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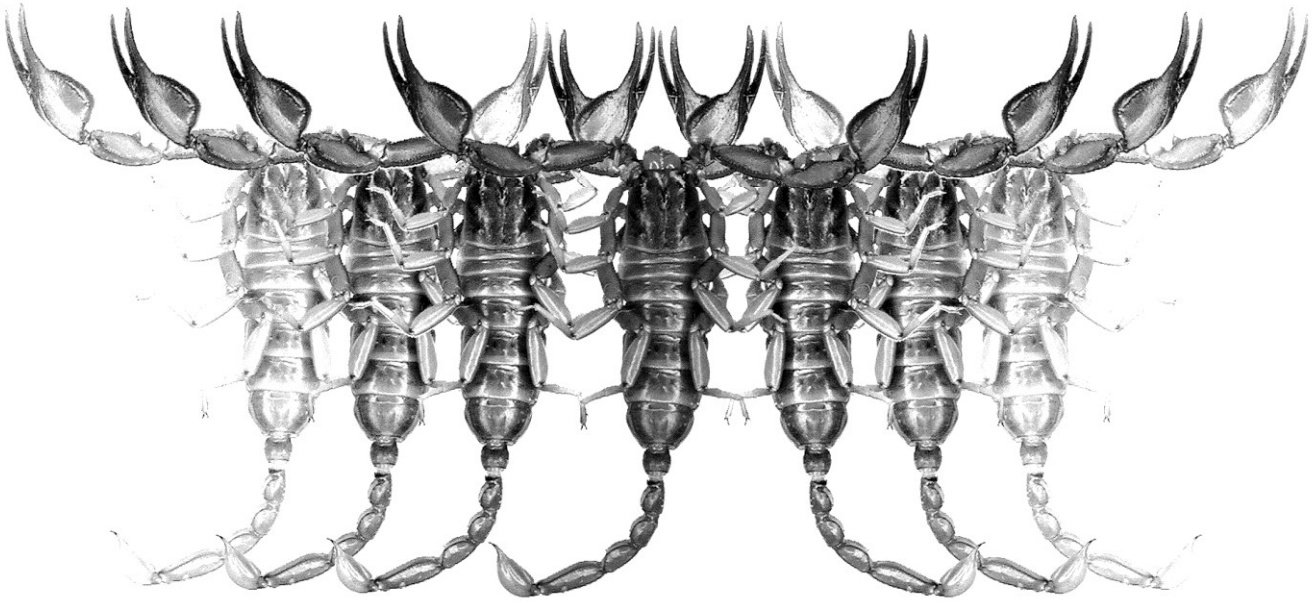

A New Species of *Hottentotta* Birula, 1908 (Scorpiones: Buthidae) from Southern Morocco

Carlos Turiel

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A new species of *Hottentotta* Birula, 1908 (Scorpiones: Buthidae) from southern Morocco

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Summary

A new scorpion species, *Hottentotta sousai* **sp. n.** is described based on two males and two females collected around Tan-Tan, in southern Morocco. Sousa et al. (2011) reported four distinct clades within the genus *Hottentotta* from Morocco. This description of a new species is based on the specimens from the Low Draa Valley clade, which is closely related to *Hottentotta gentili* (Pallary, 1924). The new species, however, differs from the central clade of *H. gentili* by 12.1% divergence in COI mitochondrial DNA sequence, and is morphologically characterized primarily by very dense setation over all body parts and a lower length to width ratio of all metasomal segments.

Introduction

After the extensive revision of the genus *Hottentotta* by Kovařík (2007), *Hottentotta franzwerneri* (Birula, 1914) was redefined, and its former subspecies *H. franzwerneri gentili* (Pallary, 1924) was elevated to species rank. A few years later, a phylogenetic study based on DNA sequence data confirmed this decision. Sousa et al. (2011) were the first to study of the genus *Hottentotta* from Morocco using cytochrome oxidase subunit I (COI) mitochondrial DNA marker to assess phylogenetic relationships. This study revealed possible cryptic species and showed four well-supported clades of Moroccan *Hottentotta*: the central clade, the Ziz Valley clade, the Low Draa Valley clade, and *H. franzwerneri* clade, thus confirming the status of *Hottentotta gentili*. Two more clades were identified by Sousa et al. (2011); their relationship with other clades is remote enough to justify separate species status for these two populations. The Low Draa Valley clade is the most genetically divergent according to COI data, with a distance of 12.1 % between the Low Draa Valley clade and the central clade. This suggests that this clade may merit species status. The current description of a new species from the Low Draa Valley presents existing morphological differences between this clade and the central clade of *H. gentili.*

Material & Methods

Specimens were studied, photographed with Nikon Coolpix S8100, Nikon D800, AF-S VR Micro-Nikkor 105mm f/2.8G IF-ED, ring flash Metz 15 MS 1 and under NOVEX AP8 microscope. Digital images were slightly processed using Capture NX 2 and ACDSee Pro 3. Measurements (in mm) were taken with Electronic Digital Caliper DMV-SL05. The specimens were fixed in 70% ethanol and deposited in the collection of the Centro de Investigação em Biodiversidade e Recursos Genéticos (CIBIO), Portugal**.** Trichobothrial notations follow Vachon (1974), and morphological terminology mostly follows Stahnke (1970) and Hjelle (1990). Fig. 1 is a purchased royalty-free image by fotolia.com.

Abbreviations

CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, Portugal.

NHMW, Naturhistorisches Museum Wien, Vienna, Austria.

RTOC, Rolando Teruel personal collection, Santiago de Cuba, Cuba.

Systematics

Hottentotta sousai Turiel, **sp. n.**
(Figs. 1–3, 6–13, 17, Tables 1–3)
http://zoobank.org/urn:lsid:zoobank.org:act:C76DAF62-C628-4AB5-BED1-1663874C964A

TYPE MATERIAL: *Holotype* ♂, **Morocco**: *Tan-Tan Province*, Tan-Tan, 2011 (CIBIO Sc136). *Paratypes*: Tan-Tan, 2013, 1 ♀ (CIBIO Sc2389); 6 km ESE of Elk-

Figure 1: Type locality of *H. sousai* **sp.n.** (green star).

halona, on R101 heading S from Tan-Tan, 28.028° N 11.357° W, 2011, 1 ♀ im. (CIBIO Sc137); Tan-Tan, 2011, 1 ♂ (CIBIO Sc138); right margin of Oued Draa Valley, 2 km W of the intersection with road N1 heading N from Tan-Tan, 28.544° N 10.957°E, 2011, 1 ♀ (CIBIO Sc142). All types leg. P. Coelho.

DISTRIBUTION: Only known from the type locality (Fig. 1).

ETYMOLOGY: The specific epithet honors Pedro Sousa, the first author of the work (Sousa et al., 2011) on the genetic diversity of Maghrebian *Hottentotta*, which first pointed at the existence of the new species described herein.

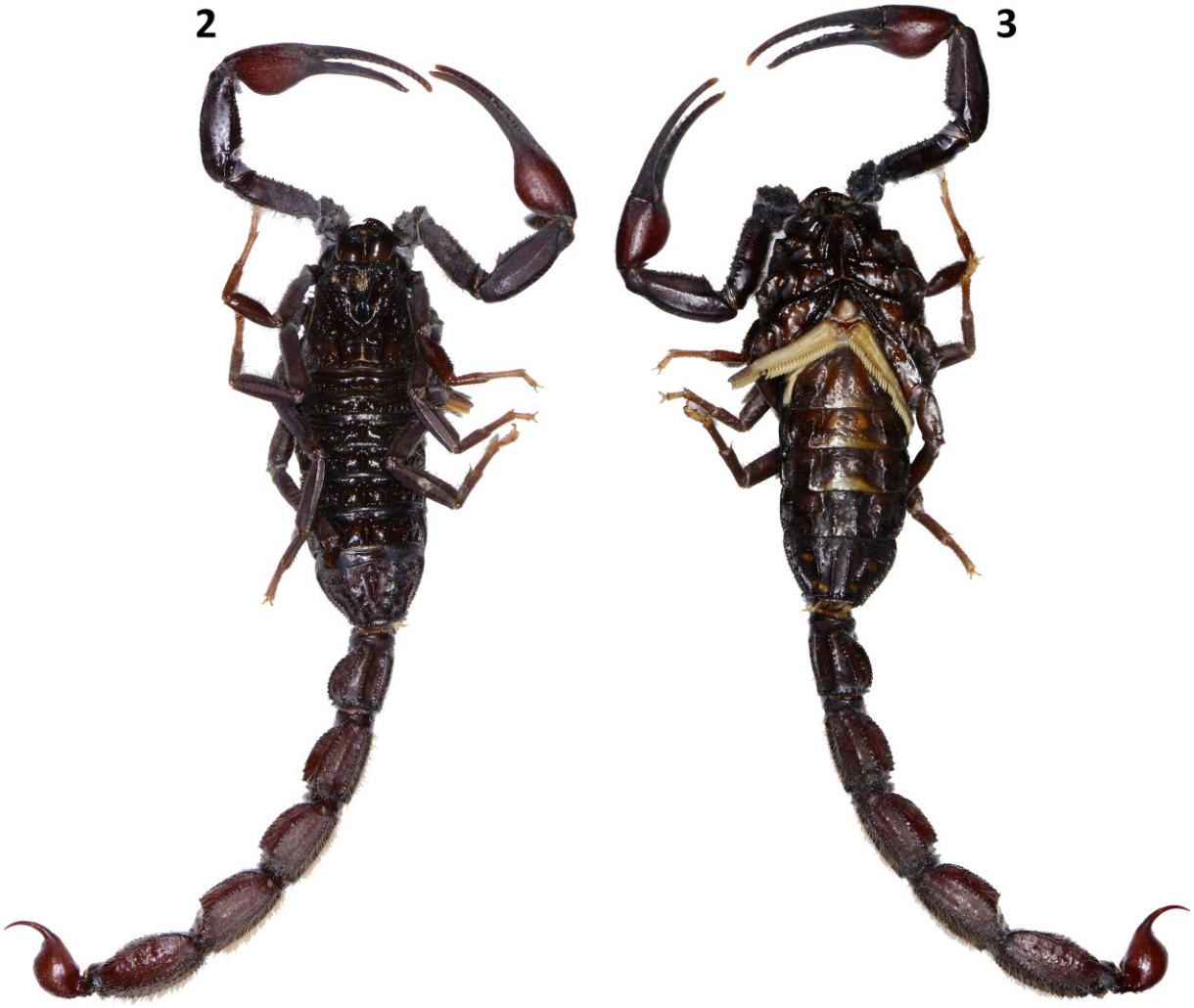
DIAGNOSIS: Total length 73–85 mm. Basic coloration dark brown except reddish brown chela of pedipalps. Pedipalps, mesosoma and metasoma reddish dark, brown to black. Carapace and tergites markedly granulated with strong carinae, lacking lyre-shaped configuration. Movable fingers of pedipalps with 14 rows of granules. Surfaces of femur and patella smooth and densely covered with long setation. Sexual dimorphism: a basal lobe/notch combination on the movable finger in males. Metasoma narrow, very densely hirsute, with 10-8-8-8-5 carinae. Metasomal segment V lacks lobes and

		***H. sousai* sp.n.** ♂	***H. sousai* sp.n.** ♂	***H. gentili*** ♂	***H. franzwerneri*** ♂
		Holotype Sc136	**Paratype** Sc138	**Quarzazate**	**Figuig**
Carapace	L/Wp	9.8 / 10.3	8.4 / 9	10 / 10.3	9.3 / 10.1
Pedipalp	L	37	33.5	40.2	40.2
Chela	L	18.1	16.1	19.2	19.4
Manus	W	4.2	3.6	3.8	4.1
Movable finger	L	12.1	10.7	12.4	13.2
Patella	L/W	10.2 / 3.7	9.3 / 3.3	11 / 3.7	10.9 / 3.5
Femur	L/W	8.7 / 2.7	8.1 / 2.5	10 / 2.9	9.9 / 2.8
Metasoma	L	49.4	46.1	55	54.2
Segment I	L/W/D	6.2 / 6.1 / 4.9	5.8 / 5.3 / 4.3	6.7 / 5 .8 / 4.7	6.7 / 5.8 / 4.6
Segment II	L/W/D	7.4 / 5.9 / 4.8	6.9 / 5 / 4.3	8.1 / 5.3 / 4.5	8.1 / 5.3 / 4.4
Segment III	L/W/D	8 / 5.7 / 4.9	7.2 / 5 / 4.3	8.5 / 5.1 / 4.6	8.8 / 5.2 / 4.6
Segment IV	L/W/D	9 / 5.5 / 5.1	8.2 / 4.9 / 4.4	10 / 4.4 / 4.8	10.3 / 5 / 4.7
Segment V	L/W/D	10.2 / 5.2 /5.1	9.5 / 4.6 / 4.5	12 / 4.8 / 4.8	11 / 4.8 / 4.9
Telson	L	8.6	8.5	9.7	9.3
Vesicle	L/W	5.1 / 3.9	5.1 / 3.8	5.3 / 4.1	5.2 / 4.3
Aculeus	L	3.5	3.4	4.4	4.1
Total length	L	84.7	77.8	78.2	91.2

Table 1: Measurements in mm (L = length, W = width, Wp = posterior width, D = depth).

		***H. sousai* sp.n.** ♀	***H. sousai* sp.n** ♀	***H. gentili*** ♀	***H. gentili*** ♀
		Paratype Sc142	**Paratype** Sc2389	**Tiguezmert**	**Quarzazate**
Carapace	L/Wp	9.2 / 10	8.6 / 9.5	10 / 10.9	9.8 / 10.8
Pedipalp	L	33.4	33.6	39	36.9
Chela	L	16.4	16.3	19.2	17.9
Manus	W	3.4	3.2	4.2	3.4
Movable finger	L	11.4	11.2	13	12.1
Patella	L/W	9.1 / 3.7	9.1 / 3.5	10.4 / 4	9.9 / 3.7
Femur	L/W	8.4 / 2.7	8.2 / 2.6	9.4 / 3.1	9.1 / 2.8
Metasoma	L	44,4	44.1	50.4	48.8
Segment I	L/W/D	5.4 / 5.5 / 4.4	5.4 / 5.3 / 4.3	6.4 / 5.9 /4.7	6 / 5.7 / 4.6
Segment II	L/W/D	6.4 / 5.1 / 4.4	6.3 / 4.9 / 4.3	7.4 / 5.2 / 4.5	7.3 / 5.1 / 4.4
Segment III	L/W/D	6.8 / 4.8 / 4.5	6.8 / 4.6 / 4.3	7.9 / 4.9 / 4.5	7.5 / 4.8 / 4.3
Segment IV	L/W/D	7.9 / 4.4 / 4.5	7.7 / 4.3 / 4.4	9 / 4.7 / 4.6	8.9 / 4.5 / 4.5
Segment V	L/W/D	9.3 / 4.2 / 4.5	9.3 / 4.1 / 4.3	10.4 / 4.5 /4.7	10 / 4.4 / 4.4
Telson	L	8.7	8.6	9.3	9.1
Vesicle	L/W	5.1 / 3.9	4.8 / 3.6	5.4 / 4.3	5.2 / 3.8
Aculeus	L	3.6	3.8	3.9	3.9
Total length	L	77.9	73.6	90	83.3

Table 2: Measurements in mm (L = length, W = width, Wp = posterior width, D = depth)

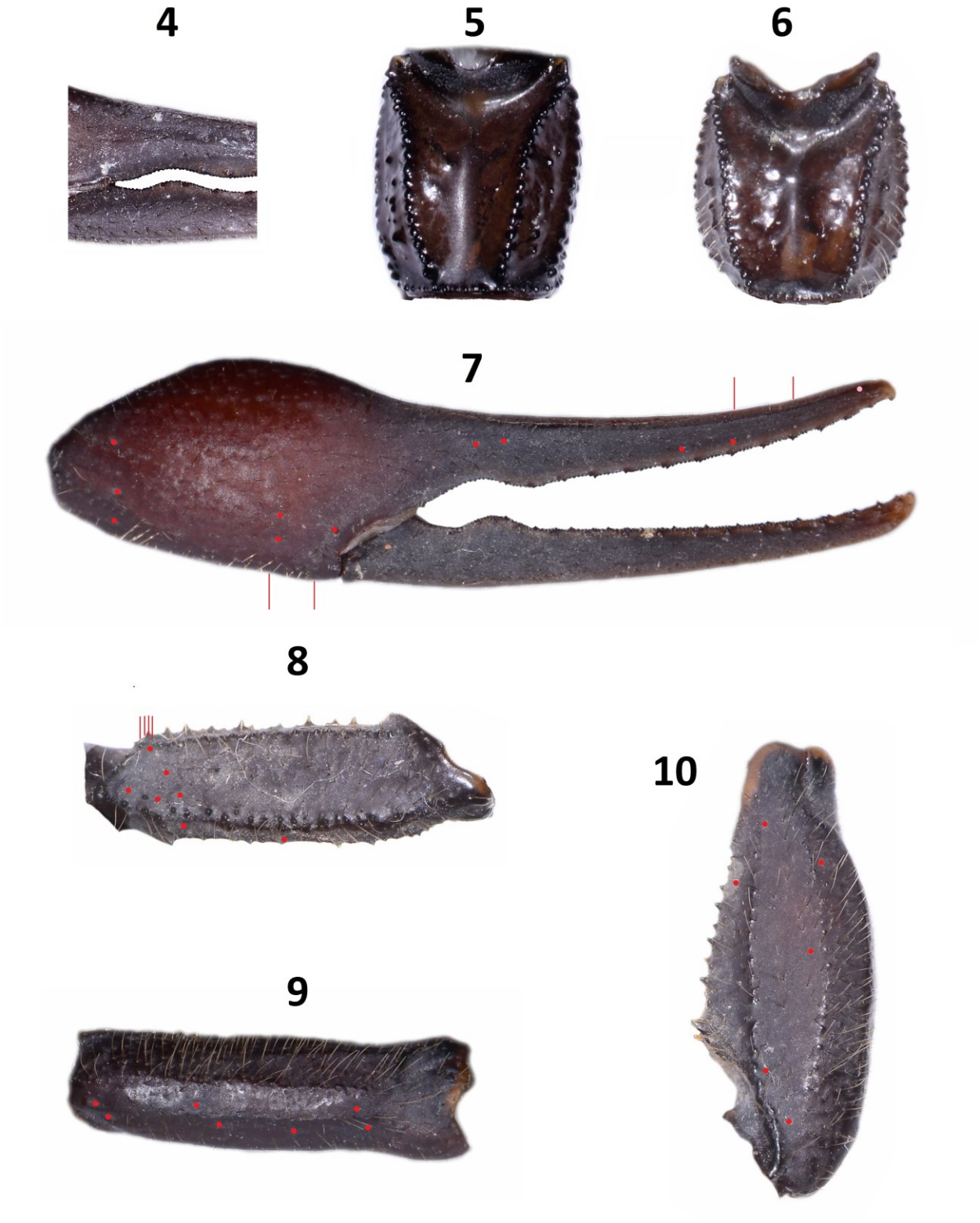


Figures 2–3: 2. *H. sousai* **sp.n.**, dorsal and **3.** ventral view, holotype male.

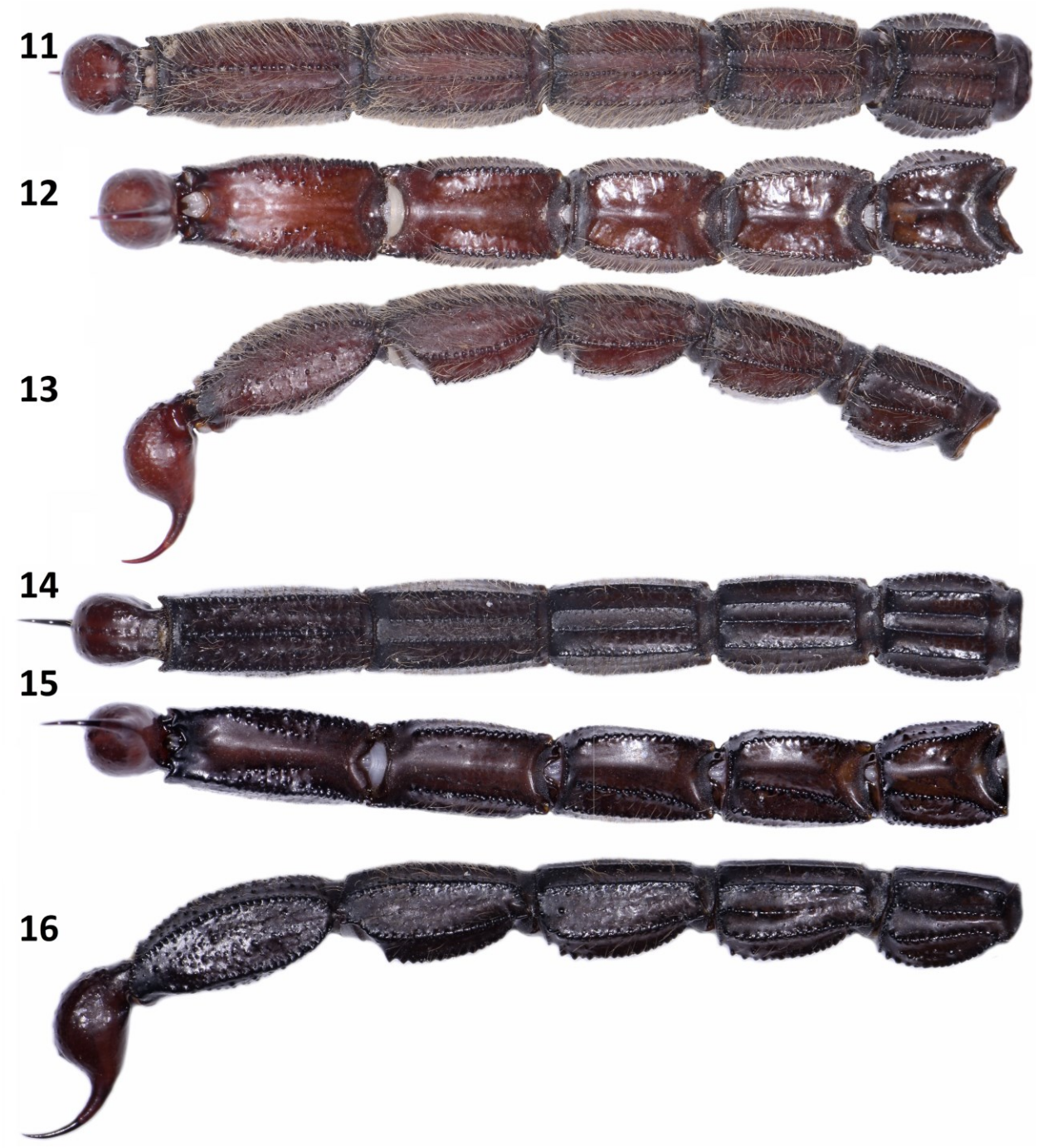
	H. sousai **sp.n.** ♂	*H. gentili* ♂	*H. franzwerneri* ♂
	(***n*** **= 2)**	**(** ***n*** **= 8)**	**(** ***n*** **= 1)**
Metasoma			
Segment I	1-1.1	1.1-1.2	1.2
Segment II	1.3-1.4	1.4-1.5	1.5
Segment III	1.4	1.6-1.7	1.7
Segment IV	1.6-1.7	1.9-2.1	2.1
Segment V	2-2.1	2.2-2-5	2.3

Table 3: Length/width (L/W) ratios of the metasomal segments.

spines on the ventrolateral carinae, all granules of the ventrolateral carinae on the same level. Dorsal surface of metasoma smooth, segment V bears two short, inconspicuous carinae. All metasomal segments of both sexes longer than wide. Metasomal segment V length to width ratio 1.6–1.7 in males. Entire body hirsute, pedipalps,



Figures 4–10: *H. gentili* male; **4.** *H. gentili*, base of the fingers; **5.** metasomal segment I, dorsal aspect. *H. sousai* **sp.n.**, holotype male; **6.** metasomal segment I, dorsal aspect; **7–10.** Trichobothrial pattern of the right pedipalp; **7.** Chela, external aspect; **8.** Femur, dorsal aspect; **9–10.** Patella, external and dorsal aspects.



Figures 11–16: Metasoma ventral, dorsal and lateral aspect. **11-13.** *H. sousai* **sp.n.**, holotype male; **14-16.** *H.gentili* male.

legs, lateral and ventral surfaces of metasomal segments usually densely hirsute in both sexes. Vesicle sparsely hirsute. Pectinal teeth number 34–36 in males, 30–31 in females.

DESCRIPTION (based on male holotype):

Coloration: Basic coloration dark brown except reddish brown chelae of pedipalp. Chelicerae reticulate.

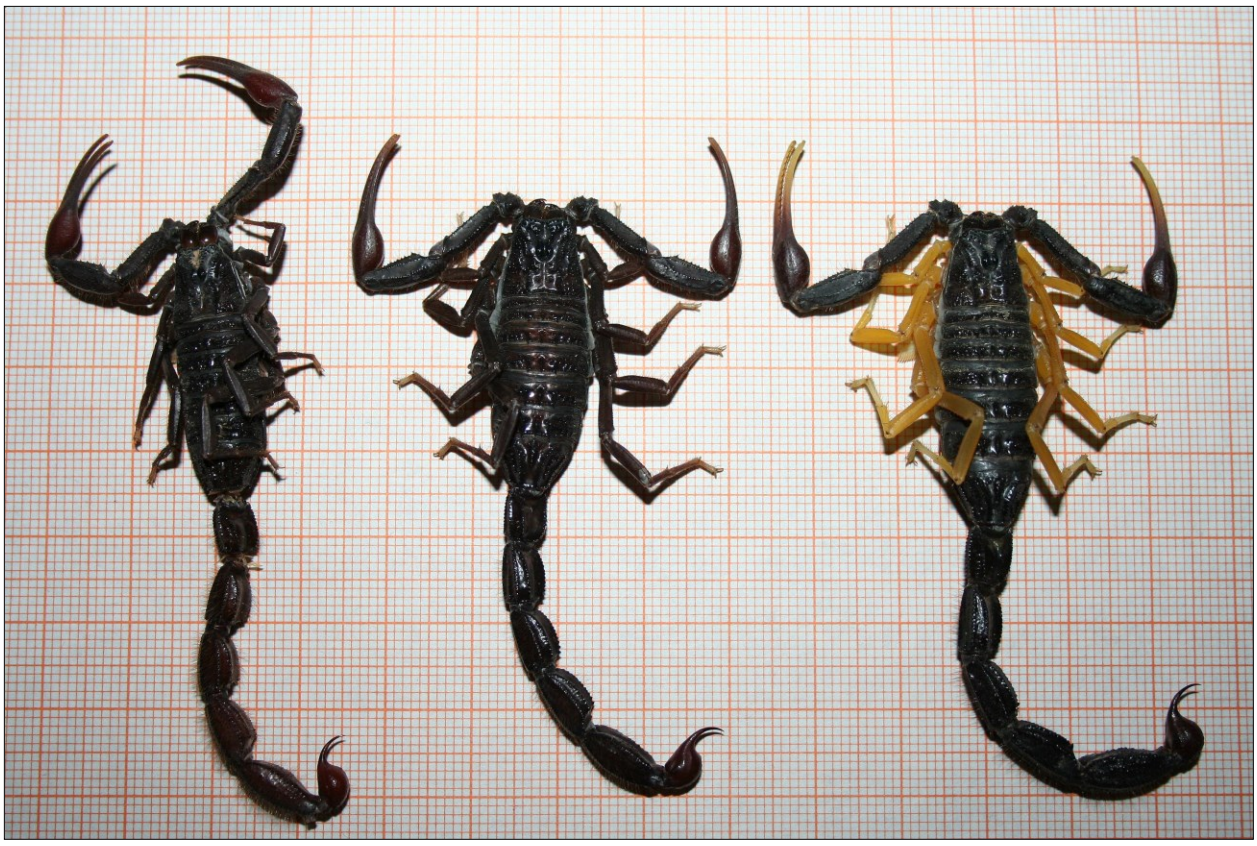


Figure 17: *H. sousai* **sp.n.**, paratype male; *H. gentili*, male; *H. franzwerneri*, male (from left to right).

Vesicle reddish brown with darkening aculeus.

Carapace: Central ocular, lateral ocular, central lateral, central median and posterior median carinae of carapace are strongly marked and covered by some marked granules, sparsely hirsute, most hairs along the anterior margin.

Mesosoma & Tergites: All tergites markedly granulated and with three strong carinae. Almost all hairs along the posterior margin of the tergites, except the tergite VII; tergite VII with five carinae, one axial and in each case two proximal connected lateral carinae. Sternites finely granulated and sparsely hirsute; sternite V with two medial and two lateral carinae. Pectinal teeth number 34.

Pedipalps: Chela externally with short macrosetation, movable finger with 14 rows of denticles and five terminal denticles. Trichobothrium *db* on fixed finger situated at the level of *et*. Conspicuous basal lobe/notch combination. Patella with eight carinae and covered densely with numerous setae; L/W ratio of 2.8. Femur with five carinae, internal carinae irregular scattered and covered densely with numerous setae with a L/W ratio of 3.2; manus slightly wider than patella in males; trichobothrial pattern orthobothriotaxic of type A-ß (beta).

Metasoma & Telson: All metasomal segments of both sexes longer than wide and densely hirsute. Metasomal segment I with ten well-marked regular carinae, intercarinal tegument sparsely granulated except between the dorsal and dorsolateral area covered with two to three conspicuous granules. Metasomal segment II with eight well-marked regular carinae with incomplete lateral carinae reduced by four to five granules, intercarinal tegument sparsely granulated. Metasomal segment III with eight well-marked regular carinae, intercarinal tegument sparsely granulated; lateral carinae reduced to one granule; L/W ratio 1.4. Metasomal segment IV with eight well marked regular carinae, inter-carinal tegument sparsely granulated, L/W ratio 1.6. Metasomal segment V with eight well marked regular carinae, intercarinal tegument moderately granulated; dorsal furrow of metasoma smooth, only IV and V segments bear two inconspicuous carinae. Telson sparsely hirsute with some granules and becoming distally weaker.

Legs: smooth except external surface of femur, covered with some finely granulation and with well-marked carinae. Dorsal surface of patella smooth with well-marked carinae but without granules, internal surface with some scattered spines with macrosetae. Tibia

and tarsus covered with macrosetae and ventrally with spiniform setae. Prolateral and retrolateral spurs presenting in all legs. Tibial spurs presenting in legs three and four. Tarsus ventrally with two rows of 6–7 spiniform setae each.

Ecological Notes

Throughout the year, there is virtually no rainfall in the Tan-Tan region. About 95 mm of precipitation fall annually. The driest month is August. Most precipitation falls in winter, with an average of 30 mm in December. The average annual temperature is 20.4 °C. The warmest month is August with an average temperature of 24.2°C. In January, the average temperature is 16.1 °C, the lowest average temperature of the year. The difference in precipitation is 30 mm between the wettest and the driest months. The average temperatures vary during the year by 8.1 °C (http://de.climate-data.com).

The new species could have been isolated during the past 192,000 years. Castañeda et al. (2009) reported three wet periods within this time. In this fertile age of the Sahara, there was a continuous stream presented in the Oued Draa River, which formed a natural barrier (Osborne et al., 2008) and may have separated the Low Draa clade from the central clade (*sensu* Sousa et al., 2011). Our specimen localities, however, show that this barrier is now overcome (see localities of Sc142 & Sc143) and more extensive distribution northwards could be possible.

Unfortunately, I have no satisfying habitat information. Judging from similar tarsal armature, *H. sousai* **sp.n.** could be semi-lithophilic as its allopatric sister species *H. gentili*, which is found in rocky habitats, bark of palm trees, palm gardens, oases, and along river beds (Arabic: Oueds) with dense palm tree vegetation (personal observation in September 2013).

Affinities and Key

H. sousai **sp. n.** is similar to *H. gentili*, with which it shares most combinations of characters, but can be distinguished from all other Maghreb *Hottentotta,* by a conspicuous basal lobe/notch combination in males; stronger setation in nearly all body parts, especially patella and femur of pedipalps; and lower length to wide ratio of the fourth metasomal segment in males. Furthermore, I want to note a difference in the intercarinal tegument between the dorsal and dorsolateral carinae of the first metasomal segment, which is covered with one to four granules, whereas all samples of *H. gentili* bear four to twelve granules and are not always arranged in parallel fashion. However, I am not sure if this feature represents a constant difference; this could be a random variation.

Diagnosis of *H. gentili* was published by Kovařík & Ojanguren Affilastro (2013: 164) who also presented a key of all *Hottentotta* species. In #4 of their key to African *Hottentotta* on page 160 there is a printing error that should be, according to F. Kovařík (pers. comm.), corrected as follows:

4. Legs yellow. .....***H. franzwerneri*** (Birula, 1914)
− Legs black or reddish brown…….
……..***H. gentili*** (Pallary, 1924)

With inclusion of *H. sousai* **sp. n.**, this key to African *Hottentotta* changes as follows:

4. Legs yellow. ……..... ***H. franzwerneri*** (Birula, 1914)
− Legs black or reddish brown. ……..... 4a.

4a. Pedipalp lobe/notch combination in males moderately expressed. Length/width ratio of metasomal segment IV >1.8. Dorsal surface of the patella and femur of the pedipalps and metasoma moderately hirsute ……. ……..……...***H. gentili*** (Pallary, 1924)
- Pedipalp lobe/notch combination in males strongly expressed. Length/width ratio of metasomal segment IV <1.8. Dorsal surface of the patella and femur of the pedipalps and metasoma very densely hirsute …….. ……..……..…… ***H. sousai*** Turiel, **sp. n.**

Comparative Material Studied

Hottentotta franzwerneri (Birula, 1914): **Morocco**, Figuig, 32.104° N, 1.225° W, 1 ♂, 1 ♀ im. (RTOC).

Hottentotta gentili (Pallary, 1924): **Morocco**, near Quarzazate, leg. G. Molisani, 2 ♂, 1 ♀ im. (NHMW); near Quarzazate, leg. G. Molisani, 2 ♀ (RTOC); road N9 between Quarzazate and Agdz, 30.842° N, 6.873° W, leg. C. Weber, 2 ♂, 1 ♀ im. (RTOC); Tiguezmert, 29.712° N, 7.972° W, leg. M. Stockmann, 1 ♀ (RTOC); Agadir, 30.428° N, 9.613° W, leg. M. Stockmann, 1 ♂, 1 ♂ im. (RTOC); unknown locality, leg. L. Georg, 3 ♂ (NHMW).

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