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## Review study of scorpion classification in Iran

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### Abstract

This is a review study about scorpions. Scorpions are the order of *Arachnida*. They have poisonous and painful stings and their habitat is in the tropical and temperate regions of the world. In Iran, scorpion sting is one of the main health concerns, affecting many persons annually, and some of them lead to death. Identification of the scorpion species in each region and knowing their ecology and biology in order to prevent and treat the victims is very important. The aim of the present study was the reevaluation of scorpion taxonomy condition in Iran. Up to now, a total of 59 species of *Scorpionidae* have been reported in Iran. More than 84% of the identified species belonged to the family of *Buthidae*, 1.5% belonged to the *Hemiscorpiidae* and about 5% of them related to the *Scorpionidae*. Identification of scorpions in Iran has been done based on the morphologic parameters. For the completion of the data on scorpions in Iran, beside the morphologic methods the cell and molecular methods are recommended.

**Keywords:** Scorpion, *Buthidae*, *Scorpionidae*, *Hemiscorpiidae*, Iran

### Introduction

The evolutionary history of scorpions goes back to the Silurian area 450 millions years ago. Due to their deadly venom, always they have been under the attention and hatred worldwide. They are night active with deadly sting used in hunting the prey and as a defensive device<sup>[1,2]</sup>. They mostly live in desert and in the non-residential areas, but if their nest is destroyed they may enter the residential areas<sup>[1,3]</sup>. Scorpions are harmful for human due to their deadly sting. Therefore, scorpions are significant from the medical point of view. They are the major cause of death attributed to the *Arthropoda*<sup>[4]</sup>. Their natural habitat is in the northern hemisphere to the geographical latitude of 52 degree and in the south to the geographical latitude of 50 degree.

Scorpion venom is one of the main health concerns in the tropical and subtropical countries like Iran, with many dead cases annually<sup>[5,6]</sup>. Based on the obtained data and the survey of the National Centers for the Non contagious Diseases, every year fifty thousand of scorpion sting in Iran, most cases in Khuzestan and Hormozgan provinces<sup>[4-7]</sup>.

For this reason, the study and classification of the scorpion have been under attention. But the classification attributed to the *arthropoda* during the last decades has been controversial. In 1980, a total number of six families attributed to the scorpion, but in 1989 Stockwell reported some subfamilies, and also introduced some genera.

Fet *et al.* (2000) reported seventeen families of scorpion<sup>[8,9]</sup>. The number of scorpion families has undergone changes from 1980 through 2005. Soleglad *et al.* (2005) reported 6 super families, 13 families, 18 subfamilies, 10 order and about 2000 species<sup>[10]</sup>. Systematic changes in the scorpion have been done worldwide. Birula (1903) and Vachon (1973) reported the scorpions of Iran in two families of *Buthidae* and *Scorpionidae*<sup>[11]</sup>. Kovarik (1997) classified the scorpions of Iran in three families of *Buthidae*, *Scorpionidae* and *Diplocentridae*<sup>[12]</sup>.

Dehghani reported the classification of scorpion in three families of *Buthidae*, *Scorpionidae* and *liocheilidae*, 18 genera, 29 species and 5 sub species. While some Iranian researchers reported the presence of the scorpions in 4 families: *Buthidae*, *Scorpionidae*, *Hemiscorpiidae* and *Diplocentridae*<sup>[13,14]</sup>. Taxonomy of scorpions in the world and likewise in Iran faces certain problems due to lack of scientific method nomenclature and classification<sup>[13]</sup>. Despite development of molecular method and biochemical tests, still the traditional morphometric methods used for the classification<sup>[13,14]</sup>.

Therefore this paper is prepared by reviewing of the relevant literatures on the scorpions in Iran.

## Results

Researchers classified the scorpions of Iran in three families of Buthidae, Scorpionidae and Hemiscorpiidae. In general, comprising of 19 genera and 59 species (ie. 51 species in Buthidae, 5 species in Hemiscorpiidae and three species in Scorpionidae). Over 84% of identified species in Iran belong to the *Buthidae*, 10.5% in the Hemiscorpiidae and 5% belong to the *Scorpionidae* (table- 1), [13, 14, 15].

Identification of scorpion is based on the morphometric methods. Still the changes in the number of the family, genus and species of scorpion in Iran is in progress, in a way that some researchers classify the scorpion of Iran in 4 families and some in three families. Considering the papers represented by the Iranian and the others researchers, all of them agree on the presence of two families of scorpion such as *Buthidae* and *Scorpionidae* in Iran.

Of course it was achieved following the different revisions on the habitat of the scorpions in the world [5, 13, 14]. New development of identification methods, particularly study in the classification of the arthropods and the high curacy and sensitivity of molecular methods in identification of the arthropods and insects could lead to the further changes in the classification of the scorpions. Based on the latest study there are three families of scorpion in Iran as follow: *Buthidae*, *Scorpionidae* and *Hemiscorpiidae*. Therefore we introduce the mentioned three families here.

### a- *Buthidae*

Buthidae is the largest family, can be found on all continents except south and north polar regions. Members of this family are particularly living in the tropical and subtropical regions, with 20 to 120 mm length and tree angles sternum. Some of the species in this family are included as the longest scorpions, while others are considered the medium length.

They have the same color of the living environment, though some of them may look gray and dark. The lateral eyes are 2 to 5 pairs; the tail length is the same as the length of abdomen and the cephalothorax.

Members of this family have more world distribution among other members of family [16]. The sting is painful followed by swelling and sense less. Pain is more felt at night.

Member of this family due to medical importance, have been under attention worldwide. Some members of this family are harmless.

Lourenco in 2001 introduced 80 genera of *Buthidae* [9] and 20 species of them are dangerous for man. This family is the largest in Iran, having 16 genera and 51 species.

Geographically, due to extensive distribution throughout Iran, particularly in the tropical and subtropical regions, some of the members of this family have deadly sting and the others have painful sting. Hence *Odontobuthus*, *Hottentata*, *Compsobuthus*, *Apistobuthus*, *Androctonus*, *Mesobuthus*, *Orthochirus* and *Olivirus* are medically significant.

Hypertension, increase of heart rate, convulsion, senseless, confusion, anxiety and restlessness are the symptoms of scorpion venom. List of the genera of this family is given in the table-1, [1, 13, 45].

### b- *Scorpionidae*

Up to the year 1998, a total of 9 genera and 133 species of this family have been introduced. Two genera and two species of this family have been extricated. Their species are living in Africa, Asia and Australia. Numbers of the largest scorpions are included in this family. For this reason, a number of this family species, like *Pandinus imperator* are

used in the domestic animal keeping industry.

It members are living in India and Sri Lanka, with 15-20 centimeters length and 32 gram weight. Members of this family have five- angled sternum wide and very strong pedipalp.

These scorpions prefer wet lands and the warm plains, but some species like, scorpion live in the dryer habitat. Major species of this family are harmless.

After many revision the subfamily of Hemiscorpiidae replaced to family. After the last revisions, by Solglad and Fet (2003) the number of the genera increased to 14 and the species to 208.

All genera of the family Diplosentroidae replaced to the family and sub family. At present, this family consists of 17 genera and 259 species [16]. These scorpions with the subaculear spine are distinguished from scorpion. The scorpions in the subfamily of *Diplocenridae* have worldwide distribution. The scorpions in the Nebo genus included in sub family, are living in North America, Mexico, the United State of America (Texas, New Mexico, Arizona); the Central America (Costa Rica, El Salvador, Goat mala, Honduras, Nicaragua), South America (Colombia, Venezuela, Caribbean Islands), Asia (Iran, Jordan, Lebenan, Oman, Saudi Arabia, Syria and Yeman) and Africa (Egypt).

They are not medically significant. Some reports indicate of Nebo sting from Middle East. In Iran in addition to genus Scorpio, presence of the genus Nebo has been reported in the Kerman province [13, 17, 31].

Only one genus and one species of this family have been reported in Iran, which are harmless [14]. They have five-angled sternum and wide pedipalp. The habitat is wet lands and warm plains. Though some members of this family live in the dry plain [16].

The only identified species of their scorpion is *Scorpio maurus* and species of the Nebo [14, 31, 32, 39].

### c- *Hemiscorpiidae*

This family was known as Ischnuridae, previously. But in 2003 based on the international code of zoological nomenclature (ICZN), it renamed as *Liochelidae* [16]. Soleglad *et al.* (2005) named this family *Hemiscorpiidae* and the genus *Heteroscorpion* [4] included to this family [46]. In the same year, Lourenco and Monod (2005) introduced the genus *Habibella*, *Hemiscorpius* and *Synonym*.

Now, this family consists of 12 genera and 87 species. They have much similarity to the *Scorpionidae* family, hence previously they were known as a family. These insects have worldwide distribution except North America regions. They also live in the tropical and some parts of subtropical regions. Some of them have long tails and some with wide body. This morphology is due to the living in the burrow sand cracks. Previous reports indicate the presence of species of this family in Africa (Somalia and Erythra); Asia (Iran, Iraq, Oman, Pakistan, Saudi Arabia, Samha Islands, Sumatra Ilands, United Arab Emirate and Yaman). The *Hemiscorpius lepturus* is harmful and is present in Iran [31]. Due to much similarity of this family to the *Scorpionidae*, they were placed in one family previously.

Species of this family have five- angled sternum, with the tropical and subtropical distribution. Due to environmental compromise, they have different morphological changes. Some of them with long tail and some with wide body to enter the burrows [35].

In Iran one genera and 6 species have been identified, as follow [14, 17, 27, 33, 34, 37]:

**Table 1:** Frequency of scorpions in Iran based on the family, genus and species [6, 8, 9, 10, 12-17, 36-43]

Family	Number genus	Percentage genus	Number species	Percentage species
Buthidae	16	84.25	51	86.5
Hemiscorpiidae	1	5.25	5	8.5
Scorpionidae	2	10.5	3	5
Total	19	100	59	100

**List of the Scorpions family, genus and species reported in Iran****A: Family Buthidae (C. L. Koch, 1837)**Genus: *Androctonus* (Ehrenberg, 1828)

1. *Androctonus crassicauda* (Olivier, 1807)
2. *Androctonus baluchicus* (Lournco 2005)

Genus: *Apistobuthus* (Finnegan, 1932)

3. *Apistobuthus pterygocercus* (Finnegan, 1932)
4. *Apistobuthus susanae* (Lourenço, 1998)

Genus: *Buthacus* (Birula, 1908)

5. *Buthacus leptochelys* (Hemprich & Ehrenberg, 1829)
6. *Buthacus macrocentrus* (Ehrenberg, 1828)
7. *Buthacus tadmorensis* (Simon, 1829)

Genus: *Compsobuthus* (Vachon, 1949)

8. *Compsobuthus garyi* (Lourenço et Vachon, 2001)
9. *Compsobuthus jakesi* (Kovařík, 2003)
10. *Compsobuthus kafkai* (Kovařík, 2003)
11. *Compsobuthus kaftani* (Kovařík, 2003)
12. *Compsobuthus matthiesseni* (Birula, 1905);
13. *Compsobuthus persicus* sp. n. (Navidpour et al, 2008)
14. *Compsobuthus petrioli* (Vignoli, 2005)
15. *Compsobuthus plutenkoi* (Kovařík, 2003)
16. *Compsobuthus acutecarinatus* (Simon, 1882)
17. *Compsobuthus rugosulus* (Pocock, 1900)
18. *Compsobuthus sobotniki* (Kovařík, 2003)

Genus: *Hottentotta* (Birula, 1908)

19. *Hottentotta alticola* (Pocock, 1895)
20. *Hottentotta jayakari* (Pocock, 1895)
21. *Hottentotta khoozestanus* sp. n. (Navidpour et al, 2008)
22. *Hottentotta lorestanus* sp. n (Navidpour et al, 2010)
23. *Hottentotta sauleyi* (Simon, 1880)
24. *Hottentotta chach* (Birula, 1905)
25. *Hottentotta zagrosensis* Kovařík,

Genus: *Iranobuthus* (Kovařík, 1997)

26. *Iranobuthus krali* (Kovařík, 1997)

Genus: *Kraepelinia* (Vachon, 1974)

27. *Kraepelinia palpator* (Birula, 1903)

Genus: *Liobuthus* (Birula, 1898)

28. *Liobuthus kessleri* (Birula, 1898)

Genus: *Mesobuthus* (Vachon, 1950)

29. *Mesobuthus eupeus* (C. L. Koch, 1839)
30. *Mesobuthus macmahoni* (Navidpour et al 2011)
31. *Mesobuthus phillipsii* (mirhashemi et al 2011)
32. *Mesobuthus vesiculatus* (Pocock, 1899)
33. *Mesobuthus zarudnyi* (Birula, 1900)
34. *Olivierus caucasicus* (Nordmann, 1840) or *Mesobuthus caucasicus*

Genus: *Odontobuthus* (Vachon, 1950)

35. *Odontobuthus bidentatus* (Lourenço et Pézier, 2002)
36. *Odontobuthus doriae* (Thorell, 1876)
37. *Odontobuthus odonturus* (Pocock, 1897)

Genus: *Orthochirus* (Karsch, 1891)

38. *Orthochirus farzanpayi* (Vachon et Farzanpay, 1987)
39. *Orthochirus fuscipes* (Pocock, 1900)
40. *Orthochirus gruberi* (Kovařík et Fet, 2006)
41. *Orthochirus iranus* (Kovařík, 2004)
42. *Orthochirus scrobiculosus* (Birula, 1900)
43. *Orthochirus stockwelli* (Lourenço et Vachon, 1995) comb. n.;
44. *Orthochirus varius* (Kovařík, 2004)
45. *Orthochirus zagrosensis* (Kovařík, 2004)

Genus: *Polisius* (Fet et al., 2001)

46. *Polisius persicus* (Fet, Capes et Sissom, 2001)

Genus: *Razianus* (Farzanpay, 1987)

47. *Razianus zarudnyi* (Birula, 1903)

Genus: *Sassanidotus* (Farzanpay, 1987)

48. *Sassanidotus gracilis* (Birula, 1900)
49. *Sassanidotus zarudnyi* (Birula, 1903)

Genus: *Simonoides*

50. *Simonoides farzanpay*

Genus: *Vachoniolus* (Levy et al., 1973)

51. *Vachoniolus iranus* sp. n. (Navidpour et al., 2008)

**B: Family Scorpionidae (Latreille, 1802):**Genus: *Scorpio* (Linnaeus, 1758)

52. *Scorpio maurus townsendi* (Pocock, 1900)

Genus: *Nebo* (Simon, 1878)

53. *Nebo henjamicus* (Franck, 1980)
54. *Nebo* sp. (Dehghani Kerman)

**C: Family Hemiscorpiidae Pocock, 1893**Genus: *Hemiscorpius* (Peters, 1861)

55. *Hemiscorpius acanthocercus* (Monod et Lourenço, 2005)
56. *Hemiscorpius enischnochela* (Monod et Lourenço, 2005)
57. *Hemiscorpius gaillardi* (Vachon, 1974)
58. *Hemiscorpius lepturus* (Peters, 1862)
59. *Hemiscorpius persicus* (Birula, 1903)

**Discussion**

The three identified families of scorpions were *Buthidae* with 86.5%, *Hemiscorpiidae* 8.5% and *Scorpionidae* 5% frequency (table-1). Review of the literatures about the presence of scorpions in Iran indicates that taxonomy has undergone changes and likely to more changes will occur. Considering the use of new methods of identification in taxonomy, it is expected that these changes be continued. In future, changes in the genus of the family is probable. One of the major reasons of instability of the classification is particularly denoted to the species structural changes in different geographical regions. This problem could be solved by the molecular and genetic methods that could help in the taxonomy of the scorpions. Referring to the latest study about the scorpions in Iran, it was found that there are three families of *Buthidae*, *Scorpionidae* and *Hemiscorpiidae*, with

19 genera and 59 species. The latest changes are as follow: the genus *Paraorthochirus* included in the *Orthochirus* and the genus *Habibi ala* in the *Hemiscorpius*.

*Olivierus caucasicus* is the same name of *Mesobuthus caucasicus* and *Androctonus amoreuxi* renamed to *baluchicus*. The subspecies of *Mesobuthus macmahoni* and *Mesobuthus phillipsi* improved to the species.

An unknown species in the genus *Nebo* have been identified in the Jiroft region of Kerman province in Iran [6, 8, 9, 10, 12, 17, 36, 43]. *Androctonus crassicauda* and *Hemiscorpius lepturus* in the family *Buthidae* and *Hemiscorpidae* respectively are the most deadly scorpions. Which are the main medically significant scorpions in Iran too, that causes the death in many individuals living in the west and south west of Iran [47, 49]. Three species of *scorpionidae* in Iran are less important medically. *Nebo henjamicus* from the *Scorpionidae* have been reported by Franke (1980) in the Hengam Iland in the Persian Gulf [45], for the first time. The *Nebo* genus for the first time has been hunted in the flat areas of Kerman province, Iran, [17]. The south and the west south regions of Iran are the habitats of different species of scorpions [17, 22, 37, 38].

### Conclusion

Present study indicates that most of the diversity and frequency of the species is attributed to the south and west south regions of Iran. In order to completion of the data of the presence of the scorpions in Iran, the molecular methods of identification are needed. It seems that using the new methods of identification with the high accuracy and sensitivity and changes in the genus and species level are probable. Also, it demands future study that covers the whole country regions. It is found that the presence of scorpion declines from the South West of Iran to the North East and North West.

### Disclosure

The authors declare no conflict of interest.

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