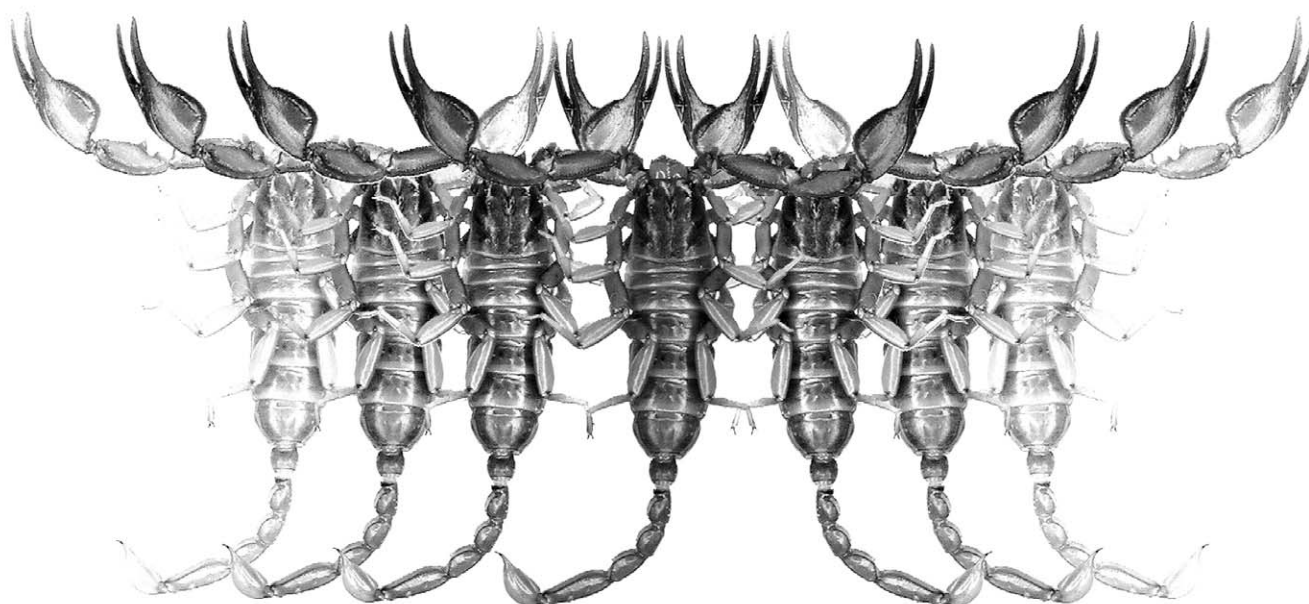


Euscorpius

Occasional Publications in Scorpiology



**Review of Northwestern African *Buthacus*, with Description
of *Buthacus stockmanni* sp. n. from Morocco and
Western Sahara (Scorpiones, Buthidae)**

František Kovařík, Graeme Lowe & František Štáhlavský

December 2016 — No. 236

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Publication date: 12 December 2016

<http://www.zoobank.org/urn:lsid:zoobank.org:pub:43AA8CDF-9C04-40E8-BE69-BDE1E436DA18>

Review of Northwestern African *Buthacus*, with description of *Buthacus stockmanni* sp. n. from Morocco and Western Sahara (Scorpiones, Buthidae)

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<http://www.zoobank.org/urn:lsid:zoobank.org:pub:43AA8CDF-9C04-40E8-BE69-BDE1E436DA18>

Summary

Northwestern African *Buthacus* species are revised. *Buthacus stockmanni* sp. n. from Morocco and Western Sahara is described and fully complemented with color photos of live and preserved specimens, as well as their habitat. The hemispermatophore of *B. stockmanni* sp. n. is illustrated and described. In addition to morphology and hemispermatophores, we also describe the karyotypes of *B. stockmanni* sp. n. ($2n=20$). *B. stockmanni* sp. n. is compared with *B. occidentalis* Vachon, 1953 and *B. ziegleri* Lourenço, 2000. Both these species are differentiated from *B. stockmanni* sp. n. geographically and morphologically. The male of *B. stockmanni* sp. n. has fingers of pedipalp chela strongly twisted proximally and males of the other two species have fingers straight or almost straight. *Buthacus huberi* Lourenço, 2001 is synonymized with *Buthacus occidentalis* Vachon, 1953; *Buthacus mahraoui* Lourenço, 2004 and *Buthacus leptochelys algerianus* Lourenço, 2006 are synonymized with *Buthacus ziegleri* Lourenço, 2000.

Introduction

The first species of the genus *Buthacus* were described by Ehrenberg in Hemprich & Ehrenberg (1828, 1829) as *Androctonus (Leiurus) leptochelys* Ehrenberg, 1829, *Androctonus (Leiurus) thebanus* Ehrenberg, 1828, and *Androctonus (Leiurus) macrocentrus* Ehrenberg, 1828. Kraepelin (1891: 60) regarded all of them as a single species, which he called *Buthus leptochelys*. Birula (1908: 139) originally described *Buthacus* as a subgenus of *Buthus*, with the type species *Buthus (Buthacus) leptochelys*.

Kovařík (2005: 3) designated lectotypes for *Androctonus (Leiurus) leptochelys* Ehrenberg, 1829, *Androctonus (Leiurus) thebanus* Ehrenberg, 1828, and *Androctonus (Leiurus) macrocentrus* Ehrenberg, 1828. In previous papers, the latter two species have been regarded as synonyms of *Buthacus leptochelys*, however its type series is composed of seven specimens that in reality belong to three species. The type series of *Androctonus leptochelys* includes specimens belonging to *Buthacus leptochelys* and *Buthacus spatzi* (Birula, 1911), and the type series of *Androctonus macrocentrus* includes specimens belonging to *Buthacus leptochelys*

and *Buthacus tadmorensis* (Simon, 1892). In order to preserve stability, Kovařík (2005: 3) designated as the lectotype of *A. leptochelys* a specimen that does not cause changes in the taxonomic position of *Buthacus leptochelys* and its complex. Upon designation of the lectotype of *A. macrocentrus*, it became a valid species *Buthacus macrocentrus* (Ehrenberg, 1828) with the junior synonyms *Buthus tadmorensis* Simon, 1892, *Buthus pietschmanni* Penther, 1912, and *Buthacus yotvatensis* Levy, Amitai et Shulov, 1973.

Lourenço (2006) did not agree with Kovařík (2005) and without any explanation incorrectly claimed that *Buthacus tadmorensis* (Simon, 1892) is a valid species. Along with several coauthors, he continued to describe other species without defining the diagnostic characters for the genus *Buthacus* (Lourenço & Qi, 2007; Lourenço & Leguin, 2009; Zambre & Lourenço, 2010). The generic taxonomic position of these recently described species is unclear.

Kovařík et al (2013) established the genus *Gint* Kovařík et al, 2013, which exhibits some similarities to *Buthacus*, transferred *Buthus calviceps* Pocock, 1900 to the new genus, and defined the basic characters for the genus *Buthacus*.

Methods, Material & Abbreviations

Nomenclature and measurements follow Stahnke (1971), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974). Hemispermatophore terminology follows Kovařík et al. (2016).

Specimen Depositories: BMNH (The Natural History Museum, London, United Kingdom); FKCP (František Kovařík, private collection, Prague, Czech Republic); MNHN (Muséum National d'Histoire Naturelle, Paris, France); SMTD (Staatliches Museum für Tierkunde, Dresden, Germany); ZMUH (Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany). *Morphometrics*: D, depth; L, length; W, width.

Systematics

Family Buthidae C. L. Koch, 1837

Buthacus Birula, 1908
(Figs. 1–63, Table 1)

Buthus (*Buthacus*) Birula, 1908: 139–140.

Buthacus: Simon, 1910: 74 (in part); Fet & Lowe, 2000: 81–86 (in part, complete reference list until 2000); Kovařík, 2005: 1–10, figs. 1–8 (in part); Kovařík, 2009: 30; Kovařík et al., 2013: 1–4, fig. 5.

TYPE SPECIES. *Androctonus* (*Leiurus*) *leptochelys* Ehrenberg, 1829.

DIAGNOSIS. Total length 40–90 mm (except *B. villiersi* Vachon, 1949 and *B. clevai* Lourenço, 2001); carapace trapezoidal, in lateral view preocular area not distinctly inclined towards anterior margin, level with or higher than postocular area; surface of carapace conspicuously granular, with only anterior median carinae developed, anterior part of carapace glossy; ventral aspect of cheliceral fixed finger with two denticles; tergites with three carinae of which lateral pair on I and II inconspicuous; pectines with fulcra, hirsute; hemispermatophore flagelliform, capsule with 4 lobes, lobes separated from flagellum, basal lobe small, knob-like; sternum subtriangular; metasomal segments I–III with 8–10 carinae; metasoma II as wide as other metasomal segments; metasoma V with enlarged "lobate" dentition on ventrolateral carinae; telson without subaculear tubercle, with long curved aculeus, longer than vesicle (except *B. buettikeri* Hendrixson, 2006); all segments of metasoma hirsute, with long setae in both sexes, dentate margin of movable finger of pedipalp with 9–12 rows of granules, each row equipped with one internal accessory granule, and with (*B. leptochelys* complex) or without

(*B. arenicola* complex) one external accessory granule, 4 terminal and one basal terminal granules present; trichobothrial pattern orthobothriotaxic type A; dorsal trichobothria of femur arranged in β -configuration; pedipalp patella with 7 external trichobothria; pedipalp femur with trichobothrium d_2 on dorsal surface; d_2 of pedipalp patella present; patella trichobothrium d_3 internal to dorsomedian carina; tibial spurs present on legs III–IV but could be reduced or absent on leg III.

COMMENTS. Many of the diagnostic characters applied to differentiate *Buthacus* from other buthid genera seem to be plesiomorphic, so the genus is not strongly supported by derived characters. Thus, *Buthacus* may be a paraphyletic assemblage of taxa containing several distinct lineages. It is beyond the scope of this paper to completely revise and divide *Buthacus*.

B. agarwali Zambre et Lourenço, 2010 from India definitely does not belong in *Buthacus* because it differs in the characters cited in the diagnosis above as well as in other aspects of its morphology, mainly in shape of the pedipalp segments. The taxonomic position of *B. maliensis* Lourenço et Qi, 2007 from Mali is also doubtful. It has a short aculeus, the anterior part of the carapace is probably not glossy, the movable finger of pedipalp has nearly linear rows of granules, and the total length is 29.8 mm.

It appears that the most reliable diagnostic character for *Buthacus* is the presence of 9–12 rows of granules on the movable finger. The only species for which this character is inapplicable is *Buthacus williamsi* Lourenço et Leguin, 2009 from the United Arab Emirates, described from three females that have 6 or 7 rows of granules on the movable finger. We are convinced, however, that this species does not belong to the genus *Buthacus* but probably to the genus *Vachoniolus* Levy, Amitai et Shulov, 1973.

Buthacus occidentalis Vachon, 1953
(Figs. 46–48, 52–55, 63)

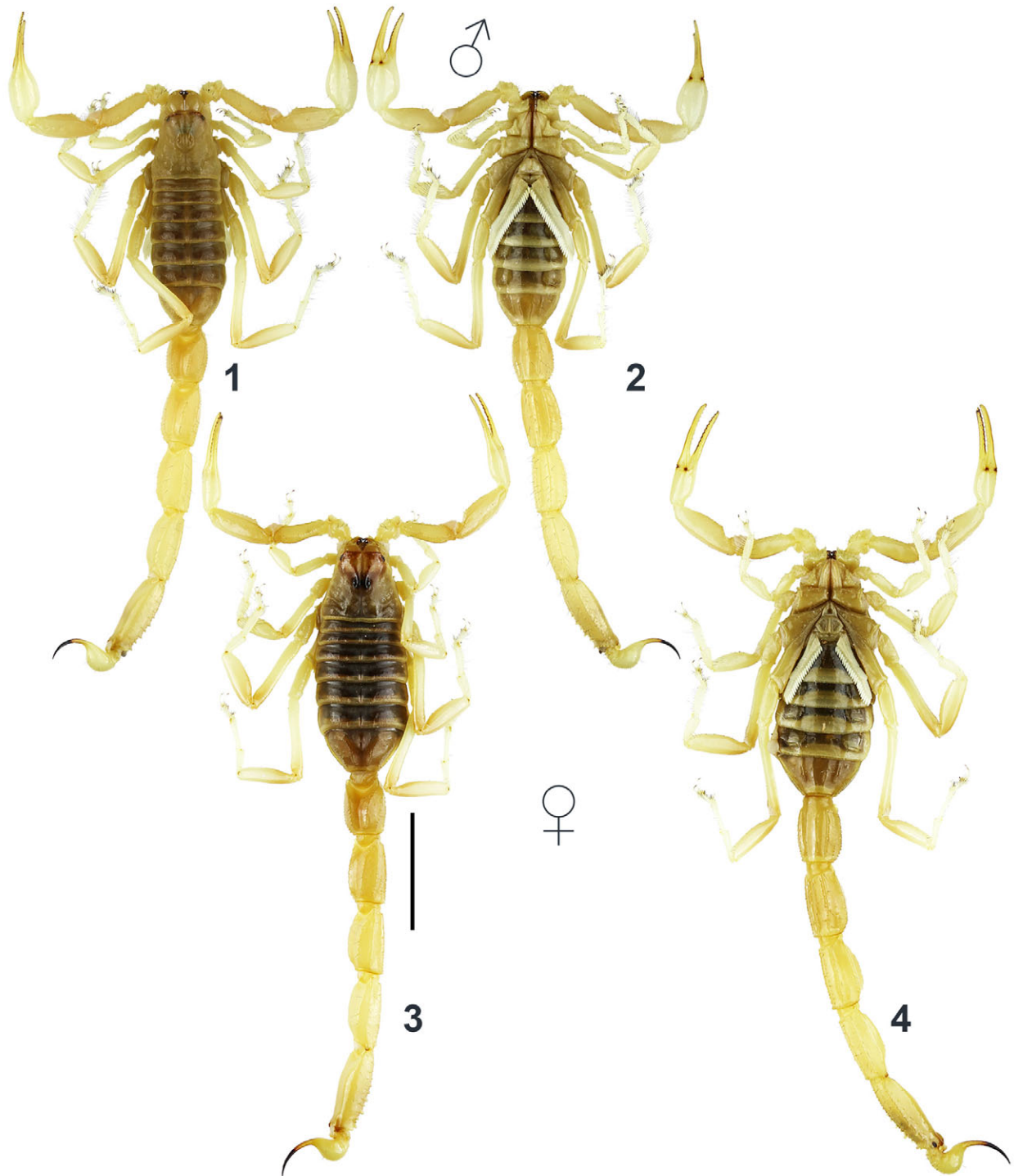
Buthacus leptochelys occidentalis Vachon, 1953: 1017–1020, figs. 3–9; Fet & Lowe, 2000: 84–85 (complete reference list until 2000).

Buthacus occidentalis: Lourenço, 2000: 5; Lourenço, 2001: 259; Lourenço, 2004: 230; Lourenço, 2006: 62, figs 10–12; Lourenço, 2013: 97, figs. 10–11.

= *Buthacus ehrenbergi* Kovařík, 2005: 3–5, figs. 3–4, table 1 (syn. by Lourenço, 2006: 62).

= *Buthacus huberi* Lourenço, 2001: 257–259, figs. 1, 4–9, 23. **Syn. n.**

TYPE LOCALITY AND TYPE DEPOSITORY. Mauritania, Chinguetti, designated according to lectotype by Lourenço (2006), MNHN-RS-1676.

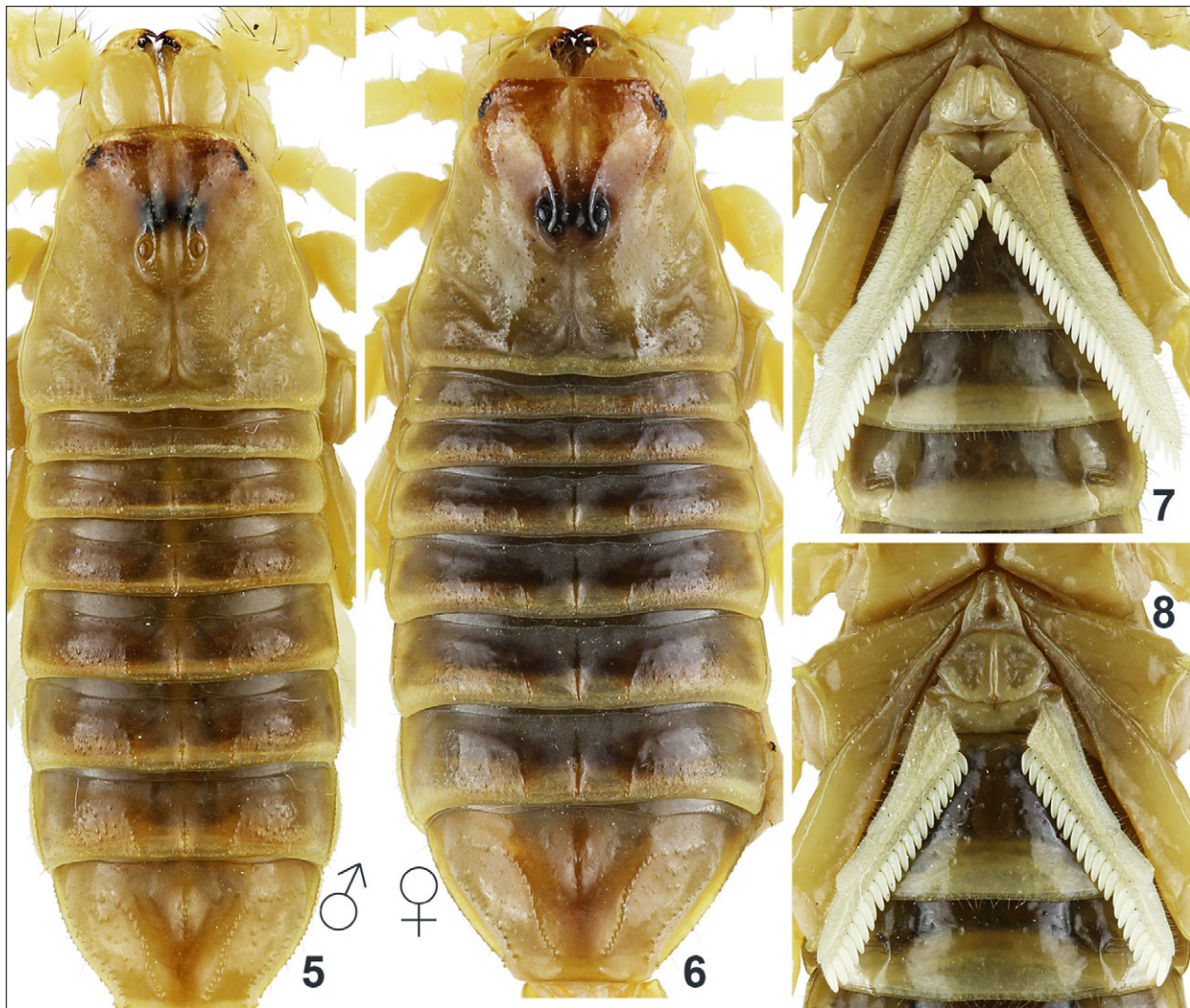


Figures 1–4: *Buthacus stockmanni* sp. n. **Figures 1–2.** Male holotype in dorsal (1) and ventral (2) views. **Figures 3–4.** Female paratype from the type locality in dorsal (3) and ventral (4) aspects. Scale bar: 10 mm.

TYPE MATERIAL EXAMINED. Mauritania, Chinguetti env., 20°26'N - 12°26'W, 1♂ (Figs. 46–48, 52–55, holotype of *Buthacus ehrenbergi* Kovařík, 2005), leg. R. Demis, FKCP; south of Aftout, 2.VIII.1994, 1♂juv. (holotype of *Buthacus huberi* Lourenço, 2001, incorrectly cited in

original description as adult female), ZMUH No. A23 /01.

DIAGNOSIS. Total length 44–50 mm; carapace densely granulated with only anterior median carinae developed;



Figures 5–8: *Buthacus stockmanni* sp. n. **Figures 5 and 7.** Male holotype, carapace and tergites (5), coxosternal area and sternites III–V (7). **Figures 6 and 8.** Female paratype from the type locality, carapace and tergites (6), coxosternal area and sternites III–IV (8).

anterior margin of carapace straight; pectine teeth 23–29 in male and 19–23 in female; sternites III–VI lacking carinae; sternite VII with four smooth carinae; metasomal segments I–IV with intercarinal surfaces smooth or almost smooth; metasomal segment V of both sexes ventrally granulated; metasomal segment I bears 10 carinae, segments II–IV bear 8 carinae (lateromedial carinae on segments II–III indicated by several granules on posterior part only); ventrolateral carinae of metasomal segment V bear several lobate granules in their posterior half; dorsal and lateral surfaces of segment V smooth, without granules in both sexes; all metasomal segments sparsely setose; metasomal segment V with ca. 35 long setae in both sexes; telson with long curved aculeus, longer than vesicle in both sexes; legs I–III with tarsal bristle combs composed of long, thin setae; tibial spurs present on legs III–IV, moderate

on leg IV and extremely reduced or absent on leg III; movable and fixed fingers of pedipalp with 9 rows of granules, with external and internal accessory granules (*Buthacus leptochelys* complex). Males with broader pedipalp chelae than females, fingers straight in both sexes.

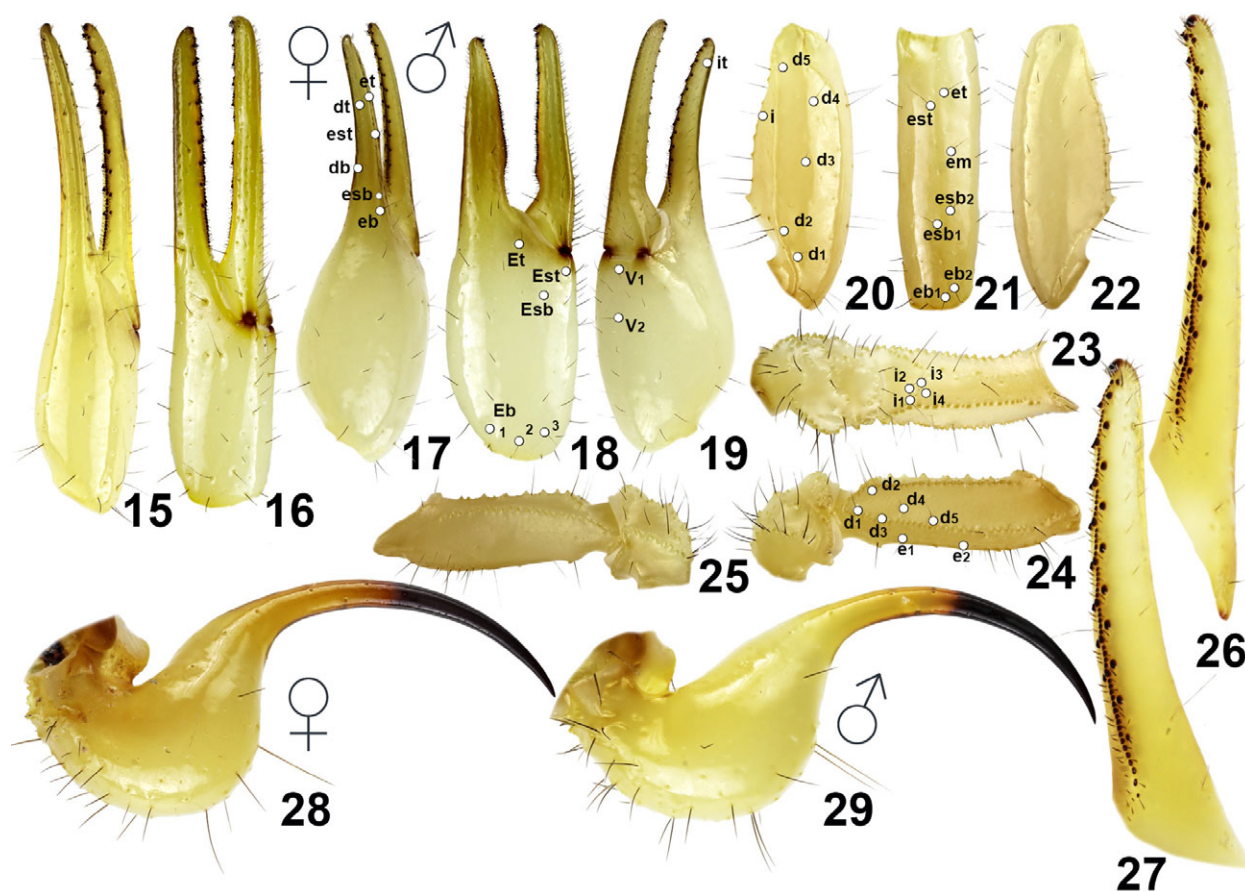
COMMENTS. Lourenço (2001: 257) stated that the types of *Buthacus huberi* are two females (the male is unknown) that have 28 pectinal teeth, from which he conjectured that in "males it should range from 30–33" and so created a fictive incorrect character for distinguishing between *B. huberi* and *B. occidentalis*. He acknowledged that Vachon (1953) cited for *B. occidentalis* 26–29 pectinal teeth in males and 20–25 in females, but explained (Lourenço, 2001: 268, Lourenço, 2004: 230) that "the most common for *B. occidentalis*



Figures 9–14: *Buthacus stockmanni* sp. n., metasoma and telson. **Figures 9–11.** Male holotype, lateral (9), ventral (10), and dorsal (11) views. **Figures 12–14.** Female paratype from the type locality, lateral (12), ventral (13), and dorsal (14) views. Scale bars: 10 mm.

are 23 or 24 to (*sic*) males and 21 for females" and the high number of pectinal teeth cited by Vachon (1953) is due to the fact that Vachon "referred to specimens from Morocco (now lost)". The type series of *B. occidentalis* included specimens from Mauritania and southern Morocco, and Lourenço (2006: 62) designated as lectotype a specimen from the locality of Chinguetti in Mauritania, which 'coincidentally' happens to be the type locality of *B. ehrenbergi* Kovařík, 2005, thereby synonymizing the latter species. The lost Morocco syntypes were presumed to be the same species (c.f. fig. 23 in Lourenço, 2001: 267). In fact, the Morocco populations represent a different undescribed species, which we here describe as *B. stockmanni* sp. n.. However, by designating as a lectotype of *B. occidentalis* a male from Mauritania with 27–28 pectinal teeth, Lourenço contradicted his own

previously published speculation that the number of pectinal teeth is normally 23–24 (excluding the lost Morocco syntypes of Vachon presumed to have high tooth counts) without commenting on the discrepancy. H. Dastych of ZMUH kindly allowed the first author to study the "female" holotype of *B. huberi*, and examination reveals that it is not an adult female at all, but a juvenile male. Comparison of the holotype of *B. huberi* with another specimen of *B. occidentalis* (the holotype of *B. ehrenbergi*) did not reveal any measurable variation that could be regarded as a species-level character. We therefore conclude that *B. huberi* Lourenço, 2001 is a synonym of *B. occidentalis* and the type locality of *B. huberi* represents the southernmost record in the range of *B. occidentalis*.



Figures 15–29: *Buthacus stockmanni* sp. n. **Figures 15–16:** Female paratype from the type locality, chela dorsal (15) and external (16). **Figures 17–19:** Male holotype, chela dorsal (17), external (18), and ventral (19). **Figures 20–22:** Patella dorsal (20), external (21) and ventral (22). **Figures 23–25:** Femur internal (23), dorsal (24), and ventral (25). **Figures 26–27:** Movable finger (26) and fixed finger (27) dentition. Trichobothrial pattern is indicated in Figures 17–21 and 23–24. **Figures 28–29:** Telson lateral, female paratype from the type locality (28) and male holotype (29).

***Buthacus stockmanni* sp. n.**
(Figs. 1–45, 63, Table 1)

<http://www.zoobank.org/urn:lsid:zoobank.org:act:8116F5A3-3A84-40A9-87AC-9AA502ED2667>

Buthacus sp. Stockmann et al., 2016: 9.

TYPE LOCALITY AND TYPE DEPOSITORY. Morocco, North of Zag, 28.24872°N 09.33291°W; FKCP.

TYPE MATERIAL. Morocco, North of Msied, 28.04383°N 10.85038°W, X.2016 (Fig. 42), 3♂1♀ (paratypes), leg. Omar Hassan; North of Zag, 28.24872°N 09.33291°W, X.2016 (Fig. 41), 1♂ (holotype, Figs. 1–2, 5, 7, 9–11, 17–27, 29–33, 39) 1♂1♀ (paratypes, Figs. 3–4, 6, 8, 12–14, 15–16, 28, 34–38, 40, 43–44), leg. Omar Hassan. **Western Sahara**, 28 km E Laayoune, 27°13'N 12°54'W, 123 m a.s.l., 10.V.2011, 2♀3♂juvs. (paratypes), leg. P. Kabátek; Saquia el Hamra N Smara, 26°51'N 11°56'W, 140 m a.s.l., 8.V.2011, 2♀1♂juv. (paratypes), leg. P.

Kabátek. All types are in the first authors collection (FKCP).

ETYMOLOGY. It is a pleasure to name this species after a scorpialogist Mark Stockmann (Germany).

DIAGNOSIS. Total length 48–59 mm; carapace densely granulated with only anterior median carinae developed; anterior margin of carapace straight; pectine teeth 23–29 in males and 16–22 in females; sternites III–VI lacking carinae; sternite VII with four smooth carinae; metasomal segments I–IV intercarinal surfaces smooth or almost smooth; metasomal segment V of both sexes ventrally granulated; metasomal segment I bears 10 carinae, segments II–IV bear 8 carinae (lateromedial carinae on segments II–III indicated by several granules on posterior part only); ventrolateral carinae of metasomal segment V bear several lobate granules in their posterior half; dorsal and lateral surfaces of segment V smooth, without granules in both sexes; all metasomal segments



Figures 30–33: *Buthacus stockmanni* sp. n., male holotype, left legs I–IV, retrolateral aspect.

sparsely setose; metasomal segment V with ca. 35 long setae in both sexes; telson with long curved aculeus, longer than vesicle in both sexes; legs I–III with tarsal bristle combs composed of long, thin setae; tibial spurs present on legs III–IV, longer on leg IV and moderate on leg III; movable and fixed fingers of pedipalp with 9 rows of granules, with external and internal accessory granules (*Buthacus leptochelys* complex). Males with broader pedipalp chelae than females, fingers twisted proximally in males, straight in females.

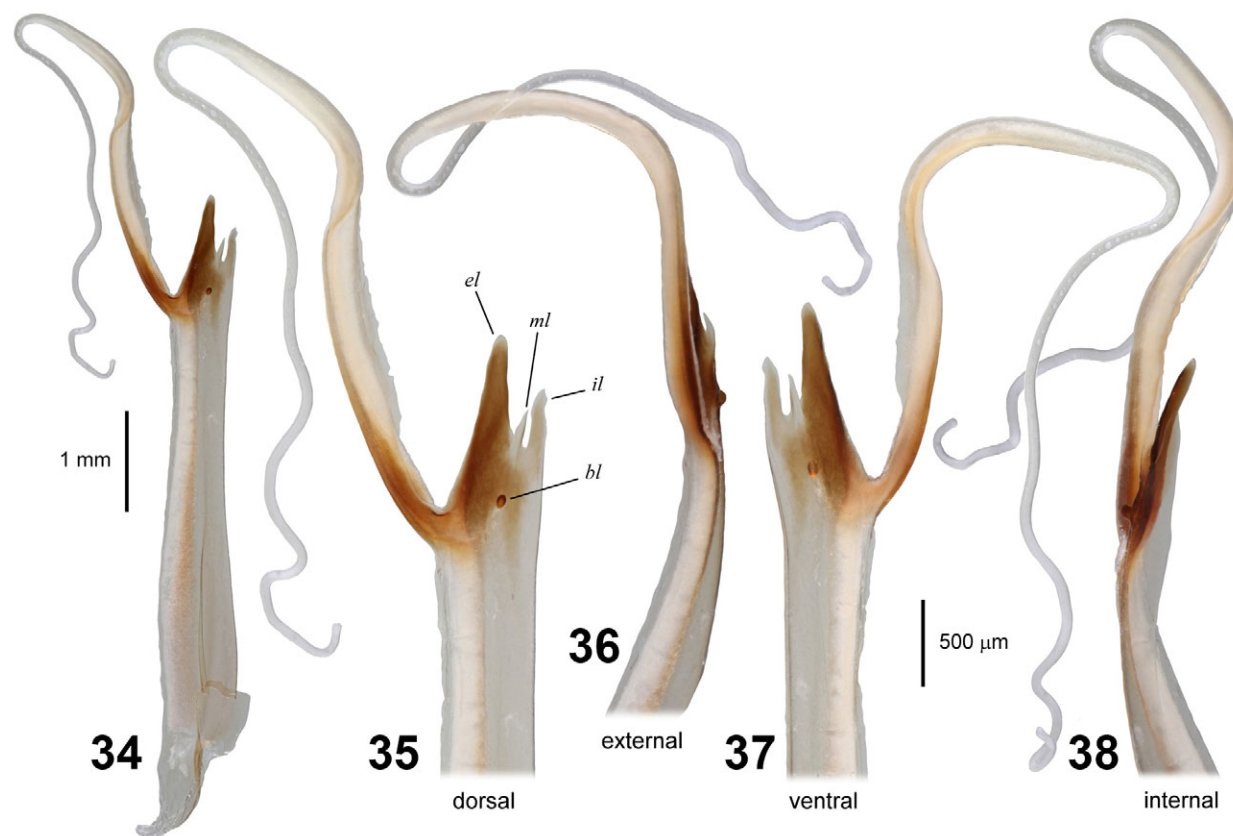
DESCRIPTION. Adult males are 48–54 mm long and the adult females are 52–59 mm long. The habitus is shown in Figs. 1–4. For position and distribution of trichobothria of pedipalps see Figs. 17–24. *Sexual dimorphism:* males have longer pectines than females (Figs. 7–8) and broader pedipalp chelae than females, with fingers twisted proximally (Figs. 15–19, Table 1).

Coloration (Figs. 1–8). Basic color is yellow to orange with darker carapace and mesosoma with characteristic

orange to brown area on the anterior part of carapace. The chelicerae are yellow without reticulation; dentition is reddish to black.

Carapace (Figs. 5–6). The surface is granulated. The anterior margin is straight and bears eight to ten macrosetae. Anterior median carinae coarsely granular. There are 5 lateral eyes on each side (3 larger, 2 smaller).

Mesosoma (Figs. 5–8). The tergites bear three coarsely granular carinae, of which the lateral pair on the tergites I–II could be inconspicuous. All tergites with dense coarse and fine granulation. The pectinal tooth count is 23–29 (1 × 23, 5 × 24, 5 × 25, 1 × 26, 3 × 27, 2 × 28, 1 × 29) in males and 16–22 (2 × 16, 1 × 17, 2 × 18, 4 × 19, 1 × 20, 4 × 22) in females. The marginal tips of the pectines extend to the end of sternite IV in females, and to the anterior half of sternite V in males. The pectines have 3 marginal lamellae and 7–9 middle lamellae. The lamellae and fulcra bear numerous dark setae. Sternites III–VI lack carinae, and surfaces are smooth. Sternite



Figures 34–38: *Buthacus stockmanni* sp. n., right hemispermatophore, male holotype. **Figure 34.** Whole hemispermatophore, dorsal view. **Figures 35–38.** Capsule region and flagellum: dorsal (35), external (36), ventral (37) and internal (38) views. Abbreviations: *bl*, basal lobe; *el*, external lobe, *il*, internal lobe; *ml*, median lobe. Scale bars: 1 mm (34), 500 µm (35–38).

VII has two pairs of smooth carinae. All sternites bear many long macrosetae on their surfaces and margins.

Hemispermatophore (Figs. 34–38). Flagelliform, relatively stout, trunk 3.7 times length of capsule region. Flagellum well separated from capsule lobes, pars recta long, 0.77 times length of trunk, tapered, proximal half broader, compressed, with narrow fin running along internal margin; pars reflecta long, narrow, hyaline, 0.94 times length of trunk. Capsule region with 4 lobes arranged in 3 + 1 configuration typical of the "Buthus" group (Fet et al., 2005; Kovařík et al., 2016): external lobe largest, forming tapered lamina with blunt apex; median lobe smallest, acuminate, with weak carina on internal margin; internal lobe intermediate in size, laminate; basal lobe a small, rounded knob with weak distal flange.

Metasoma and telson (Figs. 9–14). Metasoma I bears 10 carinae, the ventromedial pair being obsolete. Metasoma II–III bear 8 carinae. Median lateral carinae are indicated by three to six granules on posterior part only. Ventromedial and ventrolateral carinae on metasoma II–III are granulated, with larger granules posteriorly. Metasoma IV bears 8 carinae from which both ventromedial and dorsal carinae are obsolete and only

ventrolateral carinae are present with several granules. Metasoma V in both sexes has only ventrolateral carinae, which in posterior halves bear several lobate granules. Granules on the ventral surface of segment V form a median carina in both sexes. Intercarinal surfaces of segments I–IV are almost smooth in both sexes. Dorsal and lateral surfaces of segment V are smooth, without granules and carinae in both sexes. The anal arch consists of three or four lobes in both sexes. All segments are sparsely setose; segment V has ca. 35 long setae in both sexes. The telson with long curved aculeus, longer than vesicle in both sexes. The surface of the telson is smooth, sparsely hirsute, without a subaculear tubercle.

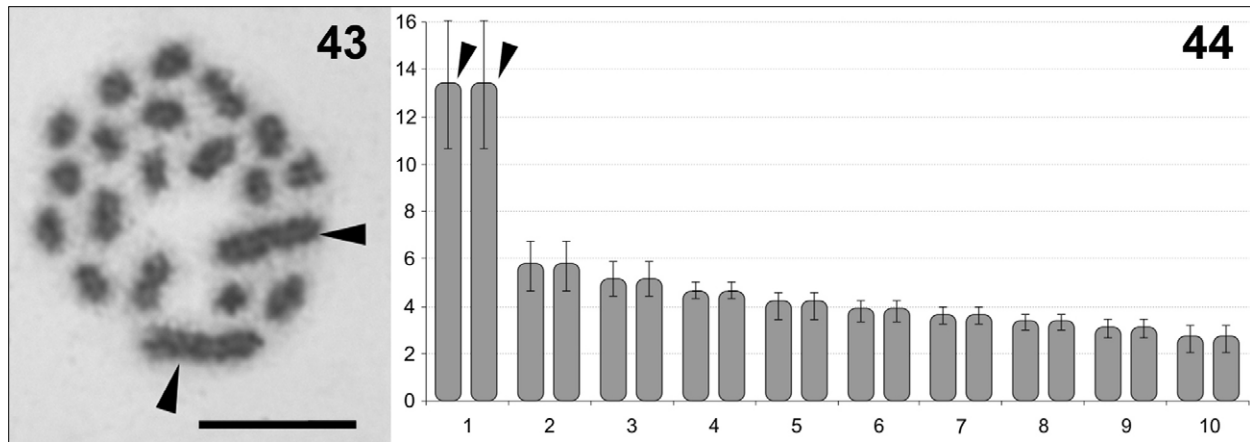
Pedipalps (Figs. 15–27, 45). The femur is finely granulated and bears three to five carinae; the ventroexternal carina is incomplete or absent, the other carinae are granular. The patella is smooth, with seven smooth and usually obsolete carinae in both sexes. The chela is smooth, with only incomplete smooth carinae indicated in females. The movable and fixed fingers are proximally twisted in males (Fig. 45) and straight in females (Fig. 16). All pedipalp segments including the trochanter are sparsely hirsute, with long, dark macro-



Figures 39–40: *Buthacus stockmanni* sp. n., in vivo habitus, male (39) holotype and female (40) paratype from the type locality.



Figures 41–42: *Buthacus stockmanni* sp. n., type locality (41) and locality Morocco, North of Msied, 28.04383°N 10.85038°W. (42).



Figures 43–44: *Buthacus stockmanni* sp. n., mitotic metaphase (43) and ideogram (44) (y axis - % of the chromosome length of the diploid set, lines indicate min.-max. values) of paratype male from the type locality. Arrowheads indicate extra large chromosomes. Scale bar = 10 µm.

Dimensions (MM)		<i>B. stockmanni</i> sp. n. ♂ holotype	<i>B. stockmanni</i> sp. n. ♀ paratype
Carapace	L / W	5.65 / 6.35	6.25 / 7.15
Mesosoma	L	12.40	13.40
Tergite VII	L / W	3.55 / 5.55	3.95 / 6.95
Metasoma et telson	L	35.37	37.88
Segment I	L / W / D	4.70 / 3.65 / 3.05	5.03 / 3.85 / 3.35
Segment II	L / W / D	5.65 / 3.55 / 3.05	5.95 / 3.63 / 3.15
Segment III	L / W / D	5.67 / 3.30 / 2.85	6.15 / 3.40 / 3.05
Segment IV	L / W / D	6.20 / 2.80 / 2.55	6.60 / 2.95 / 2.75
Segment V	L / W / D	7.05 / 2.75 / 2.45	7.35 / 2.90 / 2.70
Telson	L / W / D	6.10 / 1.95 / 1.85	6.80 / 2.25 / 2.03
Pedipalp	L	20.3	20.61
Femur	L / W	5.10 / 1.55	5.20 / 1.65
Patella	L / W	6.20 / 2.20	6.40 / 2.20
Chela	L	9.0	9.01
Manus	L / W / D	4.05 / 2.90 / 2.75	3.16 / 1.85 / 1.93
Movable finger	L	4.95	5.85
Total	L	53.42	57.53

Table 1: Comparative measurements of adults of *Buthacus stockmanni* sp. n. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

setae in both sexes. The dentate margin of the movable and fixed fingers (Figs. 26–27) has nine rows of granules, each with one external and one internal granule, and 5 terminal granules (4 terminal and one basal terminal).

Legs (Figs. 30–33). The tarsomeres bear two rows of macrosetae on the ventral surface and numerous macrosetae on the other surfaces, which on legs I–III form bristle combs. The macrosetae are thin in both sexes. The femur and patella may bear indications of four to six carinae, which however are usually obsolete. The femur bears only solitary macrosetae. The tibial spur on leg IV

is strong and longer than on the leg III where tibial spur is rather moderate.

Measurements. See Table 1.

Karyotype (Figs. 43–44). We analyzed one male paratype from the type locality using standard cytogenetic methods (e.g. Kovařík et al., 2009). The diploid complement of this specimen is composed of 20 chromosomes (Fig. 43). The chromosomes are holocentric and the meiosis is achiasmatic. Both characters are typical for the scorpions from the family Buthidae (e.g. Mattos et al., 2013). The chromosomes of the first pair are significantly longer (13.41 % of the diploid



Figures 45–51: Figure 45. *Buthacus stockmanni* sp. n., male paratype from locality Morocco, North of Msied, 28.04383°N 10.85038°W, pedipalp chela external. **Figures 46–48.** *Buthacus occidentalis*, male holotype of *Buthacus ehrenbergi*, pedipalp chela external (46) and dorsal (47), and movable finger dentition (48). **Figures 49–51.** *Buthacus zieglerei*, male from locality Morocco, Merzouga env., 31°02'59"N 04°00'16"W, pedipalp chela external (49) and dorsal (50), and movable finger dentition (51).

set) than the remaining chromosomes that gradually decrease from 5.84 % to 2.69 % of the diploid set (Fig. 44).

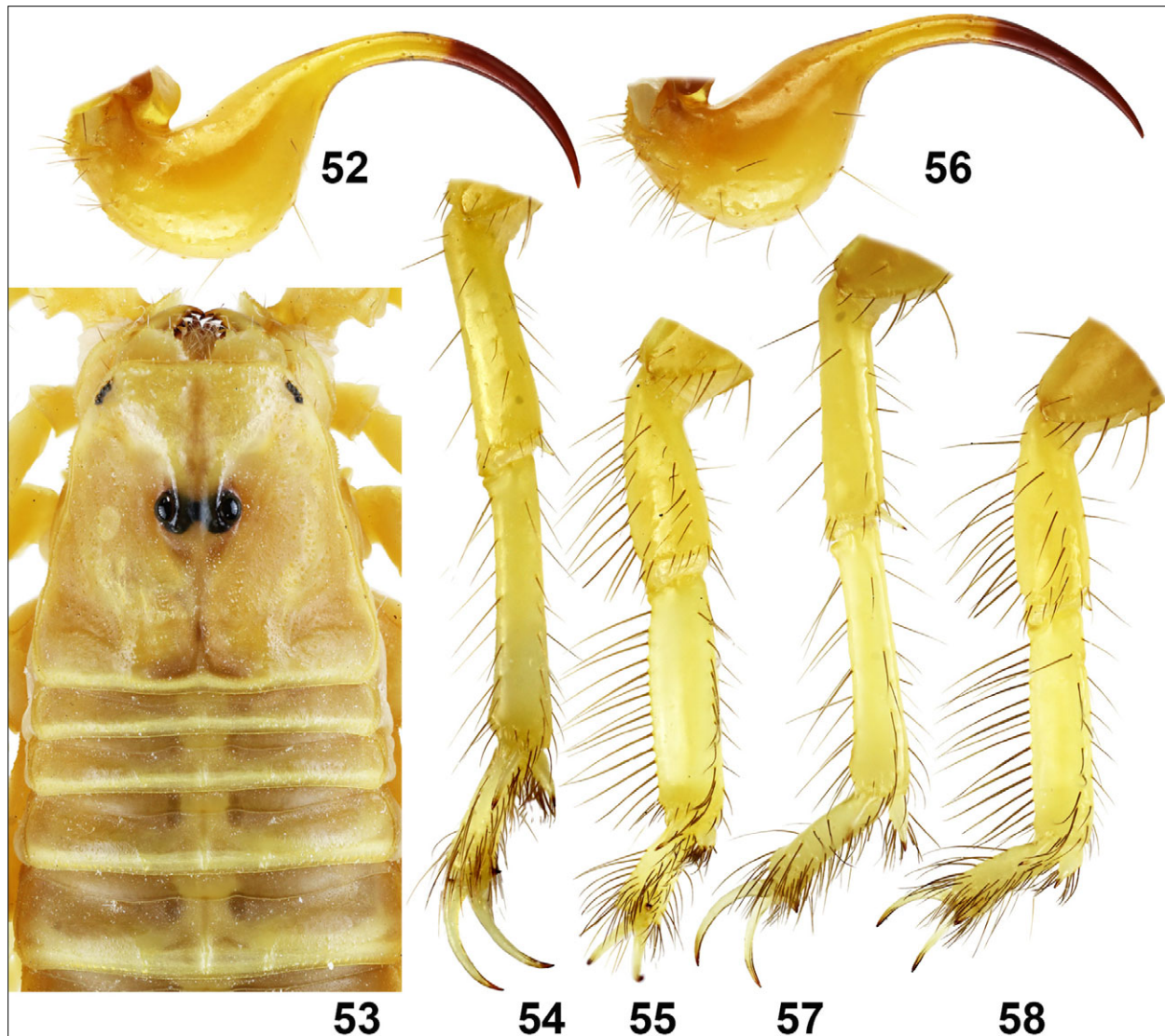
AFFINITIES. The described features distinguish *B. stockmanni* sp. n. from all other species of the genus. *B. stockmanni* sp. n. is a member of the *Buthacus leptochelys* complex (see generic diagnosis on the top) which is represented in Northwestern Africa by two other species *B. occidentalis* Vachon, 1953 and *B. zieglerei* Lourenço, 2000. Both of these species are separable from the new species geographically (see Fig. 63) and morphologically. Males of *B. stockmanni* sp. n. have the fingers of the pedipalp chela strongly twisted proximally (Fig. 45), whereas males of both *B. occidentalis* and *B. zieglerei* have the fingers straight or almost straight (Figs. 46 and 49). In the past *B. stockmanni* sp. n. was confused with *B. occidentalis* (see comments in *B. occidentalis* section and fig. 23 in Lourenço, 2001: 267). These two species can also be differentiated by their tibial spurs which are long in *B. stockmanni* sp. n. (Fig. 33) versus moderate in *B. occidentalis* (Fig. 54) on leg IV; and moderate in *B. stockmanni* sp. n. (Fig. 32) versus extremely reduced or absent in *B. occidentalis* (Fig. 55) on leg III.

COMMENTS ON LOCALITIES AND LIFE STRATEGY. The type locality (Fig. 41, Morocco, North of Zag) is a sandy

flat area surrounded by rock-strewn sand dunes with small shrubs and even some solitary trees. *Buthacus stockmanni* sp. n. occurs on the sandy flat. During the day it is possible to find a few small juveniles rarely under rocks, but the adults were collected by UV lamps at night mostly sitting at the bases of shrubs. Males were more active at night than females, and were more often found running in open terrain. In addition, at this locality *Androctonus amoreuxi* (Audouin, 1825), *Buthus marie-franceae* Lourenço, 2003, *Compsobuthus berlandi* Vachon, 1950 and *Lissothus occidentalis* Vachon, 1950 were recorded. Another locality (Fig. 42, Morocco, North of Msied) is a sandy flat area with just a few rocks. Rocky Queds (Wadis) were not far away. The whole area has a sparse cover of shrubs. In addition, at this locality *Androctonus amoreuxi* was commonly recorded. Near the hill on the horizon in Fig. 42, neither *Buthacus stockmanni* sp. n. nor *Androctonus amoreuxi* were found, but *Hottentotta sousai* Turiel, 2014 and *Orthochirus* sp. were recorded.

***Buthacus zieglerei* Lourenço, 2000**
(Figs. 49–51, 56–63)

Buthacus zieglerei Lourenço, 2000: 6–8, figs. 1–4; Lourenço, 2004: 229; Lourenço, 2006: 62.
= *Buthacus mahraoui* Lourenço, 2004: 226–230, figs. 1–10, 16, 18 (type locality: Morocco, near to the



Figures 52–58: Figures 52–55. *Buthacus occidentalis*, male holotype of *Buthacus ehrenbergi*, telson lateral (52), carapace and tergites I–IV (53), and retrolateral aspect of leg IV (54) and leg III (55). **Figures 56–58.** *Buthacus zieglei*, male from locality Morocco, Merzouga env., 31°02'59"N 04°00'16"W, telson lateral (56) and retrolateral aspect of leg IV (57) and leg III (58).

border with Algeria, 31°46' N 03°09' W, northwest of Béni-Abbés and Igli, MNHN); Kovařík, 2005: 6; Lourenço, 2006: 62–63, figs. 13–14. **Syn. n.**

= *Buthacus leptochelys algerianus* Lourenço, 2006: 61–62, figs. 3, 6–9, 42, table 1 (type locality: Algeria, Beni-Abbés, Algerian Sahara, MNHN); Lourenço, 2013: 97, fig. 14. **Syn. n.**

TYPE LOCALITY AND TYPE DEPOSITORY. Morocco, N. W. of Erfoud, central Atlas Mountains (1800 m), SMTD.

MATERIAL EXAMINED. **Morocco**, 1♀, 7.V.1991, leg. K. Karpf; south of Erfoud, V.2003, 1♂juv., leg. A. Funk; Ar Rachidia Province, Merzouga, 25.VI.1993, 1♀, leg. Rejsek; Merzouga - Erg Chebbi, 31°08.53'N 004°01.

18'W, 30.–31.I. 2005, (WGS84), 1♂3juvs., leg. R. H. Fouquè & S. Bečvář; Merzouga env., 31°02'59"N 04°00'16"W, 700 m a.s.l. (Figs. 61–62, Locality No. 08MK), 5.–6.VII.2008, 4♂1♀2ims.6juvs. (Figs. 49–51, 56–63), leg. F. Kovařík; Oued Tairhemt 14 km E Rissani, 31°15'N 4°10'W, 719 m a.s.l., 10, 13.–14.V.2011, 1♂4♀6ims.9juvs., leg. P. Kabátek. All specimens are in the first authors collection (FKCP).

DIAGNOSIS. Total length 43–65 mm; carapace granulated with only anterior median carinae developed; anterior margin of carapace straight; pectine teeth 28–37 in male and 19–24 in female; sternites III–VI lacking carinae; sternite VII with two or four smooth carinae; intercarinal surfaces of metasomal segments I–IV smooth



Figures 59–60: *Buthacus zieglerei*, in vivo habitus, male (59) and female (60) at the locality Morocco, Merzouga env., 31°02'59"N 04°00'16"W.

or almost smooth; metasomal segment V of both sexes finely granulated ventrally; metasomal segment I bears 10 carinae, segments II–IV bear 8 carinae (lateromedial carinae on segments II–III indicated by several granules which could comprise another pair of incomplete carinae); ventrolateral carinae of metasomal segment V bear

several lobate granules in their posterior half; dorsal and lateral surfaces of segment V smooth, without granules in both sexes; all metasomal segments sparsely setose; segment V usually with less than 32 long setae in both sexes; telson with long curved aculeus, longer than vesicle in both sexes; legs I–III with tarsal bristle combs



Figures 61–62: *Buthacus ziegleri*, locality Morocco, Merzouga env., 31°02'59"N 04°00'16"W.

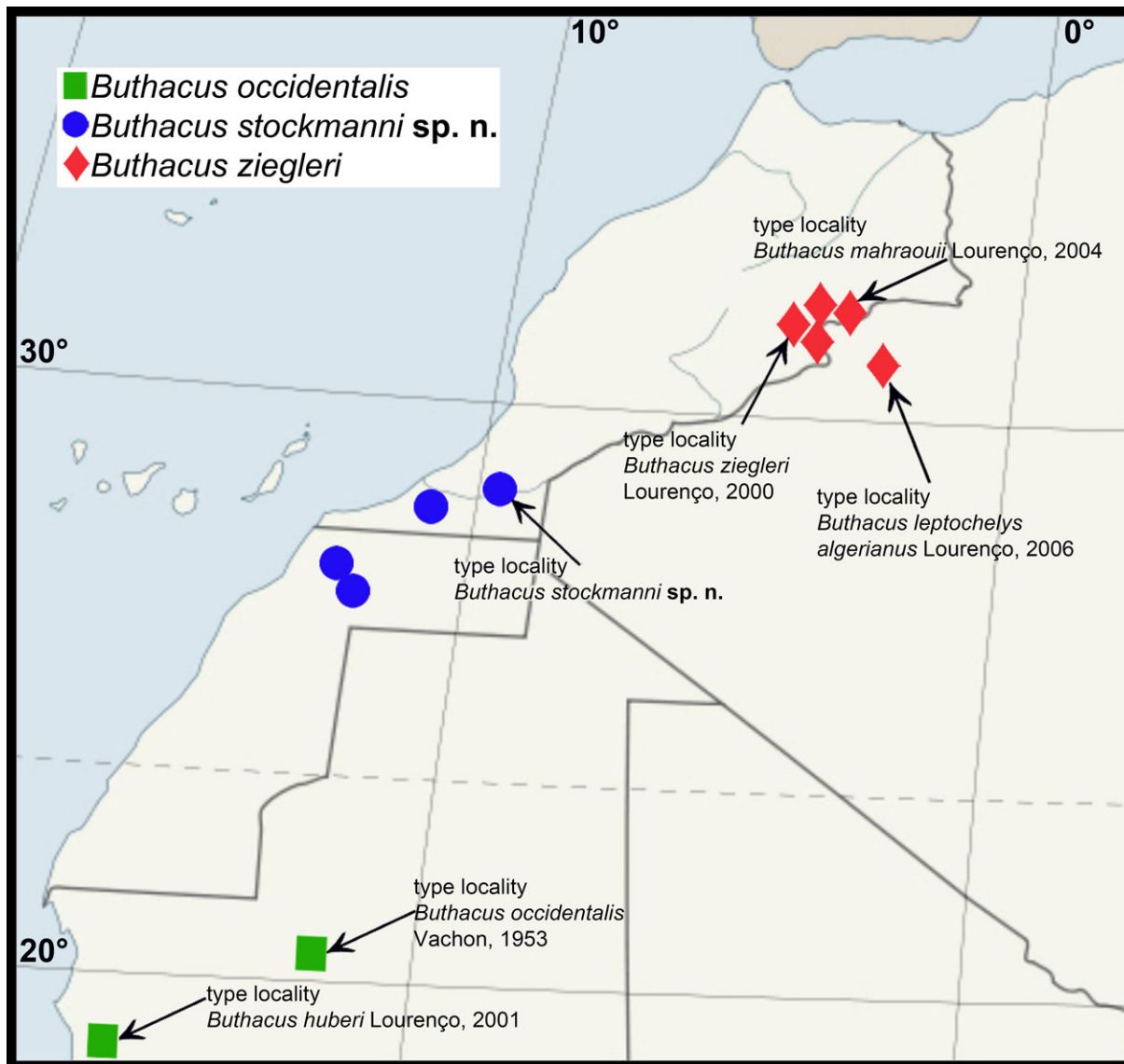


Figure 63: Map showing confirmed distribution of species of *Buthacus leptochelys* complex in Northwestern Africa.

composed of long, thin setae; tibial spurs present on legs III–IV, longer on leg IV and moderate on leg III; movable and fixed fingers of pedipalp with 9–11 rows of granules, with external and internal accessory granules (*Buthacus leptochelys* complex). Males with broader pedipalp chelae than females, fingers straight in both sexes.

COMMENTS. Lourenço based *Buthacus mahraoui* Lourenço, 2004 on a single male from Morocco. Kovařík (2005: 6) considered the species as a *nomen dubium* because its description is confused and the characters unclear, which precludes determination of whether it belongs to the *Buthacus leptochelys* complex or the

Buthacus arenicola complex. Lourenço concluded that it belongs to the *Buthacus leptochelys* complex (see Lourenço, 2004: 226). However, fig. 3 in Lourenço (2004: 227), shows that the specimen lacks external granules on the pedipalp fingers, placing it in the *Buthacus arenicola* complex. Lourenço (2006: 63) added a new figure showing the granulation of the movable pedipalp finger and wrote: "Due the variability observed in the structure of fixed and movable finger dentition, *B. mahraoui* shows very small external accessory granules which, possibly are not illustrated precisely in my figure 3", and discussed the "variability" of the character. In reality the character is stable but the accessory granules could be smaller in juveniles. It is now clear that *Buth-*

acus mahraoui Lourenço, 2004 is a synonym of *Buthacus zieglerei* Lourenço, 2000, which also occurs in the same area of distribution (Fig. 63).

Lourenço based *Buthacus leptochelys algerianus* Lourenço, 2006 on two pairs from Algeria and wrote that the location is not far from the type locality of *B. mahraoui* (Lourenço, 2006: 62), but nevertheless did not compare these species and also ignored their relationship with *B. zieglerei*. It is evident that all three of these species are synonyms and study of additional specimens from this area reveals the variation in number of pectinal teeth. For example, four males from the same locality (Morocco, Merzouga env., 31°02'59"N 04°00'16"W, Locality No. 08MK, Figs. 61–62) collected by the first author at night 5.-6.VII.2008 have 28–36 pectinal teeth (35:36, 28:31; 30:31, 30:29).

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