

Study on the Collembola Fauna of Mazandaran (Iran) and new records from the forests of this province

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Abstract

Collembola (Hexapoda) fauna of parts of Hyrcanian forest in north of Iran, Mazandaran province was studied during 2016. Sampling was done from soil and leaf litter. Then springtails were extracted by Berlese funnel. Totally, 18 genera and 2 species belonging to 10 families were collected which 14 species were identified. Of them the genus *Pogonognathellus* (Tullberg, 1871) and two species *Pogonognathellus* sp. cf. *flavescens* (Tullberg, 1871) and *Arrhopalites* sp. gr. *principalis* (Stach, 1945) are recorded for the first time from Iran. Also four new species are recorded for the first time from Mazandaran including: *Entomobrya* cf. *schoetti* Stach, 1922, *Entomobrya corticalis* (Nicolet, 1841), *Entomobrya nigrocincta* Denis, 1923 and *Arrhopalites* sp. gr. *caecus* (Tullberg, 1871).

Key words: Hyrcanian forest, Mazandaran, Collembola.

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Introduction

Collembola are widespread and abundant group of arthropods and are distributed throughout the world (Hopkin, 1997). Study of class Collembola fauna have been received more attention in recent decade. Checklist of Iranian Collembola was published by Shayanmehr *et al.* (2013) which includes 112 species belonging to 18 families and 57 genera. Later, more research was done on fauna of these arthropods in Iran such as species reports and works of Kahrarian *et al.* (2013, 2014a,b, 2016a,b) in Kermanshah province, Yoosefi Lafooraki & Shayanmehr (2013, 2014a,b, 2015a,b,c) in Mazandaran province, Qazi & Shayanmehr (2014, 2016) in Tehran province, Yoosefi Lafooraki (2014) and Alijani (2015) in Mazandaran province, Amiri & Kahrarian (2015) and Arbea & Kahrarian (2015, 2017) in Kermanshah province; Balvasi *et al.* (2015) in Mazandaran province; Hosseini *et al.* (2016) in Golestan province; Mehrafrooz Mayvan *et al.* (2015a,b) in Mazandaran province; Potapov *et al.* (2015), Darvish-Motevalli (2016) in Mazandaran province, Smolis *et al.* (2016, 2017, 2018), Alijani-Ardeshir *et al.* (2017) and Ghasemi Cherati (2017) in Mazandaran province, Kaprus' *et al.* (2017), Mohammadi Nodeheki *et al.* (2018) in Mazandaran province Ramezani and Mossadegh (2017) in Khuzestan province; Shayanmehr *et al.* (2017) in Ilam province and Abdolalizadeh (2018) in Kerman province.

The Hyrcanian forests extended along the southern parts of the Caspian Sea from the Talish region in Ardebil province to Guilan, Mazandaran and Golestan provinces, Iran (Akhani *et al.*, 2010). This forest zone is limited to the Caspian Sea shores northwards and to the Alborz Mountain southwards.

An ongoing project on the species diversity of the springtails has been carried out in 2016 in the Hyrcanian forests. In this study we present new data on the class Collembola in Mazandaran province, north of Iran.

Material and methods

The specimens were collected This study was conducted in forests of Mazandaran province using pit fall traps, and soil and leaf litter. Transferred to Berlese trap. The samples were fixed using GPS (total).

Specimens extracted were mounted on slides.....

Table 1- Information of sampling sites and examined material from forests of Mazandaran province.

Location	Latitude	Altitude	Specimens
Babol, Filband	N 52° 30' 45" E 36° 22' 12"	1950	<i>Pogonognathellus</i> sp. cf. <i>flavescens</i>
			<i>Orchesella cincta</i>
			<i>Seira domestica</i>
			<i>Heteromurus major</i>
			<i>Sminthurus</i> sp.
Neka, Hezar Jrib forest	N 36° 37' 12" E 53° 21' 31"	198	<i>Entomobrya</i> cf. <i>schoetti</i>
			<i>Pogonognathellus</i> sp. cf. <i>flavescens</i>
			<i>Heteromurus major</i>
			<i>Pseudocinella</i> sp.
			<i>Orchesella cincta</i>
Qaemshahr, Jadeh-Nezami	N 36° 27' 17" E 52° 49' 16"	188	<i>Seira domestica</i>
			<i>Heteromurus major</i>
			<i>Folsomia</i> sp.
			<i>Entomobrya nigrocincta</i>
			<i>Pogonognathellus</i> sp. cf. <i>flavescens</i>
Sari, Chahardangeh, Langar village	N 36° 14' 20" E 53° 39' 10"	1800	<i>Lepidocyrtus</i> sp.
			<i>Folsomia penicula</i>
			<i>Arrhopalites</i> sp. gr. <i>principalis</i>
			<i>Sminthurus</i> sp.
			<i>Ceratophysella stercoraria</i>
			<i>Pseudachorutes</i> sp.
			<i>E. nigrocincta</i>
Sari, Dasht-e-Naz	N 36° 71' 10" E 53° 09' 11"	-11	<i>Heteromurus major</i>
			<i>Folsomides parvulus</i>
			<i>Folsomides</i> sp.
			<i>Pseudachorutes</i> sp.
			<i>E. nigrocincta</i>
Sari, Salar Darreh forest	N 36° 27' 10" E 53° 07' 11"	178	<i>Seira domestica</i>
			<i>Heteromurus major</i>
			<i>Ceratophysella stercoraria</i>
			Neanurinae
			<i>Entomobrya corticalis</i>
Sari, Shahid Zare forest	N 36° 32' 44" E 53° 07' 53"	113	<i>Heteromurus major</i>
			<i>Isotomurus</i> sp.
			<i>Parisotoma notabilis</i>
			<i>Sminthurus</i> sp.
			<i>Pseudachorutes</i> sp.
Tonekabon	N 36° 40' 21" E 50° 49' 28"	443	<i>Pogonognathellus</i> sp. cf. <i>flavescens</i>
			<i>Desoria</i> sp.
			<i>Arrhopalites</i> sp. gr. <i>caecus</i>
			<i>Lipothrix</i> cf. <i>lubbocki</i>
			<i>Ceratophysella stercoraria</i>

Results

A total of 18 genera and 24 species of Collembola belonging to 10 families were collected which of them 14 species have been yet identified. As a result a new genus and two new species are recorded for the first time from Iran which are marked with an asterisk (*). Also four new species are new for Mazandaran province.

Folsomides sp.

Family: Isotomidae (Subfamily: Proisotominae)

Material examined: Mazandaran, Sari, Dasht-e-Naz (N 36° 71' 10" E 53° 09' 11"), -11 m, 12.8.2016, Collected by Elliyeh Yahyapour.

Folsomides parvulus

Family: Isotomidae (Subfamily: Proisotominae)

Material examined: Mazandaran, Sari, Dasht-e-Naz (N 36° 71' 10" E 53° 09' 11"), -11 m, 12.8.2016, collected by Elliyeh Yahyapour.

Distribution in Iran: Central, Guilan, E. Azarbaijan, W. Azarbaijan (Cox, 1982); Mazandaran (Cox, 1982; Yahyapour, 2012; Yoosefi Lafooraki & Shayanmehr, 2014a; Alijani-Ardeshir *et al.*, 2017); Kermanshah (Kahrarian *et al.*, 2012; Kahrarian, 2015; Amiri & Kahrarian, 2016; Arbea & Kahrarian, 2017); Guilan (Daghighi, 2012); Tehran (Qazi & Shayanmehr, 2014); Semnan (Yoosefi Lafooraki & Shayanmehr, 2013); Golestan (Hosseini *et al.*, 2016).

Isotomurus sp.

Family: Isotomidae (Subfamily: Isotominae)

Material examined: Mazandaran, Sari, Shahid Zare forest (N 36° 32' 44" E 53° 07' 53"), 113m, 30.4.2016, collected by Elliyeh Yahyapour.

Parisotoma notabilis

Family: Isotomidae (Subfamily: Isotominae)

Material examined: Mazandaran, Sari, Shahid Zare forest (N 36° 32' 44" E 53° 07' 53"), 113m, 30.4.2016, collected by Elliyeh Yahyapour.

Distribution in Iran: Central, E. Azarbaijan, W. Azarbaijan, Zanjan (Cox, 1982); Tehran (Moravvej *et al.*, 2007); Kermanshah (Kahrarian *et al.*, 2012, 2016b); Guilan (Cox, 1982; Daghighi, 2012); Mazandaran (Cox, 1982; Yoosefi Lafooraki, 2014; Yoosefi Lafooraki & Shayanmehr, 2014a); Kermanshah (Amiri & Kahrarian, 2015; Arbea & Kahrarian, 2015); Golestan (Hosseini *et al.*, 2016); Khuzestan (Ramezani & Mossadegh, 2017); Kerman (Abdolalizadeh, 2018).

Folsomia sp.

Family: Isotomidae (Subfamily: Anurophorinae)

Material examined: Mazandaran, Qaemshahr, Jadeh-Nezami (N 36° 27' 17" E 52° 49' 16"), 188m, 18.5.2016, collected by Elliyeh Yahyapour.

Folsomia penicula

Family: Isotomidae (Subfamily: Anurophorinae)

Material examined: Mazandaran, Sari, Chahardangeh, Langar village (N 36° 14' 20" E 53° 39' 10"), 1800 m, 29.4.2016, collected by Elliyeh Yahyapour.

Distribution in Iran: Central, E. Azarbaijan (Cox, 1982); Golestan (Falahati *et al.*, 2011); Guilan (Daghighi, 2012); Tehran (Qazi & Shayanmehr, 2014); Mazandaran (Cox, 1982; Yoosefi Lafooraki, 2014; Yoosefi Lafooraki & Shayanmehr, 2014a; Mehrafrooz *et al.*, 2015a; Ghasemi Cherati, 2017); Kermanshah (Arbea and Kahrarian, 2015).

Desoria sp.

Family: Isotomidae (Subfamily: Isotominae)

Material examined: Mazandaran, Tonekabon (N 36° 40' 21" E 50° 49' 28"), 443m, 10.11.2016, collected by Elliyeh Yahyapour.

Arrhopalites sp. gr. caecus

Family: Arrhopalitidae

Material examined: Mazandaran, Tonekabon (N 36° 40' 21" E 50° 49' 28"), 443m, 10.11.2016, collected by Elliyeh Yahyapour.

Distribution in Iran: Guilan, E. Azarbaijan (Cox, 1982); Kermanshah (Ghahramaninezhad *et al.*, 2012). The species is new for Collembola fauna of Mazandaran.

Arrhopalites sp. gr. principalis*

Family: Arrhopalitidae

Material examined: Mazandaran, Sari, Chahardangeh, Langar village (N 36° 14' 20" E 53° 39' 10"), 1800 m, 29.4.2016, collected by Elliyeh Yahyapour.

Distribution in Iran: The species is new for Iran.

Sminthurus sp.

Family: Sminthuridae (Subfamily: Sminthurinae)

Material examined: Mazandaran, Sari, Chahardangeh, Langar village (N 36° 14' 20" E 53° 39' 10"), 1800 m, 29.4.2016, 12.8.2016; Babol, Filband (N 52° 30' 45" E 36° 22' 12"), 1950m, 25.8.2016; Sari, Shahid Zare forest (N 36° 32' 44" E 53° 07' 53"), 113m, 30.4.2016, collected by Elliyeh Yahyapour.

Lipothrix cf. lubbocki

Family: Sminthuridae (Subfamily: Sphyrothecinae)

Material examined: Mazandaran, Tonekabon (N 36° 40' 21" E 50° 49' 28"), 443m, 10.11.2016, collected by Elliyeh Yahyapour.

Distribution in Iran: Mazandaran (Mehrafrooz *et al.*, 2015a).

Ceratophysella stercoraria

Family: Hypogastruridae

Material examined: Mazandaran, Tonekabon (N 36° 40' 21" E 50° 49' 28"), 443m, 10.11.2016; Sari, Chahardangeh, Langar village (N 36° 14' 20" E 53° 39' 10"), 1800 m, 29.4.2016; Sari, Salar Darreh forest (N 36° 27' 10" E 53° 07' 11"), 178m, 28.4.2016, collected by Elliyeh Yahyapour.

Distribution in Iran: Kermanshah (Kahrarian *et al.*, 2012); Kohgiluyeh and Boyer-Ahmad (Falahati *et al.*, 2012); Tehran (Qazi & Shayanmehr, 2014); Mazandaran (Yoosefi Lafooraki, 2014; Yoosefi Lafooraki & Shayanmehr, 2015c; Mehrafrooz *et al.*, 2015a; Alijani-Ardeshir *et al.*, 2017; Mohammadi Nodeheki *et al.*, 2018; Ghasemi Cherati, 2017); Kerman (Abdolalizadeh, 2018).

Xenylla sp.

Family: Hypogastruridae

Material examined: Mazandaran, Neka, Hezar Jrib forest (N 36° 37' 12", E 53° 21' 31"), 198m, 12.8.2016, collected by Elliyeh Yahyapour.

Pseudachorutes sp.

Family: Neanuridae (Subfamily: Pseudachorutes)

Material examined: Mazandaran, Sari, Shahid Zare forest (N 36° 32' 44" E 53° 07' 53"), 113m, 30.4.2016; Sari, Chahardangeh, Langar village (N 36° 14' 20" E 53° 39' 10"), 1800 m, 29.4.2016; Sari, Dasht-e-Naz (N 36° 71' 10" E 53° 09' 11"), -11 m, 12.8.2016; collected by Elliyeh Yahyapour.

Neanurinae

Family: Neanuridae

Material examined: Mazandaran, Sari, Salar Darreh forest (N 36° 27' 10" E 53° 07' 11"), 178m, 28.4.2016, collected by Elliyeh Yahyapour.

Entomobrya cf. schoetti

Family: Praentomobryidae (subfamily: Entomobryinae)

Material examined: Mazandaran, Neka, Hezar Jrib forest (N 36° 37' 12", E 53° 21' 31"), 198m, 12.8.2016, Collected by Elliyeh Yahyapour

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Distribution in Iran: Kermanshah (Kahrarian *et al.*, 2014a). The species is recorded for the first time from Mazandaran province.

E. corticalis

Family: Praentomobryidae (Subfamily: Entomobryinae)

Material examined: Mazandaran, Sari, Shahid Zare forest (N 36° 32' 44" E 53° 07' 53"), 113m, 30.4.2016, Collected by Elliyeh Yahyapour.

Distribution in Iran: Guilan (Cox, 1982). The species is recorded for the first time from Mazandaran province.

E. nigrocincta

Family: Praentomobryidae (Subfamily: Entomobryinae)

Material examined: Mazandaran, Sari, Chahardangeh, Langar village (N 36° 14' 20" E 53° 39' 10"), 1800 m, 29.4.2016; Sari, Dasht-e-Naz (N 36° 71' 10" E 53° 09' 11"), -11 m, 24.5.2016; Sari, Salar Darreh forest (N 36° 27' 10" E 53° 07' 11"), 178m, 28.4.2016, Collected by Elliyeh Yahyapour.

Distribution in Iran: Kermanshah (Kahrarian *et al.*, 2014a, 2016b). The species is recorded for the first time from Mazandaran province.

Pogonognathellus sp. cf. flavescens*

Family: Tomoceridae

Material examined: Mazandaran, Neka, Hezar Jrib forest (N 36° 37' 12", E 53° 21' 31"), 12.8.2016; Sari, Chahardangeh, Langar village (N 36° 14' 20" E 53° 39' 10"), 1800 m, 29.4.2016; Tonekabon (N 36° 40' 21" E 50° 49' 28"), 443m, 10.11.2016; Babol, Filband (N 52° 30' 45" E 36° 22' 12"), 1950m, 25.8.2016, Collected by Elliyeh Yahyapour.

Distribution in Iran: The genus and species are recorded for the first time from Iran.

Seira domestica

Family: Seiridae

Material examined: Mazandaran, Neka, Hezar Jrib forest (N 36° 37' 12", E 53° 21' 31"), 12.8.2016; Babol, Filband (N 52° 30' 45" E 36° 22' 12"), 1950m, 25.8.2016; Sari, Salar Darreh forest (N 36° 27' 10" E 53° 07' 11"), 178m, 28.4.2016; Qaemshahr, Jadeh-Nezami (N 36° 27' 17" E 52° 49' 16"), 188m, 12.6.2016, Collected by Elliyeh Yahyapour.

Distribution in Iran: Mazandaran (Yahyapour *et al.*, 2011; Yahyapour, 2012), Kermanshah (Kahrarian *et al.*, 2011), Guilan (Daghghi, 2012), Golestan (Hosseini *et al.*, 2016).

Heteromurus major

Family: Orchesellidae (Subfamily: Heteromurinae)

Material examined: Mazandaran, Neka, Hezar Jrib forest (N 36° 37' 12", E 53° 21' 31"), 12.8.2016; Babol, Filband (N 52° 30' 45" E 36° 22' 12"), 1950m, 25.8.2016; Sari, Salar Darreh forest (N 36° 27' 10" E 53° 07' 11"), 178m, 28.4.2016; Qaemshahr, Jadeh-Nezami (N 36° 27' 17" E 52° 49' 16"), 188m, 12.6.2016; Sari, Dasht-e-Naz (N 36° 71' 10" E 53° 09' 11"), -11 m, 24.5.2016; Sari, Shahid Zare forest (N 36° 32' 44" E 53° 07' 53"), 113m, 30.4.2016, Collected by Elliyeh Yahyapour.

Distribution in Iran: Central, Mazandaran, Guilan, E. Azarbaijan (Cox, 1982), Mazandaran (Yahyapour *et al.*, 2011; Yahyapour, 2012; Yoosefi Lafooraki & Shayanmehr, 2014; Balvasi *et al.*, 2015; Mehrafrooz Mayvan *et al.*, 2015), Guilan (Daghighi, 2012), Tehran (Qazi & Shayanmehr, 2014), Golestan (Hosseini *et al.*, 2016), Kermanshah (Kahrarian *et al.*, 2014a),

***Lepidocyrtus* sp.**

Family: Lepidocyrtidae (Subfamily: Lepidocyrtinae)

Material examined: Sari, Chahardangeh, Langar village (N 36° 14' 20" E 53° 39' 10"), 1800 m, 29.4.2016, Collected by Elliyeh Yahyapour.

***Pseudocinella* sp.**

Family: Lepidocyrtidae (Subfamily: Lepidocyrtinae)

Material examined: Mazandaran, Neka, Hezar Jrib forest (N 36° 37' 12", E 53° 21' 31"), 198m, 12.8.2016, Collected by Elliyeh Yahyapour.

Orchesella cincta

Family: Orchesellidae (Subfamily: Orcheseliinae)

Material examined: Mazandaran, Neka, Hezar Jrib forest (N 36° 37' 12", E 53° 21' 31"), 12.8.2016; Babol, Filband (N 52° 30' 45" E 36° 22' 12"), 1950m, 25.8.2016, Collected by Elliyeh Yahyapour.

Distribution in Iran: Mazandaran (Yoosefi Lafooraki & Shayanmehr, 2013, 2014; Balvasi *et al.*, 2015), Golestan (Hosseini *et al.*, 2016).

Discussion

The genus *Pogonognathellus* and two species *Pogonognathellus* sp. cf. *flavescens* and *Arrhopalites* sp. gr. *principalis* were new record the Iranian fauna of Collembola. Therefore number of identified species of the springtails in Iran reaches to 218 species. Also four species *Entomobrya* cf. *schoetti*, *Entomobrya corticalis*, *Entomobrya nigrocincta* and *Arrhopalites* sp. gr. *caecus* are added to the collembolan fauna of Mazandaran province.

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معرفی فون و گزارش جدید از پادمان (Collembola, Hexapoda) بخشی از جنگل‌های مازندران (ایران)

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چکیده

به دنبال مطالعه فون پادمان در بخشی از جنگل‌های هیرکانی در شمال ایران، نمونه‌برداری‌هایی در نقاط مختلف استان مازندران طی سال‌های ۱۳۹۴ و ۱۳۹۵ صورت گرفت. نمونه‌های خاک و خاک‌برگ جمع‌آوری شده در قیف برلیز قرار گرفته و پادمان موجود در آن‌ها استخراج شدند. در مجموع ۱۸ جنس و ۲۴ گونه متعلق به ده خانواده جمع‌آوری شد که ۱۴ گونه از آن‌ها شناسایی شدند. گونه‌های مورد مطالعه به شرح زیر است:

Isotomidae: *Folsomides* sp., *Folsomides parvulus* (Stach, 1922), *Isotomurus* sp., *Parisotoma notabilis* (Schäffer, 1896), *Folsomia* sp., *Folsomia penicula* Bagnall, 1939, *Desoria* sp.

Praentomobryidae: *Entomobrya* cf. *schoetti* Stach, 1922, *E. corticalis* (Nicolet, 1841), *E. nigrocincta* Denis, 1923

Tomoceridae: *Pogonognathellus* sp. cf. *flavescens* (Tullberg, 1871)

Seiridae: *Seira domestica* (Nicolet, 1842)

Orchesellidae: *Heteromurus major* (Moniez, 1889)

Lepidocyrtidae: *Lepidocyrtus* sp., *Pseudocinella* sp.

Orchesellidae: *Orchesella cincta* Lubbock, 1873

Arrhopalitidae: *Arrhopalites* sp. gr. *caecus* (Tullberg, 1871), *Arrhopalites* sp. gr. *principalis* (Stach, 1945)

Sminthuridae: *Sminthurus* sp., *Lipothrix* cf. *lubbocki* (Tullberg, 1872)

Hypogastruridae: *Ceratophysella stercoraria* (Stach, 1963), *Xenylla* sp.

Neanuridae: *Pseudachorutes* sp., *Neanurinae*

جنس *Arrhopalites* sp. gr. و *Pogonognathellus* sp. cf. *flavescens* (Tullberg, 1871) دو گونه

Entomobrya principalis برای اولین بار از ایران گزارش می‌شوند. همچنین چهار گونه *Entomobrya cf. schoetti*،

Entomobrya corticalis و *Entomobrya nigrocincta* برای اولین بار از مازندران گزارش می‌شوند.

واژه‌های کلیدی: جنگل‌های هیرکانی، مازندران، پادمان

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