

# New records of Collembola (Hexapoda: Entognatha) for Iranian fauna from Mazandaran, Semnan and Isfahan provinces

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YOOSEFI LAFOORAKI, E. & SHAYANMEHR, M.: *New records of Collembola (Hexapoda: Entognatha) for Iranian fauna from Mazandaran, Semnan and Isfahan provinces.*

**Abstract:** In this study, a new genus *Thalassaphorura* Bagnall, 1949 and eight new species *Orchesella cincta* (Linnaeus, 1758), *Hypogastrura vernalis* (Carl, 1901), *Tullbergia simplex* Gisin, 1958, *Sminthurus nigromaculatus* (Tullberg, 1872), *Isotomurus fucicola* Schött, 1893, *Protaphorura aurantiaca* (Ridley, 1880), *P. fimata* (Gisin, 1952) and *T. encarpata* (Denis, 1931) are reported for Iranian Collembola fauna. Additionally the species *Cyphoderus albinus* (Nicolet, 1842) and *Pseudosinella octopunctata* Börner, 1901 are reported for Isfahan province and *Folsomides parvalus* (Stach, 1922) is reported for Semnan province. The specimens of the species were collected from different regions of Mazandaran, Semnan and Isfahan provinces in Iran during 2011-2012. The specimens were extracted by Berlese funnel from soil, leaf litter and moss or were caught by pitfall traps. Sampling and morphological information on species are presented.

**Keywords:** Collembola, Iran, Mazandaran, Semnan, Isfahan.

## Introduction

Collembola is one of the oldest groups among Arthropoda. The most ancient fossil record of insects belongs to this group (RAPOPORT 1971). In most terrestrial ecosystems they occur in high numbers and are extremely important in influencing the structure of soils (HOPKIN 2002). Although, Iran is the 18th largest countries which located in western Asia but Collembola fauna of Iran has been investigated poorly. The first record of springtails in Iran was made by FARAHBAKHS (1961) who described species *Sminthurus viridis* Linnaeus, 1758 from wheat and alfalfa fields in southern Iran. COX (1982) described 70 species from northern, western and central provinces of Iran. Recently, some researchers have studied the biodiversity of springtails locally (MORAVVEJ et al., 2007; NEMATOLLAHI et al., 2009; YAHYAPOUR 2012; KAHRARIAN et al., 2012; DAGHIGHI 2012). At present, 116 species, belonging to 18 families and 51 genera are known from Iran (SHAYANMEHR et al., 2013). In this study, one new genus and eight new species are added to Iranian Collembola fauna.

## Materials and methods

Species were collected from three provinces of Iran including Mazandaran, Semnan and Isfahan during 2011-2012. Mazandaran province is located in the northern Iran, the southern coast of the Caspian Sea. Semnan province is located in central Iran and finally, Isfahan province is located on the main north-south and east-west routes crossing Iran. The specimens were collected in two ways. Some of them were caught by pitfall traps (*S. nigromaculatus* and *H. vernalis*) and majority of specimens were extracted by Berlese funnel from soil, leaf litter and moss. The specimens were collected from different habitats (Table 1). They preserved in 75% alcohol and then were cleared in potassium hydroxide and mounted on slides in Hoyer medium and observed using a phase contrast microscope.

## Results and Discussion

A total of eleven species of Collembola belonging to seven families and ten genera were collected and identified from Iran by this research. The information of collected species is presented in Table 1. The species, *Orchesella cincta*, *Tullbergia simplex*, *Sminthurus nigromaculatus*, *Isotomurus fucicola*, *Protaphorura aurantiaca*, *P. fimata* and *Thalassaphorura encarpata* and the genus *Thalassaphorura* are new for Iranian fauna. Also *Hypogastrura vernalis* is recorded for the first time from Mazandaran province (Northern Iran). *Cyphoderus albinus* and *Pseudosinella octopunctata* are reported for Isfahan province. *Cyphoderus albinus* was recorded before from Gilan province by DAGHIGHI (2012) and *Pseudosinella octopunctata* was recorded from Central, Mazandaran, Gilan, E. Azarbaijan, W. Azarbaijan and Zanjan provinces by COX (1982) and from Mazandaran province by YAHYAPOUR (2012). *Folsomides parvalus* is reported from Semnan province for the first time. It was reported before from Central, Mazandaran, Gilan, E. Azarbaijan, W. Azarbaijan and Kermanshah provinces (COX, 1982; DAGHIGHI, 2012; YAHYAPOUR, 2012; KAHRARIAN et. al., 2012).

### **Taxonomic description:**

*Tullbergia simplex* Gisin, 1958 Family: Tullbergidae

Material examined: 12 specimens, Mazandaran, Savadkooh, Alasht, Serin, in moss, 16 September 2012.

Description: Size 0.8 mm. Post antennal organ (PAO) with about 50 primary vesicles which are irregularly subdivided giving the organ a 'filled' appearance. Pseudocellar formula: 11/111/1111. The two small sensilla in Antenna, segment 3 organ partly covered by integumentary folds. Integument with coarse granulation, in particular in lateral and mid-section on thorax, and on last two abdominal segments. Characteristic features are: Thorax, segment 2 without p<sub>1</sub>, Thorax, segments 2-3 with p<sub>4</sub> much shorter than p<sub>5</sub>, Abdomen, segments 2-4 with m<sub>4</sub> shorter than m<sub>5</sub>, Abdomen, segment 5 with short a<sub>2</sub>. The two anal spines long and curved, 1.5 times as long as inner unguis. Claws simple, unguiculus vestigial (FJELLBERG 1998).

*Sminthurus nigromaculatus* (Tullberg, 1872) Family: Sminthuridae

Material examined: 11 specimens, Mazandaran, Savadkooh, Alasht, Serin, meadows, 15, 16 September 2012.

**Table 1: Information on eleven new species recorded from Mazandaran, Semnan and Isfahan provinces (Iran)**

Species	Location	Date	Habitat	Coordinate	Altitude (m)	Identified by
<i>Tullbergia simplex</i> Gisin, 1958	Mazandaran, Savadkooh, Alasht	16/ 9/ 2012	Moss on the trees of <i>Crataegus</i> , <i>Mespilus</i> and <i>Pyrus</i> genera	N 36°, 03 E 52°, 53	1493- 1900	Hans Jürgen Schulz
<i>Sminthurus nigromaculatus</i> (Tullberg, 1872)	Mazandaran, Savadkooh, Alasht	15, 16/ 9/ 2012	Meadows	N 36°, 03 E 52°, 53	1493- 1900	Hans Jürgen Schulz
<i>Isotomurus fucicola</i> Schött, 1893	Mazandaran, Ghaemshahr	7 /9/2012	Rice field, soil	N 36°, 46 E 52°, 51	51.2	Hans Jürgen Schulz
<i>Protaphorura aurantiaca</i> (Ridley, 1880)	Semnan, Shahmirzad	11 /7/ 2012	Forest, leaf litter	N 35°, 46 E 53°, 19	2050	Hans Jürgen Schulz
<i>P. fimata</i> (Gisin, 1952)	Isfahan, Zarrinshahr	31 /8/ 2012	Cantaloupe	N 45°, 32 E 59°, 51	1685	Hans Jürgen Schulz
<i>Orchesella cincta</i> (Linnaeus, 1758)	Mazandaran, Savadkooh, Alasht	15 /9/ 2012	Moss on the stones	N 36°, 03 E 52°, 53	1493- 1900	Rafael Jordana
<i>Hypogastrura vernalis</i> (Carl, 1901)	Mazandaran, Savadkooh, Alasht	15, 16/ 9/ 2012	Meadows	N 36°, 03 E 52°, 53	1493- 1900	Hans Jürgen Schulz
<i>Cyphoderus albinus</i> (Nicolet, 1842)	Isfahan, Zarrinshahr	31 /8/ 2012	Cantaloupe	N 45°, 32 E 59°, 51	1685	Rafael Jordana
<i>Pseudosinella octopunctata</i> Borner, 1901	Isfahan, Zarrinshahr	31 /8/ 2012	Cantaloupe	N 45°, 32 E 59°, 51	1685	Rafael Jordana
<i>Folsomides parvalus</i> (Stach, 1922)	Semnan, Mahdishahr	10 /7/ 2012	Fruit garden, soil	N 35°, 42 E 53°, 21	1630	Masoumeh Shayanmehr
<i>Thalassaphorura encarpata</i> (Denis, 1931)	Mazandaran, Sari	11/9/2011	Olive garden, soil	N 36°, 34 E 53°, 30	40	Rafael Jordana

Description: Total length up to 2 mm in females, 1.5 mm in males. Color greenish to dark purple, pigment forming spots or larger patches up to completely dark purple. There are 2 median black spots on segment 6 of abdomen and long, rough setae on head apex and large abdomen. Postantennal seta is rather long. Segment 2 of antenna has 4 short ventral setae, segment 3 proximally has 5 long, rough setae and segment 4 has 15-17 subsegments, basal whorl with 4 setae. Anterior side of femora 2 and 3 with proximal seta. Subcoxa 3 has 2 distal setae. Claws with tunica, inner and weak basal outer tooth, and long, weakly serrate pseudonychia; empodium 1 without, empodium 2 and 3 with tooth, all filaments long, as long as claws. Ventral tube with 2+2 and Retinaculum with 4 setae. Formula of anterior setae of dens 3,3,3,2,2,1,1. Both edges of mucro smooth; seta present. Appendices anales long, curved, pointed, smooth, or apically ciliate (BRETTFELD 1999).

*Isotomurus fucicola* Schött, 1893

Family: Isotomidae

Material examined: 5 specimens, Mazandaran, Ghaemshahr, rice field, 7 September 2012.

Description: Body size up to 2.5 mm. Color uniformly greyish or violet brown, sometimes narrowly darkened along posterior edges of abdomen, segments 4-6. Smaller specimens more reddish. Antennae slightly darker than rest of body. Antennal bases dark, as well as the neck region and a mid-dorsal spot behind the eyes. Frontoclypeal

field not darkened. Post antennal organ oval, 1.5 as long as diameter of nearest ocellus. Antenna has a group of 2-4 short ventroapical sensilla on segment 1 and several short, blunt sensilla in lateral position on segments 2 and 4. Labial palp with 8-10 proximal setae. Basomedian field with 8-9 setae. Ventral side of head with up to 15 postlabial setae on each side of ventral line. Maxilla with 3-toothed capitulum and 6 lamellae. Lamella 1 projects beyond tip of capitulum, with coarse serrations along the edges, no serration on the inner face except some delicate filaments (tooth-brush) near base. Lamella 2-6 with serration both along the edges and on the inner face. The serrations are finer on Lamella 5 than on the others. Body with a dense cover of dark setae, macrochaetae of the legs and last three abdominal segments densely ciliated. Short setae smooth. Median macrochaeta on abdomen, segment 5 are 3.2-3.4 as long as inner length of claw 3. Sensillary equipment of tergites normal. Ventral tube with 3+3 laterodistal setae, frontal and caudal setae numerous. Retinaculum with 8-11 setae. Manubrium with sharp ventroapical teeth. (FJELLBERG 2007).

*Protaphorura aurantiaca* (Ridley, 1880) Family: Onychiuridae

Material examined: 35 specimens, Semnan, Shahmirzad, forest, 11 July 2012.

Description: The pseudocellar formula is 33/022/33343.

*P. fimata* (Gisin, 1952) Family: Onychiuridae

Material examined: 23 specimens, Isfahan, Zarrinshahr, soil, 31 August 2012.

Description: White, 2.5 mm The pseudocellar formula is 33/022/3333. Subcoxa each with seta's absent. Thorax 1 with seta m usually present (FJELLBERG 1998).

*Orchesella cincta* (Linnaeus, 1758) Family: Entomobryidae

Material examined: 18 specimens, Mazandaran, Savadkooh, Alasht, Serin, moss, 15 September 2012.

Description: Body size up to 3 mm. Characteristic is the dark dorsal disk of Abdomen 3 and the contrasting white part of abdomen 2. In younger specimens the dark pattern is less developed, while very large individuals become almost black, leaving only antenna 3-4 distal part of antenna 1, distal parts of legs and furca and posterior part of abdomen 2 unpigmented. Ventroapical manubrial thickening with 3-4 large teeth. The color pattern will normally identify this species, in particular the dark abdomen 2. The almost glowing white part of antenna 1 is typical in large dark specimens (FJELLBERG 2007).

*Hypogastrura vernalis* (Carl, 1901) Family: Hypogastruridae

Material examined: In high density, Mazandaran, Savadkooh, Alasht, Serin, meadows, 15, 16 September 2012.

Description: Size 1.2 mm, color dark bluish-red. Post antennal organ with 4 slightly irregular lobes, a little larger than an ocellus. Lamella 1 with 2 fan-shaped rows of cilia at apex, shaft with some coarse denticles near base in addition to a bundle of stiff filaments projecting towards the space behind the three maxillary teeth (tooth-brush). Antenna 1 with 7 setae. Antenna 3 organ simple, without additional spines. Antenna With simple apical bulb and 6-7 curved sensilla which are only slightly thicker than other antennal setae. Body hairs short, uniform, rather thick, distinctly serrate. Macrochaetae not developed. Body integument with fine, uniform granulation. Anal spines short, straight, as long as their basal papillae. Retinaculum with 4+4 teeth. Dorsal

side of dens with 7 setae and tubercles which become enlarged towards apex. Mucro characteristic, with a plug-shaped tip and a large, angular dorsal lamella. Tibiotarsi with one clavate tenent hair. Claws with distinct inner tooth, lateral teeth present. Unguiculus reaching slightly beyond inner tooth of unguis, with broad basal lamella (FJELLBERG 1998).

*Cyphoderus albinus* (Nicolet, 1842) Family: Cyphoderidae

Material examined: 30 specimens, Isfahan, Zarrinshahr, soil, 31 August 2012.

Description: Body size 1.6 mm. White, eyes absent. Body shaped flattened, broad. Sides of Thorax 2-3 roof like flattened, hiding bases of legs. Thin transparent scales are present on dorsal side of head and body, including legs, two basal segments of antennae and ventral side of dens. Antennae about 2.5 as long as head diagonal. Antennae 1 with 7-8 ventral and 3 dorsal (at Antennae 3 organ inconspicuous, with small apical sensilla and guards. Antennae 2-3 with a short, triangular spin like sensillum in mid-ventral position. Antennae 4 has a short club-shaped subapical organ. Labrum with 4/554 smooth setae, two setae of the mid-row stronger than others. Labral edge unmodified. Frontoclypeal field with 4+5 setae, of which the posterior 5 are ciliated. Labial palps with a normal papillary complex, with proximal setae. Papilla E with 4 guards. Basal fields with 4 median and 5 lateral setae. Maxillary palp simple, sublobal hairs absent. Maxilla with 3-toothed capitulum and a fused pad-shaped lamellary complex which is not easily interpreted. Tip of longest lamella reaches beyond capitate teeth. Top of head with 1+1 long trichobothria. Head with 3+3 postlabial setae. Thorax and abdomen with macrochaetae and ciliated setae only along sides, not on dorsal disc. Mesothorax with a row of short, spin-like setae along anterior edge. Ventral tube with 2+2 long anterior setae, 2+2 short distal and 6-7 posterior setae of which three are longer than others. Retinaculum with 4+4 teeth and one setae. Coxal parts of mid-legs with 2-3 particularly strong macrochaetae. Claws slender, apically expanded, unguis with a long needle-like basal tooth on the back side, inner edge with a small subapical tooth. Unguiculus with a strong, wing-like ventral tooth. Trochanteral organ of last leg V-shaped, with about 10 setae. Manubrium with a differentiated cover of dorsal ciliate setae, in particular the 3+3 lateral macrochaetae in distal half are distinct. Dens dorsally with double rows in a single row of 4 ciliate macrochaetae. Proximal part with 3 setae, of which one is smooth. Ventral side of dens with many hyaline scales. Mucro elongate, almost half as long as dens, with two apical teeth (FJELLBERG 2007).

*Pseudosinella octopunctata* Börner, 1901 Family: Entomobryidae

Material examined: 6 specimens, Isfahan, Zarrinshahr, soil, 31 August 2012.

Description: Body size up to 1.1 mm. Color white, with diffuse bluish grey pigment on antennae and dorsal and ventral side of head, body with scattered brownish red pigment. Ocelli 4+4, set on square eye-spot. Maxillary outer lobe with 3 sublobal hairs and a small spine. Head with both macrochaetae S and T present. Trichobothrial microsetae all slim and smooth, also on third abdomen segment. Segment 4 of abdomen with 3+3 macrochaetae in the median field. Setae of the trichobothrial fields smooth, except one. Claws narrow, with small paired inner teeth, posterior slightly larger and more distal than anterior. Lateral teeth small, set beyond middle of unguis. Unguiculus narrow lanecolate, without distinct teeth (FJELLBERG 2007).

*Folsomides parvalus* (Stach, 1922)      Family: Isotomidae  
Material examined: 30 specimens, Semnan, Mahdishahr, soil, 10 July 2012.

Description: Body shape very long and tubular, size up to 0.9 mm. Abdomen, segments 5-6 prolonged. Post antennal organ narrow elongate. Ocelli 2+2. White, dark spots only under the ocelli. Macrochaetae well developed, also on anterior abdominal segments. Lower two pairs of sensilla on abdomen, segment 5 not thicker than upper pairs. The upper segment 4 sensillum set close to the macrochaetae. Retinaculum with 3+3 teeth, no setae. Furca with long and slender dens which has only 3 dorsal setae, no ventral. Mucro with two teeth. Only females are seen (FJELLBERG 2007).

*Thalassaphorura encarpata* (Denis, 1931)      Family: Onychiuridae  
Material examined: 1 specimens, Mazandaran, Sari, soil, 11 September 2011.

Description: Post antennal organ with about 25 simple vesicles in a narrow arrangement. The pseudocellar formula is 32/233/33343. There are 2 pseudocelli on each subcoxae. Antennae 1 with 8 setae. Antennae 3 organ with 5 papillae, 2 rods and two sensory clubs with irregular ribs giving a moral-like impression. Body integument with fine, uniform granulation. Macrochaetae moderately developed. Sensilla weak. Microsensilla present on second and third thorax. Anal spines curved, slender, about as long as inner edge of claws. Ventral tube with 1+1 frontal setae, 6-7 distal, and 1 on each side at base. Claws without teeth, unguiculus gradually tapering, subequal to inner length of unguis (FJELLBERG 1998).

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