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Article Review

A review study on *Hottentotta* Birula, 1908, (Scorpionida:Buthidae) species collected from Iran

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ABSTRACT

Hottentotta is one of the most widely distributed genera of the family Buthidae, with species present throughout Africa, the Arabian Peninsula, and in Asia to Pakistan and India. Recently**,** Kovarik (2007) revised genus of *Hottentotta* in the world and reported 29 different species-group name in the genus of *Hottentotta*. *Hottentotta* is one of the six medical important scorpions of Iran that distributed in almost all parts of country. So, in this article morphological and morphometrical characters of six species of *Hottentotta* for better distinguishing have been described.

Keywords: Scorpiones, Buthidae, *Hottentotta spp.*, Morphology, Morphometry

INTRODUCTION

The work of Vachon on the taxonomy of North African scorpions with its focus on the family Buthidae, which started in the 1940s, led to a subdivision into about 10 genera of what was until then the genus *Buthus* Leach. One of these genera proposed by Vachon (1949) was *Buthotus*. This comprised the majority of species in the old subgenus *Hottentotta* Birula, 1908 (Vachon & Stockmann 1968). However, Kraepelin (1891) was the first to distinguish a *hottentotta* species-group within the genus *Buthus*. Most of the species within it were allied to *Buthus hottentotta* (Fabricius). Subsequently, Birula(1908) created the subgenus *Hottentotta*, but without explaining his motive. Vachon (1949) disregarded both *Hottentotta* Birula and *Dasyscorpio* Pallary, and established a new name, *Buthotus*. *Hottentotta* is, however, a valid senior synonym for *Buthotus* and was re-established by Fracke (1985). Other valid subgenera in addition to the nominotypical *Hottentotta*are *Balfourianus*which was described by Vachon (1979) to include the species *Hottentotta socotrensis* (Pocock),which is endemic to the Island of Socotra, and *Deccanobuthus*, described byLorenco (2000) for the species *Hottentotta* (*Deccanobuthus*) *geffardi* from India.The precise composition of the genus *Hottentotta* remains undecided. Vachon & Stockmann (1968) and Vachon & Kinzelbach (1987) suggested that the African, Saharo-Sindian and Indian lineages might be

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different. In fact, several species thought to belong to the Indian lineage are currently placed in the genus *Mesobuthus* Vachon, 1950 but, according to Fet & Lowe (2000), their status remains uncertain. Recently, this genus was revised by Kovarik (2007). The most extensive work, dealing with African species, was published by Vachon & Stockmann (1968). Pocock published a series of papers on the Asian species between 1889 and 1903, and Tikader & Bastawade (1983) concentrated on the Indian species, which however due to lack of comparisons with taxa from other regions they transferred to the genus *Mesobuthus* and did not even compare them with species today assigned to *Mesobuthus*. Some of the large-sized species of *Hottentotta* of the Middle East were first described from different parts of Iran and other countries like Iraq, Turkey, Afghanistan and Pakistan (Yagmur 2008, Lourenco 2007, Kovarik 2007, Akabari *et al* 1997, Farzanpay 1988). *Hottentotta* is one of the six medical important scorpions of Iran that distributed in almost all parts of country. So, in this article morphological and morphometrical characters of *Hottentotta* species for better distinguishing have been described.

Hottentotta Birula, 1908

Description. Dorsal trichobothria of femur arranged in beta-configuration with d2 situated on dorsal surface. Trichobothrium d3 of patella situated dorsal of dorso-median carina. Trichobothrium db on the fixed finger of pedipalp usually located between est and et, or may be on level with trichobothrium est, rarely between est and esb. Trichobothrium eb clearly on fixed finger of pedipalp. Pectines with fulcra. Dentate margin of pedipalp-chela movable finger with distinct granules divided into 11–16 rows and 5–7 terminal granules. Cheliceral fixed finger with two ventral accessory denticles. Tergites I–VI of mesosoma bear three carinae. Carapace with distinct carinae, entire dorsal surface nearly planate. Third and fourth legs with well developed tibial spurs, first and second tarsomeres with paired ventral setae. First sternite with two granulated lateral stridulatory areas, which however may be reduced in some species (e. g. in *H. pachyurus* and *H. trilineatus*). Ventrolateral carinae of fifth metasomal segment with all granules more or less equal in size and never lobate. Total length 30–130 mm.

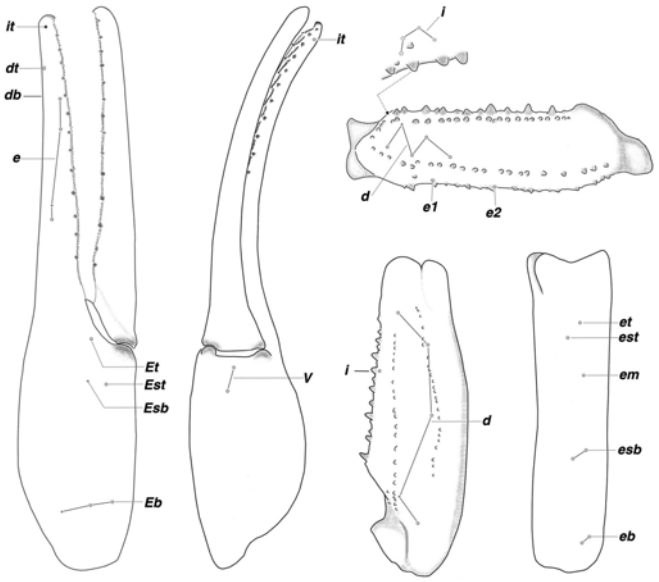

Figure 1. Trichobothrial pattern (notation according to Vachon, 1974) (*Hottentotta lorestanus*).

List of species in the genus *Hottentotta* Birula, 1908 of Iran

Hottentotta jayakari (Pocock 1895)
Hottentotta saulcyi (Simon 1880)
Hottentotta schach (Birula 1905)
Hottentotta zagrosensis (Kovařík 1997)
Hottentotta khoozestanus (Navidpour *et al* 2008)
Hottentotta lorestanus (Navidpour *et al* 2010)
Hottentotta jayakari (Pocock 1895)

Hottentotta jayakari (Figure 2)

Buthus jayakari Pocock, 1895: 300; Kraepelin, 1899: 19; Kraepelin, 1901: 267. Buthus (Hottentotta) jayakari: Birula, 1914: 654; Birula, 1917: 214.
Buthus (Buthus) jayakeri: Roewer, 1943: 206.
Buthotus jayakari: Vachon, 1949: 147 (1952: 233); Vachon, 1958: 134; Vachon, 1966: 210; Vachon & Stockmann, 1968: 91; Pérez Minocci, 1974: 21; Vachon 1977, 210; Farzanpay 1988: 37; Al-Safadi 1992: 97; El-Hennawy 1992: 116.

Hottentotta jayakari: Sissom, 1994: 36; Kovařík, 1997a: 49.
Hottentotta (Hottentotta) jayakari: Kovařík, 1998: 110; Fet & Lowe, 2000: 140.
Buthotus jayakari jayakari: Vachon, 1980: 255.
Hottentotta (Hottentotta) jayakari jayakari: Fet & Lowe, 2000: 140.
Hottentotta jayakari jayakari: Hendrixson, 2006: 78.
Description. Total length 65–90 mm Trichobothrium *db* on the fixed finger of pedipalp situated between trichobothria *et* and *est*. Chelicerae yellow to brown, reticulate. Sexual dimorphism not readily apparent; width of pedipalp chela and metasomal segments same in both sexes, males have fingers of pedipalps somewhat more twisted then females. Pectinal teeth number 37–42 in males, 32–35 in females. Pedipalps densely hirsute, metasoma sparsely hirsute. Carapace, mesosoma, patella and chela of pedipalps, fourth and fifth metasomal segments and telson yellowish brown to black. Anterior part of carapace with black spot. Mesosomal segments often with a median longitudinal yellowish-brown stripe. Femur of pedipalps, legs, and first and second metasomal segments yellow to yellowish green. Femur of pedipalp with 5 carinae, patella with 8 carinae, chela lacks carinae. Movable fingers of pedipalps with 14–15 rows of granules and 5 or 6 terminal granules. Seventh metasomal segment with 4 well marked ventral carinae. First metasomal segment with 10 carinae; second segment with 8 carinae and lateral median short row of granules; third and fourth segments with 8 carinae; fifth segment with 5 carinae, 3 ventral (1 median, 2 lateral) and 2 dorsal. All metasomal carinae granulated. Dorsal carinae of metasomal segments bear larger terminal granules. Dorsal surface smooth, fifth metasomal segment bears 2 short, inconspicuous carinae. First metasomal segment of adults usually longer than wide or as long as wide, second metasomal segment always longer than wide. Second to fourth metasomal segment width ratio less than 1.1.
DISTRIBUTION: United Arab Emirates (Hendrixson, 2006: 79), Oman (Pocock, 1895: 302), Saudi Arabia (Hendrixson, 2006: 79), and Yemen (Al-Safadi, 1992: 97). Record for Iran (Werner, 1929: 243; Farzanpay, 1988: 37) and India (Kraepelin, 1901: 267).
In Iran**:** Hormozgan province(Farzanpay, 1988)

Figure2. *Hottentotta jayakari*

Hottentotta saulcyi (Simon 1880) (Figure 3)
Buthus saulcyi Simon 1880a: 378; Simon 1880b: 29; Kraepelin 1899: 18; Kraepelin 1901: 267; Weidner 1959: 99.
Buthus (Hottentotta) saulcyi: Birula 1905: 136; Birula 1917: 214; Birula 1918: 30; Vachon 1940b: 255.
Buthotus saulcyi: Vachon 1949: 147 (1952: 233); Vachon 1958: 134; Pringle 1960: 79; Khalaf 1962: 2; Khalaf 1963: 64; Vachon 1966: 210; Vachon & Stockmann 1968: 91; Habibi 1971: 43; Pérez Minocci 1974: 21; Farzanpay 1988: 37; El- Hennawy 1992: 118; Kovařík 1992: 90; Kovařík 1992: 183; Dupré Lambert & Gérard 1998: 70.
Hottentotta saulcyi: Kovařík 1997a: 40; Crucitti & Vignoli 2002: 446; Vignoli Kovařík & Crucitti 2003: 4; Karatas 2003: 315.
Hottentotta (Hottentotta) saulcyi: Kovařík 1998: 110; Fet & Lowe 2000: 143.
Buthus hottentotta: Kraepelin 1891: 185 (in part).
Description. Total length 75–120 mm, males usually smaller than females. Trichobothrium *db* on the fixed finger of pedipalp situated between trichobothria *et* and *est*. Male with slightly longer and narrower metasomal segments, width of pedipalp chela same in both sexes. Pectinal teeth number 28–36 in males, 24–29 in

females. Nearly entire body hirsute, pedipalps, dorsal surface of mesosoma, legs, lateral and ventral surfaces of metasomal segments, and vesicle densely hirsute. The hairs on patella of pedipalps are long. Chelicerae black, reticulate. Color yellow to yellowish green or brown, except black anterior part of carapace, telson and fifth metasomal segment. Ventral carinae on third and fourth metasomal segments may be also black. Femur of pedipalp with 5 carinae. Patella with 4–8 carinae. Chela lacks carinae. Movable fingers of pedipalps with 14–16 rows of granules and 5 or 6 terminal granules. Seventh metasomal segment with 4 well marked ventral carinae. First metasomal segment with 10 carinae; second and third segments with 8 or 10 carinae; fourth segment with 6–10 carinae; fifth segment with 5 carinae, 3 ventral (1 median, 2 lateral) and 2 dorsal. Carinae of metasomal segments often smooth. All metasomal segments smooth, without granules between carinae. First and second metasomal segments of both sexes longer than wide. Second to fourth metasomal segment width ratio less than 1.2.

DISTRIBUTION: Afghanistan (Kovařík 1997a: 40), Iraq (Simon, 1880a: 379), Iran (Vachon 1966: 210), and Turkey (Crucitti & Vignoli 2002: 446). Record for Syria (Kinzelbach 1985, El-Hennawy 1992: 118) must be considered dubious.

In Iran: from Koozestan, Lorestan, Chahrmahal & Bakhtiyari, Kohgiluyeh & Boyreahmad, Bushehr, Fars and Ilam provinces (Navidpour *et al* 2008a, 2008b, 2008c, 2008d, 2010, Pirali-Kheirabadi *et al* 2009).

Figure 3. *Hottentotta saulcyi*

Hottentotta schach (Birula 1905) (figure 4)

Buthus schach, Birula, 1905:134.

Buthotus schach: Vachon, 1949: 147 (1952: 233); Vachon, 1958: 134; Vachon

Stockmann, 1968: 91; Habibi, 1971: 43; Pérez Minocci, 1974: 20; Farzanpay, 1988: 37; El-Hennawy, 1992: 118. ottentotta schach: Farzanpay & Pretzmann, 1974: 215; Kovařík, 1997a: 40.

Hottentotta (Hottentotta) schach: Kovařík, 1998: 110; Fet & Lowe, 2000: 143.

Description. Total length 100–130 mm. Trichobothrium *db* on the fixed finger of pedipalp situated between trichobothria *et* and *est* Male with slightly longer and narrower metasomal and pedipalp segments, width of pedipalp chela same in both sexes. Pectinal teeth number 33–35 in males, 26–29 in females. Nearly entire body hirsute, pedipalps, dorsal surface of mesosoma, legs, lateral and ventral surfaces of metasomal segments, and vesicle densely hirsute. The hairs on patella of pedipalps are long. Color yellowish green except black patella and chela of pedipalps, anterior part of carapace, telson and fourth and fifth metasomal segments. Ventral surfaces of second and third metasomal segments may be also black. Chelicerae black, reticulate. Femur of pedipalp with 5 carinae. Patella with 8 carinae. Chela lacks carinae. Movable fingers of pedipalps with 15 or 16 rows of granules and 5 or 6 terminal granules. Seventh metasomal segment with 4 well marked ventral carinae. First metasomal segment with 10 carinae; second segment with 8 or 10 carinae; third segment with 8 carinae and a short row of granules in center of lateral part; fourth segment with 8 carinae; fifth segment with 5 carinae, 3 ventral (1 median, 2 lateral) and 2 dorsal. Dorsal surface smooth, fifth metasomal segment bears 2 short, inconspicuous carinae. First and second metasomal segments of both sexes longer than wide. Second to fourth metasomal segment width ratio less than 1.2.

DISTRIBUTION: Iraq (Vachon 196 6: 211), Iran (Birula 1905: 134).

In Iran: Koozestan and Fars provinces (Kovarik 2007, Navidpour *et al* 2008, Navidpour *et al* 2012).

Figure 4.*Hottentotta schach*

Hottentotta zagrosensis Kovařík 1997(Figure 5)

Hottentotta zagrosensis Kovařík 1997a: 41; Kovařík 1998: 111; Fet & Lowe 2000: 144.

Description. Male holotype 102 mm long, female allotype 103 mm long. Trichobothrium *db* on the fixed finger of pedipalp located between trichobothria *et* and *est*. Male with slightly longer and narrower metasomal segments, width of pedipalp chela same in both sexes. Pectinal teeth number 34–36 in males, 27–33 in females. Nearly entire body hirsute, pedipalps, dorsal surface of mesosoma, legs, lateral and ventral surfaces of metasomal segments, and vesicle densely hirsute. The hairs on patella of pedipalps are long. Color black except reddish brown chela of pedipalps; sometimes ends of first and second tarsomeres yellow, coxa and trochanter on ventral side of mesosoma marbled, and pectens yellowish brown . Femur of pedipalps with 5 carinae and a row of granules in middle part of internal surface. Ventral surfaces of femur and patella smooth to glossy. Patella with 8 carinae. Chela lacks carinae. Movable fingers of pedipalps with 16 rows of granules and 5 terminal granules. Seventh metasomal segment with 4 well marked ventral carinae. First and second metasomal segments with 10 carinae; third segment with 8 or 10 carinae; fourth segment with 8 carinae; fifth segment with 5 carinae, 3 ventral (1 median, 2 lateral) and 2 dorsal, smooth and sometimes indistinct. Dorsal surface smooth and glossy, fifth segment bears 2 short, inconspicuous carinae. First metasomal segment of female may be wider than long, in male is always longer than wide. Second metasomal segment always longer than wide. Second to fourth metasomal segment width ratio less than 1.1.

DISTRIBUTION: Iran (Kovařík, 1997a: 41), Koozestan, Chahrmahal&Bakhtiyari, Kohgiluyeh & Boyreahmad and Fars provinces.(Navidpour *at al*,2008a, 2008d, 2012, Pirali-Kheirabadi *et al* 2009**.**

Figure5. *Hottentotta zagrosensis*

Hottentotta khoozestanus Navidpour et al. 2008 (Figure 6)

Descrioption. Total length of female holotype 119.5 mm.Trichobothrium *db* on fixed finger of pedipalp situated between trichobothria *et* and *est* or dt and et. Chelicerae reticulate. Pectinal teeth number 28–30. Pedipalps and metasoma bear only a few hairs. Color yellowish green except black spot on anterior part of carapace. Femur of pedipalp with 3 carinae, patella with 8 carinae (some of them weakly indicated), chela lacks carinae. Movable fingers of pedipalps with 16 rows of granules and 4 or 5 terminal granules. Seventh mesosomal sternite smooth, with 4 smooth carinae. First and second metasomal segments with 10 carinae; third and fourth segments with 8 carinae and fifth segment with 5 carinae, 3 ventral (1 median, 2 lateral) and 2 dorsal. Dorsal carinae of metasomal segments bear terminal granules of size approximately equal to preceding granules. Dorsal surface smooth, fifth metasomal segment with 2 short, inconspicuous carinae. Ventral carinae on first to fourth metasomal segments smooth, without granules. All metasomal segments longer than wide.

The described features distinguish *H. khoozestanus* from all other species of the genus. They are recounted in the key below. Together with *H. saulcyi* (Simon 1880) and *H. schach* (Birula 1905), the new species is among the largest in the genus. The last species hitherto described from Iran is *H. zagrosensis* Kovařík, 1997. *H. khoozestanus* can be easily distinguished from the above named three species on two characters: (1) Hairless pedipalps and metasoma, which in the other three species are densely hirsute. And (2) coloration; whereas *H. khoozestanus* has the fifth metasomal segment and telson yellow, in the other three species those parts are black (*H. zagrosensis* is entirely black).

Figure 6. *Hottentotta khoozestanus*

Hottentotta lorestanus Navidpour et al 2010 (Figure7)

Description. Total length of female holotype 112.5 mm. Trichobothrium db on fixed finger of pedipalp situated between trichobothria *et* and *dt*, close to or on level with *et*. Chelicerae black, reticulate. Pectinal teeth number 28 and 29. Nearly entire body hirsute, pedipalps, dorsal surface of meso-soma, legs, lateral and ventral surfaces of metasomal segments, and vesicle densely hirsute. Color greenish grey except black anterior part of carapace, telson and part of fifth metasomal segments. Pedipalps and legs are yellow. Femur of pedipalp with 3 carinae, patella with 8 carinae (some of them weakly indicated), chela lacks carinae. Movable fingers of pedipalps with 16 MD rows, and fixed fingers, with 13 MD rows. Mesosomal sternite VII smooth, with 4 smooth carinae. Metasomal segments I to III with 10 carinae; segment IV with 8 carinae and segment V with 5 carinae, 3 ventral (1 median, 2 lateral) and 2 dorsal. Dorsal carinae of metasomal segments bear terminal granules of size approximately equal to pre-ceding granules. Dorsal surface smooth. All metasomal segments longer than wide. The described features distinguish *H. lorestanus* from all other species of the genus. They are recounted in the key below. Together with *H. khoozestanus* Navidpour et al., 2008, *H. saulcyi* (Simon, 1880), and *H. schach* (Birula 1905), the new species is among the largest in the genus. *H. lorestanus* can be easily distinguished from *H. khoozestanus* Navidpour et al., 2008 by its nearly entire body being hirsute. *H. lorestanus* can be easily distinguished from the other above named three species by coloration; whereas only *H. lorestanus* has pedipalps entirely yellow (*H. zagrosensis* has pedipalps entirely black, and *H. schach* has a black chela of pedipalps) and metasomal segments I to IV are greenish gray (in *H. saulcyi*, these segments are yellow).

Figure 7. *Hottentotta lorestanus*

Based on the above described specifications provided for *Hottentotta* species the key for identification is summarized as below.

Key to the species of the genus *Hottentotta* (Birula 1908) occurring in Iran

1. Color black except reddish brown chela of pedipal, legs may also be reddish brown …..…….....2

-Color not entirely black 3

2. Pedipalps entirely black, movable fingers of pedipalps with 16 cutting edges, ventral surfaces of metasomal segments and vesicle densely hirsute. .....*H. zagrosensis*.

- Pedipalps entirely yellow, fingers of pedipalps with 16 cutting edges, ventral surfaces of metasomal segments and vesicle densely hirsute. …….. *H. lorestanus*

3. Chela of pedipalp always darker than femur of pedipalp 4

- Chela of pedipalp of same color as femur of pedipalp, not darker 5

4. Ventral surfaces of metasomal segments and vesicle densely hirsute……*H. schach*

- metasomal segments and vesicle not hirsute……..*H. jayakari*

5. Male has markedly broader manus than female, fifth metasomal segment and telson yellow, ventral surfaces of metasomal segments and vesicle not hirsute……*H. khoozestanus*

-Width of manus of pedipalp same in sexes, fifth metasomal segment and telson black, ventral surfaces of metasomal segments and vesicle densely hirsute…….....*H. saulcyi*

Conclusion

Unique ecological condition of Iran is very important factor in existence of various species of scorpions in different regions of this country. Previously, research workers reported three species of *Hottentotta* in Iran (Farzanpey, 1988 ; Akbari, 1997) . Kovarik in 2007 reported *H.zagrosensis* for the first time in Iran. However further studies by Navidpour et.al.(2008,2009) distinguished two new species from Khoozetan province (*H.khoozestanus*) and Lorestan province (*H.lorestanus*). Although *Hottentotta* species are morphologically and color wise sufficiently distinct from each other and their distributions rarely overlap, however the confusion exist between the species of *Hottentotta* internally and with *Mesobuthus.* Hence this review by providing a key can help the scientist to distinguish this genus from other genera in Iran.

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