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First record of two species of gall midges (Diptera: Cecidomyiidae) from Iran

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ABSTRACT. Five species of gall midges (Diptera: Cecidomyiidae) were found during investigations in the Kerman province in the years 2010–2016. Two of these, *Xerephedromyia bipartita* Mamaev, 1972 and *Xerephedromyia mitroshinae* Fedotova, 1992, causing galls on *Ephedra major* (Ephedraceae), were recorded for the first time from Iran. Both species are very rare and have not been found since the time of their original description. *Rhopalomyia efremovi* (Fedotova, 1999), *Rhopalomyia hispanica* Tavares, 1904 and *Rhopalomyia navasi* Tavares, 1904, causing galls on various species of *Artemisia* (Asteraceae), already known to occur in north-eastern and central Iran, were recorded for the first time in the Kerman province.

Key words: Diptera, Cecidomyiidae, *Xerephedromyia*, *Rhopalomyia*, Iran, distribution, new records

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Introduction

Galls (in Latin *cecidia*) are defined as any deviation in the normal pattern of plant growth produced by a specific reaction to the presence and activity of a foreign organism (animal or plant) (Bloch 1965). The galls support species-rich and closed communities of inquilines (including cynipids, gall midges, moths and beetles) and parasitic Hymenoptera (predominantly Chalcidoidea) (Redfern, 2011). It is possible to identify the causer of the gall if we know the host plant and use identification keys in several books written in the past (Houard, 1908–1908, 1912, 1913, 1922–1923). Galls are caused by different insect orders, such as Hymenoptera, Diptera, Coleoptera, Lepidoptera which have been considered as an important source of information on herbivore-plant relationships and on the interaction between herbivores and their natural enemies (Redfern, 2011; Mahdavi et al., 2015; Moeinadini et al., 2014). Gall midges (Cecidomyiidae) are one of the most species rich families of the order Diptera, suborder Nematocera. This family contains the largest group of gall-inducing animals in the world. Gagné & Jaschhof (2014) listed 6203 known species and 736 genera of living and fossil gall midges. Altogether 3122 species in 344 genera occur in the Palaearctic Region (Skuhravá, 2006). The known gall midge fauna of Iran is

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composed of 61 species belonging to 33 genera; most of them are phytophagous and their larvae cause galls (Skuhravá et al., 2014b). Gall midges have been recorded mainly in the northern parts of Iran during recent years (Gol et al., 2015, Hashemi Khabir et al., 2012, Honarmand et al., 2014, Joghataie et al., 2014, Karimpour & Skuhravá, 2012, Sadeghi et al., 2012). Only three species of gall midges are known from Kerman province, viz. *Baldratia anabasis* Möhn, 1969, *B. kermanensis* Möhn, 1969 and *B. similis* Möhn, 1969, all described on the basis of larvae, adults are undescribed (Möhn, 1969; Skuhravá 1986; Gagné & Jaschhof, 2014). The aim of the present study was to investigate the gall midge species (Cecidomyiidae) associated with *Ephedra major*, *Artemisia* sp. and *Artemisia aucheri* in Kerman province, southeast of Iran.

Material and methods

The present research was conducted within the range of four regions, Bidkhan, Sang-e-Sayad, Rabor and Dalfard Rural Districts, in Kerman province, located in the southeast of Iran, from April 2010 to June 2016 (Fig. 1). The Bidkhan village is located about 90 km southwest of Kerman city and 40 km southwest of Bardsir County at maximum 3500 m (Bidkhan Mountain) above sea level. The Sang-e-Sayad is located to the southwest of Kerman city and southeast of Bardsir County at about 3112 m above sea level. Dalfard is a rural district in Sarduiyeh District, Jiroft County, Kerman province, Iran. It is located 30 km north of Jiroft in the Jabalbarz Mountains. Fresh and dry stem galls of *Ephedra major* (Host), *Artemisia* sp. and *Artemisia aucheri* (Boiss) (Asteraceae) were collected. The galls were transferred to the laboratory and kept at room temperature in mesh-covered transparent plastic rearing containers under room conditions until the emergence of adult specimens. The containers were checked every day and emerged specimens removed. The emerged gall midges were preserved in 75% ethanol. The external morphology of the specimens was studied using a Nikon SMZ800 stereomicroscope. Identification of galls caused by gall midges is based on the keys of Buhr (1964-1965), Houard (1908-1909, 1912, 1913, 1922-1923) and Skuhravá (2011). Identification of gall midge larvae is based on Möhn (1955, 1966–1971) and of adults on the keys to genera of Skuhravá (1997). The gall midge species were identified using the specific shape of galls. The gall material is deposited in the Zoological Museum of Shahid Bahonar University of Kerman, Kerman, Iran (ZMSBUK) and in the collection of Marcela Skuhravá in Praha, Czech Republic.

Results

Five species of gall midges were found during investigations in the Kerman province in the years 2010–2016. Two species of the genus *Xerephedromyia* were recorded from Iran for the first time: *Xerephedromyia bipartita* Mamaev, 1972 and *Xerephedromyia mitroshinae* Fedotova, 1992. Each of them causes galls of characteristic shape on *Ephedra major* (Ephedraceae). Three species of the genus *Rhopalomyia* Rübsaamen, 1892, known to occur in north-eastern and central Iran, were recorded for the first time in Kerman province located in south-eastern Iran: *Rhopalomyia efremovi* (Fedotova, 1999), *Rhopalomyia hispanica* Tavares, 1904 and *Rhopalomyia navasi* Tavares, 1904. These species cause galls of characteristic shape on various species of *Artemisia* (Asteraceae). They already were found in north-eastern and central Iran during 2011–2012 (Joghataie et al., 2015) and recently were recorded in Kerman province for the first time.

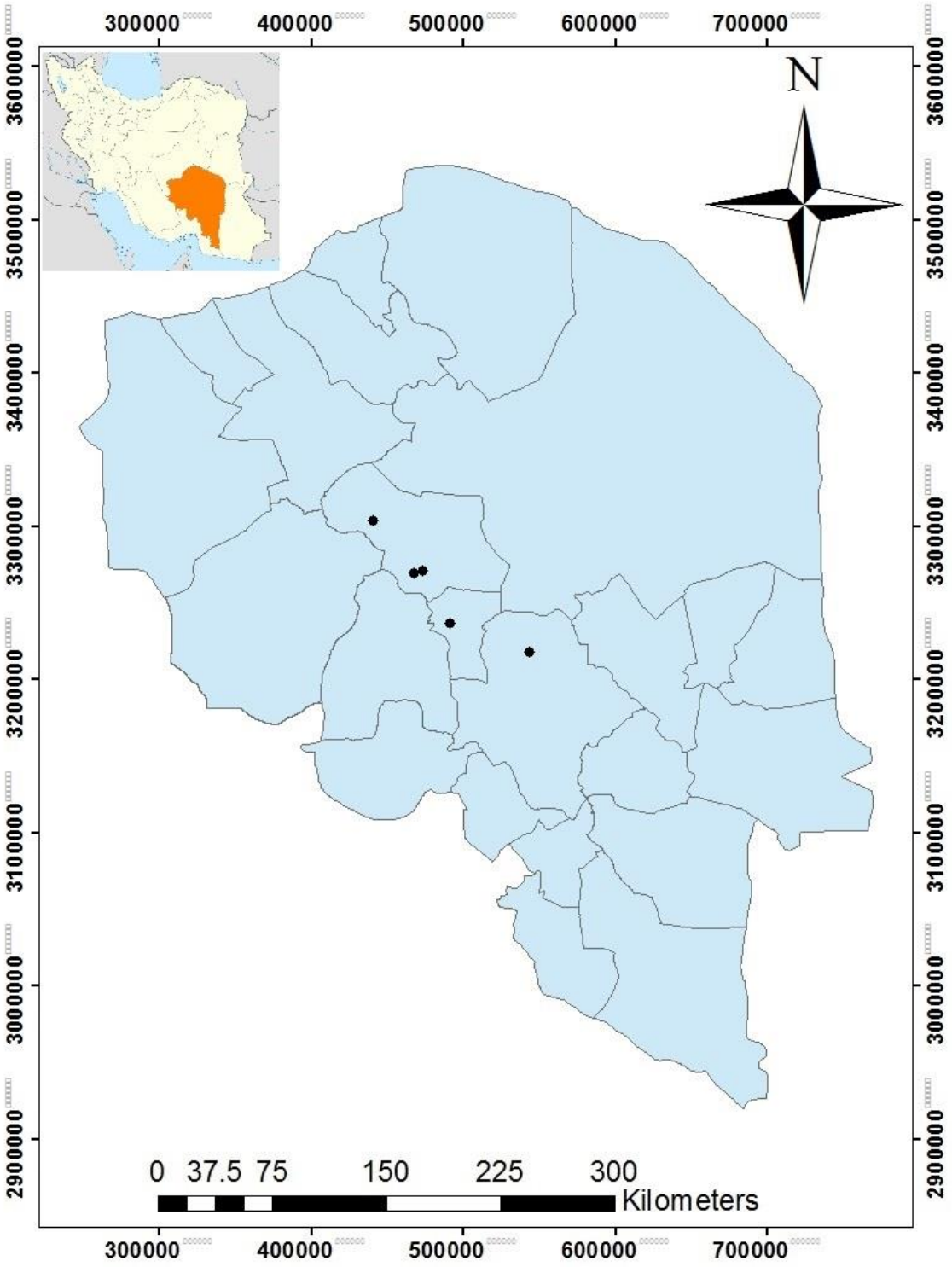

Figure 1. Map of the sampling localities in Kerman province, south-east Iran.

Genus *Xerephedromyia* Mamaev, 1972

The genus *Xerephedromyia* Mamaev, 1972 with the type species *X. bipartita* Mamaev, 1972, includes only three species which are associated with host plants of the genus *Ephedra* L. (Ephedraceae) in the Palaearctic Region (Gagné & Jaschhof, 2014). Two species of this genus were found recently in Iran.

***Xerephedromyia bipartita* Mamaev, 1972**

Material examined: Galls on stem of *Ephedra major* (Host) (Ephedraceae). Iran: Kerman province, Rabor, Seyed Morteza Fall, 27 April 2016, 29°12′19.7″N, 57°6′11.9″E, 2446 m a. s. l., S. M. Madjdzadeh leg.

Remarks: Two stems each including two galls were found on *Ephedra major. A* couple of galls were situated at the basis of the internode. The egg-shaped gall is 5–8 mm long, with thin walls and large chamber where the larva develops and pupates in a white cocoon. At the time of collecting the gall was empty, with a white cocoon inside and with an opening after emergence of the adult. The shape of collected galls fully corresponds to the shape of galls in the description in Mamaev (1972, p. 895, Fig. 5.5). He described this species on the basis of adults reared from galls on *Ephedra strobilacea* found at Kuldzhuktau in Uzbekistan, 19 March, 1961.

Distribution: Asian (Turano-Iranian). This species was found only in Uzbekistan. It is the first record from Iran.

***Xerephedromyia mitroshinae* Fedotova, 1992**

Material examined: Iran: Kerman province, Bardsir, Sang-e- Sayad; reared from galls on *Ephedra major* (Host) (Ephedraceae), collected on 5 April 2011; 8 adults (2♂♂, 6♀♀); reared from galls on 11 April 2011, 29°39′40.3″N 056°44′86.8″E, 2666 m a. s. l., A. Moeinadini leg. Adults in bad condition, heavily damaged, without antennae and legs.

Remarks: The gall of *X. mitroshinae* on *Ephedra major* is an ovoid swelling of the stem at the base of the internode; usually two or three galls arise from one internode (Fig. 2).

Figure 2. . Ovoid gall of *Xerephedromyia mitroshinae* Fedotova, 1992 on stem of *Ephedra major* (Host). Iran: Kerman province, Bardsir, Sang-e-Sayad, at an altitude of 2666 metres above sea level.

The shape of galls fully corresponds to the shape of galls in the description of this species given in Fedotova (1992: Fig. 3b). She reared adults from galls on *Ephedra strobilacea* (Bunge) and *E. lomatolepis* (Schrenk) found in Turkmenistan, in southern Karakum Desert.

Distribution: Asian (Turano-Iranian). This species was found only in Turkmenistan. It is the first record from Iran.

Genus *Rhopalomyia* Rübsaamen, 1892

The genus *Rhopalomyia* Rübsaamen, 1892 with the type species *Oligotrophus tanaceticola* Karsch, 1879 is one of four species rich genera of the family Cecidomyiidae. It includes recently 267 species in the world (Gagné & Jaschhof, 2014; Skuhravá, 2006). Many species were found and occur in Central Asia, mainly in Kazakhstan (Fedotova, 2000). Larvae induce galls on stems, buds and leaves of host plants mainly of the family Asteraceae. Galls often occur on several organs of the same host plant species. Alternation of plant organs is connected with the development of several generations per year (Skuhravá & Skuhravý, 2010). Five species of this genus were found in northern Iran during the period from 2010 to 2012 (Skuhravá et al., 2014b). Three of them were found recently in Kerman province in southeastern Iran.

***Rhopalomyia efremovi* (Fedotova, 1999)**

Material examined: Iran: Kerman province, Bardsir, Sang-e- Sayad; Gall in the form of spindle swelling on the stem of *Artemisia* sp. (Asteraceae), collected on 27 April 2011, 11 adults (2♂♂, 9♀♀), reared from galls in May 2011, 29°37′81.8″N 056°51′74.1″E, 2733 m a. s. l., A. Moeinadini leg. Adults in very bad condition: dried, shriveled bodies, without antennae and legs; not utilizable for identification.

Remarks: Fedotova (1999) found galls on *Artemisia dracunculus* (L.) in the mountain complex Talasskiĭ Alatau in southern Kazakhstan and described this species under the name *Dracunculomyia efremovi* (Fedotova, 1999). Gagné (2004) synonymized the genus *Dracunculomyia* Fedotova, 1999 under the genus *Rhopalomyia* Rübsaamen, 1892. Stem galls on *Artemisia* sp. found in Kerman province in Iran are similar to galls described by Fedotova (1999) (Fig. 3).

Figure 3. Gall of *Rhopalomyia efremovi* (Fedotova, 1999) in the form of spindle swelling on the stem of *Artemisia* sp. Iran: Kerman province, Bardsir, Sang-e-Sayad, at an altitude of 2733 metres above sea level.

It is necessary to find these galls once more, rear adults and identify the species on adults, to be sure that the galls belong to this species.

Distribution: Asian (Turano-Iranian). This species was found in Kazakhstan, Kyrgyzstan (Fedotova, 2000: 651) and Iran. It is the first record from the Kerman province and the second record from Iran (Skuhravá et al., 2014b).

***Rhopalomyia hispanica* Tavares, 1904**

Material examined: Iran: Kerman province, Sarduiyeh: Dalfard; several galls on stems of *Artemisia aucheri* Boiss (Asteraceae): 1♂, 7♀♀, 29.02726°N, 57.619435°E, collected on 29 April 2016, 2413 m a. s. l., S. M. Madjdzadeh leg. Adults in very bad condition, not utilizable for identification.

Remarks: Tavares (1904) described adults reared from galls on *Artemisia herba-alba* collected in the mountain massif Sierra de Guara situated in northern Spain at an elevation of about 2000 m a. s. l.. Galls on *Artemisia aucheri* found in Kerman province correspond to the shape of galls described by Tavares (1904). They are small and globular, with a small ovoid inner gall forming a chamber (Fig. 4).

Distribution: Euro-Asian with disjunctive area (Irano-Mediterranean), recorded only from Spain (Skuhravá et al., 2006) and Iran. It is the first record from Kerman province and the second record from Iran (Skuhravá et al., 2014b).

***Rhopalomyia navasi* Tavares, 1904**

Material examined: Iran: Kerman province, Bardsir: Bidkhan, several galls on stems of *Artemisia aucheri* Boiss (Asteraceae), 1♂, 2♀♀, 29°36´00.8˝N 56°30´23.1˝E, 2644 m a. s. l., A. Moeinadini leg.; collected on 20 May 2016. Adults in very bad condition, not utilizable for identification.

Remarks: Tavares (1904) described adults reared from galls on *Artemisia herba-alba* collected in the Mountain massif Sierra de Guara situated in northern Spain at an elevation of about 2000 m a. s. l. It is not clear if galls were collected at the same place where galls of *R. hispanica* were found. Galls of *R. navasi* are large galls, 10–30 mm in diameter, densely white pubescent. Several chambers occur inside one gall. Only one larva develops in each chamber where it also pupates. Galls on *Artemisia aucheri* found in Kerman province fully correspond in the shape to galls described by Tavares (1904) (Fig. 5).

Distribution: Euro-Asian (Irano Mediterranean), known to occur in Spain, Romania, Morocco, Algeria, Tunisia, Libya, Egypt, Syria and Iran (Skuhravá 1986, Skuhravá et al., 2014a). It is the first record from the Kerman province and the second record from Iran (Skuhravá et al., 2014b).

Figure 4. Cluster of small globular galls of *Rhopalomyia hispanica* Tavares, 1904 on stem of *Artemisia aucheri* Boiss. Iran: Kerman province, Sarduiyeh: Dalfard, at an altitude of 2413 metres above sea level.

Figure 5. Large gall of *Rhopalomyia navasi* Tavares, 1904, densely white pubescent, on stem of *Artemisia aucheri* Boiss. Iran: Kerman province, Bardsir: Bidkhan, at an altitude of 2644 metres above sea level.

Discussion

Because of the scarcity of information on the gall midges fauna of Kerman province, a recent preliminary study of the gall midges fauna of this region associated with a few host plants has been locally performed. In the present study we report five gall midges species associated with plant galls, *Ephedra major*, *Artemisia* sp. and *Artemisia aucheri*. The genus *Xerephedromyia* Mamaev, 1972 with the type species *Xerephedromyia bipartita* Mamaev, 1972, includes only three species which are associated with host plants of the genus *Ephedra* (L.) (Ephedraceae) in the Palaearctic Region (Gagné & Jaschhof, 2014). Two species of this genus were found recently in Iran, viz. *Xerephedromyia bipartita* Mamaev, 1972 and *X. mitroshinae* Fedotova, 1992. Both species are very rare and have not been found since the time of their original description. Unfortunately, from the viewpoint of biodiversity, Kerman province, located in the southeast of Iran, has been given little attention. In addition, some habitats in other parts of Kerman and parts of southern provinces have not been studied in detail to date. Further taxonomic investigations are necessary to increase the knowledge of diversity and applicability of this group of insects in Kerman province and also other parts of Iran.

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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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اولین گزارش دو گونه از دوبالان گالزا (Diptera: Cecidomyiidae) از ایران

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چکیده: در این تحقیق پنج گونه از دوبالان گال‌زا (Diptera: Cecidomyiidae) طی سال‌های ۱۳۹۰تا ۱۳۹۶ در استان کرمان یافت شد. از این تعداد دو گونه، *Xerephedromyia mitroshinae* Fedotova, 1992 و *Xerephedromyia bipartita* Mamaev, 1972 که در گیاه *Ephedra major* (Ephedraceae) گال ایجاد می‌کنند برای اولین بار از ایران گزارش شدند. هر دو گونه بسیار نادر بوده و از زمان توصیف اولیه آنها تا کنون یافت نشده‌اند. سه گونه: *Rhopalomyia efremovi* (Fedotova, 1999)، *Rhopalomyia hispanica* Tavares, 1904 و *Rhopalomyia navasi* Tavares, 1904 که در گونه‌های مختلف *Artemisia* (Asteraceae) گال ایجاد می‌کنند و در نواحی شمال شرقی و مرکزی ایران یافت می‌شوند برای اولین بار از استان کرمان گزارش شدند.

واژگان کلیدی: دوبالان، Cecidomyiidae، *Xerephedromyia*، *Rhopalomyia*
ایران، پراکنش، گزارش جدید