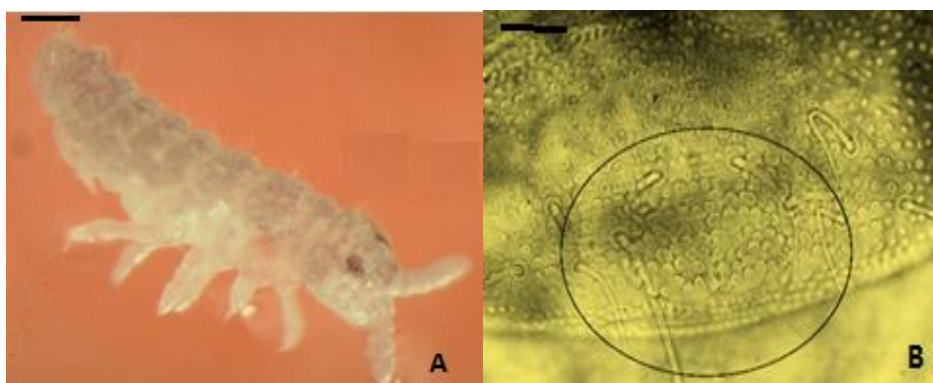


Fig. 6. *Ceratophysella gibbosa* (Bagnall): A: Body habitus (Scale bar: 1000 μ m), B: a granulated and wart-like hump on abdomen 5. (Scale bar: 25 μ m) (Original).

Family Tullbergidae

This family belongs to the order Poduromorpha which already was classified as a subfamily of Tullberginae in Onychiuridae. Today includes 226

genera in the world (Bellinger *et al.*, 1996-2015). In Iran only 3 species have been recorded (Shayanmehr, *et al.*, 2013).

***Mesaphorura macrochaeta* (Rusek, 1976)**

Material examined: Tehran, Shahid Bakeri Highway, soil under Ivy plant, N 35° 44' E 51° 17', (4456 m.a.s.l.), April 5, 2013, F. Qazi.

Distribution. Cosmopolitan (Dunger and Schlitt, 2011). This species is reported for the first time from Iran.

Diagnosis: Species of *Mesaphorura* are very small (typically 0.7 mm in length) soil-dwelling Collembola (Fig. 7). Until relatively recently, most *Mesaphorura* have been recorded under the name *M. krausbaueri* but following work by Rusek and others, it is clear that there are several species 'hiding' under this name. The post-antennal organ has about 40 simple vesicles, the sensory organ on the third antennal segment has two inwardly pointing blunt sensory sensilla, the mandibles have a stout molar plate and the pseudocelli (PSO) are rosette-shaped. The PSO formula of *M. macrochaeta* is 11/011/10011. Other diagnostic characters include five setae in tibiotarsal 'B' ring, seta a2 present on thorax 3, distance between p1 setae on abdomen 4 shorter than the distance between the p2 setae, seta m0 on abdominal segment 4 absent, 3+3 short setae on abdominal segment 5 between the long a4 setae, and anal setae l2' present (this latter character is the only discernible difference from *M. krausbaueri* in which anal setae l2' are absent) (Hopkin, 2004).

***M. krausbaueri* (Borner, 1901)**

Material examined. Tehran, Dar Abad, soil and leaf litter under cypress trees, N 35° 49' E 51° 29' (5604 m.a.s.l.), October 31, 2013, F. Qazi.

Distribution. Central Europe, Greenland, Russia (Dunger and Schlitt, 2011). In Iran: Guilan, Zanjan, Central, East and West Azerbaijan, and Mazandaran (Cox, 1982). This species is recorded for the time from Tehran province.

Family Neanuridae

This family includes 1450 species in the world (Mehrafroz *et al.*, 2015). In Iran, 14 species have been recorded (Shayanmehr, *et al.*, 2013).

***Friesea claviseta* (Axelson, 1900)**

Material examined: Tehran, Taleghani Park, Soil and leaf litter under pine and Cypress trees, N 35° 45' E 51° 25' (7587 m.a.s.l.), October 4, 2013, F. Qazi.

Distribution. Cosmopolitan (Fjellberg, 1998). This species is recorded for the first time from Iran.

Diagnosis: Body size 1.0 mm (Fig. 8), color bluish-grey, variable. On tibiotarsi 1 setae A₁, A₃, A₆ and A₇ are sub equally long and clavate, on Tibiotarsi 2-3 also A₂ is long/clavate. Setae A₄ and A₅ present.

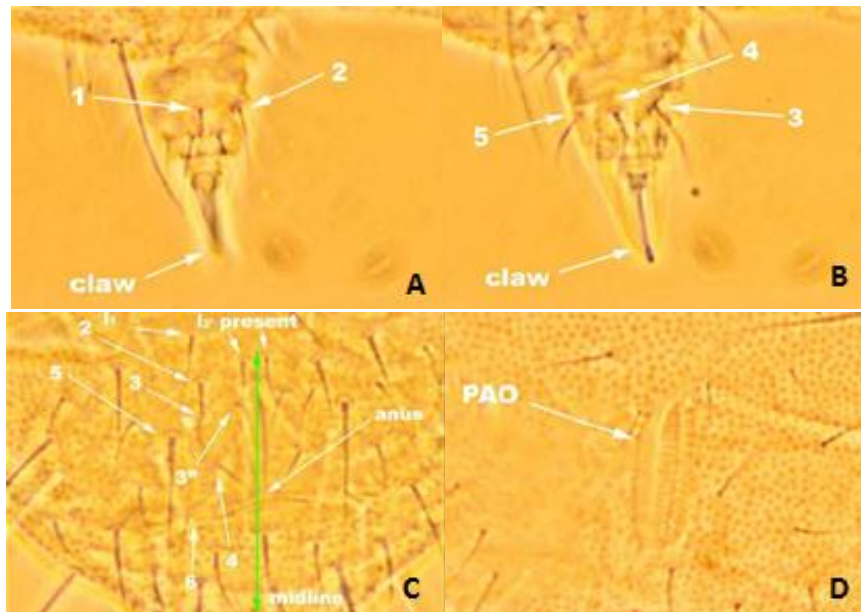


Fig. 7. *Mesaphorura macrochaeta* (Rusek): A, B: Five setae in tibiotarsal 'B' ring C: Anal setae l2' present, D: PAO (post antennal organ). (From S.P. Hopkin, 2004).

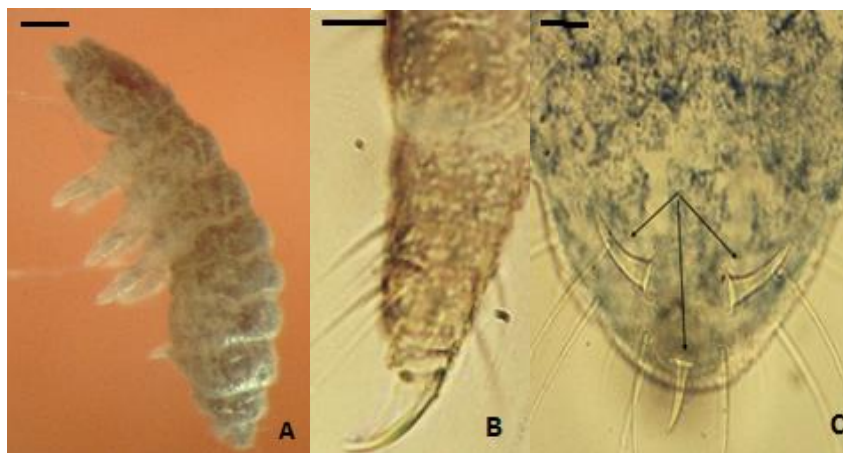


Fig. 8. *Friesea claviseta* (Axelson): A: Body habitus (Scale bar: 1000 µm), B: Tibiotarsi and claws, C: three anal spines on abdomen 6. (Scale bar: 25 µm) (Original).

***Friesea cf. mirabilis* (Tullberg 1871)**

Material examined. Tehran, Taleghani Park, Soil and leaf litter under pine trees, N 35° 45' E 51° 25' (7587 m.a.s.l.), October 4, 2013; Tehran, Dar Abad, Soil and leaf litter under Cypress, N 35° 49' E 51° 29' (5604 m.a.s.l.), October 31, 2013, F. Qazi.

Distribution. *F. mirabilis* is a bluish-grey very common and widespread soil-dwelling species with three anal spines (Hopkin, 2004). In Iran: Central of Iran, Guilan, E. Azarbaijan (Cox, 1982). More study is needed for identifying the species of the Iranian specimen.

***Pseudachorutes dubius* Krausbauer, 1898**

Material examined. Tehran, Kuhsar park, soil and leaf litter under Mulberry trees, N 35° 45' E 51° 33' (1496 m.a.s.l.), February 22, 2013, F. Qazi.

Distribution. Cosmopolitan (Fjellberg, 1998). In Iran: Central, Guilan, and E. Azarbaijan (Cox, 1982). This species is recorded for the time from Tehran province.

Family Brachystomellidae

This family includes 131 species in the world (Bellinger *et al.*, 1996-2015). In Iran, is represented by only two species (Shayanmehr *et al.*, 2013).

***Brachystomella parvula* (Schaffer, 1896)**

Material examined. Tehran, Eslamshahr, soil under Pomegranate, N 35° 33' E 51° 14' (1072 m.a.s.l.), April 23, 2014, F. Qazi.

Distribution. Common and widespread (Hopkin, 2004). In Iran: Central, Guilan, E. Azarbaijan, Zanzan (Cox, 1982); Tehran (Moravvej, 2003).

Diagnosis: *B. parvula* is a soil species which reaches a length of 1.1 mm (Fig. 9). The empodium is absent on the foot. The head bears 8+8 ommatidia and with a PAO (Post antennal organ). In cleared specimens, the distinctive mouthparts are highly specific (absence of mandibles). In collections of Collembola extracted from soil cores, the experienced eye can spot *B. parvula* with its distinctive bluish or reddish-violet color and teddy-bear like body shape, but you must clear a few to check their mouthparts to confirm (Hopkin, 2004).

Family Isotomidae

This family includes 1408 species in the world (Bellinger *et al.*, 1996-2015). 27 species have been recorded from Iran (Shayanmehr, *et al.*, 2013).

***Folsomia ksenemani* (Stach, 1947)**

Material examined. Tehran, Bahareh and Aghaghiya park (Jannat Abad), soil under Acacia and prunus trees, N 35° 45' E 51° 18' (1463 m.a.s.l.), April 20, 2013, F. Qazi.

Distribution. Europe (Potapow, 2001). In Iran: The species (Fig. 10) was recorded from Mazandaran (Yoosefi lafooraki and Shayanmehr, 2014a). This species is recorded for the first time from Tehran province.

***Hemisotoma pontica* (Stach, 1947)**

Material examined. Tehran, Bahareh park, soil under pine trees, N 35° 45' E 51° 18' (1463 m.a.s.l.), June 15, 2013, F. Qazi.

Distribution. Cosmopolitan (Potapow, 2001).

This species as *Cryptopygus ponticus* (Fig. 11) was

reported from Central, Mazandaran, Guilan, and E. Azarbaijan (Cox, 1982); Tehran (Moravvej *et al.*, 2003); Kermanshah (Kahrarian *et al.*, 2012); Mazandaran/Sari (Yahyapour, 2012).

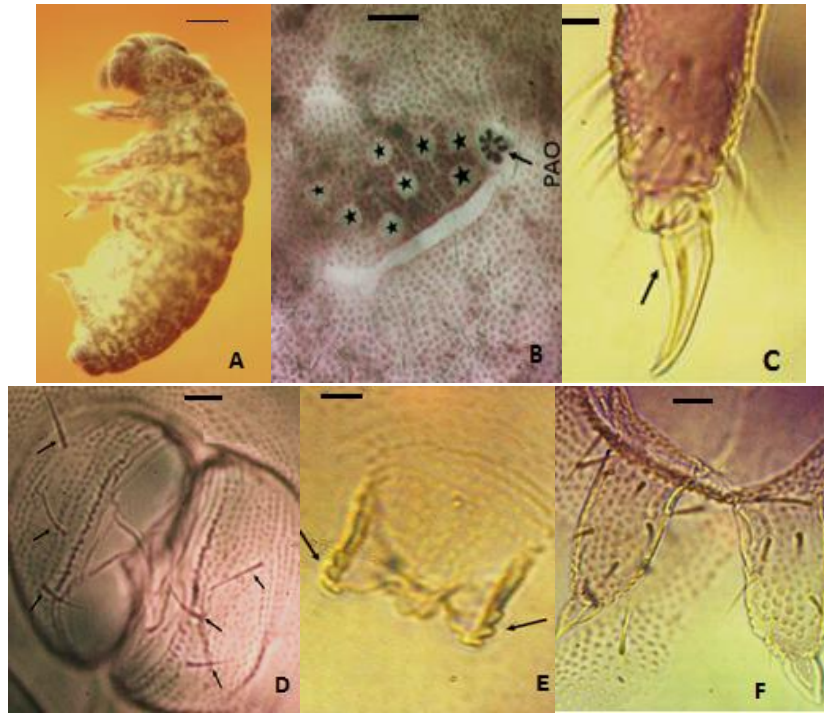


Fig.9. *Brachystomella parvula* (Schaffer): A: Body habitus (Scale bar: 1000 μ m), B: 8 ommatidia and PAO, C: Tibiotarsi and claws, D: Collophore on abdomen 1, E: Retinaculum, F: Furca (Scale bar: 25 μ m) (Original).

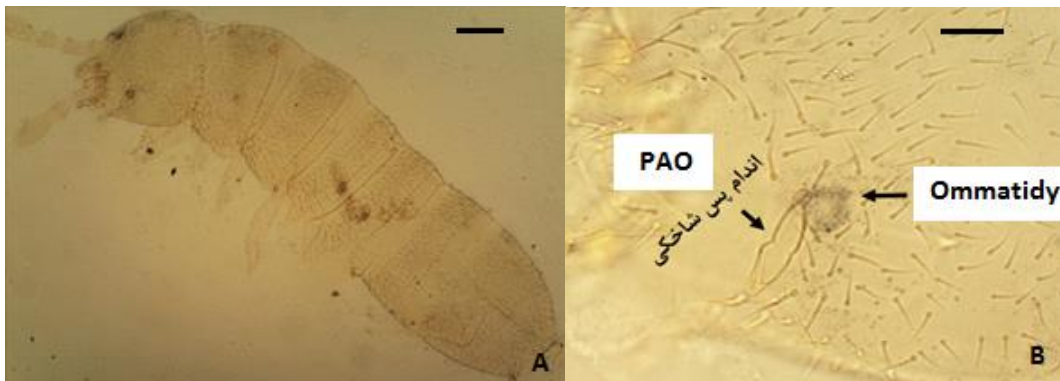


Fig.10. *Folsomia ksenemani* (Stach): A: Body habitus (Scale: 1000 μ m), B: one ommatidy and PAO on head, (Scale bar: 25 μ m) (Original).

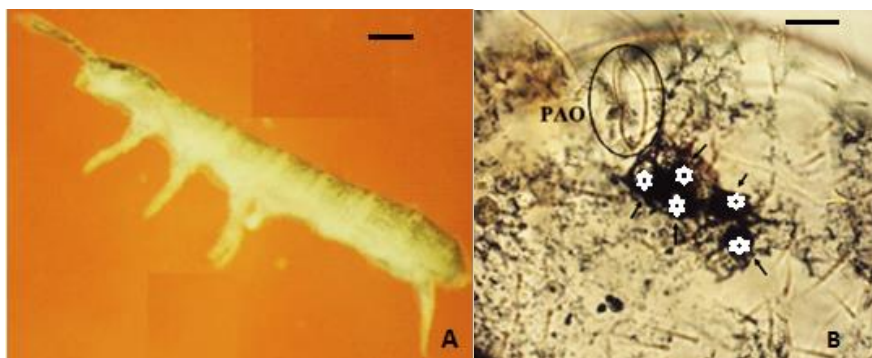


Fig.11. *Hemisotoma pontica* (Stach): A: Body habitus (Scale bar: 1000 μ m), B: five ommatidia and PAO, (Scale bar: 25 μ m) (Original).

Proisotoma subminuta (Denis, 1931)

Material examined. Tehran, Tochal, soil in mountain, N 35° 53' E 51° 25' (12924 m.a.s.l.), April 12, 2013, F. Qazi.

Distribution. Widespread species (Fig.12) (Potapow, 2001); Tehran (Moravvej, 2003); Guilan/Rasht (Daghighi *et al.*, 2013).

Isotomiella minor (Schaffer, 1896)

Material examined. Tehran, Parvane Park, soil under box-tree, N 35° 44' E 51° 33' (4897 m.a.s.l.), June 15, 2013; Tehran, Taleghani park, Soil under pine trees, N 35° 45' E 51° 25', (7587 m.a.s.l.), October 4, 2013, F. Qazi.

Distribution. Cosmopolitan (Fig. 13) (Potapow, 2001). In Iran: Mazandaran, Guilan, E. Azarbaijan (Cox, 1982); Tehran (Moravvej, 2003); Mazandaran/Sari (Yahyapour, 2012); Guilan/Rasht (Daghighi *et al.*, 2013a & Daghighi *et al.*, 2013b); Kermanshah (Ghahramaninezhad *et al.*, 2012).

Isotomorus cf. punctiferus (Yossi, 1963)

Material examined. Tehran, Ardakani Park, leaf litter under Cypress tree, N 35° 44' E 51° 17' (4320 m.a.s.l.), March 15, 2014; Tehran, Hafte Tir, soil under pine trees, N 35° 42' E 51° 25', (4051 m.a.s.l.), May 12, 2013, F. Qazi.

Distribution. Japan (Potapow, 2001) (Fig. 14). In Iran: Golestan/Gorgan (Falahati, 2012 & Falahati *et al.*, 2013a); Guilan/Rasht, (Daghighi, 2012; Daghighi *et al.*, 2013a & Daghighi *et al.*, 2013b). More study is needed for identifying the species of the Iranian specimen.

Family Entomobryidae

This family includes 1365 species in the world (Hopkin, 1997) and Entomobryinae (Bellinger *et al.*, 1996-2015). In Iran, 25 species have been recorded (Shayanmehr, *et al.*, 2013).

Entomobrya atrocincta (Schott, 1986)

Material examined: Tehran, Kuhsar park, soil and leaf litter under Mulberry tree, N 35° 45' E 51° 33' (1496 m.a.s.l.), October 31, 2013, F. Qazi.

Distribution. North America and Europe (Jordana, 2012). Mazandaran/Sari (Yahyapour, 2012 & Yahyapour *et al.*, 2011); Kermanshah/ Harsin (Kahrarian *et al.*, 2012). This species is recorded for the first time from Tehran province.

Lepidocyrtus sp.

Material examined. Tehran, Taleghani park, soil under pine tree, N 35° 45' E 51° 25' (7587 m.a.s.l.), October 4, 2013, F. Qazi.

Distribution. *Lepidocyrtus* is one of the largest genera within the Collembola. Until now up to 200 species on the global scale were reported (Bellinger *et al.* 1996–2015).

Diagnosis: Body color with yellowish background with scales that make appearance dark (Fig. 16) with mucro short, two teeth with basal spine. Head with 8+8 ommatidia.

Sinella curviseta (Brook, 1882)

Material examined. Tehran, Ekbatan, soil of Meadow, N 35° 41' E 51° 25' (3825 m.a.s.l.), March 1, 2014, F. Qazi.

Distribution. Europe (Hopkin, 2004). Mazandaran (Yoosefi lafooraki and Shayanmehr, 2014b); Tehran (Moravvej, 2003).

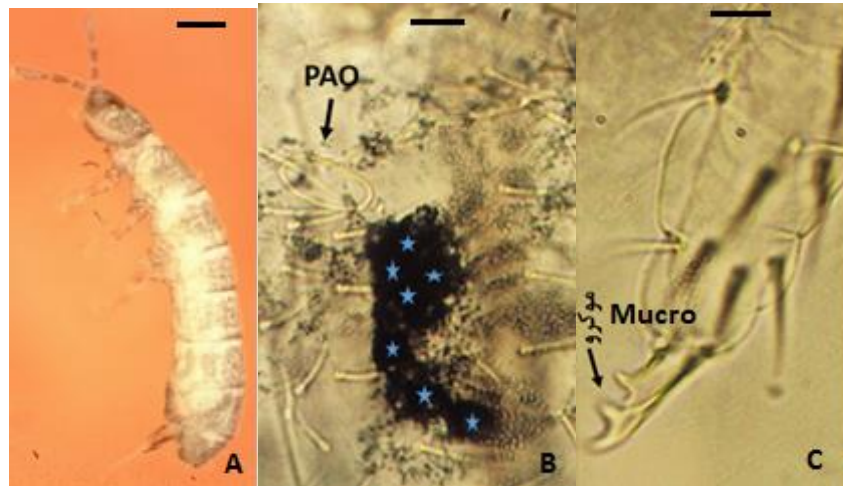


Fig.12. *Proisotoma subminuta* (Denis): A: Body habitus (Scale bar: 1000 μm), B: 8 ommatidia and PAO, C: Dens and mucro, (Scale bar: 25 μm) (Original).

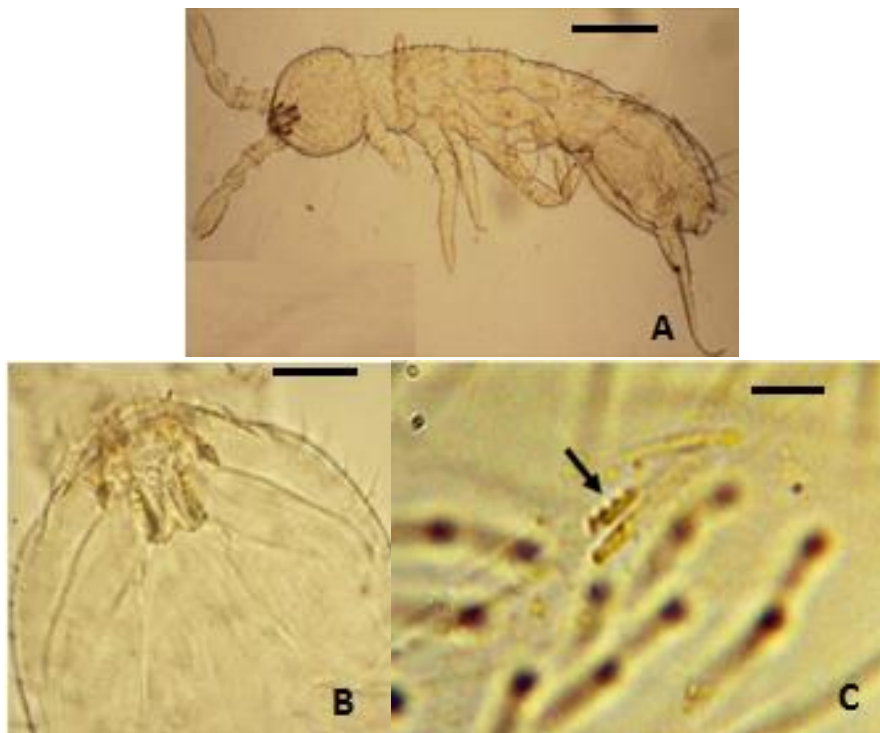


Fig. 13. *Isotomiella minor* (Schaffer): A: Body habitus (Scale bar: 1000 μm), B: without ommatidia and PAO, C: Retinaculum, (Scale bar: 25 μm) (Original).

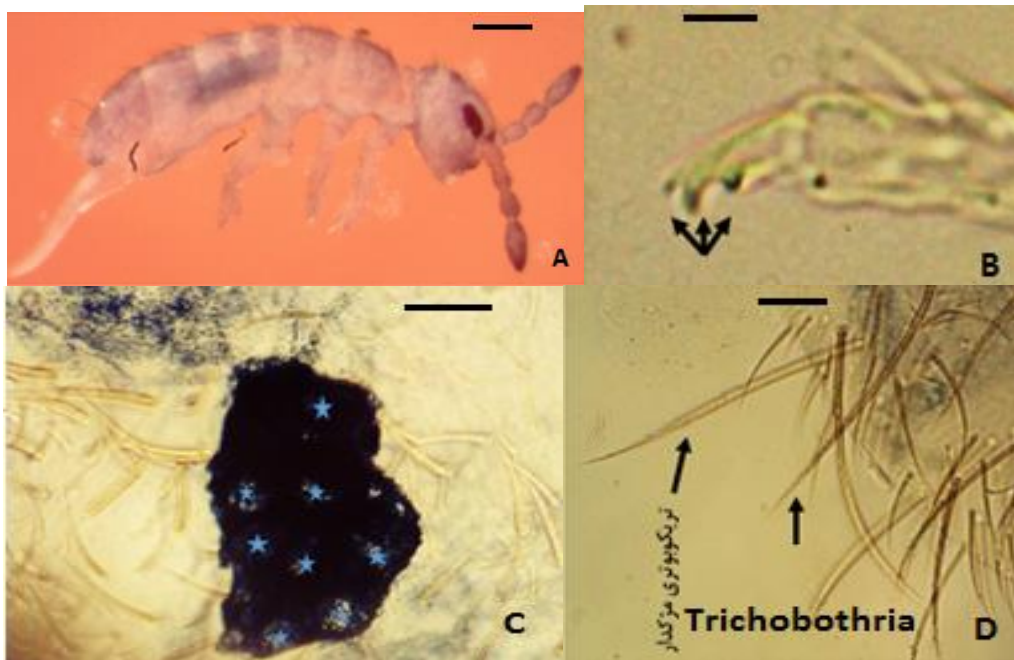


Fig. 14. *Isotomorus* cf. *punctiferus* (Yossi): A: Body habitus (Scale bar: 1000 μ m), B: Mucro, C: 8 ommatidia, D: Trichobothria on abdomen, (Scale bar: 25 μ m) (Original).

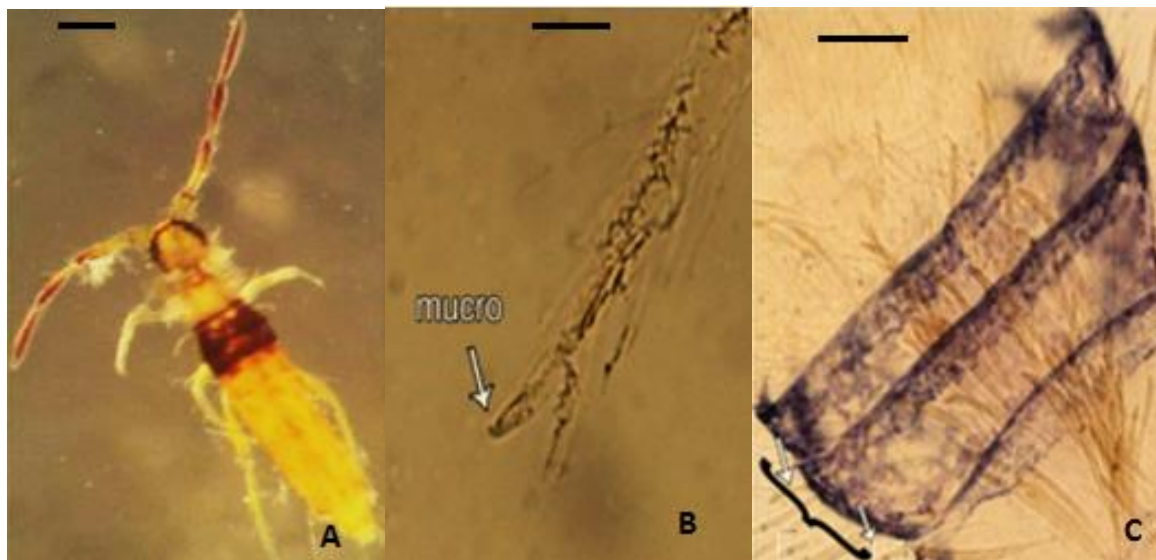


Fig. 15. *Entomobrya atrocincta* (Schott): A: Body habitus (Scale bar: 1000 μ m), B: Mucro, C: dark band on thorax and abdomen, (Scale bar: 25 μ m) (Original).

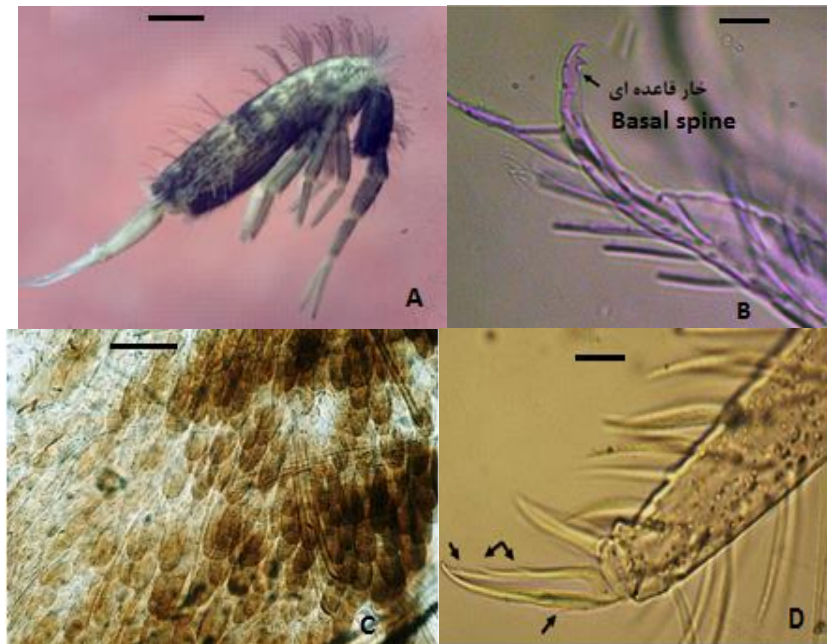


Fig. 16. *Lepidocyrtus* sp.: A: Body habitus (Scale bar: 1000 μ m), B: Mucro, C: Scales on body, D: Tobiotarsi, claws and empodium, (Scale bar: 25 μ m) (Original).

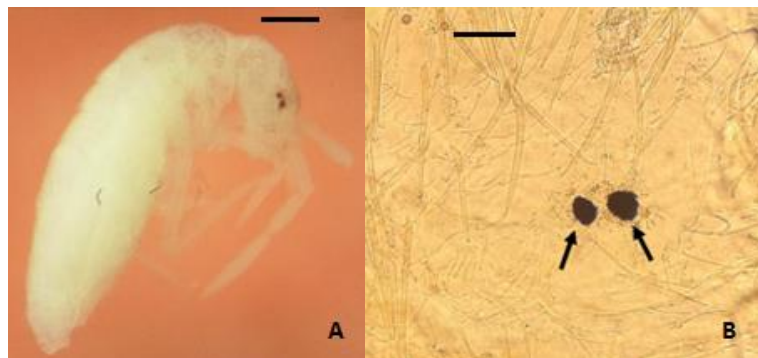


Fig. 17. *Sinella curviseta* (Brook): A: Body habitus (Scale bar: 1000 μ m), B: two ommatidia on head, (Scale bar: 25 μ m) (Original).

Family Katiannidae

This family belongs to the order of Symphypleona which are characterized by a globular body (Bretfeld *et al.*, 1999). This family includes 220 species in the world (Bellinger *et al.*, 1996-2015). In Iran, only three species have been recorded (Shayanmehr, *et al.*, 2013).

Sminthurinus elegans (Fitch, 1863)

Material examined: Tehran, Dar Abad, soil and leaf litter under cypress trees, N 35° 49' E 51° 30' (5604 m.a.s.l.), October 31, 2013; Tehran, Laleh park, soil and leaf litter under pine trees, N 35° 42' E 51° 23'

(5213 m.a.s.l.), December 7, 2013; Tehran, Ekbatan, soil under Meadow, N 35° 41' E 51° 25' (3825 m.a.s.l.), March 1, 2014; Tehran, Ardakani Park, leaf litter under Cypress trees, N 35° 44' E 51° 17' (4320 m.a.s.l.), March 15, 2014; Tehran, Lavizan Park, leaf litter under pine tree, N 35° 46' E 51° 30' (5095 m.a.s.l.), April 15, 2014; Tehran, Khazaneh Park, leaf litter under willow tree, N 35° 38' E 51° 24' (3617 m.a.s.l.), April 26, 2014, F. Qazi.

Distribution. Cosmopolitan (Fjellberg 2007). Tehran (Moravvej, 2003); Mazandaran/ Sari (Yahyapour, 2012); Golestan/ Gorgan (Falahati, 2012) and Kermanshah (Ghahramaninezhad *et al.*, 2012).



Fig. 18. *Sminthurinus elegans* (Fitch): A: Body habitus (Scale bar: 1000 μ m), B: Dens and mucro, C: Abdomen 6 in female, (Scale bar: 25 μ m) (Original).

Other species in Tehran province

A checklist of 50 species of Collembola of Tehran province is summarized. The recorded species in this research raised the number of collembolan species from Tehran province to 71 species.

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