

Three new species of the subterranean huntsman spider genus *Spariolenus* (Araneae, Sparassidae, Heteropodinae) in Iran

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Abstract

The taxonomy of the genus *Spariolenus* Simon, 1880 in Iran is revisited by describing three new species: *Spariolenus fathpouri* **sp. n.** (male & female) from Pebdeh cave ecosystem (Khuzestan Province), *S. mansourii* **sp. n.** (male and female) a more widespread species discovered in the Pataveh and Nezel Caves entrances (Kohgiluyeh-va-Buyeh Ahmad Province), and *S. hormozii* **sp. n.** (female) from the Geno Biosphere Reserve (Hormozgan Province). Notes on the current status of the explored caves are given. The recently erected species, *S. khoostanensis* is redescribed based on the examination of the holotype and an additional diagnosis is provided. The Iranian plateau can be considered as the hotspot diversity for this genus in the world by hosting 8 out of 13 known species.

Keywords

New species, Middle East, Cave, taxonomy, huntsman spiders

Introduction

Members of the genus *Spariolenus* Simon, 1880 are medium to large huntsman spiders living underground both in caves and/or other karstic substrates close to active water stream systems (Moradmand and Jäger 2011, per obs.). These spiders are active hunters in caves or nocturnal hunters close to the cave entrances and karstic regions (pers obs.).

Moradmand and Jäger (2011) revised *Spariolenus* and gave extended diagnosis for a better understanding of its taxonomy in addition to describing four new species. Molecular phylogeny recovered *Spariolenus* in the “true” Heteropodinae clade and as the sister taxon of *Heteropoda* Latreille, 1804 (Moradmand et al. 2014). *Spariolenus khoozestanus* Zamani, 2016 was described from a single female specimen from Iran. It is here redescribed and illustrated.

Materials and methods

The specimens new to science in this paper (except *S. hormozii* sp. n.) were recently collected by the author from different subterranean habitats in Iran (2015–2017). The male specimens, collected as immatures, were subsequently reared in captivity, in some cases over one year to get mature and ready for description and a more reliable taxonomic decision over their identity as new species. Morphological characters were studied and illustrated using Leitz Wetzlar and Olympus SZX12 stereomicroscopes equipped with a drawing tube. For this purpose, specimens were submerged in 75% ethanol. The description style follows Moradmand and Jäger (2011) and Moradmand (2013). Measurements are given in millimetres. The size classes of specimens follow Jäger (2001) [small (3–10), medium (10–20), large (20–30)]. The spination pattern is given according to Davies (1994): sum of all spines (prolateral, dorsal, retrolateral, ventral), the latter is only listed if present.

The following abbreviations are used throughout the text: **AB** – anterior band of epigynal field; **ALE** – anterior lateral eyes, **AME** – anterior median eyes; **BRB** – basal retrolateral bulge; **C** – conductor; **CO** – copulatory opening; **DE** – distal part of embolus; **EF** – Epigynal field; **EP** – epigynal pit; **ET** – embolus tip; **FC** – first coil of vulva; **FD** – fertilisation duct; **LID** – lumen of internal duct system; **MEP** – margin of epigynal pit; **PET** – prolateral part of embolus; **PLE** – posterior lateral eyes; **PME** – posterior median eyes; **RET** – retrolateral part of embolus; **RTA** – retrolateral tibial apophysis; **SD** – sperm duct, **T** – tegulum; **SC** – second coil of vulva; **SD** – tissue sample for spider DNA catalogue number deposited in ZMUI; **SS** – slit sensillum; **TC** – third coil of vulva; **I–IV** – 1st to 4th leg.

Depositories. **SMF** – Senckenberg Research Institute, Frankfurt am Main, Germany (Julia Altmann, Peter Jäger). **ZMUI** – Zoological Museum, Department of Biology, University of Isfahan, Isfahan, Iran (Majid Moradmand).

Results

Family Sparassidae Bertkau, 1872

Subfamily Heteropodinae Thorell, 1873

Genus *Spariolenus* Simon, 1880

For description and diagnosis see Moradmand and Jäger (2011).

***Spariolenus fathpouri* Moradmand, sp. n.**

<http://zoobank.org/4221312C-BFB7-4B28-9CD8-65E86D04C5EF>

Figs 1, 2, 3A

Type material. *Holotype*: ♂, IRAN: Khuzestan Province: N of Lali, Pebdeh Cave, 32°26.50'N, 42°13.35'E, 11 April 2015, SD 111, M. Moradmand, F. Moin, Sh. Es-mailegi, A. Bagheri leg. (SMF). *Paratypes*: 1♂ and 2♀♀ with same data as for holotype (1♂, 1♀ ZMUI; 1♀ SMF)

Etymology. The species is named in honour of Dr Hossein Fathpour, retired associate professor of Zoology (University of Isfahan), who first perceived and supported the author's enthusiasm for investigating the world of arthropods; genitive case.

Diagnosis. The male can be distinguished from other congeners by its bifurcated ET (similar to *S. zagros* and *S. mansourii* sp. n.) but differ from the two later by the crescent shape of the prolateral ET (PET) having a notch (Fig. 1A–D). The female vulva can be distinguished by having unique expansion in EP anteriorly, constructing a marsupial-like structure (Fig. 2B).

Description. *Male: Measurements.* Medium-sized Sparassidae; holotype: total length 14.0, carapace length 6.7, width 5.5, anterior width 3.6, opisthosoma length 7.3, width 4.3. Anterior eye row slightly recurved, posterior eye row straight (Fig. 1F).

Chelicerae. With 3 anterior and 4 posterior teeth, cheliceral furrow with 10–15 intermarginal denticles; retromargin with two bristles at base of fang (Fig. 1E).

Eyes. AME 0.27, ALE 0.70, PME 0.48, PLE 0.76, eye inter distances: AME-AME 0.17, AME-ALE 0.06, PME-PME 0.28, PME-PLE 0.53, AME-PME 0.34, ALE-PLE 0.52.

Legs. Leg formula: II I IV III. Palp 10.8 [3.6, 1.5, 2.2, 3.5], I 47.0 [12.2, 4.6, 13.5, 13.2, 3.5], II 51.2 [13.8, 4.5, 15.5, 14.2, 3.2], III 38.0 [10.8, 3.7, 11.2, 9.7, 2.6], IV 39.9 [11.1, 3.5, 11.2, 11.3, 2.8].

Spination. Palp 131, 101, 1013; Legs: Femur I–III 323, IV 321; Patella I–IV 101; Tibia I 222(10), II 222(10), III 1218, IV 3236; Metatarsus I 0004, II–III 2024, IV 3036.

Palp. As in diagnosis, with cymbium 1.5 times longer than tibia, BRB present, RTA short, dRTA pointed and vRTA blunt in retrolateral view, both are blunt and the same length in ventral view, PET shorter than RET, PET cover proximal half of RET partially in ventral view. Conductor hyaline and not extending beyond or roughly the same length of ET (Fig. 1A–D).

Female: Habitus as in Fig. 3A. *Measurements.* Large-sized Sparassidae; total length 27.6, carapace length 13.6, width 11.7, anterior width 6.5, opisthosoma length 14.0, width 8.0.

Chelicerae. With 3 anterior and 5 posterior teeth, cheliceral furrow with 15–20 intermarginal denticles.

Eyes. AME 0.51, ALE 1.1, PME 0.70, PLE 1.3, eye inter distances: AME-AME 0.23, AME-ALE 0.11, PME-PME 0.48, PME-PLE 0.97, AME-PME 0.67, ALE-PLE 0.95.

Legs. Leg formula: II I IV III. Palp 19.8 [5.7, 3.0, 4.5, 6.6], I 71.3 [18.2, 8.2, 20.4, 19.5, 5.0], II 79.3 [21.4, 8.9, 22.8, 21.2, 5.0], III 66.6 [18.2, 7.3, 17.2, 17.3, 6.6], IV 68.7 [18.7, 7.3, 17.9, 19.5, 5.3].

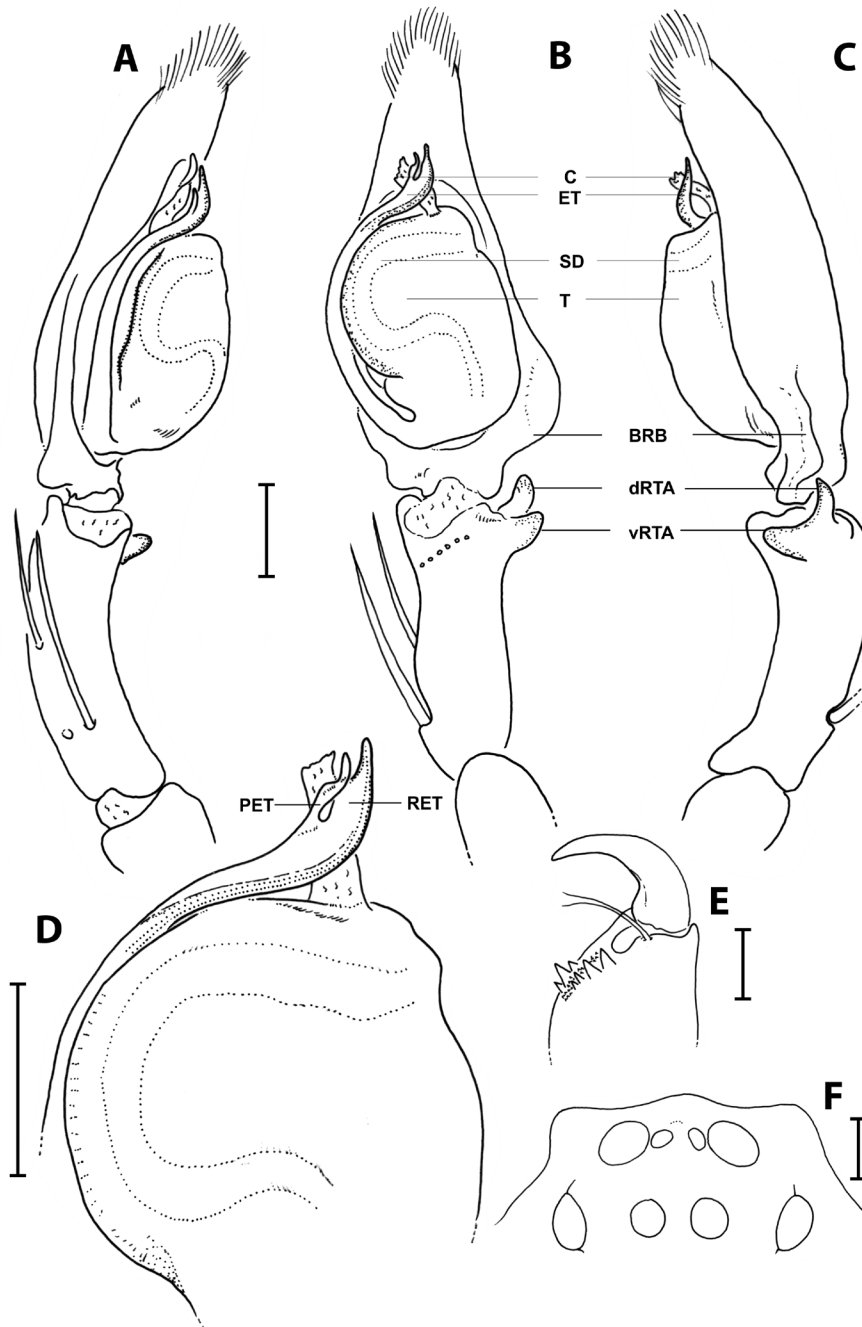


Figure 1. *Spariolenus fathpouri* sp. n., male holotype, Khuzestan, Pebdeh Cave, Iran (SMF). **A–C** left palp (**A** prolateral **B** ventral **C** retrolateral) **D** bulbus, ventral **E** chelicerae, ventral **F** eye arrangement, dorsal. Abbreviations: BRB – basal retrolateral bulge, C – conductor, ET – embolus tip, PET – prolateral part of embolus, RET – retrolateral part of embolus, RTA – retrolateral tibial apophysis, SD – sperm duct, T – tegulum. Scale bars: 1 mm (**A–C, E, F**), 0.5 mm (**D**).

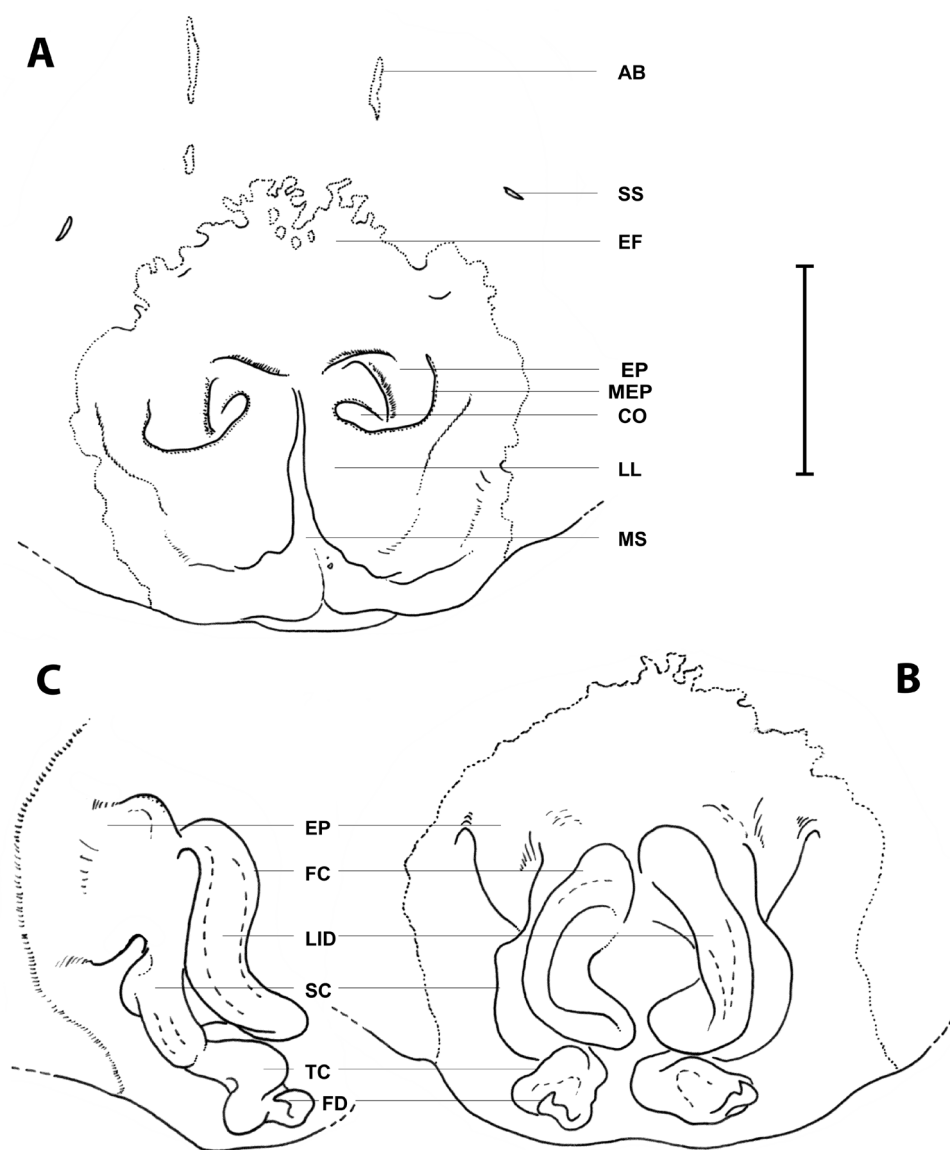


Figure 2. *Spariolenus fathpouri* sp. n., female paratype, Khuzestan, Pebdeh Cave, Iran (ZMUI). **A** epigynum, ventral **B** vulva, dorsal **C** right vulva, lateral. Abbreviations: CO – copulatory opening; EF – epigynal field; EP – epigynal pit; FC – first coil of vulva; FD – fertilisation duct; LID – lumen of internal duct system; MEP – margin of epigynal pit; SC – second coil of vulva; SS – slit sensillum; TC – third coil of vulva. Scale bar: 1 mm.

Spination. Palp 131, 101, 2221, 2014; Legs: Femur I–III 323, IV 321; Patella I–IV 101; Tibia I 101(10), II 111(10), III 2228, IV 2226; Metatarsus I– II 0004, III 2024, IV 3036.

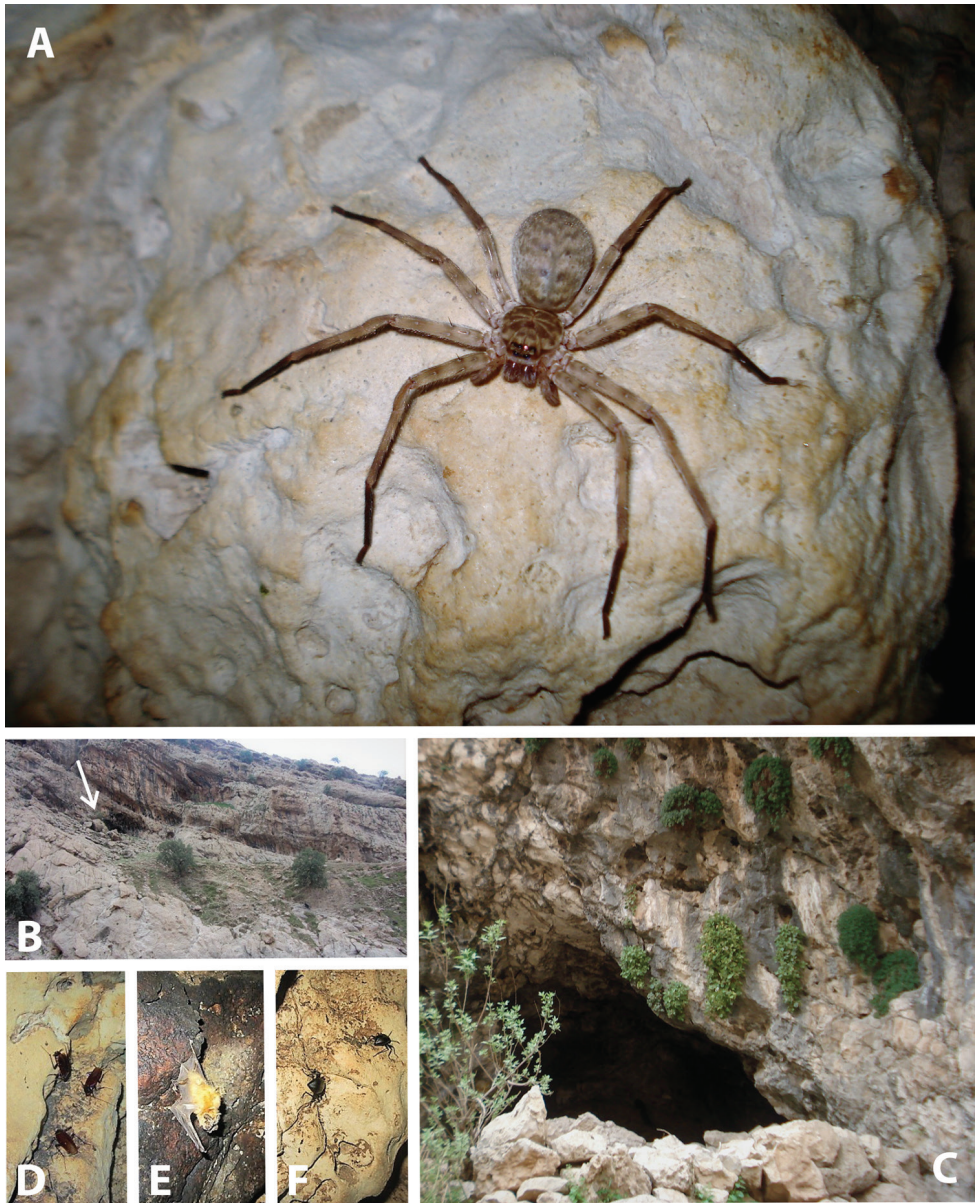


Figure 3. **A** Habitus of *Spariolenus fathpouri* sp. n., paratype female, alive in the type locality **B** Pebdeh Cave, Iran, the type locality, entrance (arrow) **C** ditto, Pebdeh Cave **D** Blattidae **E** dead Bat suffered from fire **F** Coleopteran beetles.

Epigynum. As in diagnosis, with EF as long as wide, AB present but short, MEP extending first half laterad and second half frontad (Fig. 2A–C).

Distribution and habitat preferences. Known only from the type locality, the Pebdeh cave ecosystem (Fig. 3B, C). The cave is rich in biodiversity of arthropods in-

cluding unidentified species of insects (Fig. 3D, F). A relatively large population of bats inhabit the cave and produce huge piles of guano, a source of energy for a potential food chain inside the cave.

Conservation status of the type locality. The Pebdeh cave suffered from a man-made fire just a few years ago which resulted in a decline of the bat population (Fig. 3E) and of the rest of the diversity of inhabitants (pers. ob.). The cave is fortunately under formal registration as national heritage of Iran because of evidences of earliest date of human occupation inside the cave.

***Spariolenus mansourii* Moradmand, sp. n.**

<http://zoobank.org/F79FD97F-E8DF-43CF-AB40-4B90A74CFF14>

Figs 4, 5A

Type material. Holotype: ♂, IRAN: Kohgiluyeh and Bouyer-Ahmad Province: Sarfaryab, Choram, Nezel Cave entrance, at night, 30°47'29.47"N, 50°56'52.25"E, 4 June 2016, Naghsh-e-Jahan Caving club, M. Moradmand and M. Saboohi leg. (SMF). **Paratypes:** 1♂ and 2 ♀♀, 1♂ *Kohgiluyeh and Bouyer-Ahmad Province*: Pataveh, Deh-Sheikh Cave, first corridor, 30°57'N, 51°14'E (ZMUI). 2♀♀ with same data as for holotype (1♀ ZMUI; 1♀ SMF).

Etymology. The species is named in honour of Mr Mohammad Mansouri (Iran: Isfahan), a highly qualified caving instructor. I experienced my first underground adventure with him and I owe him my caving skills; genitive case.

Diagnosis. The male is distinguished from other congeners by dRTA 1.5 times longer than vRTA and the shape of ET bifurcated (same as *S. zagros* and *S. fathpouri* sp.nov.). It differs from *S. zagros* by the prolateral ET shorter than retrolateral one (same size in *S. zagros*) (Fig. 4A–D). The female differ from other *Spariolenus* spp. by vulva with lateral extension of the first coil continuous to second coil (similar to those of *S. manesht*, but differ from it by dorsal epigynum lacking continuous ridge anterior to the CO) (Fig. 5A–C).

Description. Male: Measurements. Small to medium-sized Sparassidae; holotype: total length 11.0, carapace length 5.2, width 4.1, anterior width 2.6, opisthosoma length 5.8, width 3.2.

Chelicerae. With 3 anterior and 4 posterior teeth, cheliceral furrow with 10–15 intermarginal denticles (Fig. 4E).

Eyes. AME 0.27, ALE 0.57, PME 0.36, PLE 0.65, eye inter distances: AME-AME 0.12, AME-ALE 0.03, PME-PME 0.24, PME-PLE 0.48, AME-PME 0.25, ALE-PLE 0.54. Anterior and posterior eye rows slightly recurved (Fig. 4F).

Legs. Leg formula: II I IV III. Palp 5.7 [2.8, 1.3, 1.6], I 32.8 [8.5, 3.4, 9.1, 9.2, 2.6], II 35.8 [9.6, 3.5, 9.9, 10.1, 2.7], III 28.4 [8.2, 2.8, 7.6, 7.5, 2.3], IV 29.4 [8.4, 2.9, 7.3, 8.3, 2.5].

Spination. Palp 131, 101, 1013; Legs: Femur I 223, II–III 323, IV 321; Patella I–IV 101; Tibia I–II 131(10), III 2128, IV 2126; Metatarsus I–III 2024, IV 3036.

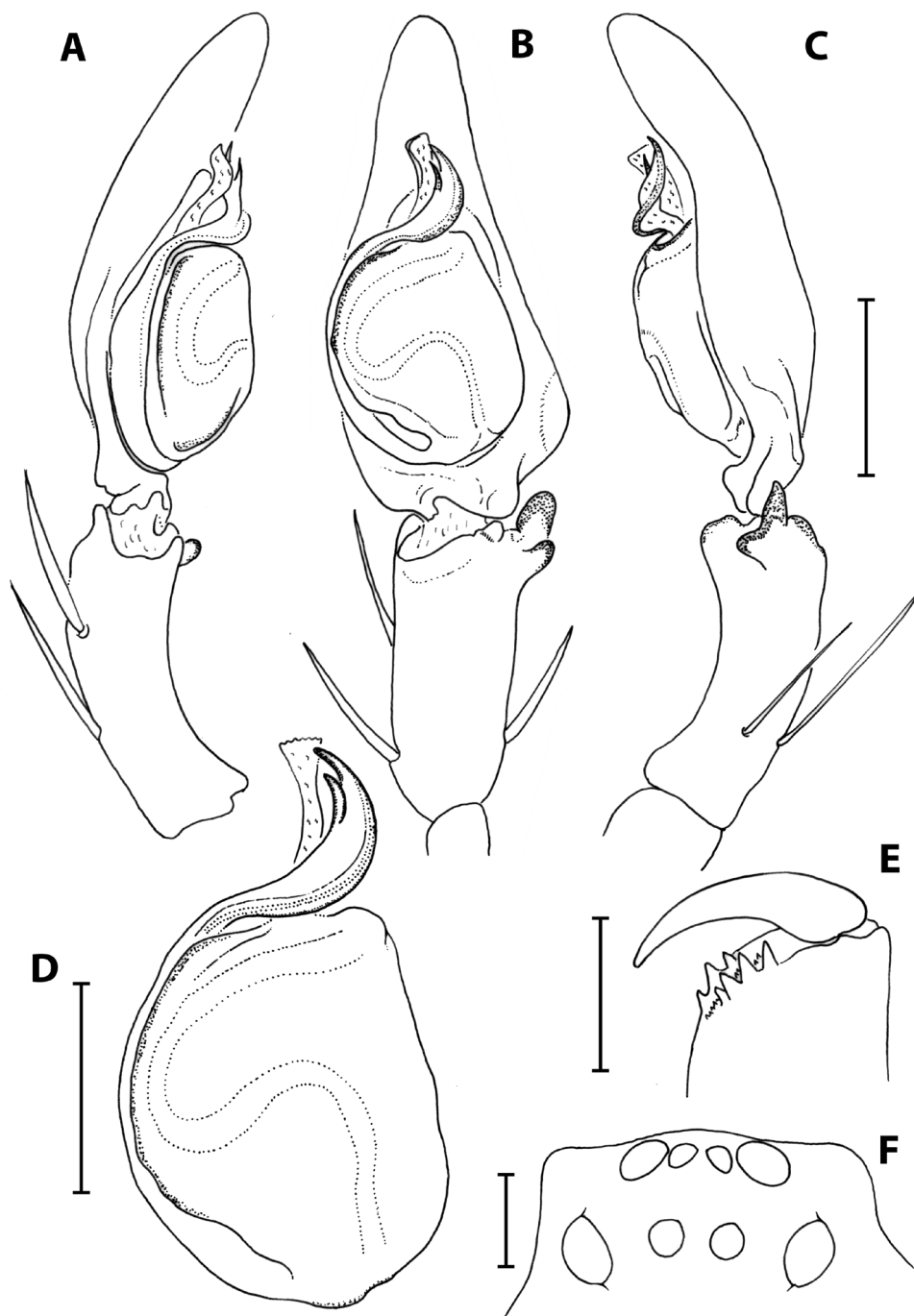


Figure 4. *Spariolenus mansourii* sp. n., male holotype, Kohgiluyeh and Bouyer-Ahmad Province, Nezel Cave entrance, Iran (SMF). **A–C** left palp (**A** prolateral **B** ventral **C** retrolateral) **D** bulb, ventral **E** chelicerae, ventral **F** eye arrangement, dorsal. Scale bars: 1 mm.

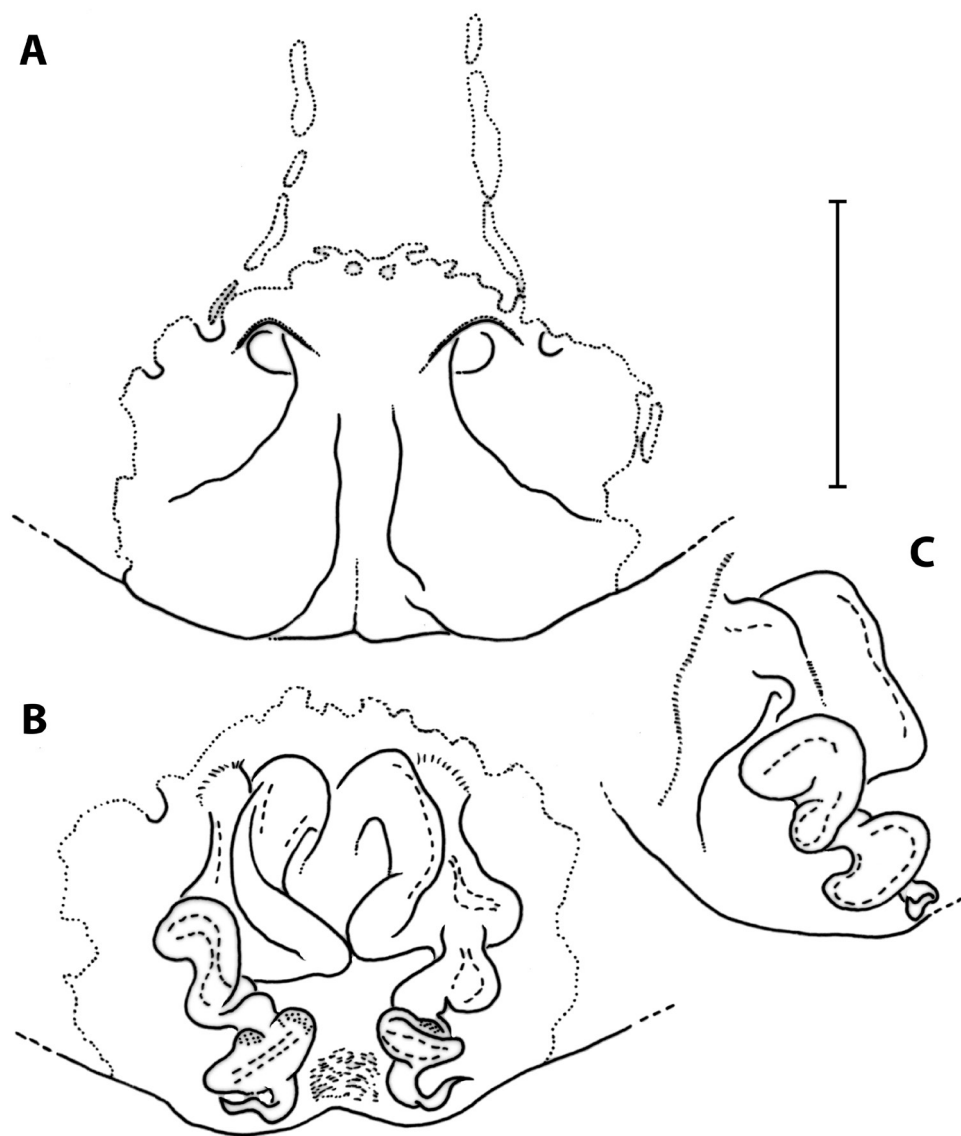


Figure 5. *Spariolenus mansourii* sp. n., female paratype, Kohgiluyeh and Bouyer-Ahmad Province, Nezel Cave entrance, Iran (ZMUI). **A** epigynum, ventral **B** vulva, dorsal **C** right vulva, lateral. Scale bar: 1 mm.

Palp. As in diagnosis, with cymbium 1.5 times longer than tibia, BRB present, RTA short, dRTA 2 times longer than vRTA, both distally rounded in ventral view, PET and RET both pointed distado-prolaterad, PET shorter than RET. Conductor hyaline and extending beyond ET in ventral view (4A–D).

Female: Measurements. Medium-sized Sparassidae; total length 15.4, carapace length 7.6, width 6.1, anterior width 3.7, opisthosoma length 7.8, width 5.2.



Figure 6. A Habitat of *Spariolenus mansourii* sp. n., Nezel pit cave entrance (arrow) **B** Nezel pit cave entrance, the type locality, Naghsh-e-Jahan caving club entering the cave.

Chelicerae. With 3 anterior and 4 posterior teeth, cheliceral furrow with 10–15 intermarginal denticles.

Eyes. AME 0.28, ALE 0.78, PME 0.47, PLE 0.77, eye inter distances: AME-AME 0.19, AME-ALE 0.05, PME-PME 0.28, PME-PLE 0.69, AME-PME 0.57, ALE-PLE 0.63.

Legs. Leg formula: II I IV III. Palp 8.2 [2.6, 1.4, 1.8, 2.9], I 25.4 [7.2, 3.1, 6.8, 6.5, 1.8], II 27.7 [8.2, 3.3, 7.5, 6.7, 2.0], III 23.6 [7.1, 2.8, 6.2, 5.8, 1.7], IV 25.2 [7.4, 2.9, 6.5, 6.6, 1.8].

Spination. Palp 131, 101, 2121, 1013; Legs: Femur I–III 323, IV 321; Patella I–IV 101 (000); Tibia I–II 101(10), III 2028, IV 2026; Metatarsus I–III 2024, IV 3036.

Epigynum. As in diagnosis, with EF wider than long, AB present and elongated, MEP extending in anterior half in posteriorly and posterior half in laterally.

Remarks. This is the smallest *Spariolenus* species ever described. Both male and female are small to medium sized (11–15 mm). On the other side, *S. iranomaximus* Moradmand and Jäger, 2011 is the largest species, with 18–31 mm body length.

Distribution and habitat preferences. Known from the type locality, the Nezel cave (Fig. 6A, B) and Pataveh (or Deh-Sheikh) cave. The specimens were observed in relatively large population around the karstic regions and entrances of the Nezel cave at night. The Nezel Cave is composed of four deep pits connected by horizontal corridors. The first pit is 43 meters deep (Fig. 6B).

The Pataveh cave has three entrances. Specimens were observed inside the entrance corridors during daytime. In both caves, the more humid parts inside where the walls were covered with a layer of condensed water, no *Spariolenus* specimens were observed.

Conservation status of the type locality. The Pataveh Cave was recently transformed into a tourist attraction and the corridors suffered from man-made constructions, a serious alert for its biodiversity.

***Spariolenus hormozii* Moradmand, sp. n.**

<http://zoobank.org/120A6B4D-1B1D-42B1-8C13-335A5997D8DD>

Fig. 7

Type material. *Holotype*: female, IRAN: Hormozgan Province: Hamag Protected area, Southern Zagros, Kuhe Fareghan, Hamag-e-Paen, 27°51'52.00"N, 56°28'31.00"E, June 2015, S. Sami leg. (SMF).

Etymology. The species is named in honour of Mr Parwiz Hormozi who with his colleague Mr Mohammad Dehghani sacrificed their lives and were killed by poachers in 2016 while carrying out their duties as park rangers protecting the Wildlife in the Geno Biosphere Reserve, Hormozgan Province; genitive case.

Diagnosis. This species is distinguished from all other congeners by CO and EP largely widened (CO 1/2 EP width and EP 1/2 EF length) (Fig. 7A).

Male. Unknown.

Female. *Measurements.* large Sparassidae; total length 23.6, carapace length 11.1, width 10.0, anterior width 5.7, opisthosoma length 12.5, width 8.5.

Legs. Leg formula: II I IV III. Palp 14.2 [4.6, 2.5, 3.3, 4.8], I 49.4 [13.6, 5.7, 13.3, 13.7, 3.1], II 53.7 [15.3, 6.2, 15.1, 14.0, 3.1], III 45.1 [13.3, 5.2, 12.2, 11.6, 2.8], IV 48.1 [13.7, 5.2, 12.6, 13.5, 3.1].

Chelicerae. With 3 anterior and 4 posterior teeth, cheliceral furrow with 10–15 intermarginal denticles (Fig. 7D).

Eyes. AME 0.48, ALE 1.1, PME 0.67, PLE 1.4, eye inter distances: AME-AME 0.37, AME-ALE 0.12, PME-PME 0.53, PME-PLE 0.83, AME-PME 0.57, ALE-PLE 1.0.

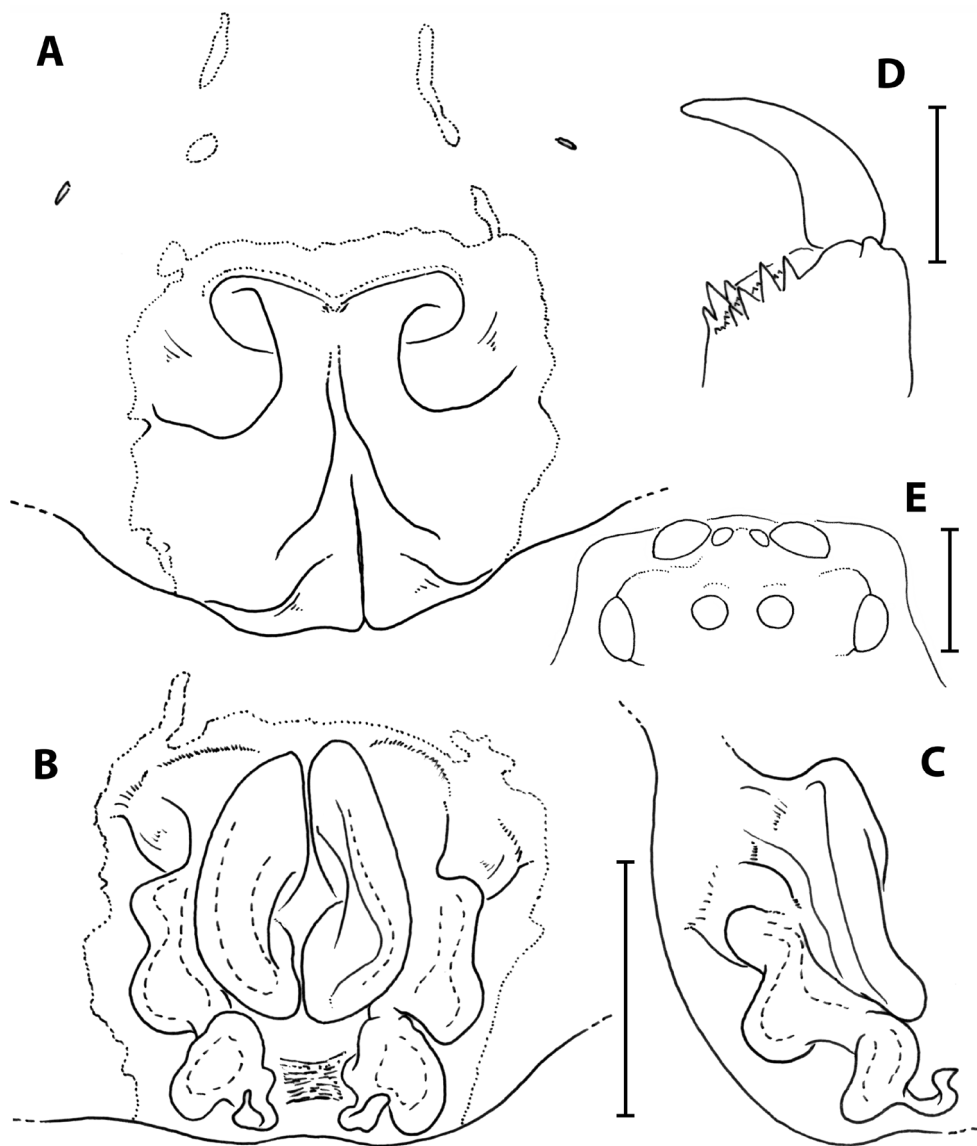


Figure 7. *Spariolenus hormozii* sp. n., female holotype, Hormozgan Province, Hamag Protected area, Iran (SMF). **A** epigynum, ventral **B** vulva, dorsal **C** right vulva, lateral **D** chelicerae, ventral **E** eye arrangement, dorsal. Scale bars: 1 mm.

Eyes as Fig. 7E.

Spination. Palp 131, 101, 2121, 2013; Legs: Femur I–III 323, IV 321; Patella I–IV 101; Tibia I–II 101(10), III 1018, IV 2026 (2126); Metatarsus I–III 2024, IV 3036.

Epigynum. As in diagnosis, with EF as wide as long, EF quadrate in shape, AB present, MEP extend anterior half posteriorly and posterior half laterally, CO large and partitioned half of EP area (Fig. 7A–C)

***Spariolenus khoozestanus* Zamani, 2016**

Fig. 8

Spariolenus khoozestanus Zamani, 2016: 421, figs 1–5 [holotype female (SMF) examined and illustrated]

Extended diagnosis. This single female differs from those of other species in having the anterior half of the FC extend transversally while in other species extend more longitudinally (Fig. 8A–C). The only exception is *S. iranomaximus* Moradmand and Jäger, 2011 but this species is unique in having wide spread HGO in SC and TC (Moradmand and Jäger 2011: figs 12–13).

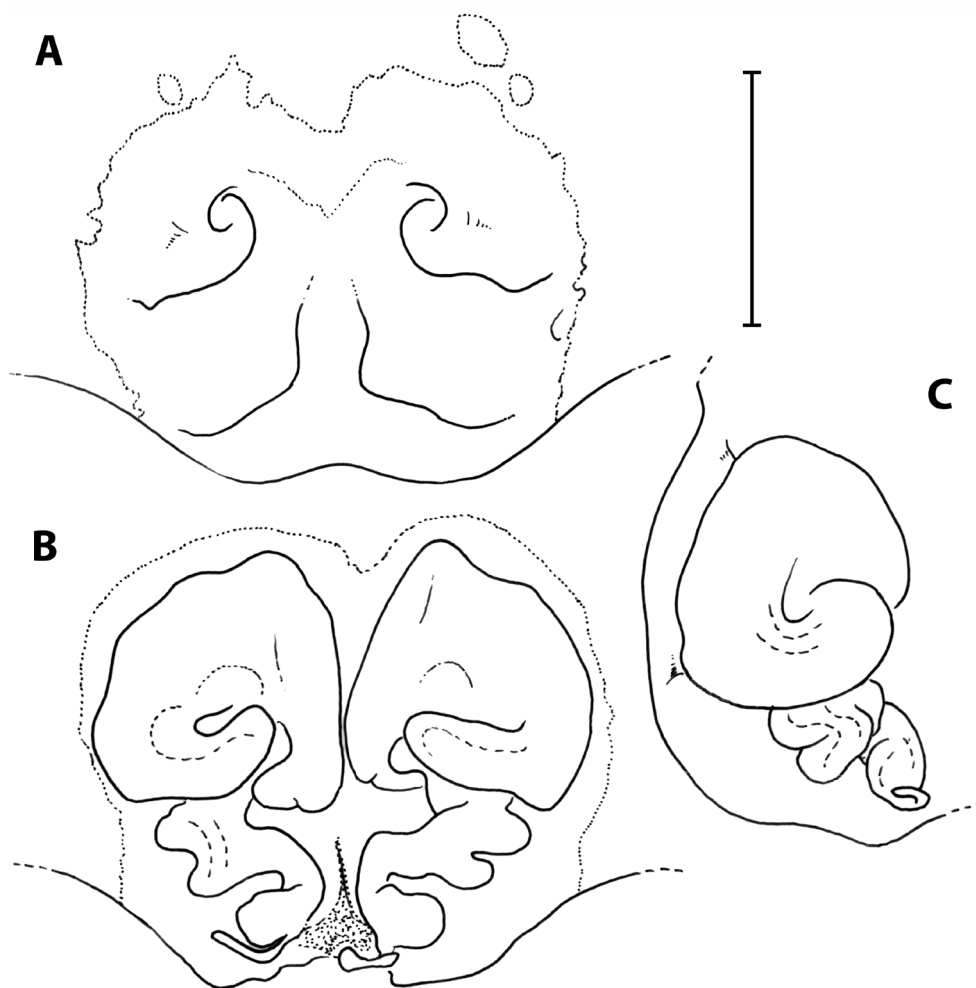


Figure 8. *Spariolenus khoozestanus* Zamani, 2016, female holotype (SMF). **A** epigynum, ventral **B** vulva, dorsal **C** right vulva. Scale bar: 1 mm.

Comments. This species is erected on the basis of a single female specimen collected in Lali city, close to the type locality of *S. fathpouri* sp. n. In the original diagnosis, this species was compared with *S. tigris* Simon, 1880 from India, occurring far away from the type locality. Nevertheless its closest similar species seems to be *S. iranomaximus* which is more widespread in Southwest Zagros (per. obs). Both species share the character of widened FC of vulva, the shape of the CO, EP and the pattern of MEP. Since there are variations in the females copulatory structures (in particular the vulva of *S. iranomaximus* (see Moradmand and Jäger 2011: figs 12, 18, 19), *S. khoozestanus* is probably a junior synonym of the former species, but until the male is discovered from the type locality the taxonomic decision cannot be made confidently.

Discussion

Before this study ten species of *Spariolenus* were known worldwide, half of them described from Iran. This study increased the known species to 13. The distribution pattern of *Spariolenus* is currently known from Iran (eight species), Oman in the Arabian Peninsula (one species), and far South Indian Peninsula (four species). The diversity of *Spariolenus* spp. in the Iranian plateau seems to be higher than what is known today. Since Iranian species are discovered along the Zagros Mountain Range, thus their evolutionary history may be connected with the orogeny of these mountains (Moradmand and Jäger 2011).

Five out of 13 known species of *Spariolenus* are described from both sexes. Among known males, the shape of bifurcated ET, previously observed only in *S. zagros* can be seen in two other males herein described. This could mean that bifurcated ET is more common than simple ones and probably a plesiomorphic character.

In a recent checklist on cavernicolous arthropods in Iran, Malek-Hosseini and Zamani (2017) listed 89 taxa from only 47 subterranean habitats. Since the number of explored caves in Iran is more than 2000 (Raeisi et al. 2012) and the global diversity of cavernicolous species is estimated at 100,000 (Culver and Holsinger 1992). Thus the species richness of Iranian caves is expected to be much higher. The discovery of the three new species herein described supports this assumption.

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and Mr A. Zamani are acknowledged for providing the specimen from Hormozgan Province. Dr Y. M. Marusik (Turku) kindly sent the holotype of *S. khoozestanus*, for this, I am very thankful.

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