TÜBİTAK

Turkish Journal of Zoology

http://journals.tubitak.gov.tr/zoology/

Short Communication

Turk J Zool
(2016) 40: 608-614
© TÜBİTAK
doi:10.3906/zoo-1507-34

Contribution to the solpugid (Arachnida: Solifugae) fauna of Iran

Mahsa KHAZANEHDARI[1], Omid MIRSHAMSI[1,2,*], Mansour ALIABADIAN[1,2]
[1]Department of Biology, Faculty of Science, Ferdowsi University of Mashhad, Mashhad, Iran
[2]Institute of Applied Zoology, Faculty of Science, Ferdowsi University of Mashhad, Mashhad, Iran

Received: 26.07.2015 • **Accepted/Published Online:** 05.01.2016 • **Final Version:** 09.06.2016

Abstract: This study reports records of camel spiders from the NE and NW of Iran: *Galeodes bacillatus* (♂♀), *Galeodes caspius* (♂♀), *Gylippus* (*Hemigylippus*) *lamelliger* (♀), *Rhagodes melanochaetus* (♀), *Rhagodes aureus* (♂), *Karschia persica* (♀), and *Karschia mastigofera* (♂). Of these, *K. mastigofera* is recorded for the first time from Iran.

Key words: Solpugids, Iranian Plateau, fauna, new record

Arachnologists have studied solpugids for decades; however, their biology is still elusive. This is largely due to difficulties in observing individuals in the wild, lack of success raising solpugids in captivity, and a generally low yield of specimens from field collection efforts (Punzo, 1998). Research on solpugids has been ignored by Iranian zoologists; the fauna of solpugids in Iran is mostly unknown and according to the literature it includes 74 species belonging to five families: Daesiidae, Galeodidae, Gylippidae, Karschiidae, and Rhagodidae (Harvey, 2003). The records of these arachnids are those reported by Pocock (1895, 1899), Kraepelin (1901), Birula (1905, 1907, 1908, 1918, 1935, 1937, 1938), Hirst (1908), Roewer (1933, 1934, 1941, 1952, 1959), Kraus (1959), Gromov (2000), Maddahi et al. (2015), and Harvey (2002, 2003).

The known distribution of solpugid species in Iran is still fragmentary, with large areas without records. This study was performed to improve our understanding of the diversity of camel spiders in NE and NW Iran.

Specimens were collected from the NE and NW of Iran from May to September 2013 by hand-collecting method at nighttime and by rock-rolling in daytime. All specimens were housed in the solpugid collection at the Zoological Museum, Ferdowsi University of Mashhad, Iran (ZMFUM). All examined material was preserved in 75%–96% alcohol. Digital images were taken with a SONY DSC-H70 digital camera. Specimens were identified following the identification keys of Birula (1905, 1938) and Roewer (1933, 1934). The specimens were also compared with the original descriptions of species. Terminology used in this paper follows that of Roewer (1932, 1933).

A distribution map was provided using DIVA-GIS Version 7.4, by superimposing point locality records on the GTOPO30 global digital elevation model (https://lta.cr.usgs.gov/, GTOPO30) (Figure 1).

Abbreviations. ZMFUM: Zoological Museum, Ferdowsi University of Mashhad, Mashhad, Iran. SMF: Forschungsinstitut und Naturmuseum Senkenberg, Frankfurt am Main, Germany.

Here we present data on faunistic records for seven camel spider species from various localities of NE and NW Iran (Figure 1), one of the least studied territories of the country (see below). Images are provided in Figures 2A–2F, 3A–3C, 4A–4C, and 5A–5E.

Family Galeodidae Sundevall, 1833

Genus *Galeodes* Olivier, 1791

***Galeodes bacillatus* Birula, 1905**

(Figures 2A and 2B)

Material: 1♀ (ZMFUM-SOL-1001), Khorasan-e Razavi Prov., Mashhad, Ferdowsi University of Mashhad campus (36°18′21.74″N, 59°31′53.63″E), 1034 m a.s.l., vi.2012, O. Mirshamsi; 1 ♀ (ZMFUM-SOL-1007), Khorasan-e Razavi Prov., Mashhad (36°17′60.00″N, 59°36′0.00″E), 982 m a.s.l., 01.ix.2012, O. Mirshamsi; 1♀ (ZMFUM-SOL-1013), Khorasan-e Razavi Prov., Chenaran, Kahoo (36°26′31.89″N, 59°12′19.40″E), 1419 m a.s.l., 23.vii.2012, O. Mirshamsi; 1♀ (ZMFUM-SOL-1020), Khorasan-e Razavi Prov., Chenaran, Kahoo (36°26′31.89″N, 59°12′19.40″E), 1419 m a.s.l., 10.v.2002, O. Mirshamsi; 1♀ (ZMFUM-SOL-1022), Khorasan-e Razavi Prov., Mashhad (36°17′35.97″N, 59°31′49.42″E), 1082 m a.s.l., 27.v.2013, M. Khazanedari; 1♀ (ZMFUM-SOL-1028), Khorasan-e

* Correspondence: mirshams@um.ac.ir

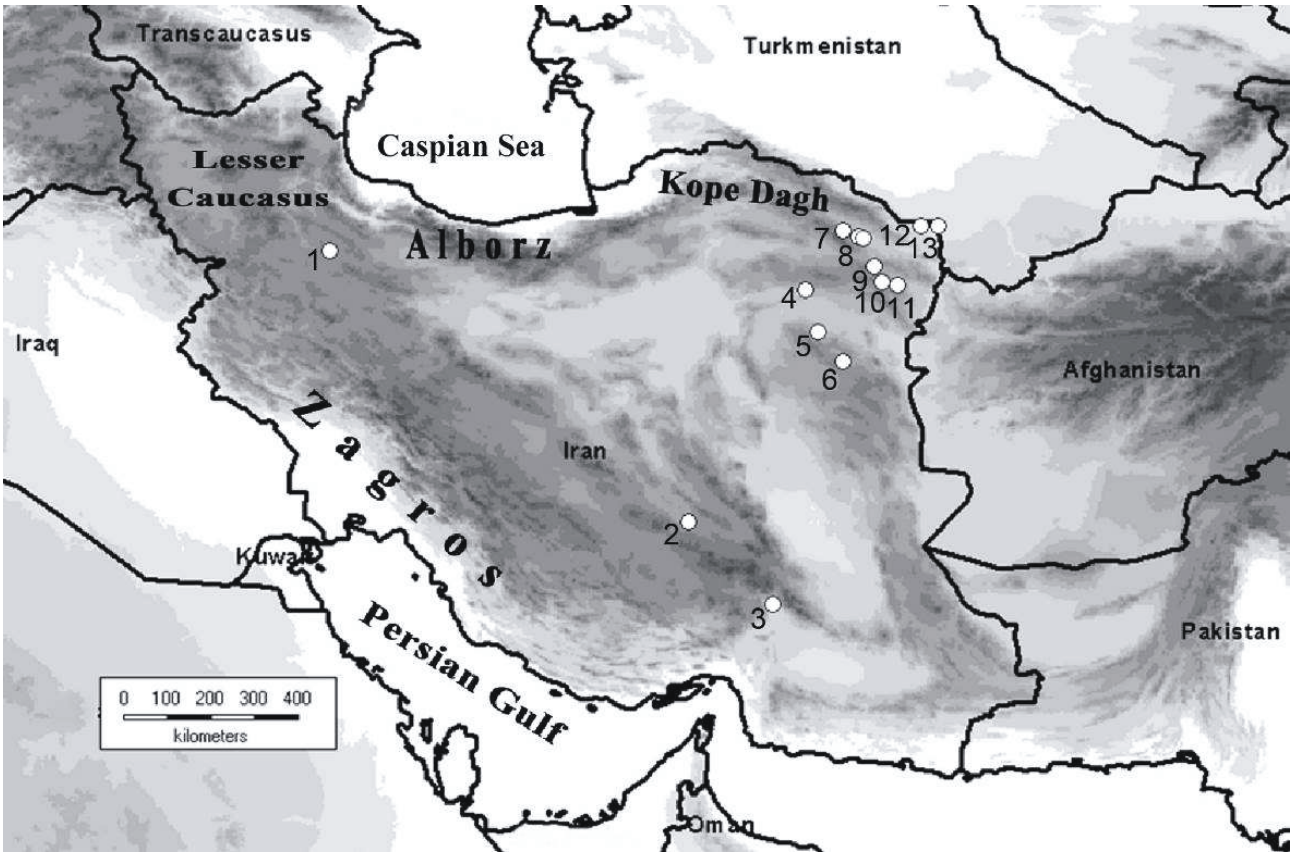

Figure 1. Map of Iran plotting the sampling localities of studied specimens: 1) *K. mastigofera*; 2) *G. bacillatus*; 3) *R. melanochaetus*, *G. bacillatus*; 4) *G. bacillatus*; 5) *G. bacillatus*; 6) *G. bacillatus*, *G. caspius*, *R. aureus*; 7) *G. bacillatus*, *G. caspius*; 8) *G. bacillatus*, *G. caspius*, *Gylippus lamelliger*, *R. melanochaetus*; 9) *G. bacillatus*; 10) *G. bacillatus*; 11) *G. bacillatus*, *K. persica*, *R. melanochaetus*; 12) *G. bacillatus*; 13) *G. bacillatus*, *G. caspius*.

Razavi Prov., Fariman, Samarghave (35°18′22.34″N, 60°19′28.57″E), 1325 m a.s.l., v.2013, M. Khazanedari; 2♀ (ZMFUM-SOL-1051,1052), Khorasan-e Razavi Prov., Sarakhs (36°36′50″N, 60°52′11″E), 470 m a.s.l., 26.vii.2013, M. Khazanedari; 1♂ (ZMFUM-SOL-1008), Khorasan-e Razavi Prov., Mashhad, Ferdowsi University of Mashhad campus (36°18′21.74″N, 59°31′53.63″E), 1034 m a.s.l., 04.vii.2011, Hosseinie; 1♂ (ZMFUM-SOL-1010), Khorasan-e Razavi Prov., Fariman (35°42′25.00″N, 59°51′0.00″E), 1396 m a.s.l., 13.vi.2009, O. Mirshamsi; 2♂ (ZMFUM-SOL-1026,1027), Khorasan-e Razavi Prov., Fariman, Samarghave (35°18′22.34″N, 60°19′28.57″E), 1325 m a.s.l., v.2013, M. Khazanedari; 6♂, 1 juvenile (ZMFUM-SOL-1031,1032,1034-1037,1006), Khorasan-e Razavi Prov., Sarakhs, Bazangan Lake (36°31′60″N, 60°48′22″E), 854 m a.s.l., 27.vi.2013, M. Khazanedari; 1♂ (ZMFUM-SOL-1041), Khorasan-e Razavi Prov., Mashhad (36°18′21.74″N, 59°31′53.63″E), 1034 m a.s.l., ix.2012, M. Monfared; 1♂ (ZMFUM-SOL-1044), Kerman Prov., Rafsanjan (30°24′24.00″N, 55°59′38.00″E), 1514 m a.s.l., ix.2003, O. Mirshamsi; 1♂ (ZMFUM-SOL-1047), Khorasan-e Razavi Prov., Gonabad (34°21′10.00″N, 58°41′1.00″E), 1095 m a.s.l., ix.2003, O. Mirshamsi; 1♂ (ZMFUM-SOL-1050), Khorasan-e Razavi Prov., Sarakhs (36°36′50″N, 60°52′11″E), 470 m a.s.l., 26.vii.2013, M. Khazanedari; 1♂ (ZMFUM-SOL-1033), Kerman Prov., Jiroft (28°40′41.00″N, 57°44′26.00″E), 685 m a.s.l., v.2013, M. Nazari; 1♂ (ZMFUM-SOL-1017), Khorasan-e Razavi Prov., Mashhad (36°18′21.74″N, 59°31′53.63″E), 1034 m a.s.l., xi.2010, O. Mirshamsi; 1 juvenile (ZMFUM-SOL-1023), Khorasan-e Razavi Prov., Mashhad (36°10′1.52″N, 59°41′53.72″E), 997 m a.s.l., 16.v.2013, H. Banazadeh.

Distribution: Hitherto, this species had been recorded from Khorasan, Kerman, and Sistan and Baluchistan provinces (Birula, 1905). Endemic species for Iran.

Comments: This species appears most closely related to *Galeodes caspius*; however, the males are differentiated significantly from the males of *Galeodes caspius* by a transverse row of needle-like ctenidia on the 6th abdominal sternite, which is distinctly developed (see Birula, 1905: 397–398).

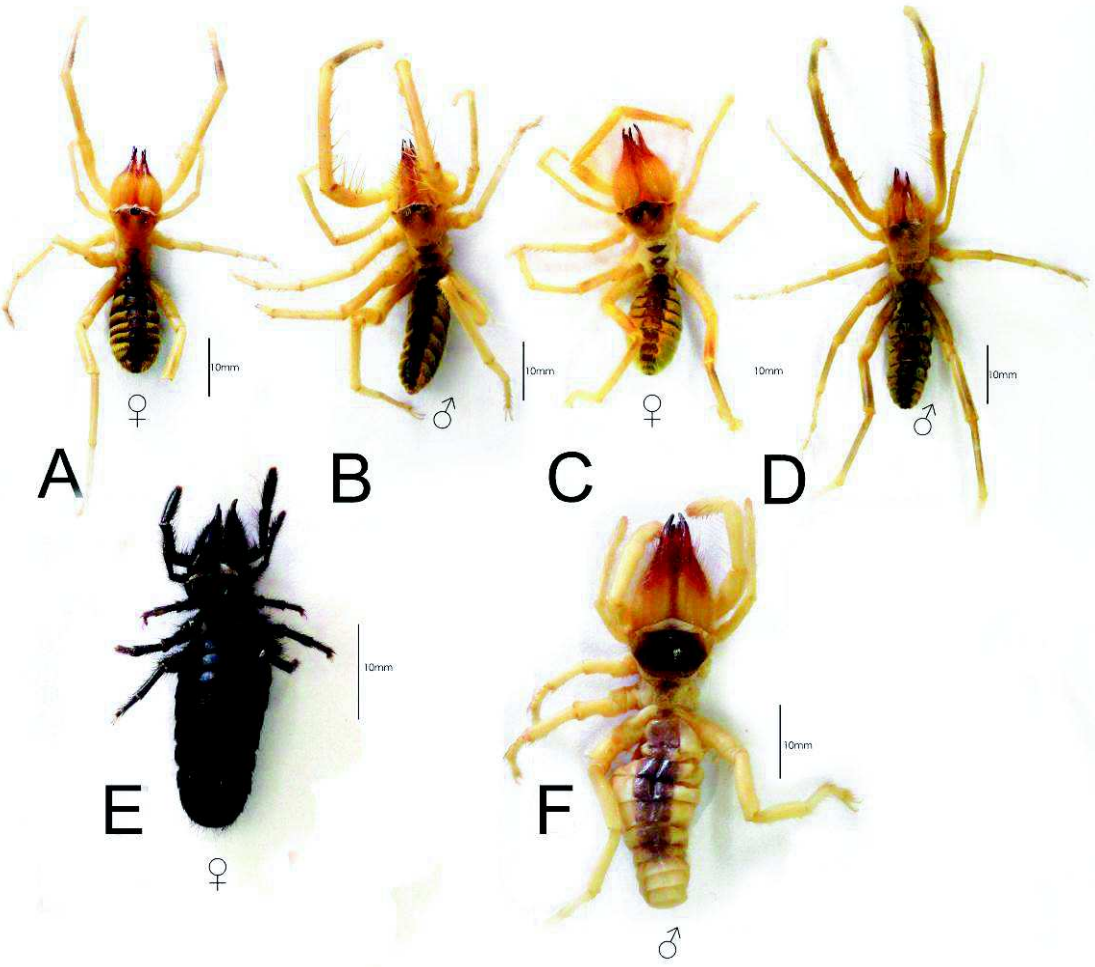

Figure 2. Dorsal habitus of the studied species. A) *Galeodes bacillatus*, female; B) *G. bacillatus*, male; C) *G. caspius*, female; D) *G. caspius*, male; E) *Rhagodes melanochaetus*, female; F) *Rhagodes aureus*, male.

***Galeodes caspius* Birula, 1890**

(Figures 2C and 2D)

Material: 1♂ (ZMFUM-SOL-1004), Khorasan-e Razavi Prov., Sarakhs (36°32′42.00″N, 61°9′28.00″E), 275 m a.s.l., 18.vii.2013, O. Mirshamsi; 1♂ (ZMFUM-SOL-1042), Khorasan-e Jonubi Prov., Qaen (33°43′36.00″N, 59°11′4.00″E), 1146 m a.s.l., 10.iv.2010, F. Abedi; 1♂ (ZMFUM-SOL-1043), Khorasan-e Razavi Prov., Chenaran, Kahoo (36°26′31.89″N, 59°12′19.40″E), 1419 m a.s.l., 12.v.2012, O. Mirshamsi; 1♀ (ZMFUM-SOL-1024), Khorasan-e Razavi Prov., Joghatai, Davarzan (36°51′51″N, 56°60′08″E), 1216 m a.s.l., 02.iv.2013, H. Maddahi; 1♀ (ZMFUM-SOL-1038), Khorasan-e Razavi Prov., Mashhad, Shelgherd (36°13′26.72″N, 59°34′45.40″E), 1132 m a.s.l., 15.vi.2013, H. Banazadeh; 1♀ (ZMFUM-SOL-1056), Khorasan-e Razavi Prov., Mashhad, (36°18′21.74″N, 59°31′53.63″E), 1034 m a.s.l., 20.viii.2013, O. Mirshamsi; 1♀ (ZMFUM-SOL-1061), Khorasan-e Razavi Prov., Mashhad (36°18′21.74″N, 59°31′53.63″E), 1034 m a.s.l., 20.x.2013, O. Mirshamsi.

Distribution: It is a common species known from Israel, Azerbaijan, Transcaucasia, Kazakhstan, Uzbekistan, Turkmenistan, Kyrgyzstan, Tajikistan, and Iran to central China (Birula, 1911; Roewer, 1934; Levy and Shulov, 1964; Aliev and Gadzhiev, 1983; Gromov and Kopdykbaev, 1994). This species is a new record for NE Iran.

Comments: It is distinguished from the closely related *Galeodes bacillatus* by the absence of ctenidia on the 6th abdominal sternite (Birula, 1905).

Family Gylippidae Roewer, 1933

Genus *Gylippus* Simon, 1879

***Gylippus (Hemigylippus) lamelliger* Birula, 1906**

(Figures 3A–3C)

Material: 1♀ (ZMFUM-SOL-1021), Khorasan-e Razavi Prov., Mashhad (36°17′35.97″N, 59°31′49.42″E), 1030 m a.s.l., 10.vi.2012, O. Mirshamsi.

Distribution: This species is distributed from SW Kazakhstan (Mangyshlak Plateau) across the Karakum and Kyzylkum deserts to NE Iran (Khorasan Prov.) (Gromov and Kopdykbaev, 1994).

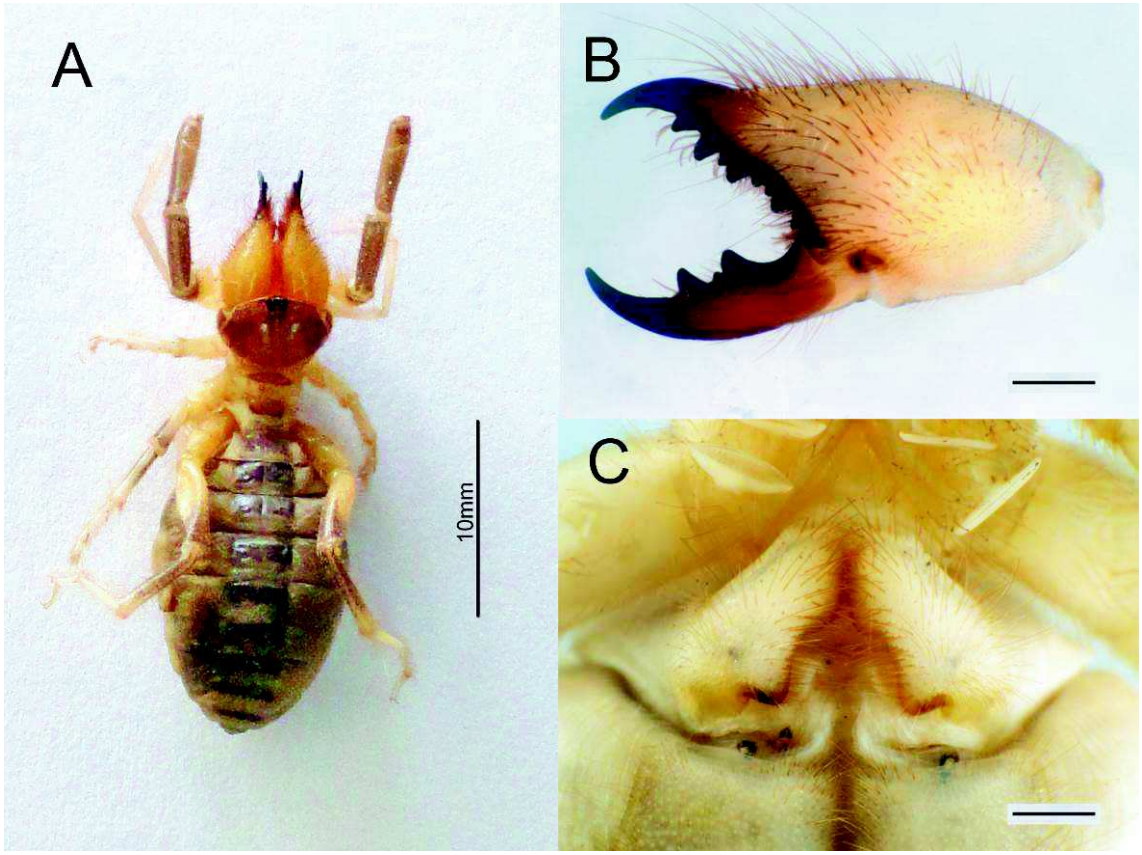

Figure 3. *Gylippus* (*Hemigylippus*) *lamelliger*: A) habitus, dorsal view; B) chelicerae, external view; C) genital operculum.

Comments: This species is easily distinguished on the basis of the shape of the chitinized genital operculum.

Diagnosis: Chelicerae with elongated movable fingers; sternite of genital segment quadrangular and convex, internally posterior corners with projection and a shallow small split; bacilli of coxae thick, expanded at the end and deeply forked; pleura grayish-yellow (see Birula, 1907: 890, fig. 5; Birula, 1938: 88, fig. 57).

Family Karschiidae Kraepelin, 1899

Genus *Karschia* Walter, 1889

***Karschia mastigofera* Birula, 1890**

(Figures 4A–4C)

Material: 1♂ (ZMFUM-SOL-1049), Zanjan Prov., Qeydar, Gojeyelagh (36°0.1′7.34″N, 48°32′13.06″E), 1825 m a.s.l., 15.vi.2013, A. Mahmoudi.

Distribution: This species is known from Turkey, Armenia, Azerbaijan, and Georgia (Harvey, 2003). New record for Iran.

Diagnosis: This species can be easily distinguished by its spiral flagellum, exits at the base of fixed fingers with a long feather-shaped seta; dorsally with two short thick spines, ventrally with a row of long thick spines and rows of feather-shaped setae (see Birula, 1938: 56–57, figs. 30, 31); ventral-medial aspect of metatarsus with palpal papillae; 4th sternite with curved needle-like ctenidia.

***Karschia persica* Kraepelin, 1899**

(Figures 5A–5E)

Material: 1♀ (SMF-RII -9903456), Fars Province, Shiraz (Syntype); 1♀ (ZMFUM-SOL-1053), Khorasan-e Razavi Prov, Fariman (35°22′6.21″N, 59°59′21.17″E), 2222 m a.s.l., 05.viii.2013, M. Khazanedari.

Distribution: This species is already known from Fars Province in the SW of Iran (Roewer, 1933), but it is a new record for NE Iran.

Diagnosis. This species can be easily distinguished from *K. mastigofera* by the dentition of chelicerae; fixed finger with six teeth, three front teeth approximately equal in size, the second only slightly smaller than the first, next three teeth from distal to proximal gradually become larger in size. Cheek part with four small ectal teeth and two mesial ones. Moveable finger with 9 or 10 teeth, of which the 4th and 7th are larger than the others (see Kraepelin, 1901: 147, fig. 114).

Family Rhagodidae Pocock, 1897

Genus *Rhagodes* Pocock 1897

***Rhagodes aureus* (Pocock, 1889)**

(Figure 2F)

Material: 1♂ (ZMFUM-SOL-1002), Khorasan-e Jonubi Prov., Qaen (33°43’36.00″N, 59°11’4.00″E), 1146 m a.s.l.,16.ix.2010, F. Abedi.

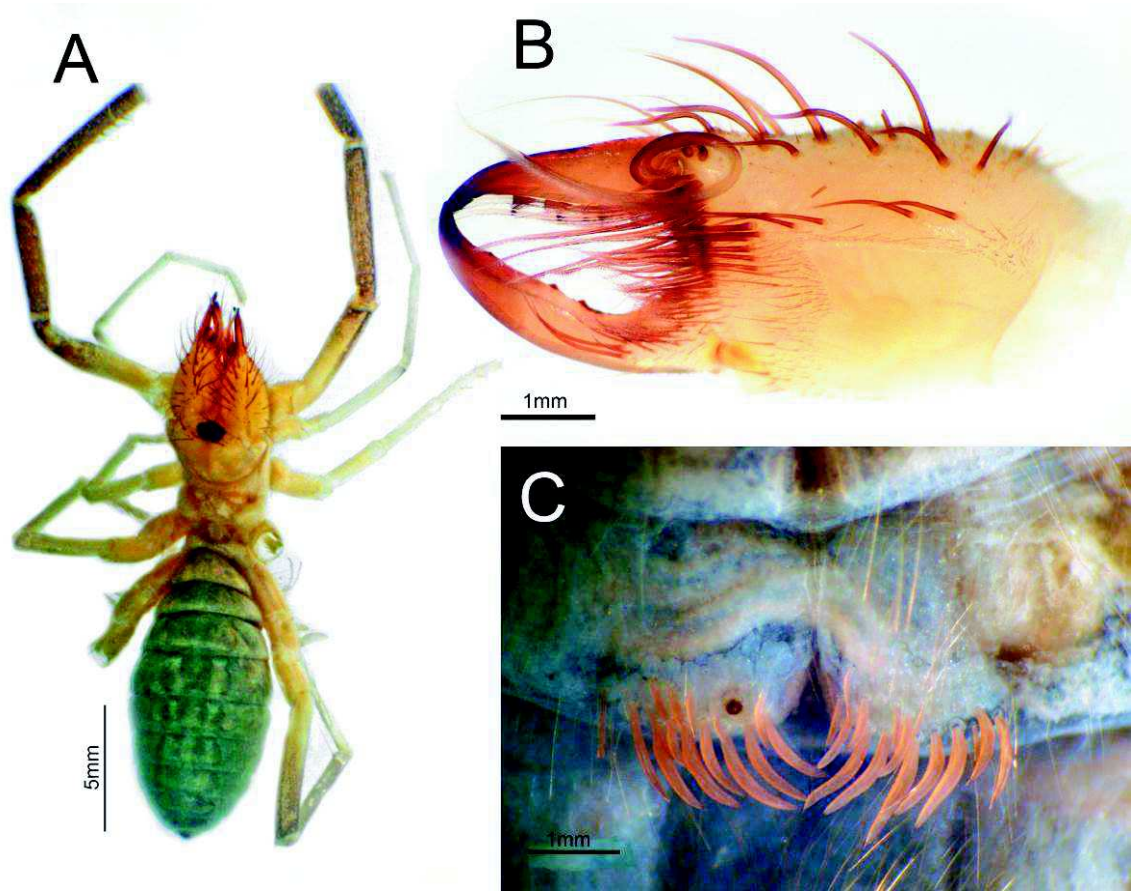

Figure 4. *Karschia mastigofera*: A) habitus, dorsal view; B) chelicerae, internal view showing flagellum; C) ventral view of opisthosoma.

Distribution: This species has been previously recorded from SE Turkmenistan to SW Afghanistan, Somalia, and E Iran (Khorasan and Sistan and Baluchistan provinces) (Birula, 1938; Lawrence, 1956; Harvey, 2003).

Diagnosis: This species can be easily distinguished by the presence of a purple median band, dorsally extending from posterior of propeltidium to the 7th abdominal segment; chelicerae and pedipalps pale yellow, tip of the pedipalps and first legs reddish-brown (Birula, 1905).

***Rhagodes melanochaetus* Heymons, 1902**

(Figure 2E)

Material: Syntype: 1♀ (SMf-RII-9903049), Turkmenistan, Transcaspian, Balkan Welayaty (Nebitdag), C. Fr. Roewer; 1♀ (ZMFUM-SOL-1015), Razavi Khorasan Prov., Mashhad (36°17′60.00″N, 59°36′0.00″E), 982 m a.s.l., 30.v.2008, O. Mirshamsi; 1♀ (ZMFUM-SOL-1030), Razavi Khorasan Prov., Torbat-e Jam, Jafarabad (35°27′49″N, 60°21′0″E), 1095 m a.s.l., 14.vi.2013, M. Khazanedari; 1♀ (ZMFUM-SOL-1040), Kerman Prov., Jiroft (28°40′41.00″N, 57°44′26.00″E), 685 m a.s.l., 14.vi.2013, M. Nazari.

Distribution: This species has been recorded from the Caspian coast of Turkmenistan to NE Iran and central Afghanistan (Birula, 1938; Lawrence, 1956).

Comments: Based on Roewer (1933: 283) and examining the syntype specimen from Turkmenistan, we found that it is a female not a male (originally labeled as male).

Diagnosis: Birula (1938) distinguished this species from *Rhagodes grimmi* and *R. g. septentrionalis* based on the body coloration, hairs, and bristles of the propeltidium and the formula of dorsal spines on legs 2–4.

According to the data presented in this study, four families, four genera, and seven species are recorded from NE and NW of Iran. Among the recorded species, *K. mastigofera* is recorded for the first time from the country. Considering the data presented here and the previously recorded species the number of Iranian camel spiders increases to 75. However, because of the lack of inclusive systematic studies devoted to solpugids in most regions of Iran in recent decades, it is still difficult to assess the exact species diversity of camel spiders of the country.

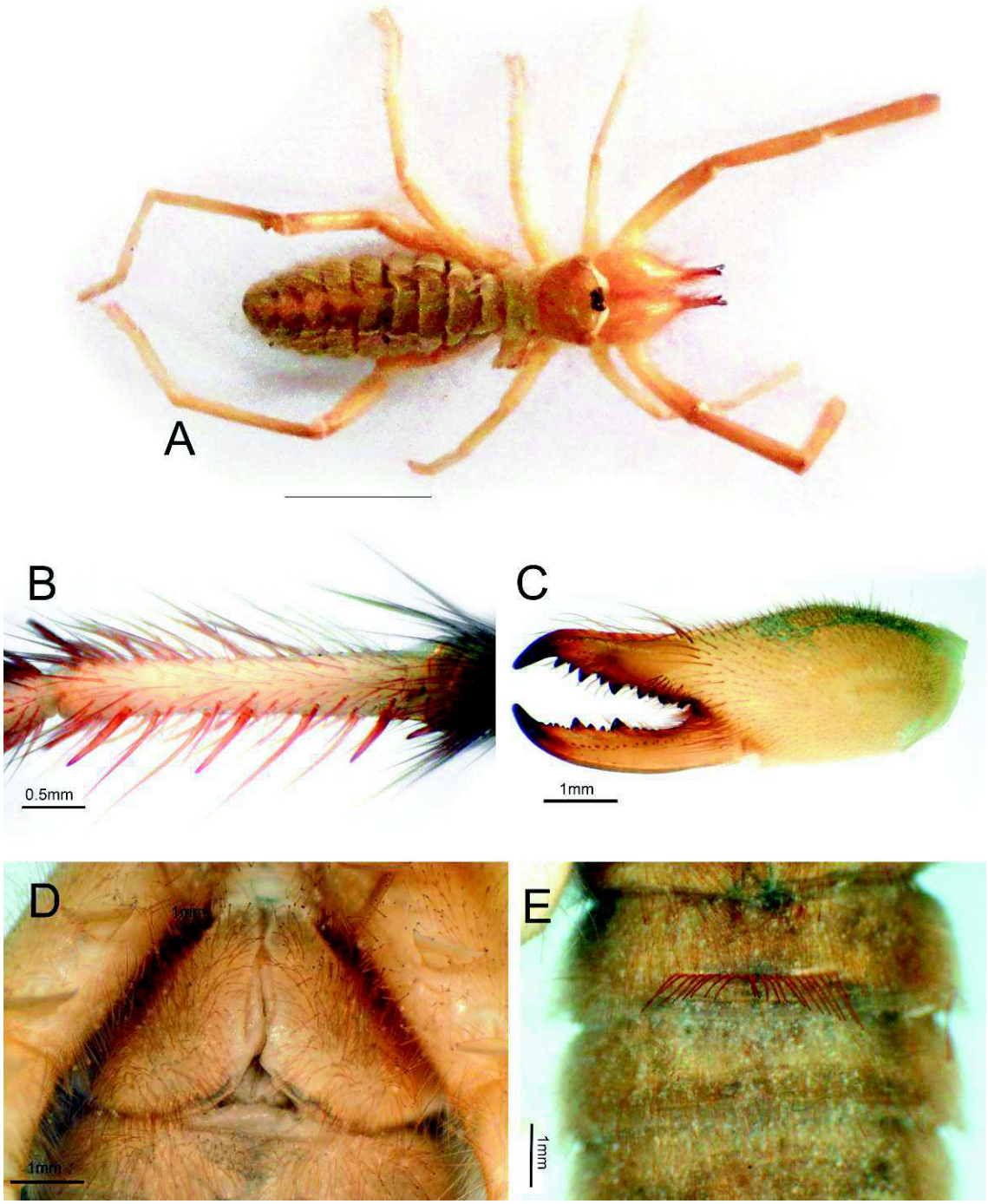

Figure 5. *Karschia persica*: A) habitus, dorsal view; B) dorsal view of metatarsus II; C) chelicerae, external view; D) genital operculum; E) ventral view of opisthosoma.

Acknowledgments

The authors give special thanks to Jamshid Darvish (Mashhad, Iran), and Alexander Gromov (Germany) for their invaluable help. We are grateful to Majid Moradmand and Peter Jäger (Senckenberg Museum, Frankfurt) for the loan of specimens. We are also thankful to H Maddahi, M Torshizi, F Abedi, and A Mahmoudi for their help during field work. Financial support was provided by the Office of Research Affairs, Ferdowsi University of Mashhad (project no: 25107) and the Iran National Science Foundation (INSF-90001780), which are gratefully acknowledged.

References

Aliev ShI, Gadzhiev AT (1983). Sol'pugi (Arachnida, Solifugae) Azerbaidzhana. Izvestiya Akademii Nauk Azerbaidzhanskoi SSR Ser Biologicheskaya 4: 43-46 (in Russian).

Birula AA (1905). Bemerkungen über die Ordnung der Solifugen. I-V. Annuaire Mus Zool Acad Sci St. Petersbourg 9: 391-416 (in German).

Birula AA (1907). Zur Systematik der Solifugen gattung *Gylippus*. Zool Anz 31: 885-893 (in German).

Birula AA (1908). Bemerkungen über die Ordnung der Solifugen. VI. Beschreibung der weiblichen *GIuviopsis nigrocincta* Bir. Annuaire Mus Zool Acad Sci St. Petersbourg 13: 332-335 (in German).

Birula AA (1911). Arachnologische Beitrage. I. Zur Scorpionen und Sollifugen-Fauna des chinesischen Reiches, Russkoe Entomologicheskoe Obozrenie 11: 195-201 (in German).

Birula AA (1918). Revisio analytica specierum asiaticarum generis *Karschia* Walter (Arachnoidea Solifugae). Annuaire Mus Zool Acad Sci St. Petersbourg 23: 197-201 (in German).

Birula AA (1935). Über eine neue *Eusimonia*-Art (Solifuga) aus Nord-Persien. Bull Acad Sci USSR 28: 1217-1222 (in German).

Birula AA (1937). Solifugen-Studien. I-II. [I. Über einige neue oder wenig bekannte *Galeodes*-arten mittelasiens. II. Über eine bemerkenswerte walzenspinne aus sudost-Persien]. Travaux Inst Zool Acad Sci URSS 4: 565-598 (in German).

Birula AA (1938). Arachnides, Ordo Solifuga. In: Fauna SSSR. Vol. 1(3): i-vii, 1-173. Moscow & Leningrad: l'Académie des Sciences de l'URSS (in Russian).

Gromov AV (2000). Solpugids of the genus *Eusimonia* Kraepelin, 1899 (Arachnida: Solifugae, Karschiidae) of Central Asia. Ekol Bratislava 19: 79-86.

Gromov AV, Kopdykbaev EE (1994). The fauna of the scorpions and solpugids (Arachnida: Scorpiones, Solifugae) of Kazakhstan. Selevinia Almaty 2: 19-23.

Harvey MS (2002). Nomenclatural notes on Solifugae, Amblyppygi, Uropygi and Araneae (Arachnidda). Rec West Aust Mus 20: 449-459.

Harvey MS (2003). Catalogue of the smaller arachnid orders of the world. Collingwood, Australia: CSIRO Publishing.

Hirst AS (1908). On some Oriental Solifugae, with descriptions of new forms. Rec Indian Mus 2: 241-247.

Kraepelin K (1901). Palpigradi und Solifugae. Das Tierreich, eine Zusammenstellung und Kennzeichnung der rezenten Tierformen 12: 1-159 (in German).

Kraus O (1959). Solifugen aus dem Iran (Arach.). Senckenbergiana Biol 40: 93-98 (in German).

Lawrence RF (1956). Solifugae (Chelicerata) from Afghanistan. The 3rd Danish Expedition to Central Asia. Zoological Results 20. Videnskabelige Maddelelserfra Dansk Naturhistorisk Forening I Kobenhavn. Kobenhavn 118: 115-140

Levy G, Shulov A (1964). The Solifuga of Israel. Israel J Zool 13: 102-120.

Maddahi H, Kami HG, Aliabadian M, Mirshamsi O (2015). Redescription of *Rhagodes eylandti* (Walter, 1889) (Arachnida: Solifugae) with notes on its morphological variation and geographic distribution. Zoology Middle East 61: 278-284.

Pocock RI (1895). Notes on some Solifugae contained in the collection of the British Museum with descriptions of new species. Ann Mag Nat Hist (Ser 6) 16: 74-98.

Pocock RI (1899). Scorpions and spiders. In: Fitzgerald EA, editor. The Highest Andes. London, UK: Methuen & Co., pp. 356-370.

Polis GA, McCormick SJ (1986). Scorpions, spiders, and solpugids: predation and competition among distantly related taxa. Oecologia 71: 111-116.

Punzo F (1998). The Biology of Camel-Spiders (Arachnida, Solifugae). Boston, MA, USA: Kluwer Academic Publishers.

Roewer CF (1932). Solifugae, Palpigradi. In Bronns HG, editor. Klassen und Ordnungen des Tierreichs. 5: Arthropoda. IV: Arachnoidea. Leipzig, Germany: Akademische Verlagsgesellschaft M.B.H., pp. 1-160 (in German).

Roewer CF (1933). Solifugae, Palpigradi. In: Bronns HG, editor. Klassen und Ordnungen des Tierreichs. 5: Arthropoda. IV: Arachnoidea. Leipzig, Germany: Akademische Verlagsgesellschaft M.B.H., pp. 161–480 (in German).

Roewer CF (1934). Solifugae, Palpigradi. In: Bronns HG, editor. Klassen und Ordungen des Tierreichs. Leipzig, Germany: Akademische Verlagsgesellschaft M.B.H., pp. 481-723 (in German).

Roewer CF (1941). Solifugen 1934-1940. Veröffentl Deutschen Kolonial- und Uebersee-Mus Bremen 3: 97-192 (in German).

Roewer CF (1952). Die Solifugen und Opilioniden der Österreichischen Iran-Expedition 1949–1950. Sitzungsberichte der Österreichischen Akademie der Wissenschaften, Mathematisch- Naturwissenschaftliche Klasse Abteilung 161: 509-516 (in German).

Roewer CF (1959). Die Araneae, Solifuga und Opiliones der Sammlungen des Herrn Dr. K. Lindberg aus Griechenland, Creta, Anatolien, Iran und Indien. Göteborgs Kungliga Vetenskapsoch Vitterhetssamhälles Handlingar 8: 1-47 (in German).