The checklist of Collembola (Hexapoda, Arthropoda) from west of Iran

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ABSTRACT. In this study, the list of Collembola from west of Iran and collection information such as study site, habitats, e.g., soils, grasslands, leaf-litter, vegetation, snowfields, etc., and collectors has been presented between years 2013-2018. Moreover, some samples were collected and identified by the author during 2017-2018. In the last case, Collembolans were extracted using the respirator or Berlese funnels. When greater clearing was required, Nesbitt's solution (40 g chloral hydrate, 25 mL distilled water, and 2.5 mL concentrated acetic acid) was used for heavily pigmented specimens. In the first Iranian checklist of Collembola published in 2013, 17 species, 15 genera and seven families were introduced from west of Iran. After review and analysis of the available literature and the examination of samples collected by the author from west of Iran, 88 species, belonging to 42 genera, 16 families and four orders. The genus Entomobrya and Folsomia are having the highest number of species for analyzed region. An up-to-date systematic checklist of Collembolans has been provided.

Key words: Springtail, Species list, Western part of Iran

Introduction

According to the checklist of Iranian Collembola published in 2013, most recorded collembolan was introduced from northern parts of Iran (Shayanmehr et al., 2013). But in recent years, the study of Collembola fauna in west of Iran also increased (Kahrarian et al., 2012, 2013, 2014a, 2014b; Kahrarian, 2012, 2017; Arebea & Kahrarian, 2015a, 2015b; Smolis et al., 2016a, 2016b). The western part of Iran has moderate and warm climate, which borders with the two countries of Iraq and Turkey. It comprised five major provinces: Kurdistan, Kermanshah, Ilam, Lorestan and Hamedan (Kahrarian, 2017). The first report of Collembola from west of Iran was from Entomobryidae which published in 2011 (Kahrarian et al., 2012). After that the number of reported species from this area were increased whereas in 2013, 17 species, 15 genera and seven families were recorded (Shayanmehr et al., 2013).

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Even until 2013, 12 new species were described to west of Iran: Hypogastrura persica sp. nov. (Kahrarian et al., 2013); Isotoma iranica sp. nov. and Isotomodes korkorensis sp. nov. (Arbea & Kahrarian, 2015a); Folsomides halshinicus sp. nov. and Folsomides subvinosus sp. nov. (Arbea & Kahrarian, 2015b); Ephemerotoma skarzynskii sp. nov. (Potapov et al., 2015); Endonura dichaeta sp. nov. Endonura ceratolabralis sp. nov. and Endonura Persica sp. nov. (Smolis et al., 2016a); Protaphorura persica sp. nov. (Arbea & Kahrarian, 2017); Heteraphorura iranica sp. nov. and Spinonychiurus persicus sp. nov. (Kaprus et al., 2017). The objective of this paper is to present the first checklist of the Collembola fauna from west of Iran.

Material and methods
The new checklist of Collembola from west of Iran was made based on the published literatures between years 2013 to 2018 and unreported species of collemboles that have been collected by the author from different regions of Kermanshah and Lorestan provinces during 2017–2018 years (Fig. 1). In the latter state, several samples were taken from diverse habitats of Kermanshah, Lorestan and Kurdistan province like, soils, grasslands, leaf-litter, etc. Collembola were extracted using the respirator or Berlese funnels. When greater clearing was required, Nesbitt’s solution (40g chloral hydrate, 25 mL distilled water, and 2.5 mL concentrated acetic acid) was used for heavily pigmented specimens (Jordana, 2012). The species were listed according to the system of Bellinger et al. (1996-2019), including the orders, the families, genera and the species.

For the new represented species in the list the general geographic distribution in the world and Iran and the resources are given. Records are updated to 28.08.2018.

Figure 1. The map of western provinces of Iran. ●: Region including collection points.
Results
After last checklist from Iran (2013) which including 17 species from west of Iran (Shayanmehr et al., 2013), the new update checklist comprised 71 species 28 genera and nine families. By adding these 71 species to previous, the total number of species from west of Iran reached to 88 species. These 88 species belonging to 43 genera and 16 families. The highest frequency percentage of species, (47.8%) was from order Entomobryomorpha, and after that orders Poduromorpha (42%) was placed (Fig. 2). Moreover, most total recorded of species and genera belong to families Isotomidae (26 species and 12 genera) and Onychiuridae (13 species and 7 genera).

![Pie chart showing species distribution by order.](image)

**Figure 2.** The frequency percentage of the different species of Collembola for each order.

**Table 1.** Checklist of Collembola from the western Iran. **New for Science, * New for Iranian fauna.

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<th>Taxonomy/Order/Family/Genera/Species</th>
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<td><strong>Entomobryomorpha</strong> Börner, 1913</td>
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<td>(Kahrarian et al., 2016a)</td>
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<td>(Kahrarian et al., 2016a)</td>
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<td>Genus: <em>Drepanura</em> Schött, 1897</td>
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<tr>
<td><em>Drepanura</em> sp.</td>
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<td>(Kahrarian et al., 2014b)</td>
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<td><strong>Desoria zlotini</strong>* Martynova, 1968</td>
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<td><em>Axenyllodes monoculatus</em>* Jordana &amp; Ardanaz, 1981</td>
<td>Kermanshah (Kahrarian, 2014)</td>
<td>Soil &amp; Leaf litter (Oak jungle)</td>
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<tr>
<td><strong>Family: Onychiuridae</strong> Lubbock, 1867</td>
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<td><strong>Genus: Heteraphorura</strong> Bagnall, 1948</td>
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<td><em>Heteraphorura innica</em>* Kaprus, Shayanmehr &amp; Kahrarian, 2017</td>
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<td><strong>Genus: Orthonychiurus</strong> Stach, 1954</td>
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<td><em>Orthonychiurus folsomi</em> (Schäffer, 1900)</td>
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<td>Soil &amp; Leaf litter (Pine and Oak tree)</td>
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<tr>
<td><em>Orthonychiurus stachianus</em> (Bagnall, 1939)</td>
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<td>Protaphorura cancellata* (Gisin, 1956)</td>
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<td>Protaphorura finata (Gisin, 1952)</td>
<td>Kermanshah (Arbea &amp; Kahrarian, 2017)</td>
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<td>Soil (Wheat farm), Leaf litter (Oak jungle)</td>
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<td>Protaphorura persica** Arbea &amp; Kahrarian, 2017</td>
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<td>Metaphorura affinis (Börner, 1902)</td>
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<td>Metaphorura denisi* Simón Benito, 1985</td>
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<td>Metaphorura riozoi* Castaño-Meneses, Palacios-Vargas &amp; Traser, 2000</td>
<td>Ilam (Shayanmehr et al., 2017)</td>
<td>Soil &amp; leaf litter (Cypress trees)</td>
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<td><strong>Genus: <em>Mesaphorura</em> Börner, 1901</strong></td>
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<td><em>Mesaphorura macrochaeta</em> Rusek, 1976</td>
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<td><em>Mesaphorura hylophila</em> Rusek, 1982</td>
<td>Kermanshah (Kahrarian et al., 2014a)</td>
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<td><strong>Genus: <em>Fissuraphorura</em> Rusek, 1991</strong></td>
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<td><em>Fissuraphorura duplex</em> (da Gama, 1962)</td>
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<td><strong>Order: Neelipleona Massoud, 1971</strong></td>
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<td><strong>Family: Neelidae Folsom, 1896</strong></td>
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<td><em>Megalothorax perspicillum</em> Schneider &amp; D’Haese, 2013</td>
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<td><strong>Family: Arrhopalitidae Stach, 1956</strong></td>
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<td><strong>Genus: <em>Arrhopalites</em> Börner, 1906</strong></td>
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<td><em>Arrhopalites caecus</em> (Tullberg, 1871)</td>
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<td><em>Dicyrtoma ghilarovi</em> Bretfeld, 1996</td>
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<td><strong>Family: Katiannidae Börner, 1913</strong></td>
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<td><strong>Genus: <em>Sminthurinus</em> Börner, 1901</strong></td>
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<td><em>Sminthurinus elegans</em> Fitch, 1863</td>
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<td>Soil &amp; Leaf litter</td>
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<td><strong>Genus: Sphaeridia Linnaniemi, 1912</strong></td>
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<td><em>Sphaeridia pumilis</em> (Krausbauer, 1898)</td>
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<td><strong>Family: Sminthuridae Lubbock, 1862</strong></td>
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<td><strong>Genus: Caprainea Dallai, 1970</strong></td>
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<td><em>Caprainea marginata</em> (Schott, 1893)*</td>
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<td><strong>Genus: Sminthurus Latreille, 1802</strong></td>
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<tr>
<td><em>Sminthurus viridis</em> (Linnaeus, 1758)</td>
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<td>Soil Grassland</td>
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</table>

**Discussion**

This review revealed 88 Collembola species recorded so far from west of Iran. While the last checklist reported from Iran, only 17 species have been identified as collembolan fauna in west of Iran (Shayanmehr et al., 2013). However, the most western provinces, except for Kermanshah province, were not included in the Shayanmehr et al. 2013 study, whereas in addition to Kermanshah some small samples were collected from the provinces of Hamedan, Kurdistan and Ilam in this study.

*Heteraphorura cf. japonica* (Yosii, 1967) has been reported from Kermanshah province (Kahrarian et al., 2016b), but after the re-description of the species, it changed to *Heteraphorura iranica* Kaprus, Shayanmehr & Kahrarian 2017 as new species (Kaprus et al., 2017). Also the scientific names of *Sminthurus marginatus* Schött, 1893 (Kahrarian et al., 2012) was changed to *Caprainea marginata* (Schött, 1893) for the new checklist.

Despite most species added to this checklist are common from Iran, 12 species new were recently described from west of Iran: *Hypogastrura persica* sp. nov. (Kahrarian et al., 2013); *Isotoma iranica* sp. nov. and *Isotonodes korkorensis* sp. nov. (Arbea & Kahrarian, 2015a); *Folsomides halshinicus* sp. nov. and *Folsomides subvinosus* sp. nov. (Arbea & Kahrarian, 2015b); *Ephemerotoma skarzynskii* sp. nov. (Potapov et al., 2015); *Endonura dichaeta* sp. nov. *Endonura ceratolabralis* sp. nov. and *Endonura Persica* sp. nov. (Smolis et al., 2016a); *Protaphorura persica* sp. nov. (Arbea & Kahrarian, 2017); *Heteraphorura iranica* sp. nov. and *Spinonychiurus persicus* sp. nov. (Kaprus et al., 2017).

Along with all the research done in recent years, the Collembola fauna is still underestimated for most regions of west of Iran. This review may be a starting point for future studies on the Collembola fauna of western Iran.

**Acknowledgments**

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Kaprus, I., Shayanmehr, M., Kahrarianm M. & Lafooraki, E.Y. (2017) Three new species of
Onychiuridae Lubbock, 1871 (Collembola, Poduromorpha) from Iran. Zootaxa, 4291(2), 335–346. https://doi.org/10.11646/zootaxa.4291.2.6


چکلیست پادمان (شش پایان: بندپایان) موجود در غرب ایران

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چکیده: در این تحقیق لیستی از پادمان موجود در زیستگاه‌های مختلف غرب ایران همراه با اطلاعاتی مانند جمع‌آوری، زیستگاه فعالیت نظیر خاک، جمنزآراها، بقا‌ی‌گاهی‌های سرچشمه، مناطق برکناری، در بین سال‌های ۱۳۹۲-۱۳۹۷ تهیه گردید.

علاوه بر آن برخی از نمونه‌ها توسط نگارنده بین سال‌های ۱۳۹۶-۱۳۹۷ جمع‌آوری و شناسایی شد. در حالی که نمونه‌های دیگر با کمک سپری‌ترور و یا قیف بلیز جدا شده و در صورت نیاز به شفافیت از محلول نسبی (۰۱ گرم کلرال هیدرات، ۲۱ میلی لیتر آب مقطر و ۵/۲ میلی لیتر اسید استیک غلیظ) استفاده شد. در نخستین چک لیست پادمان که در سال ۱۳۹۳ منتشر شد، ۱۷ گونه و هفت خانواده از پادمان گزارش شد که پس از بررسی و تحلیل مطالعات صورت گرفته و نیز مطالعه نمونه‌هایی که توسط نگارنده برای پادمان گزارش شده از غرب ایران جمع‌آوری شد، تعداد پادمان گزارش شده از غرب ایران به ۸۸ گونه، ۲۴ جنس، ۱۶ خانواده و چهار راسته افزایش یافت. دو جنس Folsomia و Entomobrya، هر کدام با داشتن ۶ گونه بیشترین فراوانی را دارند.

واژگان کلیدی: دم فنریان، لیست گونه‌ها، غرب ایران