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Psocoptera (Insecta: Psocodea) of Iran with new records from caves

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ABSTRACT. In this study, the psocids (Psocodea: 'Psocoptera') from caves and other ecosystems in Northeastern Iran were investigated during the years 2022 and 2024. Among them, *Psyllipsocus ramburii* Selys-Longchamps, 1872, and *Lepinotus inquilinus* Heyden, 1850, are new to the Iranian fauna. Additionally, all species identified in this study are newly recorded in North Khorasan and Khorasan-e Razavi provinces. Notably, this is the first report of Psocoptera from caves in Iran. In addition, we have compiled a list of psocid species of Iran based on the available literature until October 2024. A total of 22 species, belonging to 11 genera and 8 families of psocids have been reported from Iran. We made a brief analysis of the systematic, zoogeographical and ecological assignment of Iranian Procoptera. The suborder Troctomorpha, with 2 genera and 11 species, has the highest species count. From nine families recorded, the family Liposcelididae dominates, accounting for 11 species, or 50% of the total. The study includes bibliographical references and information on the global distribution of these species.

Keywords: catalogue, Iran, psocid, new records, subterranean ecosystem, troglophiles

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INTRODUCTION

Booklice, barklice, or psocids are common names for Psocoptera (i.e. non-parasitic Psocodea), a little-known group of hemimetabolous insects with a worldwide distribution (Kahrarian, 2018; Anonby, 2019; Silva-Neto & García Aldrete, 2020). Species of this group, characterized by their small size, adaptability, and high dispersal ability, can be found in a variety of environments, most often under rocks, beneath tree bark, in the nests of mammals or birds, museums, and even in the harsh conditions of caves, where they feed on dead insect carcasses, fungi, algae, lichens, and other organic materials (Lienhard & Mifsud, 2015; Chin et al., 2010; Lienhard et al., 2010; Lienhard & Ferreira, 2020). As a paraphyletic group (Yoshizawa & Lienhard, 2010), Psocoptera, along with Phthiraptera (true lice), are classified into the order Psocodea (Yoshizawa & Johnson, 2006). However, since psocids with approximately 6,000 known species and true lice have distinct habits and are studied using different methods by different specialists, for practical reasons Psocoptera is still typically treated as a group in the traditional way, but referred to as Psocodea: 'Psocoptera' (Anonby, 2019; Silva-Neto & García Aldrete, 2020; Seropian et al., 2023). Psocodea are classified into three suborders: Trogiomorpha (booklice), Troctomorpha (also booklice),

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and Psocomorpha (barklice), with the majority of species belonging to the Psocomorpha suborder (Lienhard & Smithers, 2002; Johnson & Clayton, 2003; Seropian et al., 2023).

Iran, covering approximately 1.64 million square kilometres, is situated in Southwest Asia and is composed of 31 provinces, each characterized by distinct climate zones, diverse ecosystems, and a variety of vegetation types (Karimi et al. 2012; Asa'adi, 2017; Erfanian et al., 2021; Mehrafrooz Mayvan et al., 2023). It is a semi-arid country located within the Palearctic biogeographical region. It is bordered by the Caspian Sea on the north and the Persian Gulf and the Sea of Oman on the south (Holt et al. 2013; Ficetola et al., 2017; Azizi Jalilian et al., 2020; Mehrafrooz Mayvan et al., 2021). The presence of the Zagros and Alborz mountain ranges contributes to Iran's diverse climates and ecosystems, which include the Hyrcanian forest in the north, deserts in the central region, and karst areas, among others (Mohammadi et al., 2023; Norozi et al., 2020; Davoudnia et al., 2024; Mehrafrooz Mayvan et al., 2024). The first record of psocids in Iran was noticed by Shah Hosseini & Kamali (1989), who identified *Liposcelis divinatoria* (Müller, 1776) as a storage pest in their publication on the storage pests of Iran. After that, research on psocids in Iran remained inactive for 15 years until 2004, when a new report was published on the country's fauna (Ahadiyat, 2004). To date, 22 species from 11 genera and 8 families of these insects have been documented in Iran (Kahrarian, 2018). However, due to the vast size of the country, few studies have been conducted on these insects, with research primarily limited to a handful of provinces (Kahrarian, 2018).

The present study has two aims: **1.** to investigate psocid fauna from caves and other ecosystems in Northeastern Iran, and **2.** to provide an updated and comprehensive survey of psocid genera and species recorded in Iran up to October 2024. This study also presents, for the first time, reports of these insects from several caves in Iran. It includes bibliographical references to Psocoptera records from Iran and information on the global distribution of these species. The paper is complemented with a brief analysis of systematic, zoogeographical and ecological assignment of Iranian Psocoptera.

MATERIAL AND METHODS

his study was conducted between 2022 and 2023 in caves and other ecosystems in Northeastern Iran (Fig. 1A). Specimens were collected from five caves and five villages in the North Khorasan and Khorasan-e Razavi provinces. The species found in the caves were collected using an aspirator containing propylene glycol, as well as pitfall traps made from plastic cups filled with propylene glycol. Additional Psocoptera specimens were gathered from soil and leaf litter using a Berlese funnel for extraction. After sampling, the soil samples were subsequently transferred to containers with 96% alcohol in the laboratory. The images of the living animals were taken in situ using an Olympus Stylus Tough TG-6 digital camera. Species identifications were based on Lienhard (1998). The examined material is deposited in EUPB and ZMFUM.

Abbreviations. Repositories of investigated material: EUPB – Ecology and Environmental Conservation, University of Plovdiv, Bulgaria; ZMFUM – Zoology Museum of Ferdowsi University of Mashhad, Mashhad, Iran.

RESULTS

A total of six species belonging to three genera and three families of Psocoptera were identified from North Khorasan and Khorasan-e Razavi provinces in this research. Among them, *Psyllipsocus ramburii* Selys-Longchamps, 1872 and *Lepinotus inquilinus* Heyden, 1850 are new for Iranian fauna (Fig. 2). Also, Liposcelididae (50%) family has the highest proportion of overall psocids diversity, followed by families Ectopsocidae (14%) and Trogiidae (14%) (Fig. 3B). The species marked with an asterisk (*) were recorded for the first time from North Khorasan and Khorasan-e Razavi provinces of Iran. Also, the species marked with two asterisks (**) were recorded for the first time from Iran.

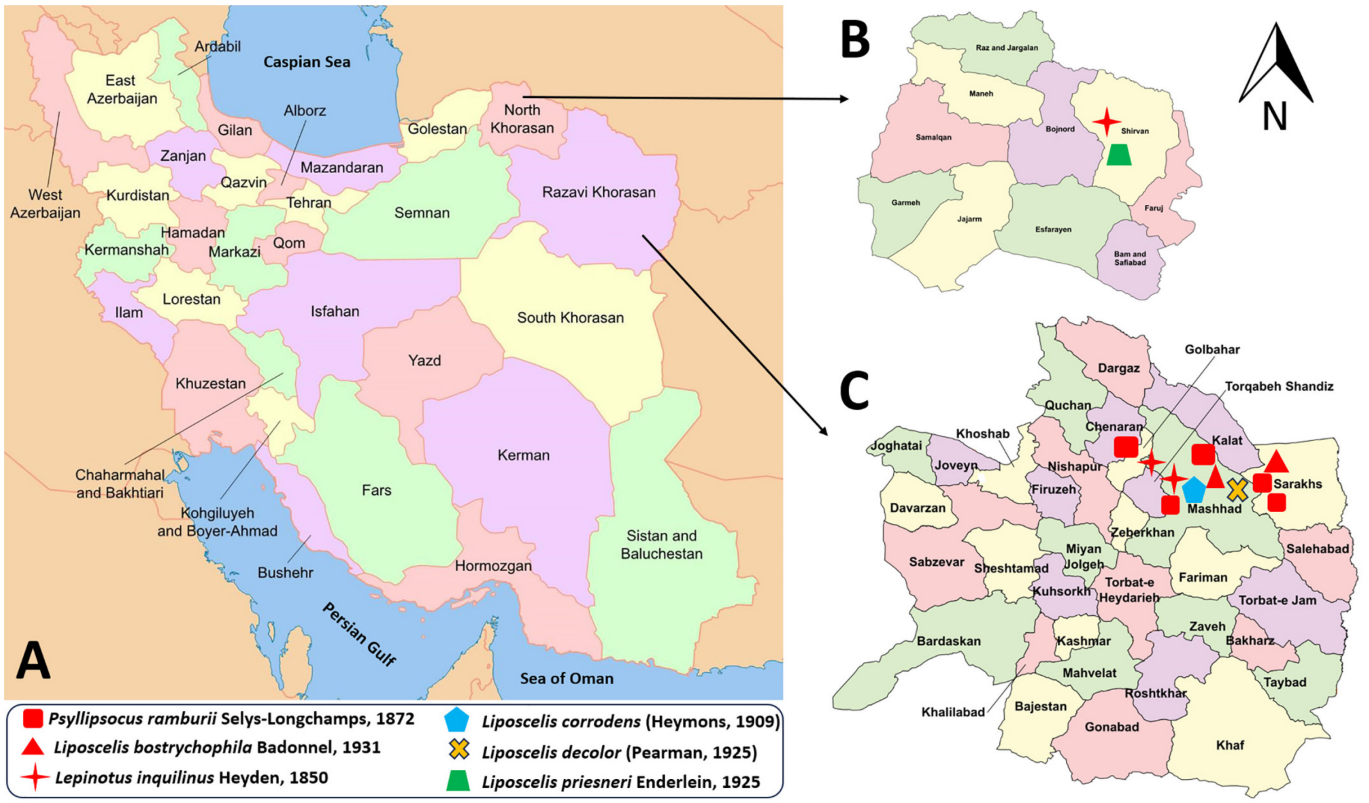


Figure 1. Location of the study areas. **A.** Map of Iranian provinces; **B.** North Khorasan province; **C.** Khorasan-e Razavi province.

Taxonomic hierarchy

Class Insecta Linnaeus, 1758

Order Psocodea ('Psocoptera') Hennig, 1966

Suborder Psocomorpha Roesler, 1944

Family Ectopsocidae Roesler, 1940

Genus *Ectopsocopsis* Badonnel, 1955

***Ectopsocopsis cryptomeriae* (Enderlein, 1907)**

Distribution in Iran. This species has been reported from Golestan (Aghadokht et al., 2015).

Ecology and habitat. Collected from citrus leaves and *Rosa canina* (Rosaceae).

General distribution. Cosmopolitan (Aghadokht et al., 2015).

Genus *Ectopsocus* McLachlan, 1899

***Ectopsocus briggsi* McLachlan, 1899**

Distribution in Iran. This species has been reported from Golestan and Mazandaran provinces in northern Iran (Ahadiyat & Zangeneh, 2007; Gol et al., 2015).

Ecology and habitat. Collected on the upper surface of orange, sour orange and tangerine leaves and from *Salix caprea* Kilmarnock (Saliaceae) and *Carpinus betulus* 'Fastigiata' (Betulaceae).

General distribution. Cosmopolitan (García Aldrete, 1991; Lienhard & Smithers, 2002).

***Ectopsocus vachoni* Badonnel, 1945**

Distribution in Iran. This species has been collected from Kermanshah Province in the west of Iran (Kahrarian, 2018).

Ecology and habitat. Collected from needle litter around Pine trees (*Pinus eldarica*).

General distribution. Cosmopolitan (García Aldrete, 2002; Lienhard & Smithers, 2002).

***Ectopsocus vishnyakovae* Schmidt, 1993**

Distribution in Iran. This species has been reported from Khorasan-e Razavi, North Khorasan (Northeastern Iran) and Kermanshah provinces (Khandehroo et al., 2015; Kahrarian, 2018).

Ecology and habitat. Collected on the ash trees and in the needle litter around Pine trees (*P. eldarica*).

General distribution. This species has already been reported from Armenia and Turkmenistan (Khandehroo et al., 2015; Kahrarian, 2018).

Family Lachesillidae Karny, 1930

Genus Lachesilla Westwood, 1840

***Lachesilla quercus* (Kolbe, 1880)**

Distribution in Iran. This species has been found in Golestan and Khorasan-e Razavi provinces (Gol et al., 2015).

Ecology and habitat. Collected from *Salix caprea* (Saliaceae) and *Fraxinus excelsior* (Oleaceae).

General distribution. Cosmopolitan (Gol et al., 2015).

Family Mesopsocidae Enderlein, 1901

Genus *Mesopsocus* Kolbe, 1880

Mesopsocus hiemalis Marikowskii, 1957

Distribution in Iran. This species has been reported from Khorasan-e Razavi province (Khandehroo et al., 2014).

Ecology and habitat. Collected on the ash trees.

General distribution. Asia (Kazakhstan, Turkmenistan) (Marikowskii, 1957; Badonnel & Lienhard, 1988).

Family Stenopsocidae Kolbe, 1880

Genus *Graphopsocus* Kolbe, 1880

***Graphopsocus cruciatus* (Linnaeus, 1768)**

Distribution in Iran. This species has been reported from Golestan province (Aghadokht et al., 2015; Gol et al., 2015).

Ecology and habitat. Collected from citrus leaves and *Rosa canina* L. (Rosaceae).

General distribution. Cosmopolitan (Aghadokht et al., 2015; Gol et al., 2015).

Family Trichopsocidae Pearman, 1936

Genus *Trichopsocus* Kolbe, 1882

***Trichopsocus dalii* (McLachlan, 1867)**

Distribution in Iran. This species has been recorded in Mazandaran province (Ahadiyat & Zangeneh, 2007).

Ecology and habitat. Collected on tangerine leaves.

General distribution. Cosmopolitan (Lienhard & Smithers, 2002).

Suborder Troctomorpha Roesler, 1944

Family Liposcelididae Enderlein, 1911

Genus *Belaphotroctes* Roesler, 1943

***Belaphotroctes* sp.**

Distribution in Iran. A species from this genus has been reported from Kermanshah (Kahrarian, 2018; however, fig. 1B of this paper shows a specimen of *Lepinotus* sp. and not *Belaphotroctes* sp. as erroneously indicated in the legend).

Ecology and habitat. Collected in the leaf litter under Walnut trees (*Juglans regia*).

Genus Liposcelis Motschulsky, 1852

Liposcelis bostrychophila Badonnel, 1931*

Material examined. 1 ♀, Iran, Khorasan-e Razavi province, Sarakhs county, Mazdavand city, Mazdavand (Mozdouran) cave (36°09'05"N 60°32'59"E, 1056 m a.s.l.), Dark zone, collecting on bat guano with an aspirator, 18.VI.2022, leg. M. Mehrafrooz Mayvan; 3 ♀♀, Khorasan-e Razavi province, Mashhad city, Kardeh village (36°39'26"N, 59°39'27"E, 1311 m a.s.l.), Extracted with Berlese funnel from soil and litter, 04.VII.2022, leg. M. Mehrafrooz Mayvan.

Distribution in Iran. This species has been collected from Isfahan and Kermanshah (Jalalizand et al., 2005; Jarayani et al., 2014; Kahrarian, 2018). It has been reported for the first time from Khorasan-e Razavi province.

Ecology and habitat. Collected on elm (*Ulmus densa*) trees, in the leaf litter around oak (*Quercus infectoria*), pine and date palm trees (*Phoenix dactylifera*), in Mazdavand Cave it was found on rotten woods and bat guano.

General distribution. Cosmopolitan (García Aldrete, 2002).

Remarks. This species has been registered for the first time from the caves of Iran.

Liposcelis brunnea Motschulsky, 1852

Distribution in Iran. This species has been collected from Kermanshah (Kahrarian, 2018).

Ecology and habitat. Collected in the litter around palm and oak trees.

General distribution. Cosmopolitan (Kahrarian, 2018).

Liposcelis corrodens (Heymons, 1909)*

Material examined. 1 ♀, 2 nymphs, Iran, Khorasan-e Razavi province, Mashhad city, Dehbar village (36°14'48"N, 59°17'07"E, 1702 m a.s.l.), extracted with Berlese funnel from soil and litter, 01.VII.2023, leg. M. Mehrafrooz Mayvan.

Distribution in Iran. This species has been collected from Isfahan and Kermanshah (Jalalizand et al., 2005; Kahrarian, 2017). It is reported for the first time from Khorasan-e Razavi province.

Ecology and habitat. Collected in the leaf litter around walnut, elm and oak trees, under stones and also in nests of birds.

General distribution. Cosmopolitan (Yoshizawa & Lienhard, 2010).

Liposcelis decolor (Pearman, 1925)*

Material examined. 1 ♀, Iran, Khorasan-e Razavi province, Mashhad city, Kardeh village (36°39'26"N, 59°39'27"E, 1311 m a.s.l.), extracted with Berlese funnel from soil and litter, 17.VIII.2023, leg. M. Mehrafrooz Mayvan.

Distribution in Iran. This species has been collected from Isfahan and Kermanshah (Jalalizand et al., 2005; Kahrarian, 2017). It is reported for the first time from Khorasan-e Razavi province.

Ecology and habitat. it inhabits grasslands, collected in the soil around straw and in the leaf and needle litter around cherry (*Prunus avium*), walnut and pine trees.

General distribution. Cosmopolitan (Lienhard & Smithers, 2002).

***Liposcelis divinatoria* (Müller, 1776)**

Distribution in Iran. This species has been reported from West Azerbaijan, Khuzestan (Southwest of Iran), Alborz (centre of Iran) and Gilan (North of Iran) provinces (Shah Hosseini & Kamali, 1989).

Remarks. *L. divinatoria* is considered as "*nomen dubium*" (Lienhard, 1998).

***Liposcelis edaphica* Lienhard, 1990**

Distribution in Iran. This species has been collected from Kermanshah province (Kahrarian, 2017).

Ecology and habitat. Collected in leaf litter around oak trees.

General distribution. Europe (Greece) and Asia (China) (Yoshizawa & Lienhard, 2010).

***Liposcelis keleri* Günther, 1974**

Distribution in Iran. This species has been found in Isfahan, Kermanshah and Mazandaran provinces (Ahadiyat, 2004; Jalalizand et al., 2005; Kahrarian, 2017).

Ecology and habitat. Collected on elm trees and in the leaf and needle litter around walnut, pine and oak trees.

General distribution. Europe and Morroco (Yoshizawa & Lienhard, 2010).

***Liposcelis paeta* Pearman, 1942**

Distribution in Iran. This species has been reported from Isfahan Province (Jarayani et al., 2014).

Ecology and habitat. Collected on decaying wood.

General distribution. Europe, Africa, Asia, Australia and North America (Lienhard, 2016).

Liposcelis priesneri* Enderlein, 1925

Material examined. 1 ♀, Iran, North Khorasan province, Shirvan city, Estarkhi village (37°11'18"N, 57°51'13"E, 1694 m a.s.l.), extracted with Berlese funnel from soil and litter, 01.VII.2023, leg. M. Mehrafrooz Mayvan.

Distribution in Iran. This species has been collected from Kermanshah province (Kahrarian, 2017). It is reported for the first time from North Khorasan province.

Ecology and habitat. Collected in the leaf litter around walnut trees.

General distribution. Albania, Cyprus, Greece, Italy and former Yugoslavia (Yoshizawa & Lienhard, 2010).

***Liposcelis silvarum* (Kolbe, 1888)**

Distribution in Iran. This species has been collected from Kermanshah province (Kahrarian, 2017).

Ecology and habitat. Collected in the leaf litter around oak trees.

General distribution. Cosmopolitan (Yoshizawa & Lienhard, 2010).

Suborder Trogiomorpha Roesler, 1940

Family Psyllipsocidae Lienhard & Smithers, 2002**

Genus *Psyllipsocus* Selys-Longchamps, 1872**

Psyllipsocus ramburii* Selys-Longchamps, 1872* (Fig. 2A)

Material examined. 9 ♀♀, Iran, Khorasan-e Razavi province, Chenaran city, Kenan 1 (Big Kenan) cave (36°33'58.9"N, 59°04'19.3"E, 1451 m a.s.l.), dark zone, hand collecting under the rocks with an aspirator, 01.VI.2022, dark zone, pitfall traps with propylene glycol, 28.VI.2022, leg. M. Mehrafrooz Mayvan; 8 ♀♀, Iran, Khorasan-e Razavi province, Chenaran city, Kenan 2 (Small) Kenan cave (36°34'03"N, 59°04'18"E, 1467 m a.s.l.), dark zone, hand collecting under the rocks with an aspirator, 29.VI.2022, leg. M. Mehrafrooz Mayvan; 13 ♀♀, Iran, Khorasan-e Razavi province, Mashhad city, Kardeh village, AL cave

(36°40'0.2"N, 59°39'19.9"E, 1693 m a.s.l.), dark zone, collected on bat guano with an aspirator, 13.X.2023, leg. M. Mehrafrooz Mayvan; 1 ♀, 6 nymphs, Iran, Khorasan-e Razavi province, Sarakhs county, Mazdavand city, Mazdavand (Mozdouran) cave (36°09'05"N, 60°32'59"E, 1056 m a.s.l.), dark zone, collected on bat guano with an aspirator, 18.VI.2022, leg. M. Mehrafrooz Mayvan; 8 ♀♀, 6 nymphs, Iran, Khorasan-e Razavi province, Sarakhs county, Bazangan village, Bazangan cave (36°18'29"N, 60°22'19"E, 1401 m a.s.l.), dark zone, pitfall traps with propylene glycol, 19.IX.2023, leg. M. Mehrafrooz Mayvan; 1 ♀, Iran, Khorasan-e Razavi province, Mashhad city, Dehbar village (36°14'48"N, 59°17'07"E, 1702 m a.s.l.), extracted with Berlese funnel from soil and litter, 01.VII.2023, leg. M. Mehrafrooz Mayvan.

Distribution in Iran. This species is reported for the first time from Iran and Khorasan-e Razavi province.

Ecology and habitat. A troglophilous species, collected in caves under rocks and on bat guano, surface records come from soil and litter.

General distribution. Cosmopolitan (Lienhard, 2016).

Remarks. This species has been registered for the first time in Iranian caves.

Family Trogiidae Roesler, 1944

Genus *Lepinotus* Heyden, 1850

Lepinotus inquilinus* Heyden, 1850* (Fig. 2B)

Material examined. 8 ♀♀, 6 nymphs, Iran, Khorasan-e Razavi province, Mashhad city, Dehbar village (36°14'48"N, 59°17'07"E, 1702 m a.s.l.), extracted with Berlese funnel from soil and litter, 01.VII.2023, leg. M. Mehrafrooz Mayvan; 4 ♀♀, 2 nymphs, Iran, Khorasan-e Razavi province, Mashhad city, Kang village (36°14'48"N, 59°17'07"E, 1702 m a.s.l.), extracted with Berlese funnel from soil and litter, 05.VII.2023, leg. M. Mehrafrooz Mayvan; 4 ♀♀, Iran, North Khorasan province, Shirvan city, Gelyan village (37°13'46"N, 57°53'24"E, 1344 m a.s.l.), extracted with Berlese funnel from soil and litter, 01.VII.2023, leg. M. Mehrafrooz Mayvan

Distribution in Iran. This species is reported for the first time from Iran and Khorasan-e Razavi and North Khorasan provinces.

Ecology and habitat. Collected from soil and litter.

General distribution. Europe, Africa, Madagascar, Asia, Australia, New Zealand, North and Latin America (Lienhard, 2016).

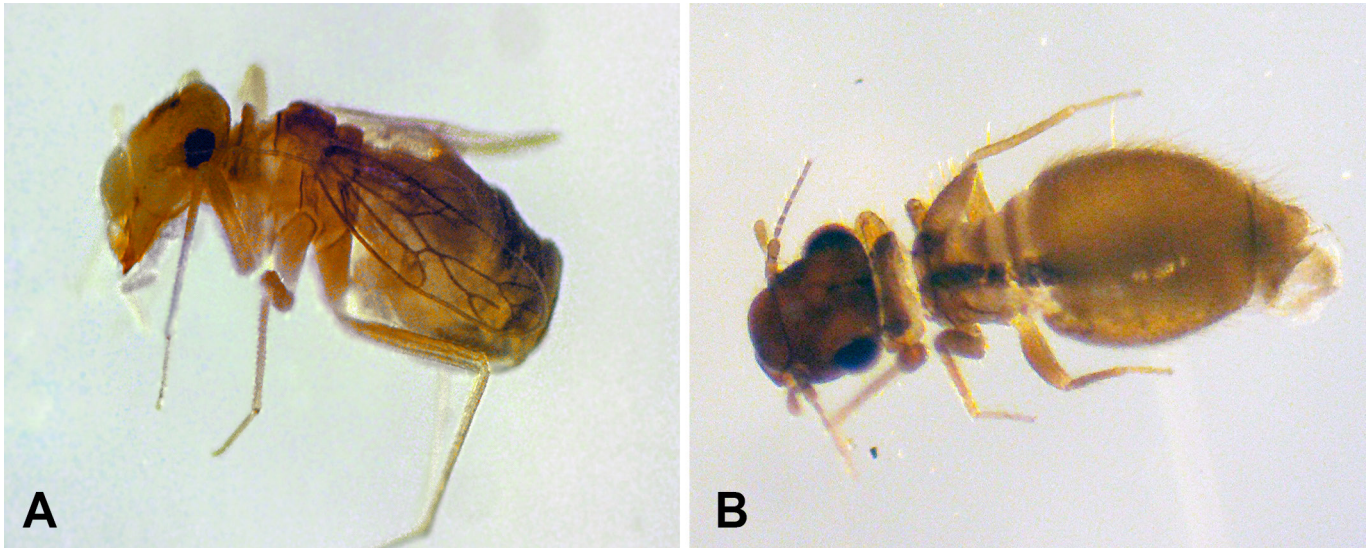


Figure 2. The newly recorded procid species from Iran. **A.** *Psyllipsocus ramburii* Selys-Longchamps, 1872; **B.** *Lepinotus inquilinus* Heyden, 1850 (Photo: M. Mehrafrooz Mayvan).

Lepinotus reticulatus Enderlein, 1905

Distribution in Iran. This species has been reported from Kermanshah, Kordestan and Khorasan-e Razavi provinces (Khandehroo et al., 2015; Kahrarian, 2018).

Ecology and habitat. Collected in a grassland under the stones, on the ash trees, in the leaf and needle litter around oak, pine, walnut, apricot (*Prunus armeniaca*) and elm trees.

General distribution. Cosmopolitan (Lienhard, 2016).

Genus *Trogium* Illiger, 1798

Trogium apterum Broadhead & Richards, 1982

Distribution in Iran. This species has been reported from Khuzestan province (Nikpay, 2017).

Ecology and habitat. Collected on the sugar cane plants.

General distribution. It was previously only known from the type locality in Kenya (Amboseli Game Reserve), found on dead and living fronds of palm *Phoenix reclinata* (Broadhead & Richards, 1982).

DISCUSSION

A total of six species, all female, belonging to three genera and three families of Psocoptera were identified from North Khorasan and Khorasan-e Razavi provinces in this study. Of them, *P. ramburii* Selys-Longchamps, 1872 and *L. inquilinus* Heyden, 1850 are new for Iranian fauna. With the addition of two new records within this study, a total of 22 species belonging to 11 genera and 8 families of psocids have been reported from Iran up to date. The suborder Troctomorpha, comprising 2 genera and 11 species, accounts for the highest number of species (48%), followed by Psocomorpha with 6 genera and 8 species (35%), and Trogiomorpha with 2 genera and 4 species (17%) (Fig. 3A). Among the families, Liposcelididae dominates with 11 species, representing 50% of the total species richness (Fig. 3B).

To date, only 10 studies have been conducted on psocids in Iran. Among the identified Iranian psocids, 15 species are cosmopolitan, while 5 are restricted to the Palearctic region. Also, *T. apterum* has been recorded in Kenya (Afrotropical realm) and Iran so far. Despite the vast territory of this country with 31 provinces, most research has focused on Kermanshah in the west and the northern provinces that encompass the Hyrcanian forests (Fig. 4).

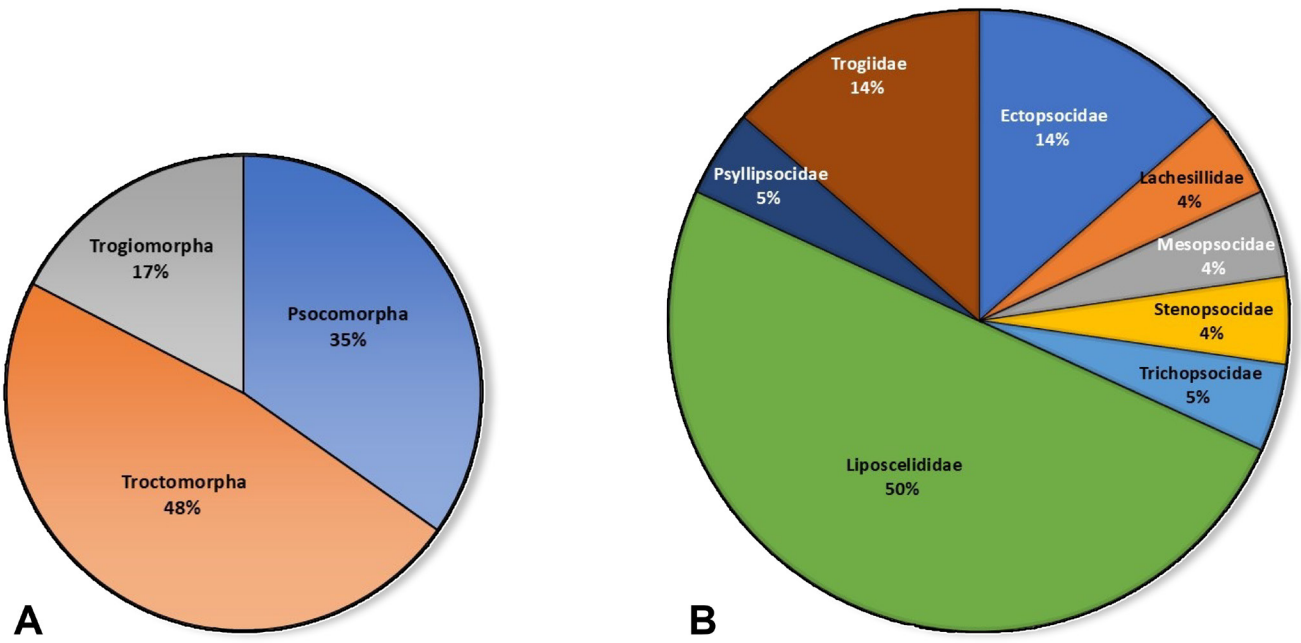
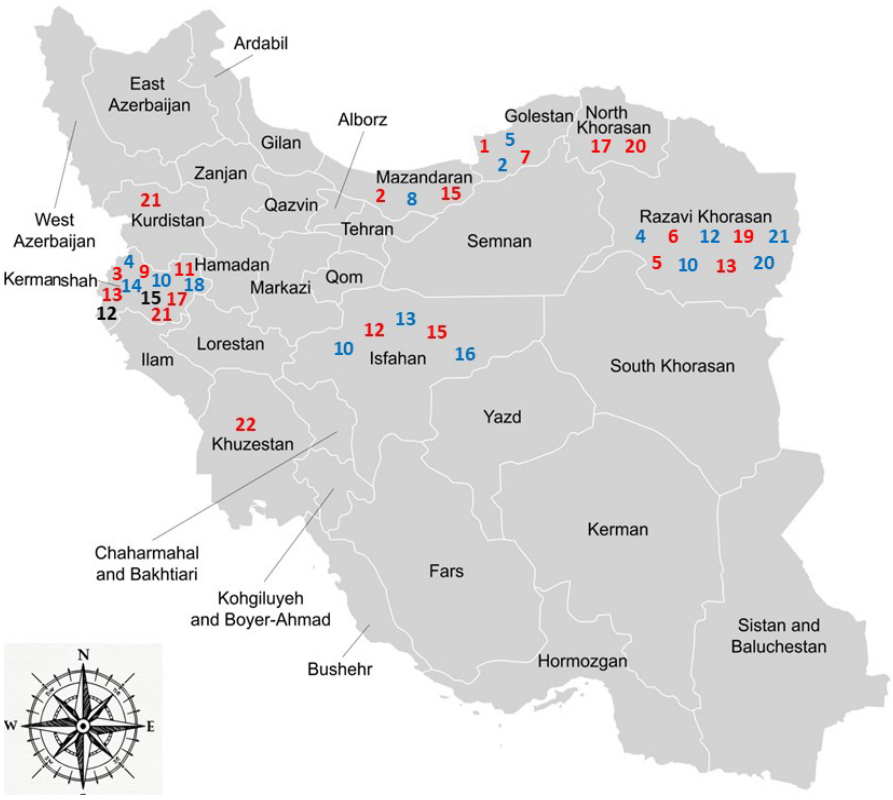


Figure 3. Percentage of **A.** suborders**; B.** families of Psocoptera recorded until October 2024 in Iran.



1. *Ectopsocopsis cryptomeriae* (Enderlein, 1907)
2. *Ectopsocus briggsi* McLachlan, 1899
3. *Ectopsocus vachoni* Badonnel, 1945
4. *Ectopsocus vishnyakovae* Schmidt, 1993
5. *Lachesilla quercus* (Kolbe, 1880)
6. *Mesopsocus hiemalis* Marikowskii, 1957
7. *Graphopsocus cruciatus* (Linnaeus, 1768)
8. *Trichopsocus dalii* (McLachlan, 1867)
9. *Belaphotroctes* sp.
10. *Liposcelis bostrychophila* Badonnel, 1931
11. *Liposcelis brunnea* Motschulsky, 1852
12. *Liposcelis corrodens* (Heymons, 1909)
13. *Liposcelis decolor* (Pearman, 1925)
14. *Liposcelis edaphica* Lienhard, 1990
15. *Liposcelis keleri* Günther 1974
16. *Liposcelis paeta* Pearman, 1942
17. *Liposcelis priesneri* Enderlein, 1925
18. *Liposcelis silvarum* (Kolbe, 1888)
19. *Psyllipsocus ramburii* Selys-Longchamps, 1872
20. *Lepinotus inquilinus* Heyden, 1850
21. *Lepinotus reticulatus* Enderlein, 1905
22. *Trogium apterum* Broadhead & Richards, 1982

Figure 4. Species records of Psocoptera in Iranian provinces.

Consequently, very few studies have been carried out in the smaller areas of 9 provinces, leaving the psocids fauna of 22 provinces completely unexplored. Given the geographic size of Iran and the diversity of its ecosystems, we can state that the diversity of psocid fauna in Iran is still highly unknown and underestimated. Exploration in unexplored areas requires further investigation.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: M. Mehrafrooz Mayvan: collection of specimens, providing of distribution data and writing of the manuscript; D. Georgiev: species identification, manuscript editing; Ľ. Kováč: review and editing of the manuscript, funding acquisition. All authors read and approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the Ecology and Environmental Conservation, University of Plovdiv, Bulgaria (EUPB); Zoology Museum of Ferdowsi University of Mashhad, Mashhad, Iran (ZMFUM) and are available from the curator, upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

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

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گونه‌های راسته Psocoptera (Insecta: Psocodea) از ایران با گزارش جدید برای غارهای ایران

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چکیـده: در این مطالعه، گونه های راسته پسوکوپترا ('Psocoptera' :Psocodea) از غارها و سایر اکوسیستم‌های شمال شرق ایران طی سال‌های ۱۴۰۱ تا ۱۴۰۳ مورد بررسی قرار گرفت. در میان گونه‌های مورد مطالعه، دو گونه *Psyllipsocus ramburii* Selys-Longchamps, 1872 و *Lepinotus inquilinus* Heyden, 1850 برای فون پسوکوپترای ایران جدید بودند. همچنین تمامی گونه‌های شناسایی شده در این مطالعه برای اولین بار از استان‌های خراسان شمالی و خراسان رضوی گزارش می‌شوند. همچنین، شایان ذکر است که این اولین گزارش از راسته پسوکوپترا در غارهای ایران است. علاوه بر این، فهرستی از گونه‌های این راسته در ایران بر اساس مقالات موجود تا آبان‌ماه ۱۴۰۳ تهیه شده است. در مجموع، ۲۲ گونه متعلق به ۱۱ جنس و ۸ خانواده تا کنون از ایران گزارش شده است. ما تحلیل مختصری از سیستماتیک، جغرافیای جانوری و بوم شناسی پسوکوپتراهای ایران را نیز انجام دادیم. زیرراسته Troctomorpha با ۲ جنس و ۱۱ گونه بیشترین تعداد گونه را شامل می شود. از ۹ خانواده ثبت شده، خانواده Liposcelididae جمعیت غالب است که ۱۱ گونه یا ۵۰ درصد از جمعیت کل را تشکیل می‌دهد. همچنین، این مطالعه شامل منابع کتابشناختی و اطلاعاتی در مورد پراکنش جهانی این گونه ها است.

واژگـان کلیدی: فهرست نامه، ایران، پسوکوپترا، گزارش جدید، بوم‌سازگان زیرزمینی، غاردوست