

Scorpion Fauna of Duhok Province, Iraq, with New Records for the Country (Arachnida: Scorpiones)

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Abstract: This study of scorpion fauna was conducted in the Duhok province of northern Iraq, from June to October 2024. In this survey 273 specimens were collected from different districts, representing six species: *Androctonus* sp., *Hottentotta saulcyi* (Simon, 1880), *Orthochirus fomichevi* (Kovařík, Yağmur, Fet & Hussen, 2019), *Compsobuthus matthiesseni* (Birula, 1905), *Scorpio kruglovi* (Birula, 1910), and *Mesobuthus faiki* (Yağmur, Kovařík & Fet, 2024). *Hottentotta saulcyi* was the most abundant species (35.9% of total individuals) followed by *Orthochirus fomichevi* 29.7%. *Compsobuthus matthiesseni*, *Mesobuthus faiki*, *Androctonus* sp. and *Scorpio kruglovi*, were less frequent (less than 16 % each). A significant finding was the first-time documentation of *Mesobuthus faiki* in Duhok province, marking it a new record for Iraq.

Keywords: Scorpion diversity, distribution, identification, *Mesobuthus faiki*, Buthidae.

Irak'ın Duhok ilinin Akrep Faunası ve Ülke İçin Yeni Kayıtlar (Arachnida: Scorpiones)

Öz: Bu çalışma Irak'ın kuzeyinde yer alan Duhok ilinde akrep faunasının belirlenmesi için 2024 yılı Haziran ile Ekim ayları arasında yürütülmüştür. Bu araştırmada farklı ilçelerden toplam 273 örnek toplanmış ve altı türe ait bireyler belirlenmiştir. Bunlar: *Androctonus* sp, *Hottentotta saulcyi* (Simon, 1880), *Orthochirus fomichevi* (Kovařík, Yağmur, Fet & Hussen, 2019), *Compsobuthus matthiesseni* (Birula, 1905), *Scorpio kruglovi* (Birula, 1910) ve *Mesobuthus faiki* (Yağmur, Kovařík & Fet, 2024). *Hottentotta saulcyi* en bol bulunan türdür ve toplam bireylerin %35,9'unu oluşturmuştur, onu %29,7 ile *Orthochirus fomichevi* takip etmiştir. *Compsobuthus matthiesseni*, *Mesobuthus faiki*, *Androctonus* sp. ve *Scorpio kruglovi* ise daha az sıklıkta (%16'dan az) gözlemlenmiştir. Bu çalışma kapsamında *Mesobuthus faiki*'nin Duhok ilinde ilk kez rapor edilmesi, türün Irak için yeni bir kayıt olarak kaydedilmesi açısından önemli bir bulgudur.

Anahtar kelimeler: Akrep çeşitliliği, dağılışı, tanımlama, *Mesobuthus faiki*, Buthidae.

1. Introduction

Scorpions, classified within the arachnid order Scorpiones, are of considerable medical importance. According to current taxonomic data, there are 2,865 recognized scorpion species distributed worldwide. Of these, the venom of approximately 30 species is considered medically significant due to its potential to cause serious harm to humans (Prendini & Wheeler, 2005; Rein, 2025).

Scorpion stings are a significant global public health issue, with approximately 1.2 million cases and 3,250 deaths recorded annually. Mexico, Colombia, and Iran report particularly high numbers of stings (Bawaskar & Bawaskar, 2012; Shahsavarinia et al., 2017). Epidemiological studies on scorpion stings in Iraq are limited. However, recent unofficial reports from the Iraqi Ministry of Health indicate a substantial incidence of scorpion envenomation, influenced by regional, climatic, and environmental factors. A study conducted in 2019 and 2020 in the Duhok, Erbil, and Sulaymaniyah provinces revealed that Duhok experienced the highest rate of scorpion stings compared to the other two provinces. Recent investigations into the scorpion fauna of these three provinces have identified 10 species (Hussen et al., 2022).

A recent review of Iraqi scorpion fauna indicates a composition of 20 species, categorized into 13 genera

across five families: Buthidae, Euscorpiidae, Hemiscurpiidae, Iuridae, and Scorpionidae. The Buthidae family constitutes the predominant group, encompassing 16 species, which represents 80 % of the total recorded species. In contrast, each of the remaining families is represented by a single species (Kachel et al., 2021; Lourenço, 2022). Several scorpion species in Iraq are known only from single locality records, often based on a limited number of specimens, sometimes a single individual. This apparent restriction in geographical distribution may stem from insufficient scientific field surveys rather than genuine ecological limitations. The species *A. crassicauda* (Olivier, 1807), *C. matthiesseni*, *H. mesopotamicus* (Lourenço and Qi, 2007), *H. salucyi*, *O. fomichevi*, and *S. kruglovi* have been previously documented in Duhok (Hussen & Ahmed, 2020; Kachel, 2020; Kachel et al., 2021; Hussen et al., 2022). Consequently, this study aims to conduct a comprehensive field survey across various districts of Duhok province to construct a geographical distribution map illustrating the diversity of scorpion species within the city.

2. Material and Method

The study area is situated within the Duhok province in northern Iraq, a mountainous region sharing borders with Turkey and Syria. Geographically, it is located between 36°40' and 37°20' North latitude and 43°20' and 44°10' East

longitude. Scorpion specimens were collected from June to October 2024 across seven districts within the Duhok Governorate: Zakho, Sumel, Duhok, Amedi, Shekhan, Akre, and Bardarash (Fig. 1). Collection methodologies encompassed searching under rocks and flooding burrows with water, as well as nocturnal UV flashlight detection. Following collection, specimens were transported to the Zoology Laboratory at the University of Zakho and individually preserved in 80-95% ethanol within small plastic boxes.



Figure 1. Maps showing the geographical outline of (A) Iraq and (B) Duhok province districts.

Species identification was conducted following the taxonomic keys and methodologies established by Levy and Amitai (1980) and Kovařík (2007). Whole specimen photographs were captured using a Canon EOS 7D camera, with image stacking performed via Helicon Focus software. The focus stacking technique was adapted from the Canon-Cognisys system as recommended by Brecko et al. (2014). Measurements were taken by a digital caliper (INGCO, China) for large specimens, whereas for small specimens, ToupView software was used to measure specimens' images which were taken by an ocular digital camera, the brand and origin of which are unspecified, attached to an AmScope stereomicroscope. Statistical analyses were performed by Microsoft Excel 2010 and SPSS v26 software. Geographical distribution of each species was constructed separately by ArcGIS pro v3.0.1 software.

3. Results

3.1. Scorpion fauna relative abundance (RA)

A total of 273 scorpion specimens were collected, comprising 161 males (58.97%) and 112 females (41.03%). Taxonomic analysis revealed the presence of six species belonging to two families: Buthidae and Scorpionidae. The most abundant species were *Hottentotta saulcyi*, representing 35.9% of the total collection, followed by *Orthochirus fomichevi* (29.7%) and *Scorpio kruglovi* (15.0%). The remaining species, *Compsobuthus matthiesseni*, *Mesobuthus faiki*, and *Androctonus* sp., were found in relatively lower numbers, accounting for 10.3%, 5.5%, and 3.6 % of the specimens, respectively (Fig. 2).

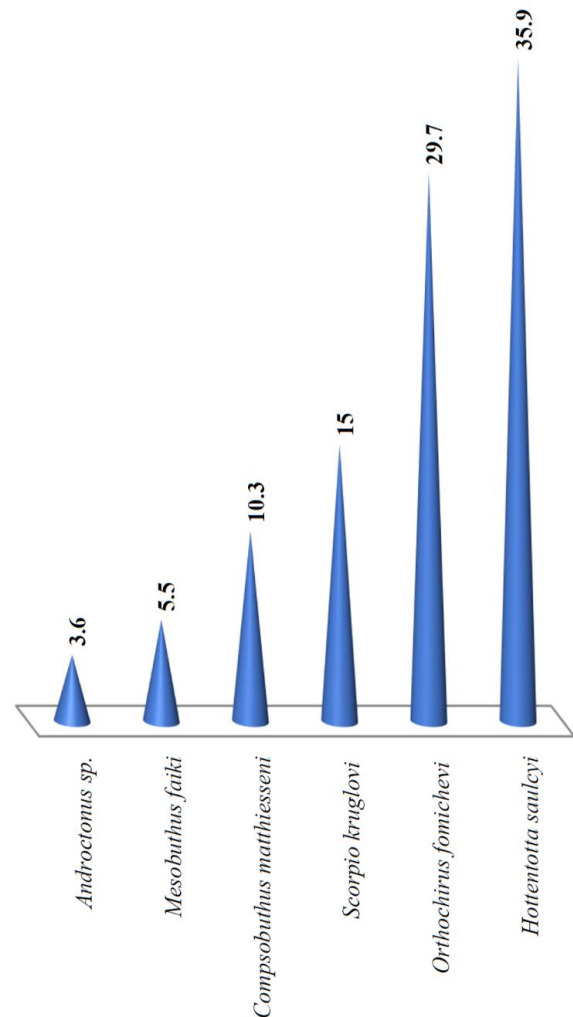


Figure 2. Relative abundance of scorpion species recorded in Duhok Province, Iraq.

3.2. Taxonomy

3.2.1. Family Buthidae C. L. Koch, 1837

The Buthidae family is recognized as the largest family of scorpions, encompassing nearly half of the global diversity of scorpion species (Štundlová et al., 2022). In this study, a total of 232 specimens were identified as belonging to this family, representing 85% of all specimens collected. These specimens included five species: *M. faiki*, *Androctonus* sp., *H. saulcyi*, *O. fomichevi* and *C. matthiesseni*. Key distinguishing features of the Buthidae family include a triangular sternum and pedipalp-patella that lack ventral trichobothria (Amr & El-Oran, 1994; Polis, 1990).

3.2.1.1. *Mesobuthus faiki* Yağmur, Kovařík & Fet, 2024 (Fig. 3e and 4)

Type material examined. Iraq, Duhok province, Duhok district, Zewka Kandala, 37°02'36.2"N 43°10'22.7"E, 1024 m a.s.l., 3♂1♀; Duhok district, Nizarke, 36°50'20.7"N 43°04'03.5"E, 659 m a.s.l., 3♂1♀; Amedi district, Barash, 37°00'23.6"N 43°15'49.5"E, 1357 m a.s.l., 7♂.

Measurements. Total length 37.09 - 45.82 mm (average: ♂ 41.74 mm, ♀ 38.34 mm), prosoma 4.14 - 4.82 mm (average: ♂ 4.46 mm, ♀ 4.50 mm), mesosoma 10.32 - 12.85 mm (average: ♂ 11.85 mm, ♀ 11.37 mm), metasoma and telson 22.63 - 28.20 mm (average: ♂ 25.43 mm, ♀ 22.47 mm). Pectines 21-26 in males and 18-19 in females.



Figure 3. General Overview of Scorpion Species in Duhok province, northern Iraq; A. *Hottentotta saulcyi*; B. *Androctonus* sp.; C. *Scorpio kruglovi*; D. *Orthochirus fomichevi*; E. *Mesobuthus faiki*; and F. *Compsobuthus matthiesseni*. Species are organized according to total body length.

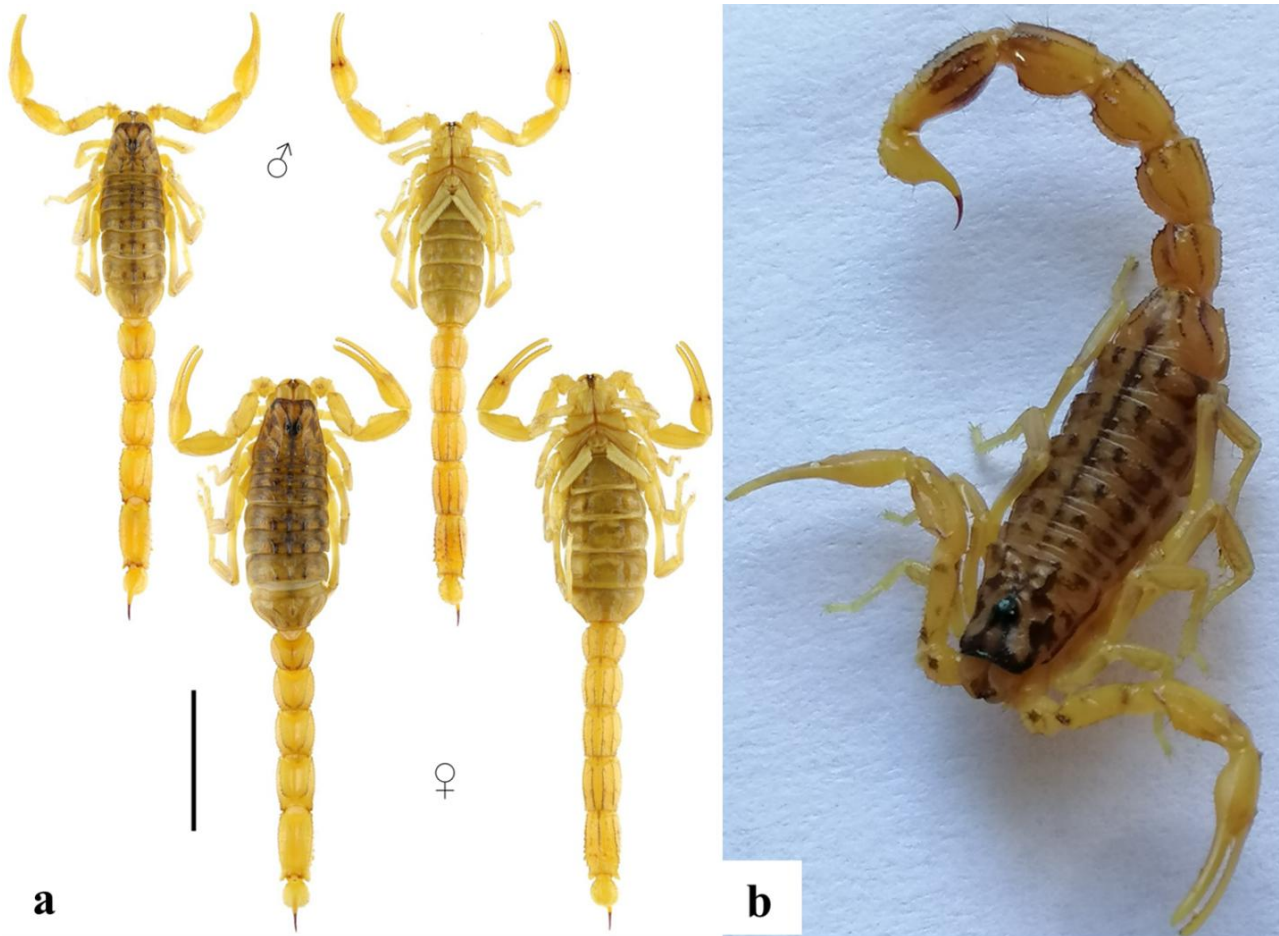


Figure 4. Whole *Mesobuthus faiki* of Iraq photographs with; A. Professional Canon EOS 7D camera, with image stacking performed via Helicon Focus software Top male Bottom female B. Normal mobile phone camera dorsal view.

Comments. During this study, fifteen *M. faiki* specimens were collected, representing 5.5% of the total sample. The

sex ratio was skewed towards males, with thirteen specimens identified as male and two as female. All

specimens exhibited a yellow body color, with the carapace and mesosoma displaying darker pigmentation, particularly in females. Brown patches were observed on the carapace, and five longitudinal dark stripes were present on mesosomal tergites I–VI. The metasoma was yellow, with carinae exhibiting increased darkness towards the posterior end. Carapace carinae exhibited a lyre-shaped configuration, in which central-lateral and posterior-median carinae were joined. Notably, metasomal segment V carinae, especially the ventrolateral carinae, displayed uneven denticles, with the posterior denticles being significantly larger. The telson was bulbous and exhibited ventral roughness. Fixed finger of pedipalp-chela with trichobothrium *db* proximal to *est*. The pedipalp-chela movable finger presented four subterminal denticles. Sexual dimorphism was evident in the pedipalp chela, with males exhibiting a prominent scalloping, facilitating differentiation from females.

3.2.1.2. *Androctonus* sp. (Fig. 3b)

Type material examined. Iraq, Duhok province, Sumel district, Asihe, 37°01'05.3"N 42°42'22.5"E, 692 m a.s.l., 2♂1♀; Duhok district, Avrike, 36°50'06.1"N 43°08'14.1"E 868 m a.s.l., 1♀; Shekhan district, Atrush, 36°51'07.7"N 43°21'54.3"E, 1014 m a.s.l., 1♀; Bardarash district, Kawnabak, 36°29'25.0"N 43°37'57.7"E, 430 m a.s.l., 3♂2♀.

Measurements. Total length 63.03 - 81.55 mm (average: ♂ 75.13 mm, ♀ 72.74 mm), prosoma 7.44 - 9.45 mm (average: ♂ 8.67 mm, ♀ 8.53 mm), mesosoma 18.42 - 24.39 mm (average: ♂ 22.17 mm, ♀ 22.14 mm), metasoma and telson 37.17 - 47.71 mm (average: ♂ 44.29 mm, ♀ 42.06 mm). Pectines 31–34 in males and 25–27 in females.

Comments. A total of ten specimens were collected during this study, constituting 3.6% of the overall sample. The specimens comprised an equal sex ratio, with five identified as males and five as females. The general body coloration was dark brown, except for the distal portions of the pedipalp-chela fingers and leg tarsomere II, which exhibited a yellow hue. Notably, these specimens displayed distinct characteristics that differentiate them from *Androctonus crassicauda*, leading to their provisional classification as *Androctonus* sp. Further investigation is necessary to ascertain whether these specimens represent a previously unrecognized species within the fauna of Duhok and Iraq.

3.2.1.3. *Hottentotta salucyi* (Simon, 1880) (Fig. 3a)

Type material examined. Iraq, Duhok province, Zakho District, Karne, 37°12'30.0"N 42°39'19.0"E, 559 m a.s.l., 26♂14♀; Zakho district, Khrababk, 37°08'30.6"N 42°45'02.1"E, 526 m a.s.l., 2♂1♀; Zakho district, Salka, 37°06'50.8"N 42°39'05.7"E, 573 m a.s.l., 2♂2♀; Zakho district, Betas, 37°04'02.6"N 42°42'06.1"E, 675 m a.s.l., 1♂; Zakho district, Khelakh, 37°07'29.5"N 42°36'44.0"E, 480 m a.s.l., 2♀; Zakho district, Shinava, 37°06'40.7"N 42°30'37.4"E, 513 m a.s.l., 3♂5♀; Zakho district, Batifa, 37°10'53.9"N 42°59'57.3"E, 605 m a.s.l., 1♂; Duhok district, Zewka kandala, 37°02'36.2"N 43°10'22.7"E, 1024 m a.s.l., 5♂3♀; Duhok district, Alkishk, 37°00'53.8"N 43°11'47.0"E, 1037 m a.s.l., 2♀; Shekhan district, Shekhan, 36°40'31.3"N 43°20'31.4"E, 433 m a.s.l., 2♂; Shekhan district, Atrush, 36°51'07.7"N 43°21'54.3"E, 1014 m a.s.l., 1♂3♀; Amedi district, Sheladiz, 37°02'09.6"N 43°46'41.4"E, 623m a.s.l.,

1♂; Akre District, Bashqal Agha, 36°44'43.1"N 43°55'11.3"E, 711 m a.s.l., 1♀; Bardarash district, Dusara, 36°25'24.6"N 43°31'47.3"E, 310 m a.s.l., 7♂14♀.

Measurements. Total length 75.35 - 115.65 mm (average: ♂ 92.51 mm, ♀ 86.08 mm), prosoma 8.18 - 11.30 mm (average: ♂ 9.25 mm, ♀ 9.39 mm), mesosoma 22.98 - 34.97 mm (average: ♂ 28.10 mm, ♀ 27.04 mm), metasoma and telson 44.19 - 69.38 mm (average: ♂ 55.15 mm, ♀ 49.65 mm). Pectines 28–34 in males and 24–28 in females.

Comments. A total of ninety-eight specimens were collected during this study, accounting for 35.9% of the overall sample, thereby establishing this species as the most abundant and widely distributed in the region. Among the collected specimens, 51 were identified as males and 47 as females. Males can be distinguished from females by their narrower mesosoma and a metasomal segment I that is longer than wide, whereas females have a broader mesosoma and a metasomal segment I that is slightly wider than long. *Hottentotta saulcyi* specimens were predominantly located in rocky habitats, where they were observed resting on rocks at night. Notably, this species exhibited the highest level of aggression among all captured specimens. The general body coloration was yellowish-brown, with the chelicerae, anterior portion of the carapace, metasomal segment V, and telson displaying black pigmentation; metasomal segments III and IV may also appear black. The body surface was characterized by moderate hairiness. Additionally, sternite VII exhibited a pentacarinat structure (Amiri et al., 2024).

3.2.1.4. *Orthochirus fomichevi* Kovařík, Yağmur, Fet & Hussen, 2019 (Fig. 3d)

Type material examined. Iraq, Duhok province, Zakho district, Shahida, 37°08'01.1"N 42°40'24.0"E, 506 m a.s.l., 2♂2♀; Zakho district, Khrababk, 37°08'30.6"N 42°45'02.1"E, 526 m a.s.l., 1♂3♀; Zakho district, Salka, 37°06'50.8"N 42°39'05.7"E, 573 m a.s.l., 2♂3♀; Zakho district, Betas, 37°04'02.6"N 42°42'06.1"E, 675 m a.s.l., 1♂; Zakho district, Dubanik, 37°02'30.2"N 42°50'19.9"E, 709 m a.s.l., 4♂3♀; Sumel district, Sumel, 36°50'31.3"N 42°51'52.8"E, 446 m a.s.l., 6♂2♀; Sumel district, Esmahil Ava, 36°57'25.3"N 42°38'12.9"E, 504 m a.s.l., 13♂11♀; Duhok district, Nizarke, 36°50'20.7"N 43°04'03.5"E, 659 m a.s.l., 6♂7♀; Shekhan district, Atrush, 36°51'07.7"N 43°21'54.3"E, 1014 m a.s.l., 7♂8♀.

Measurements. Total length 30.12 - 39.91 mm (average: ♂ 35.68 mm, ♀ 38.16 mm), prosoma 3.38 - 4.43 mm (average: ♂ 3.93 mm, ♀ 4.32 mm), mesosoma 8.68 - 10.92 mm (average: ♂ 9.96 mm, ♀ 11.23 mm), metasoma and telson 18.06 - 24.68 mm (average: ♂ 21.79 mm, ♀ 22.61 mm). Pectines 21–23 in males and 17–20 in females.

Comments. A total of eighty-one specimens were collected during this study, representing 29.7% of the total sample and making it the second most widely distributed species in the region. Of the collected specimens, 42 were males and 39 were females. These scorpions were primarily found in plain areas with sparse vegetation. Among all captured species, *Orthochirus fomichevi* was noted as the most active yet non-aggressive species. This species can be distinguished from others by its granulate sternite VII with well-developed granulate carinae; a densely granulated mesial dorsal surface of metasomal segment V; and

smooth, non-granulate, punctate, and bumpy ventral and lateral surfaces of metasomal segments II-III (Kovářík et al., 2019). The overall body coloration was black, with the exception of the pedipalp-chela fingers and distal segments of the legs, which were yellow.

3.2.1.5. *Compsobuthus matthiesseni* (Birula, 1905) (Fig. 3f)

Type material examined. Iraq, Duhok province, Zakho district, Khrababk, 37°08'30.6"N 42°45'02.1"E, 526 m a.s.l., 1♂; Zakho district, Salka, 37°06'50.8"N 42°39'05.7"E, 573 m a.s.l., 5♂3♀; Zakho district, Betas, 37°04'02.6"N 42°42'06.1"E, 675 m a.s.l., 3♂1♀; Zakho district, Khelakh, 37°07'29.5"N 42°36'44.0"E, 480 m a.s.l., 1♂; Zakho district, Shinava, 37°06'40.7"N 42°30'37.4"E, 513 m a.s.l., 1♂; Zakho district, Batifa, 37°10'53.9"N 42°59'57.3"E, 605 m a.s.l., 1♀; Sumel district, Sumel, 36°50'31.3"N 42°51'52.8"E, 446 m a.s.l., 9♂; Duhok district, Nizarke, 36°50'20.7"N 43°04'03.5"E, 659 m a.s.l., 2♂; Duhok district, Zewka kandala, 37°02'36.2"N 43°10'22.7"E, 1024 m a.s.l., 1♂.

Measurements. Total length 32.39 - 44.98 mm (average: ♂ 37.81 mm, ♀ 34.60 mm), prosoma 3.32 - 4.11 mm (average: ♂ 3.63 mm, ♀ 3.85 mm), mesosoma 9.03 - 12.07 mm (average: ♂ 10.64 mm, ♀ 10.69 mm), metasoma and telson 20.04 - 28.80 mm (average: ♂ 23.54 mm, ♀ 20.05 mm). Pectines 21-24 in males and 19-20 in females.

Comments. During the present study, twenty-eight specimens were collected, comprising 10.3% of the total sample. The collected specimens consisted of 23 males and 5 females. These scorpions were observed in plain areas characterized by sparse vegetation. The overall body coloration was yellow, with a slightly darker metasomal segment V. The pedipalp-chela fingers were elongated and lacked external accessory denticles. The pedipalp-chela movable finger presented four subterminal granules. Sexual dimorphism was evident, with males exhibiting a significantly longer metasoma compared to females.

3.2.2. Family Scorpionidae Latreille, 1802

The family Scorpionidae is an exclusively Old-World group that encompasses some of the largest extant scorpion species, reaching approximately 200 mm in length. In this study, a total of 41 specimens were identified as belonging to Scorpionidae, representing 15% of all collected specimens. These specimens were classified as a single species, *Scorpio kruglovi*. Diagnostic characteristics of the family Scorpionidae include a pentagonal sternum and a lateroapical margin of the tarsi produced into a rounded lobe (Amr & El-Oran, 1994; Polis, 1990).

3.2.2.1. *Scorpio kruglovi* Birula, 1910 (Fig. 3c)

Type material examined. Iraq, Duhok province, Zakho district, Sharanish, 37°13'53.2"N 42°50'35.8"E, 1076 m a.s.l., 4♀; Zakho district, Salka, 37°06'50.8"N 42°39'05.7"E, 573 m a.s.l., 6♂2♀; Zakho district, Dubanik, 37°02'30.2"N 42°50'19.9"E, 709 m a.s.l., 3♂1♀; Sumel district, Sumel, 36°50'31.3"N 42°51'52.8"E, 446 m a.s.l., 9♂; Duhok district, Alkishk, 37°00'53.8"N 43°11'47.0"E, 1037 m a.s.l., 1♂; Duhok district, Nizarke, 36°50'20.7"N 43°04'03.5"E, 659 m a.s.l., 1♂1♀; Duhok district, Avrike, 36°50'06.1"N 43°08'14.1"E 868 m a.s.l., 2♂1♀; Shekhan district, Atrush, 36°51'07.7"N 43°21'54.3"E, 1014 m a.s.l., 4♂1♀; Amedi district, Khanka, 37°10'34.9"N 43°20'28.9"E, 967 m a.s.l., 4♀;

Akre district, Bashqal Agha, 36°44'43.1"N 43°55'11.3"E, 711 m a.s.l., 1♂.

Measurements. Total length 50.87 - 61.24 mm (average: ♂ 53.79 mm, ♀ 61.05 mm), prosoma 7.15 - 8.58 mm (average: ♂ 7.62 mm, ♀ 8.90 mm), mesosoma 16.65 - 21.47 mm (average: ♂ 18.46 mm, ♀ 22.63 mm), metasoma and telson 26.34 - 31.48 mm (average: ♂ 27.71 mm, ♀ 29.53 mm). Pectines 10-13 in males and 9-11 in females

Comments. A total of forty-one specimens were collected during this study, accounting for 15% of the total specimens gathered. Among these, 27 were identified as male and 14 as female. Males can be readily distinguished from females by the presence of fine granules that cover the entire surface of tergites I-VI, while females exhibit a smooth and glossy appearance in this region. Additionally, males possess medially wrinkled sternites III-VI, contrasting with the smooth and shiny sternites observed in females (Abu Afifeh et al., 2024). The overall coloration of the specimens ranged from yellowish-brown to brown, with the legs consistently exhibiting a yellow hue. Notably, several specimens displayed a darker coloration in metasoma V compared to other segments.

These scorpions belong to a burrowing species, typically retreating into their burrows during daylight hours. Observations indicated that many specimens rested at the entrances of their burrows with their chelae exposed. They demonstrated a heightened sensitivity to ground vibrations, rapidly retreating into their burrows upon sensing nearby movement. This behavior suggests that a combination of methods including the use of UV flashlights, pouring water into their burrows, and shoveling proved to be more effective for capturing these scorpions. Some specimens were also successfully captured during daylight hours using similar techniques, albeit without the use of UV flashlights.

4. Discussion

Our study showed the presence of *Mesobuthus faiki* as a new record among scorpion species fauna of Duhok province and Iraq. In addition to the following species: *Androctonus* sp., *Hottentotta saulcyi*, *Orthochirus fomichevi*, *Compsobuthus matthiesseni* and *Scorpio kruglovi*. The same number of scorpion species in this study was reported from Duhok in previous investigations with few species variation (Hussen et al., 2022; Kachel et al., 2021). Previously, *H. mesopotamicus*, was identified by Lourenço and Qi (2007) in Duhok province, particularly Zakho district and also in a few previous studies in the same area (Kachel, 2020); therefore, we conclude that geographical record of this species might be a mistake. Here we were not able to investigate a few districts comprehensively because of the unstable political situation, distance from our research center and difficulties of sample collection.

The morphological characteristics and morphometric data obtained from our *M. faiki* specimens are largely consistent with the description of the *M. faiki* type specimen, which originates from the Gaziantep province in Türkiye (Yağmur et al., 2024). However, discernible differences were observed in comparison to the *M. mesopotamicus* specimen from the Mosul province (Kovářík et al., 2022) and *M. phillipsi* specimens documented in the Erbil province, adjacent to Duhok, Iraq (Hussen & Ahmed,

2020). The taxonomic classification of this genus within Iraq remains complex. Previous records from various provinces have recorded specimens to different species and subspecies level and names, suggesting a need for further taxonomic clarification via comprehensive molecular analyses (Kachel et al., 2021).

Our specimens *Androctonus* sp. has a distinctive pedipalps structure and coloration which are critical morphological characterization for accurate species identification and might be a new species for the country. *Androctonus* sp. also has the lowest abundance with limited geographical distribution and has only been reported in four districts of Duhok. The genus *Androctonus* in Iraq includes two species of significant medical importance, *Androctonus crassicauda* and the recently described *Androctonus sumericus* from Dhi Qar Province (Al-Khazali & Yağmur, 2023). In Iraq, *A. crassicauda* is widely distributed and has been recorded in twelve provinces including Duhok and is recognized for its potent venom, which poses a considerable health risk to humans

(Keegan, 1980).

The other four recorded species in the present study and previously are *H. saulcyi*, *O. fomichevi*, *C. matthiesseni*, and *S. kruglovi* (Hussen et al., 2022). The most abundant and largest species recorded in this study was *H. saulcyi*, which was recorded in six districts of Duhok Province. Likely, *S. kruglovi* were recorded from six districts followed by *O. fomichevi* and *C. matthiesseni* with four and three district records, respectively. Our data of geographical distribution (Fig. 5) of these species agree with their previous geographical distribution based on the provinces in Iraq to a certain degree (Kachel et al., 2021) with slight variation in their abundance and percentage (Hussen et al., 2022). Therefore, educating health staff and communities with necessary knowledge on the morphology and ecology of the known scorpion species and particularly on the geographical distribution of dangerous and medically important scorpion species in Duhok might lead to significant reduction in the rate of scorpion stings and mortality.

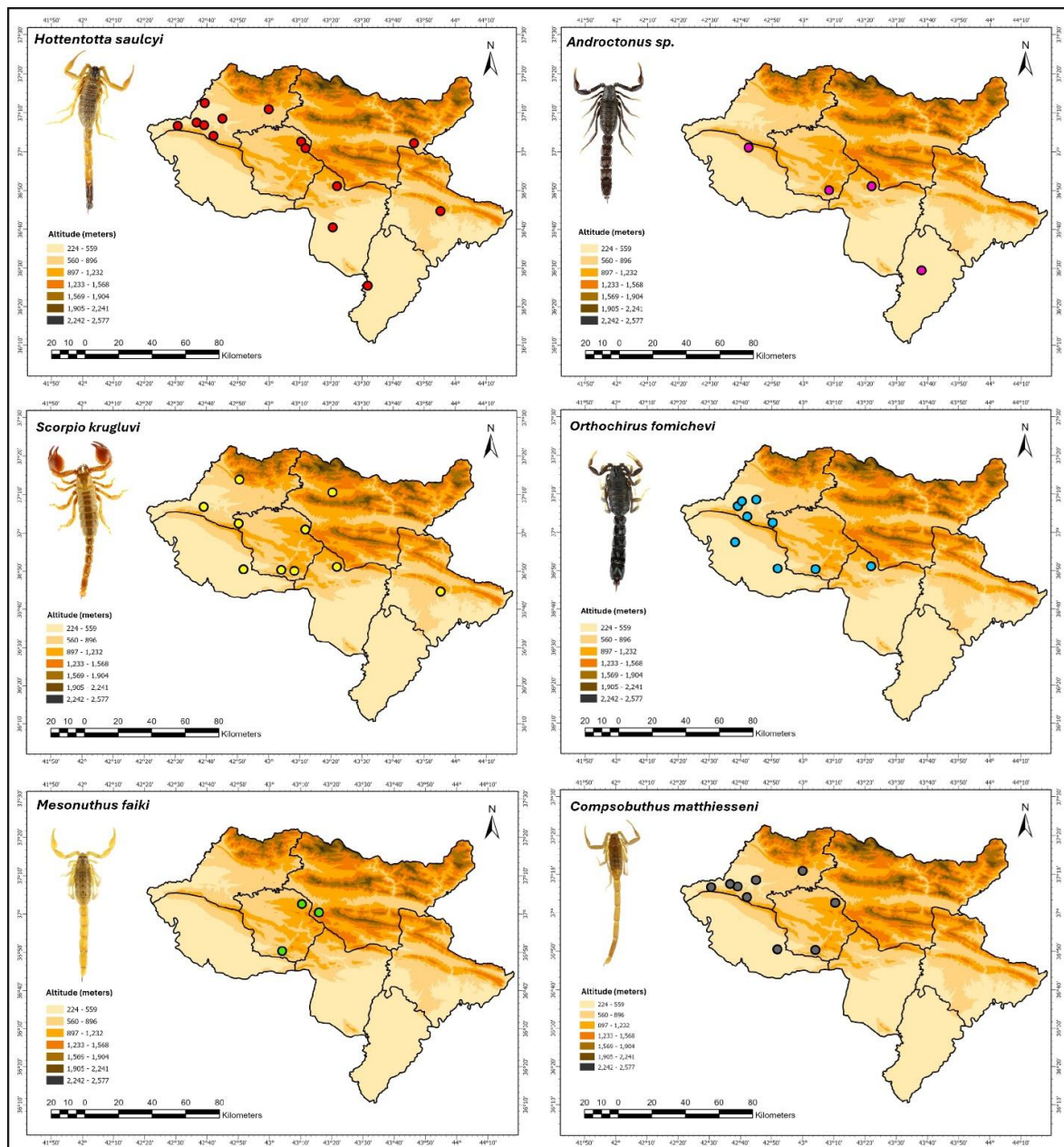


Figure 5. Show the district geographical distribution of the scorpion species of Duhok province, Iraq.

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