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A SURVEY OF CAVE-DWELLING SPIDER FAUNA OF KOHGILUYEH & BOYER-AHMAD AND FARS PROVINCES, IRAN (ARACHNIDA: ARANEAE)

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Abstract: A partial account of the results of a study on the cave-dwelling spider fauna of Kohgiluyeh & Boyer-Ahmad and Fars provinces, in southwestern and southern Iran, is presented. Ten caves were investigated, about 75 spider specimens were collected and 11 species were identified, of which *Metellina orientalis* (Spassky, 1932) (Tetragnathidae) is recorded for the fauna of Iran for the first time. Maps of localities are provided and the male of the newly recorded species is illustrated.
Key words: Araneae, Tetragnathidae, *Metellina orientalis*, troglofauna, Iran, Kohgiluyeh & Boyer-Ahmad, Fars.

La fauna de arañas troglobias de las provincias de Kohgiluyeh-va-Boyer-Ahmad y Fars, Irán (Arachnida: Araneae)
Resumen: Se presenta parte de los resultados de un estudio sobre la fauna troglobia de arañas de las provincias de Kohgiluyeh-va-Boyer-Ahmad y Fars, en el suroeste y sur de Irán. Se prospectaron diez cuevas, recogiéndose unos 75 especímenes de arañas e identificándose 11 especies, de las que *Metellina orientalis* (Spassky, 1932) (Tetragnathidae) se cita de Irán por primera vez. Se incluyen mapas de localidades y se ilustra el macho de *Metellina orientalis*.
Palabras clave: Araneae, Tetragnathidae, *Metellina orientalis*, troglofauna, Irán, Kohgiluyeh-va-Boyer-Ahmad, Fars.

Introduction

The biospeleology of Iranian caves is a relatively poorly-studied field. In regards of provinces Kohgiluyeh & Boyer-Ahmad and Fars, although the study of subterranean arthropod fauna has started only recently, new interesting data has already been published: from Fars, Sadeghi *et al*. (2014) published the first Iranian record of family Salpingidae (Coleoptera) by studying materials of *Aglenus brunneus* (Gyllenhall, 1813) from Tadovan Cave, and Dashan *et al*. (2014) provided the first Iranian record of *Niptus hololeucus* (Faldermann, 1835) (Coleoptera: Ptinidae) from Kangohar Cave, and from Gakal Cave in Kohgiluyeh & Boyer-Ahmad, the first troglobitic species of Isopoda, *Protracheoniscus gakalicus* Kashani, Malek Hosseini & Sadeghi, 2013 (Oniscidea: Agnaridae) was described by Kashani *et al*. (2013) and a new troglobitic oonopid spider was recently described by Malek Hosseini *et al*. (2015). The araneofauna of Iranian caves remains also poorly-studied. Apart from some previous scattered records (e.g. *Tegenaria lenkoranica* (Guseinov, Marusik & Koponen, 2005) from Roodafshan Cave (Zamani *et al*., 2014); *Spariolenus iranomaximus* Moradmand & Jäger, 2011 from Khofash Cave (Moradmand & Jäger, 2011)), the first comprehensive study about spider fauna of an Iranian cave was published only recently by Marusik *et al*. (2014), where they reported seven species from Shirabad Cave, Golestan Province, northern Iran. Still, none of the recorded species were true cavernicoles: all presented normal-sized eyes and no signs of depigmentation. In a recent study by Malek Hosseini *et al*. (2015), the first troglobite Iranian spider, *Trilacuna qarzi* Malek Hosseini & Grismado, 2015 (Oonopidae) was described from Gakal Cave in Kohgiluyeh & Boyer-Ahmad. Reviewing the literature, there are about 20 species of 10 families of spiders known to inhabit Iranian caves (Zamani & Malek Hosseini, unpubl.). In this study, we aimed to increase the amount of information available regarding the cave-dwelling spider fauna of this country by providing a detailed list of spider species that were found in some selected caves of the two provinces.

Material and methods

Materials were collected in 10 different caves in provinces Kohgiluyeh & Boyer-Ahmad and Fars in southwestern and southern Iran, which are addressed below (available measurements are based on the visiting days) (Fig. 1-2):

A. Kohgiluyeh & Boyer-Ahmad

1. Deh Sheikh (Pataveh) Cave: located in mountains near Deh Sheikh Village, 52 km northwest of Yasuj (30°57'22"N, 51°14′17″E, alt. 1735 m). Temperature: 15.5–16.5 °C. Relative humidity: 72-84%. CO_2 level: 439-550 ppm. Visited on September 27, 2011 and December 17, 2013.
2. Gakal Cave: situated in a mountainous region in north of Sartipabad Village, 40 km east of Gachsaran (30°18'44"N, 51°09'28"E, alt. 1100 m). Temperature: 23°C. Relative humidity: 90-99%. Water pH: 7.15. Visited on May 18, 2012, October 2, 2012 and June 24, 2013.
3. Kiler Cave: situated in Kiler valley near Roodrish Village, 140 km northwest of Yasuj (31°17'96"N, 50°35'13"E, alt. 1610 m). This cave is more than 1200 m long, with streaming water, springs and ponds. Air temperature: 12.7°C. Water temperature: 12°C with pH: 7.2-7.7. Relative humidity: 85–95%. Visited on October 27, 2011.
4. Nevel Cave: located 10 km northwest of Sisakht in Nevel valley situated in Dena Protected Area (30°49'197"N, 51°34'855"E, alt. 2900 m). Water streams through the cave. Air temperature: 8-10°C. Water temperature: 8°C. Relative humidity: 84-90%. CO_2 level: 724-744 ppm. Visited on September 28, 2011 and April 20, 2014.



Fig. 1. Location of provinces Kohgiluyeh & Boyer-Ahmad (**K**) and Fars (**F**) in Iran. **Fig. 2.** Location of the studied caves in Kohgiluyeh & Boyer-Ahmad (**A**) and Fars (**B**). 1: Deh Sheikh (Pataveh) 2: Gakal 3: Kiler 4: Nevel 5: Neyneh 6: Behesht Makan 7: Chak 8: Dalkhoon 9: Palangan 10: Tikow (Tang-e Tikab). (A) Y: Yasuj G: Gachsaran D: Dehdasht (B): Sh: Shiraz Fa: Farashband Fi: Firozabad M: Marvdasht K: Kazeroon S: Sepidan.

5. Neyneh Cave: located 45 km southwest of Dehdasht, in the mountainous Khaeiz Protected Area (30°40'18"N, 50°21'71"E, alt. 770 m). Temperature: 25°C. Relative humidity: 95–99.9%. CO_2 level: 613–700 ppm. Visited on May 17, 2012.

B. Fars

6. Behesht Makan Cave: located near Behesht Makan Village, 25 km north of Sepidan (30°24'N, 52°04'E, alt. 2196 m). Visited on April 13, 2014.

7. Chak Cave: located near Aviz Village in the way of Farashband to Kazeroon (28°56'35"N, 52°02'20"E). Visited on April 11, 2014.

8. Dalkhoon Cave: located near Dalkhoon Village, 20 km north of Sepidan (30°14'15"N, 52°05'39"E, alt. 2300 m). Visited on April 13, 2014.

9. Palangan Cave: situated in mountains near Sineye Bar-Aftab and Miyan-Ghalea villages, near Naqsh-e Rustam necropolis, north of Marvdasht and 18 km northwest of Persepolis (30°03'04"N, 52°44'18"E, alt. 1950 m). Temperature: 17°C. CO_2 level: 568 ppm. Visited on April 18, 2014 and December 18, 2014.

10. Tikow (Tang-e Tikab) Cave: situated near Taleghani Park, north of Kezeroon (29°38'02"N, 51°40'33"E, alt. 865 m). Visited on April 11, 2014.

Specimens were either collected by hand or by means of aspirators, small paint brushes, forceps, spades and small nets, and some were separated from bat guano and soil using a Berlese funnel at the laboratory. Specimens were directly preserved in 96% ethanol, and digital images were captured using a Canon EOS-1Ds Mark III camera, attached to a Nikon SMZ-1000 stereomicroscope. Voucher material will be deposited in Zoological Museum of University of Tehran (ZUTC) and Collection of Biology Department, Zoological Museum of Shiraz University (ZM CBSU). Only selected references containing images of the species are provided, for a complete list of taxonomic references of each species see World Spider Catalog (2015). Data regarding the previous Iranian records are according to Zamani *et al*. (2015).

Results

Family Eutichuridae Lehtinen, 1967

***Cheiracanthium mildei* L. Koch, 1864**

Cheiracanthium mildei: Heimer & Nentwig, 1991: 396, f. 1032 (♂♀); Paquin & Dupérré, 2003: 53, f. 370-373 (♂♀); Van Keer *et al*., 2007: 62, f. 1-3 (♂♀).

MATERIAL EXAMINED: 1♂ September 28, 2011 [4].

RECORDS IN IRAN: Previously recorded from Golestan, Ker-

man and Tehran, recorded here for the fauna of Kohgiluyeh & Boyer-Ahmad for the first time.
DISTRIBUTION: Although this species has a Mediterranean origin, it has been well-distributed in the West Palaearctic, especially covering a wide range from Southern to Central Europe. It has also been introduced in North and South America (Bayer, 2014).

Family Gnaphosidae Pocock, 1898

***Anagraphis pallens* Simon, 1893**
Anagraphis pallens: Chatzaki *et al*., 2002: 567, f. 2-7 (♂♀); Topçu *et al*., 2005: 85, f. 1-2 (♂♀); Murphy, 2007: 41, f. 230-231 (♂♀); Wunderlich, 2011: 37, f. 32-34 (♂♀).
MATERIAL EXAMINED: 4♀ May 18, 2012 [2]; 1♀ May 17, 2012 [5].
RECORDS IN IRAN: The first Iranian record of this species has been recently provided by Zamani *et al*. (2014) from Razavi Khorasan. Recorded here for the fauna of Kohgiluyeh & Boyer-Ahmad for the first time.
DISTRIBUTION: This species has been recorded from South Africa, Libya, Malta, Syria, Israel, Turkey, Crete, and reaching its easternmost record in NE Iran (Topçu *et al*., 2005; Zamani *et al*., 2014).

Family Liocranidae Simon, 1897

***Mesiotelus* cf. *scopensis* Drensky, 1935**
Mesiotelus cyprius scopensis: Lazarov, 2009: 34, f. 6-10 (♂♀).
MATERIAL EXAMINED: 2♀ September 28, 2011 [4].
RECORDS IN IRAN: The first Iranian record of this species has been recently provided by Zamani *et al*. (2014) from Tehran. Recorded here for Kohgiluyeh & Boyer-Ahmad for the first time.
DISTRIBUTION: This species is widely-distributed from Mediterranean to Turkmenistan, and has been recorded from Greece, Bulgaria, Macedonia, Turkey and Iran (Elverici *et al*., 2013; Zamani *et al*., 2014).
COMMENT: Until further samplings of males and more females, this record should be considered as provisional, as there are some differences in epigynal structures of our single specimen with available illustrations.

Family Linyphiidae Blackwall, 1859

***Sengletus latus* Tanasevitch, 2009**
Sengletus latus Tanasevitch, 2009: 409, f. 71-75 (♀).
MATERIAL EXAMINED: 1♀ September 27, 2011; 1♀ December 17, 2013 [1]; 3♀ April 20, 2014 [4]; 1♀ April 11, 2014 [10]; 2♀ 1j April 11, 2014 [7].
RECORDS IN IRAN: Previously known from West Azarbayjan only. Recorded from Kohgiluyeh & Boyer-Ahmad and Fars for the first time. Our record from Chak Cave is southernmost in the whole range.
DISTRIBUTION: Currently known from Iran only (Tanasevitch, 2009).

Family Oonopidae Simon, 1890

***Trilacuna qarzi* Malek Hosseini & Grismado, 2015**
Trilacuna qarzi Malek Hosseini & Grismado, in Malek Hosseini *et al*., 2015: 552, f. 2A-F, 3A-F, 4A-H, 5A-F, 6A-H, 7A-H, 8A-B (♂♀).
MATERIAL EXAMINED: 3♂ 3♀ June 24, 2013 [2] (ZM CBSU).
RECORDS IN IRAN: Known only from Gakal Cave in Kohgiluyeh & Boyer-Ahmad.
DISTRIBUTION: Endemic to Iran.

Family Oxyopidae Thorell, 1870

***Oxyopes lineatus* Latreille, 1806**
Oxyopes lineatus: Levy, 1999: 35, f. 4A-C, 5A-C (♂♀).
MATERIAL EXAMINED: 1♀ April 20, 2014 [4].
RECORDS IN IRAN: Previously recorded from East/West Azarbayjan, Golestan, Razavi Khorasan and Tehran. Recorded here for the fauna of Kohgiluyeh & Boyer-Ahmad for the first time.
DISTRIBUTION: This species is widely-distributed in Western Palaearctic, covering a wide range of distribution from Southern Europe to Russia (Levy, 1999; World Spider Catalog, 2015).

Family Pholcidae C. L. Koch, 1850

***Artema doriai* (Thorell, 1881)**
Artema doriai: Tabrizi, Rad & Hedayati, 2014: 35, f. 1M-N, 3L-M (♀).
MATERIAL EXAMINED: 1♀ 2j December 18, 2014 [9]; 1♀ April 13, 2014 [6].
PREVIOUS RECORDS: Previous records of this species are from Kerman, Mazandaran and Tehran, recorded here for the fauna of Fars for the first time.
DISTRIBUTION: Currently known from Iran only.

***Pholcus* spp.**
COMMENTS: More than 35 specimens were collected from localities [1], [3], [6], [7] and [9], most of which belongs to the *armeniacus*-species group. These materials will be treated in a separate paper.

Family Scytodidae Blackwall, 1864

***Scytodes* cf. *thoracica* (Latreille, 1802)**
MATERIAL EXAMINED: 2 j April 11, 2014 [10].
PREVIOUS RECORDS: Previously recorded from Golestan, Mazandaran/Gilan, Razavi Khorasan and Zanjan. Recorded here for the fauna of Fars for the first time.
DISTRIBUTION: Holarctic (World Spider Catalog, 2015).
COMMENT: This record must be considered as provisional, as it is only based on the cephalothoracic patterns and general habitus features of two juvenile specimens.

Family Sparassidae Bertkau, 1872

***Spariolenus zagros* Moradmand & Jäger, 2011**
Spariolenus zagros Moradmand & Jäger, 2011: 55, f. 27-38 (♂♀).
MATERIAL EXAMINED: 1♂ April 13, 2014 [8].
PREVIOUS RECORDS: Previously known only from Kenesht Cave in Kermanshah, recorded here for the fauna of Fars for the first time. This record is the southernmost in the whole known range.
DISTRIBUTION: Endemic to Iran (Moradmand & Jäger, 2011).

Family Tetragnathidae Menge, 1866

***Metellina orientalis* (Spassky, 1932)** Fig. 3.
Meta orientalis Spassky, 1932: 184, f. 5-8 (♂♀); *Metellina orientalis*: Marusik, 1986: 19, f. 1.1-3 (♂♀).
MATERIAL EXAMINED: 1♂ 1♀ September 28, 2011 [4]; 1♀ 1 subadult ♀ June 24, 2013 [2]; 1♀ April 11, 2014 [10]; 2♀ April 11, 2014 [7].
DISTRIBUTION: Distributed in Central Asia and the Middle East, and previously recorded from Armenia, Turkmenistan and Kazakhstan (Spassky, 1932; Marusik, 1986).

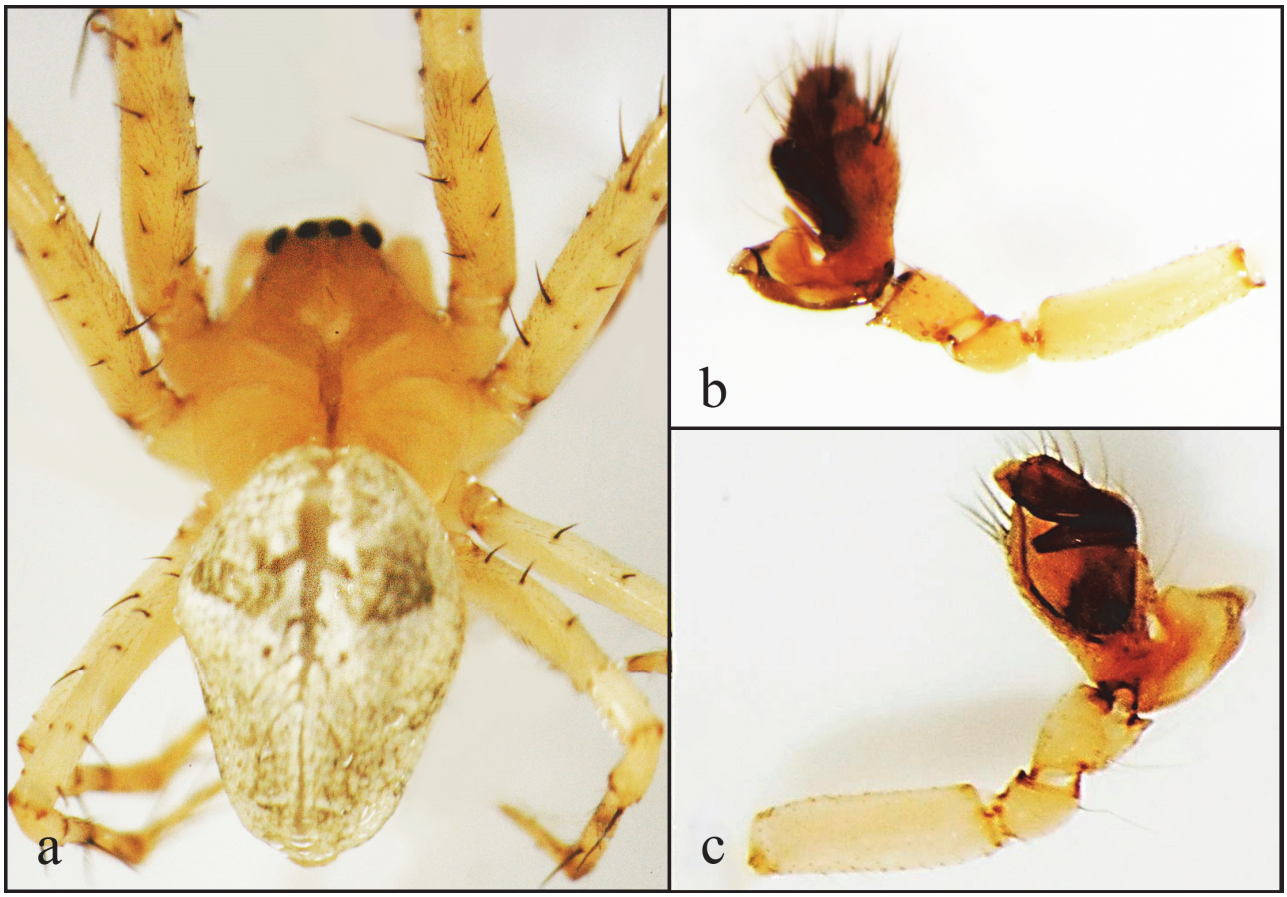


Fig. 3. *Metellina orientalis*, male. **a**: habitus, dorsal view. **b**: pedipalp, showing the dorsal view of cymbium. **c**: ditto, ventral view.

REMARK: This species is recorded from Iran for the first time (from both studied provinces). Our record from Chak Cave in Fars is the southernmost in the whole known range.

Family Theridiosomatidae Simon, 1881

***Theridiosoma gemmosum* (L. Koch, 1877)**

Theridiosoma gemmosum: Crespo, 2008: 405, f. 5A-B (♂♀).

MATERIAL EXAMINED: 2♀ April 20, 2014 [4].

PREVIOUS RECORDS: Recorded from Iran by Marusik *et al*. (2014), from Shirabad Cave in Golestan. New record for the fauna of Kohgiluyeh & Boyer-Ahmad.

DISTRIBUTION: Widely-distributed in the West Palaearctic (World Spider Catalog, 2015).

Conclusions

Based on their life style and adaptations, troglofauna are divided into three categories: troglobites, troglophiles and trogloxens (Romero, 2009). Troglobites are organisms that display troglomorphic characteristics (morphological, physiological and behavioral) such as loss of eyes and depigmentation. Troglophiles are organisms that can complete their life cycle in caves but are also able to do so outside of them as well. Trogloxens (called "accidentals" by some authors) are organisms that habitually enter caves but must return periodically to the outside for certain of its living requirements, usually food. (e.g. bats and cave birds) (Romero, 2009; Culver & Pipan, 2009). In spite of the high abundance of Iranian caves (mostly in the Zagros region), only a small portion of the subterranean ecosystems of this country has been investigated, especially in regards of arthropods, as there are only about 68 cave-dwelling arthropod species known from Iran (Zamani & Malek Hosseini, unpubl.). As a result of this study, one species was recorded as new to the fauna of Iran, seven species were recorded as new to the fauna of Kohgiluyeh & Boyer-Ahmad, five species were recorded as new to the fauna of Fars, and for three species our records represent the southernmost locality of their known range. Nine caves in this study are considered as "natural" as they have been formed in limestone rocks, but the small Behesht Makan Cave is formed in cracks of rocks as a result of earthquakes or landslides. Despite the ecological importance of some of the studied caves and their location near some well-known historical sites (e.g. Naqsh-e Rustam necropolis), they have been partially destroyed mostly due to human activities, which may cause irreversible damages to the vulnerable inhibiting fauna if necessary conservative actions are not carried out by responsible organizations in near future.

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