

RESEARCH ARTICLE

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New data on the camel spider fauna of Iran (Arachnida: Solifugae), Part I. Kohgilouyeh and Boyer Ahmad Province

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(Received: 24 November 2019; Accepted: 18 June 2020)

Abstract

In this paper, which is the first contribution in the series devoted to the camel spiders of Iran, seven species from Kohgilouyeh and Boyer Ahmad Province are reported. The genus *Gluviopsilla* and two species; *Gluviopsilla discolor* (Kraepelin, 1899) (♀) and *Paragaleodes nesterovi* Birula, 1916 (♂♀) are new to the fauna of Iran, and five species *Galeodes* cf. *krausi* Harvey, 2002 (♂♀), *Galeodes trichotichnus* Roewer, 1934 (♂), *Gylippus* (*Paragylippus*) *spinimanus* Birula, 1905 (♀), *Karschia* (*Karschia*) *persica* Kraepelin, 1899 (♂) and *Rhagodes caucasicus* Birula, 1905 (♂♀) are new records for the province. Also, the females of *P. nesterovi* and *G.* cf. *krausi* are firstly recorded.

Key words: diversity, fauna, Iranian Plateau, new records, sun spider, Zagros Mountains.

INTRODUCTION

Currently, five families, 19 genera and 64 described species have been recorded from Iran (Birula, 1905, 1938; Kraepelin, 1899, 1901; Pocock, 1899; Roewer, 1932, 1933, 1934, 1941, 1952; Kraus, 1959; Harvey, 2003; Koc *et al.*, 2015; Khazanehdari *et al.*, 2016; Maddahi *et al.*, 2017, 2019). The families Galeodidae and Rhagodidae with 34 and 13 species, respectively, are the most species-rich families, mainly recorded from the desert and semi-desert regions of eastern and central parts of the country (Harvey, 2003; Maddahi *et al.*, 2019). The family Daesiidae comprised seven species, six of them, are only distributed in east of Iran (Harvey, 2003). The two less diverse families Karschiidae and Gylippidae include seven and three species, respectively, mainly known from mountainous regions of the country (Harvey, 2003; Khazanehdari *et al.*, 2016).

Despite this diversity, few taxonomic studies have been conducted on the camel spider fauna of Iran. Distributional data is fragmented for most described taxa and there are still many regions of the country that remained uninvestigated. Former studies on camel spiders of Iran have been mainly restricted to eastern and central parts of the country. For example, *Biton* (*Bitonissus*) *xerxes* (Roewer, 1933) is the only known daesiid species from western Iran, whereas six species recorded from eastern parts. Scattered studies have been previously conducted in western Iran (Pocock, 1899; Kraepelin, 1899; Birula, 1905, 1907; Roewer, 1933, 1934, 1952; Kraus, 1959; Harvey, 2003; Maddahi *et al.*, 2020), causing its low species diversity. Moreover, the majority of the

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camel spider species from this region were described based on just one sex or few specimens and known only from the type material.

According to the extreme habitat varieties in Iran, much more diversity for camel spiders would be expected in the region. In recent years, a comprehensive study has been commenced at the Ferdowsi University of Mashhad, focusing on biodiversity, systematics and phylogeny of camel spiders of the country. In this regard, extensive field-works were performed, initiating from the northeast and the east of Iran and continuing to the south and the west of the country. The primary results were published in part, mostly focusing on the taxonomy and phylogeny of this taxon (Maddahi *et al.*, 2015, 2017, 2019, 2020). This paper is the first contribution in the series devoted to the camel spider diversity of Iran, representing the fauna of Kohgiluyeh and Boyer Ahmad Province.

MATERIAL AND METHODS

The Kohgiluyeh and Boyer Ahmad province lays in the southwestern part of Iran covering an area of 16,264 km² (Fig. 1). As a part of the central Zagros Mountains, the province is mostly mountainous (about 70%), with altitudes ranging from 410 to 4409 m a.s.l. and mostly covered with oak forests. The humidity varies from 57 to 100% and the average temperatures range up to 36°C in the summer and down to -10°C in the winter.

Specimens were collected by direct searching and rock-rolling from different habitats of the province, including foothills, mountain slopes, agricultural fields and the vicinity of cities and villages from April to August 2017 (Fig. 1). Moreover, examined type material and type series of four species were included in the present study.

The identification of camel spider specimens was made according to Kraepelin (1901), Roewer (1933, 1934), and Birula (1907, 1913, 1938). The diagnostic characters of the species were investigated using an Olympus SZH40 stereomicroscope (Japan, Tokyo). Wherever possible, they were compared with the available type material. The coordinates for some specimens were estimated as they are based on historical local information.

Depositories. Zoological Museum, Ferdowsi University of Mashhad, Mashhad, Iran (ZMFUM), Shiraz University of Medical Sciences, Shiraz, Iran (EMSUMS), Zoological Museum of the Zoological Institute of the Russian Academy of Sciences, Saint Petersburg, Russia (ZISP), Senckenberg Natural History Museum, Frankfurt, Germany (SMF) and the first corresponding author's private collection (HMC).

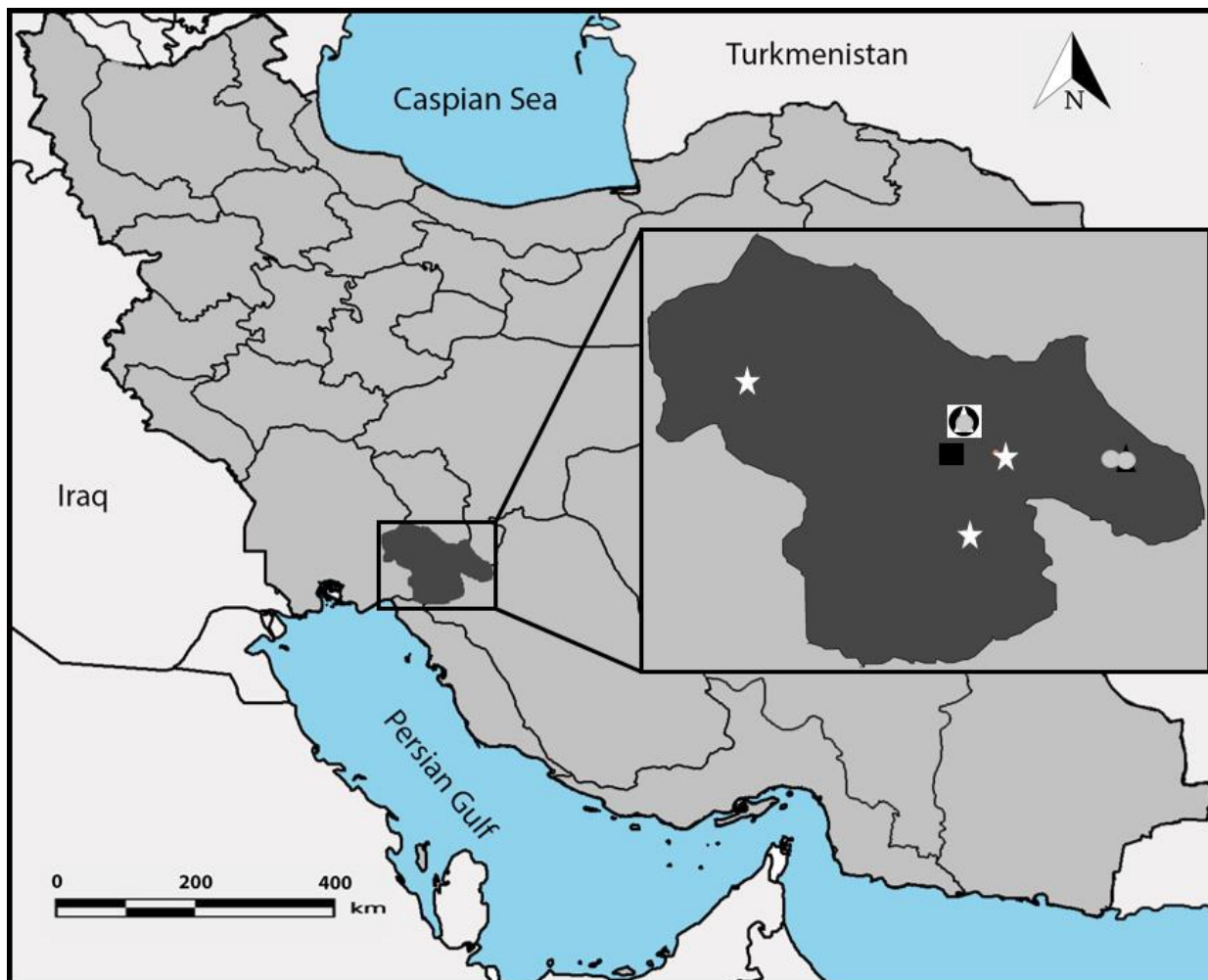


FIGURE 1. Collecting localities of camel spiders from Kohgilouyeh and Boyer Ahmad Province, southwest Iran. *Gluiopsilla discolor* (white square), *Galeodes* cf. *krausi* (white triangle), *Galeodes trichotichnus* (gray circles), *Paragaleodes nesterovi* (black triangle), *Gylippus* (*Paragylippus*) *spinimanus* (white stars), *Karschia* (*Karschia*) *persica* (black square) and *Rhagodes caucasicus* (black circle).

RESULTS

A total number of five families, six genera, and seven species were identified, all are new to the studied area. The genus *Gluiopsilla* and two species *G. discolor* and *Paragaleodes nesterovi* are firstly recorded from Iran.

SPECIES LIST

Family Daesiidae Kraepelin, 1899

Gluiopsilla discolor (Kraepelin, 1899)

Gluiopsis rufescens var. *discolor* Kraepelin, 1899

Roewer, 1933: 379, fig. 269c1-c3 (♂)

Bird *et al.*, 2015: 203, pl. 9e (♂); 332, pl. 136a-b (♂)

Material examined: *Iran: Fars Province:* 1♀ 1juv (HMC-SOL-1276 & 1277), 35 km SE Yasuj, Tang-e-Sorkh village (30°26'11"N, 51°45'45"E), 2038 m a.s.l., 12.07.2017, leg. H. Maddahi. *Kohgilouyeh and Boyer Ahmad Province:* 1juv (HMC-SOL-1278), 95 km NE Choram, 10 km S Ludab, Gardekan village (30°54'50"N, 50°53'58"E), 1487 m a.s.l., 12.07.2017, leg. M. Dezhman.

Remarks: This species has been previously recorded from Algeria, Greece (Rhodes), Somalia, Syria and Turkey (Roewer, 1933, 1941; Harvey, 2003; Bird *et al.*, 2015). Our records were collected from

mountainous regions and represent the easternmost distributional limit of the species globally. The species is new to the fauna of Iran.

Family Galeodidae Sundevall, 1833

Galeodes cf. krausi Harvey, 2002

Kraus, 1959: 95, fig. 7-8 (♂) (as *Galeodes roeweri*)

Material examined: *Iran: Kohgiluyeh and Boyer Ahmad Province:* 3♂ 5♀ (HMC-SOL-1297-1298-1299-1300-1302-1303-1304-1305), 95 km NE Choram, 10 km S Ludab, Gardekan village (30°54'50"N, 50°53'58"E), 1487 m a.s.l., 07 & 08.2017, leg. H. Maddahi & A. Barmoudeh.

Remarks: This species was only known from Khuzestan Province in southwest Iran (Kraus, 1959). This is the first female record for the species and new provincial record.

Galeodes trichotichnus Roewer, 1934

Material examined: *Iran: Kohgiluyeh and Boyer Ahmad Province:* 1♂ (HMC-SOL-1253), Yasuj (30°47'53"N, 51°22'08"E), 1867 m a.s.l., 15.06.2017, leg. S. Pourebrahimi; 1♂ (HMC-SOL-1301), 95 km NE Choram, 10 km S Ludab, Gardekan village (30°54'50"N, 50°53'58"E), 1487 m a.s.l., 07 & 08.2017, leg. H. Maddahi; 1♂ (EMSUNS-SOL-1019), 15 km SW Sisakht, Rahmali village (30°47'22"N, 51°23'28"E), 1699 m a.s.l., 11.07.2017, leg. A. Hosseinpour.

Remarks: This species was only known from the male holotype from Isfahan Province, Iran (Roewer, 1934). Freshly collected materials are considered as new provincial record.

Paragaleodes nesterovi Birula, 1916

Birula, 1916: 73, unnumbered fig. (♂)

Roewer, 1932: 131, fig. 118 (♂)

Bird *et al.*, 2015: 255, pl. 59, fig A-B (♂)

Material examined: *Iraq: Sulaymaniyah Province:* syntype: 1♂ (ZISP-606), Pendshvin (today is known as city Penjwen in 95 km E Sulaymaniyah) (35°39'56"N, 45°55'29"E), 1246 m a.s.l., 18.06.1914, leg. P. Nesterov; 1♂ (ZISP-607), Shenie (a border city in 160 km N Sulaymaniyah) (36°17'00"N, 45°16'28"E), 1202 m a.s.l., 14.07.1914, leg. P. Nesterov. *Iran: Kohgiluyeh and Boyer Ahmad Province:* 1♀ (EMSUNS-SOL-1013), 15 km SW Sisakht, Rahmali village (30°47'22"N, 51°23'28"E), 1699 m a.s.l., 22.06.2017, leg. A. Hosseinpour; 2♂ (EMSUNS-SOL-1012 & 1014), same data in 22 & 27.06.2017, respectively.

Remarks: The species was hitherto known from Azerbaijan, Iraq and Turkey (Birula, 1916; Roewer, 1934; Bird *et al.*, 2015). The Iranian records (Kohgiluyeh and Boyer Ahmad Province) lies in the easternmost and southernmost limits of the species known range. Fresh materials were collected in the mountainous regions covered with oak forests. This is the first female record for the species and new to the fauna of Iran.

Family Gylippidae Roewer, 1933

Gylippus (Paragylippus) spinimanus Birula, 1905

Birula, 1913: 402, pl. 8, fig. 10 (♂); 403, pl. 9, fig. 1-5 (♂)

Roewer, 1933: 312, fig. 229a1-a2 (♂); 314, fig. 230a (♀)

Material examined: *Iran: Khuzestan Province:* 1♂ (holotype) 1♀ (ZISP-753), Arabistan, Tscheschme-Rogan (well or spring) (unidentified site from the vicinity of Rud-e Zard, a village in the central district of Haftkel County), 31.12.1903 & 01.01.1904, leg. N. Zarudny; 2♂ (paratype) 3juv♀ (ZISP-754), Arabistan, between Kale-Tol (currently known as city Qaleh Tall in 12 km N Bagh-e Malek) and Alchorschir, 29-30.12.1903, leg. N. Zarudny; 1♀ (ZISP-755), Arabistan, near Nasrie, mostly in the Dshibel-Tyne hills, 13.01.1904, leg. N. Zarudny; 1♀ 1juv (ZISP-757), Arabistan, Disful (currently known as Dezful), (32°23'00"N, 48°25'25"E), 150 m a.s.l., 09-17.03.1904, leg. N. Zarudny. *Kohgiluyeh and Boyer Ahmad Province:* 1♀ (EMSUNS-SOL-1011), 36 km NW Basht, Shadegan village (30°33'45"N, 50°55'04"E), 1317 m a.s.l., 26.04.2017, leg. A. Hosseinpour; 2♀

(EMSUNS-SOL-1015 & 1016), 62 km E Choram, Emamzadeh Ali village (30°48'37"N, 51°01'04"E), 2265 m a.s.l., 20.05.2017, leg. A. Hosseinpour; 1juv (EMSUNS-SOL-1018), 33 km NE Likak, Sarasiyab village (31°02'12"N, 50°13'24"E), 1050 m a.s.l., 14.04.2017, leg. A. Hosseinpour.

Remarks: This species has been previously known from north and east of Khuzestan Province, southwest Iran (Birula, 1905, 1907, 1913; Roewer, 1933). Freshly sampled materials were collected from agricultural fields and mountainous region of Kohgilouyeh and Boyer Ahmad Province at both low and high altitudes. This is new camel spider record for the Kohgilouyeh and Boyer Ahmad Province.

Family Karschiidae Kraepelin, 1899

Karschia (Karschia) persica Kraepelin, 1899

Kraepelin, 1901: 147, figs. 113-114 (♂♀)

Roewer, 1932: 145, fig. 143d (♂)

Roewer, 1933: 298, figs. 222d & 223l (♂♀)

Material examined: **Iran:** *Hormozgan Province:* Syntypes: 1♂ 1♀ (SMF-RII/3456/298-71), Fars, Shiraz (as Schiras), Karak (currently known as Bandar-e Charak, a port city of the Persian Gulf in south of Hormozgan province) (26°43'50"N, 54°16'29"E), 40 m a.s.l. *Kohgiluyeh and Boyer Ahmad Province:* 1♂ (EMSUNS-SOL-1017), 29 km NW Choram, Sarfariyab village (30°48'40"N, 50°51'07"E), 1280 m a.s.l., 16.05.2017, leg. A. Hosseinpour.

Remarks: This species was only reported from Hormozgan Province (Karak) in the south of Iran (Kraepelin, 1899, 1901; Birula, 1905; Roewer, 1933). The record from northeast Iran (Khazanehdari *et al.*, 2016) is probably erroneous. This is new provincial record.

Family Rhagodidae Pocock, 1897

Rhagodes caucasicus Birula, 1905

Birula, 1938: 28-29, figs. 11-13 (♀)

Koç *et al.*, 2015: 263-267, figs. 2-6 (♀)

Material examined: **Armenia:** *Yerevan Province:* 1♀ (ZISP-834), Irevan, Prope Nork (currently known as Nor Nork district at the eastern part of the city Yerevan) (40°11'54"N, 44°33'55"E), 1327 m a.s.l., 06.07.1924, leg. Shelkovnikov; 1♂ (ZISP-835), Irevan, Konakir (currently known as Kanaker, a part of the Kanaker-Zeytun district at northeast city Yerevan) (40°13'12"N, 44°32'18"E), 1290 m a.s.l., 06.07.1926, leg. T. Antonyan. **Azerbaijan:** *Ganja-Qazakh region:* 1♀ (ZISP-828), Giandzha (currently known as Ganja) (40°40'58"N, 46°21'38"E), 408 m a.s.l., 1892, leg. Shelkovnikov. **Iran:** *East Azerbaijan Province:* 1♀ (SMF-RII/2958/47-71) (as *Rhagodella melanopyga nigricans*), Dschulfa (currently known as Jolfa, a border city in N East Azerbaijan Province) (38°56'25"N, 45°37'51"E), 713 m a.s.l. *Kohgilouyeh and Boyer Ahmad Province:* 1♂ (ZMFUM-SOL-1165), 95 km NE Choram, 10 km S Ludab, Gardekan village (30°54'50"N, 50°53'58"E), 1487 m a.s.l., 01.07.2017, leg. M. Dezhman; 1♀ (ZMFUM-SOL-1171), same data in 04.08.2017, leg. A. Barmoudeh; 1♀ (ZISP-830), Persia (no detailed locality). **Turkey:** *Iğdır Province:* 1♀ (ZISP-827), Tuzluca (formerly known as Kul'p in Armenia) (40°02'20.92"N, 43°39'46.86"E), 1105 m a.s.l., 07.1896; 1♀ (ZISP-829), Northern slope of Mount Ararat (Original label: Irevan, slope of Mount Ararat), 02.07.1909, leg. Briansky.

Remarks: The species was hitherto known from Armenia, west Azerbaijan, northwest Iran and east Turkey (Birula, 1938, Koç *et al.*, 2015, Maddahi *et al.*, 2019). The records from Kohgilouyeh and Boyer Ahmad Province represent the highest altitude (1487 m a.s.l.) in the whole species range and extend its distribution range about 900 kilometers to the south. Freshly collected materials include the first adult male record for Iran.

DISCUSSION

In the present study, the genus *Gluviopsilla* and the species *G. discolor* and *Paragaleodes nesterovi* were recorded from Iran for the first time. Therefore, the number of the camel spider species known from the country is raised to 66 species of 20 genera. Of the studied species, four species namely *Galeodes cf. krausi*, *Galeodes trichotichnus*, *Gylippus spinimanus* and *Karschia persica*, are endemic to Iran, while *Gluviopsilla discolor*, *Paragaleodes nesterovi* and *Rhagodes caucasicus* represent the easternmost or southernmost limits of the species range.

Few studies have been performed on the camel spider fauna of the western half of Iran. Previously, 24 species have been recorded from the northwest, west and southwest of the country (Pocock, 1899; Birula, 1905; Roewer, 1933, 1934, 1952; Kraus, 1959; Harvey, 2003; Koç *et al.*, 2015; Khazanehdari *et al.*, 2016). Compared to nine camel spider species previously recorded from the whole Zagros Mountains range (Birula, 1905; Roewer, 1933, 1952; Harvey, 2003); reporting seven species belonging to six genera and five families for the relatively small province of Kohgiluyeh and Boyer Ahmad located in this region would be largely related to more sampling efforts in this province. The Zagros Mountains have been considered not only as of the easternmost or westernmost limits of some animal taxa but also as a region with a high level of endemism, demonstrating its role in forming the present distribution of animal taxa (Macey *et al.*, 1998; Rastegar-Pouyani, 2006). The current study is a preliminary attempt to enhance our knowledge of the camel spiders in western Iran. According to our results, extensive field-works and comprehensive systematic studies would be fulfilled to achieve the true species diversity of camel spiders in this region.

ACKNOWLEDGMENTS

First corresponding author is grateful to Dr. Victor Krivokhatsky (Saint Petersburg, Russia) and Dr. Peter Jäger (Frankfurt, Germany) for facilitating the access to study ZISP and SMF specimens, respectively. M. Dezhman and his family are greatly acknowledged for their help during collecting trips to southwest of Iran. This study was supported in part by the Office of Research Affairs, Ferdowsi University of Mashhad, Iran.

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