

## DESCRIPTION OF THREE NEW SPECIES OF SCORPION FROM SUDAN (SCORPIONES, BUTHIDAE)

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**Abstract:** Three new species belonging to the genera *Buthus* Leach, 1815 *Babycurus* Karsch, 1886 and *Neobuthus* Hirst, 1911 (Scorpiones, Buthidae) are described from the region of Loka in the Southern region of Sudan. With the description of *Buthus jianxinae* sp. n., a second species of this genus is confirmed in the country. The descriptions of both *Babycurus solegladi* sp. n. and *Neobuthus sudanensis* sp. n. represent the first confirmation of these genera for Sudan. Some additional comments are added on the validity of the genus *Neobuthus*.

**Key words:** Scorpion, Buthidae, Sudan, New species, *Babycurus*, *Buthus*, *Neobuthus*.

### Descripción de tres nuevas especies de escorpiones del Sudán (Scorpiones, Buthidae)

**Resumen:** Se describen tres nuevas especies de escorpiones pertenecientes a los géneros *Buthus* Leach, 1815, *Babycurus* Karsch, 1886 y *Neobuthus* Hirst, 1911 (Scorpiones, Buthidae) de la región de Loka, en el sur de Sudán. Con la descripción de *Buthus jianxinae* sp. n., se confirma la presencia de una segunda especie del género en el país. *Babycurus solegladi* sp. n. y *Neobuthus sudanensis* sp. n. representan las primeras menciones de estos géneros para el Sudán. Se presentan algunos comentarios adicionales sobre la validez del género *Neobuthus*.

**Palabras clave:** Scorpion, Buthidae, *Babycurus*, *Buthus*, *Neobuthus*, nueva especie, Sudán.

### Introduction

Although several early studies have dealt with the scorpions of Sudan (e.g. Pocock, 1895; Birula, 1908, 1927; Tullgren, 1909; Hirst, 1911; Werner, 1911; King, 1925; Borelli, 1929), a precise knowledge of the scorpion fauna of this important African country is still far from having been achieved.

In a brief preliminary note, Vachon (1955) attempted to present a general view of the Sudan scorpion fauna, but he did not reach any definitive conclusions. He summarized his observations on the Sudan scorpion fauna as follows: “**Mr. Le Dr. D. J. Lewis, d’après les travaux publiés sur ce sujet, a pu relever au Soudan la présence de 25 espèces dont 20 seulement de certaines. Ces espèces, selon la nomenclature que nous avons établie à la suite de nos Etudes sur les Scorpions, se classent en 2 familles et 13 genres: Les Scorpionidae avec le genre *Pandinus* (et peut-être le genre *Scorpio*), la famille des Buthidae avec les genres *Androctonus*, *Buthacus*, *Buthotus*, *Buthus*, *Compsobuthus*, *Leiurus*, *Nanobuthus*, *Orthochirus*, *Parabuthus*, *Uroplectes* (et peut-être le genre *Babycurus*)”.**

In the same note, Vachon (1955) stated that from the study of the material collected by D.L. Lewis, he was able to identify all the genera cited below, with the exception of *Orthochirus*, *Buthus* and *Nanobuthus*. Vachon also affirmed that he had examined specimens of *Scorpio* and *Babycurus*, and that a specimen from Mvolo belonged to the genus *Butheoloides*. From this preliminary analysis, Vachon (1955) concluded that 14 genera might be present in Oriental Sudan: 12 in the family Buthidae: *Androctonus*, *Babycurus*, *Butheoloides*, *Buthacus*, *Buthotus*, *Buthus*, *Compsobuthus*, *Leiurus*, *Nanobuthus*, *Orthochirus*, *Parabuthus*, and *Uroplectes*, and two of the family Scorpionidae: *Pandinus* and *Scorpio*. This is somewhat ambiguous because on the

same page he indicated in a foot-page note as follow: “**Nous regrettons, dans tout ce matériel, l’absence de *Nanobuthus* (fort rares) et de *Buthus* afin de pouvoir effectuer une étude détaillée. Par contre, nous pouvons signaler, dès maintenant, qu’une forme, très voisine d’un *Buthus*, existe dans le djebel Meidob, au nord d’El Facher, province de Darfur. Cette forme, par certains de ses caractères extrêmement particuliers, ne peut être placée dans le genre *Buthus*”.**

In more recent studies, I have been able to locate the specimen of *Butheoloides* collected by Dr. D. J. Lewis in Mvolo, which was described as *Butheoloides hirsti* Lourenço (Lourenço, 1996). Subsequently, in a revision of the *Buthus* species of North Africa (Lourenço, 2003), I examined a specimen of *Buthus* collected in the region of Darfur by P.M. Brignoli. This was described as *Buthus brignolii* Lourenço, but it was difficult to associate with the strange form cited by Vachon (1955).

Very recently, I have located three other specimens of scorpions collected by Dr. D. J. Lewis in the region of Loka, in the extreme south of the Sudan. One was a very unusual species of *Buthus*, the second a *Babycurus* while the third turned out not to be a species of *Nanobuthus*, as suggested by Vachon (1955), but one of *Neobuthus*. After careful examination, all three specimens have been proved to be species new to science and are described below. The new *Buthus* species does present some morphological particularities. Among others, an unusually strong carination. These, however, do not justify the description of a new genus. Moreover, taking into account some unjustified decisions reached by Kovarik (2003) with regard to the genera *Butheolus*, *Neobuthus* and *Nanobuthus*, I add some taxonomic comments on these genera.

## Taxonomic Treatment

### Family BUTHIDAE C.L. Koch, 1837

#### Genus *BUTHUS* Leach, 1815

##### *Buthus jianxinae* sp. n. (Figs. 1-12; 34)

TYPE MATERIAL: Sudan, Southern region, Loka, under stones, IV/1952 (D. J. Lewis). 1 male holotype. Deposited in the Museum national d'Histoire naturelle, Paris.

ETYMOLOGY: Patronym in honour of my student Jian-xin Qi, from The college of life science Hebei University, Baoding, Hebei, China

DIAGNOSIS: Small scorpions, when compared with the average size of most species in the genus, reaching a total length of only 40 mm. General coloration pale yellow to slightly reddish-yellow. Carinae very strongly marked, especially on carapace and pedipalps. Fixed and movable fingers with 10-11 rows of granules. Pectines with 34-33 teeth in males.

RELATIONSHIPS: *Buthus jianxinae* sp. n. is undoubtedly associated with the *Buthus occitanus* 'group of species'. It can, however, be distinguished from other species of *Buthus*, and in particular from *Buthus brignolii* Lourenço, 2003 by the following characters: (i) a general yellowish coloration throughout, (ii) much stronger carinae on carapace and pedipalps, (iii) absence of very strong spinoid granules on the ventral carinae of metasomal segments.

DESCRIPTION BASED ON MALE HOLOTYPE.  
Measurements in Table I.

Coloration. Basically pale yellow to slightly reddish-yellow, without any spots. Prosoma: carapace slightly reddish-yellow; eyes surrounded by black pigment. Mesosoma: yellowish. Metasoma: segments I to IV yellowish; segment V slightly reddish-yellow; vesicle pale yellow; aculeus yellowish at its base and reddish at its extremity. Venter yellowish. Chelicerae yellowish with variegated light reddish spots; fingers and teeth reddish. Pedipalps: yellowish; fingers with the oblique rows of granules reddish. Legs pale yellow without any spots.

Morphology. Carapace moderately to strongly granular; anterior margin almost straight and without a median concavity. Carinae strong; anterior median, central median and posterior median carinae strongly granular, with 'lyre' shaped configuration. Furrows moderate to strong. Median ocular tubercle at the centre of the carapace. Eyes separated by three ocular diameters. Four pairs of lateral eyes: the first three of moderate size, the last pair only vestigial. Sternum subtriangular and reduced; larger than long. Mesosoma: tergites markedly granular. Three longitudinal carinae strongly crenulate in all tergites; lateral carinae not reduced in tergites I and II. Tergite VII pentacarinat. Venter: genital operculum divided longitudinally, forming two oval plates. Pectines: pectinal tooth count 34-33; middle basal lamella of the pectines not dilated. Sternites almost smooth with elongated spiracles; four carinae on sternite VII; other sternites with vestigial carinae. Metasoma: segments I to III with ten crenulated carinae; segment IV with eight carinae, crenulated; the first four segments with a smooth dorsal depression; segment V with five carinae; the latero-ventral

carinae crenulate with two lobate denticles posteriorly; ventral median carina not divided posteriorly; anal arc composed of eight ventral teeth, and two lateral lobes. Intercarinal spaces weakly granular, almost smooth. Telson with some granulations on the ventral surface; aculeus moderately curved and shorter than the vesicle, without a subaculear tooth. Cheliceral dentition as defined by Vachon (1963) for the family Buthidae; external distal and internal distal teeth on movable finger of approximately the same length; basal teeth totally fused, inconspicuous; ventral aspect of both fingers and manus covered with setae. Pedipalps: femur pentacarinat, strongly carinated; patella with eight carinae, strongly carinated; chela with five marked carinae; all faces weakly granular. Fixed and movable fingers with 10-11 oblique rows of granules. Internal and external accessory granules present but moderate to weak; three accessory granules on the distal end of the fingers next to the terminal denticle. Legs: tarsus with numerous setae ventrally; tibial spur moderate on legs III and IV; pro-lateral spurs moderate to strong on legs I to IV. Trichobothriotaxy: trichobothrial pattern of Type A, orthobothriotaxic as defined by Vachon (1974). Dorsal trichobothria of femur arranged in  $\beta$ -configuration (Vachon, 1975).

#### Genus *BABYCURUS* Karsch, 1886

##### *Babycurus solegladi* sp. n. (Figs. 13-21; 34)

TYPE MATERIAL: Sudan, Southern region, Loka, 4/VIII/1950 (D. J. Lewis). 1 female holotype. Deposited in the Museum national d'Histoire naturelle, Paris.

ETYMOLOGY: Patronym in honour of Michael E. Soleglad, Borrego Springs, California, USA, for his contribution to the study of scorpions.

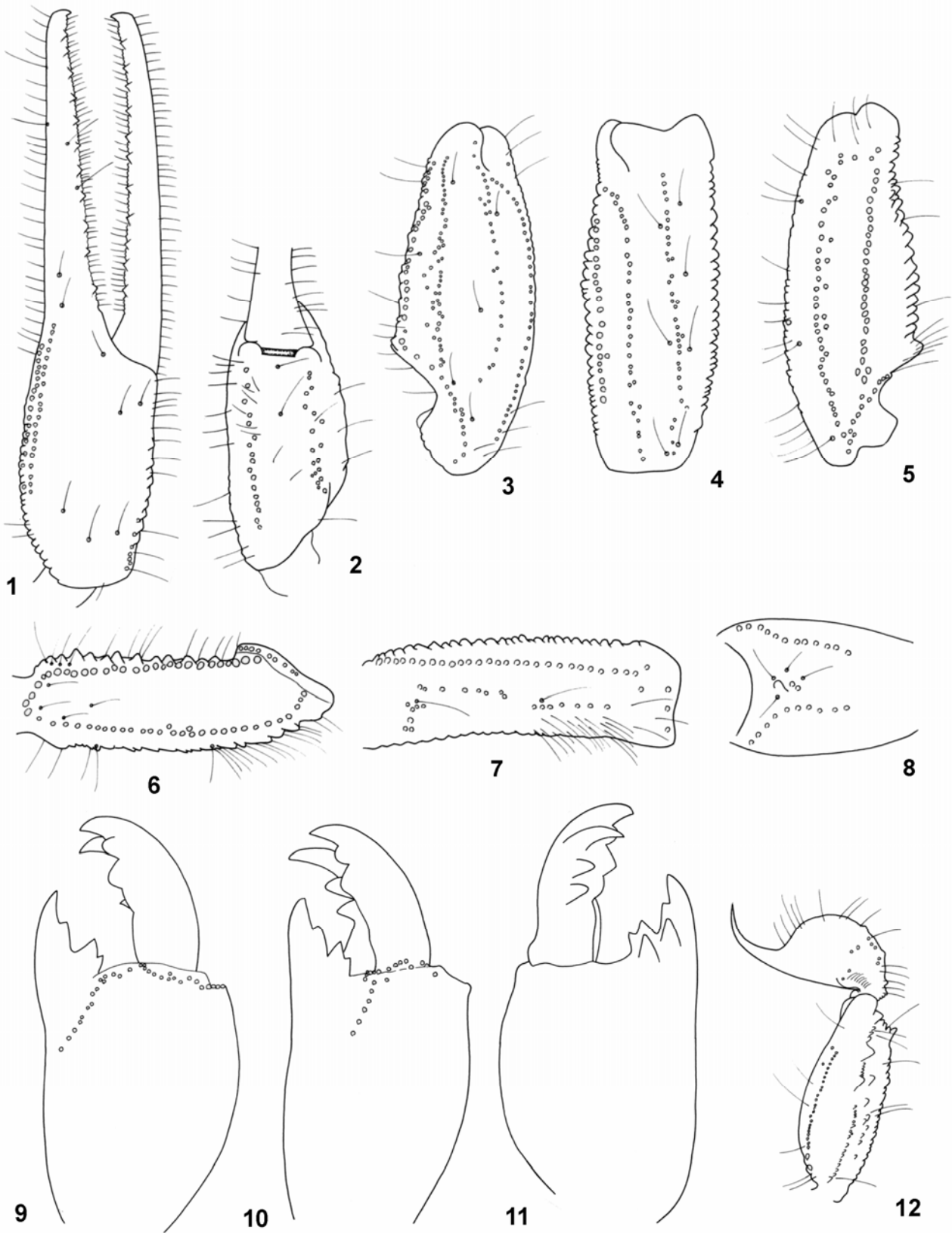
DIAGNOSIS: Scorpions of medium size, reaching a total length of 47 mm. General coloration yellowish to reddish-yellow without any spots. Carinae and granulations weak to obsolete. Fixed and movable fingers with 8-8 rows of granules. Pectines with 21-21 teeth.

RELATIONSHIPS: *Babycurus solegladi* sp. n. can be distinguished from other species of the genus *Babycurus*, and in particular from *Babycurus johnstonii* Pocock, and *Babycurus jacksoni* (Pocock) by the following characters: (i) a totally different pattern of coloration, yellowish without any spots (ii) very weakly marked carination and granulation throughout; almost smooth.

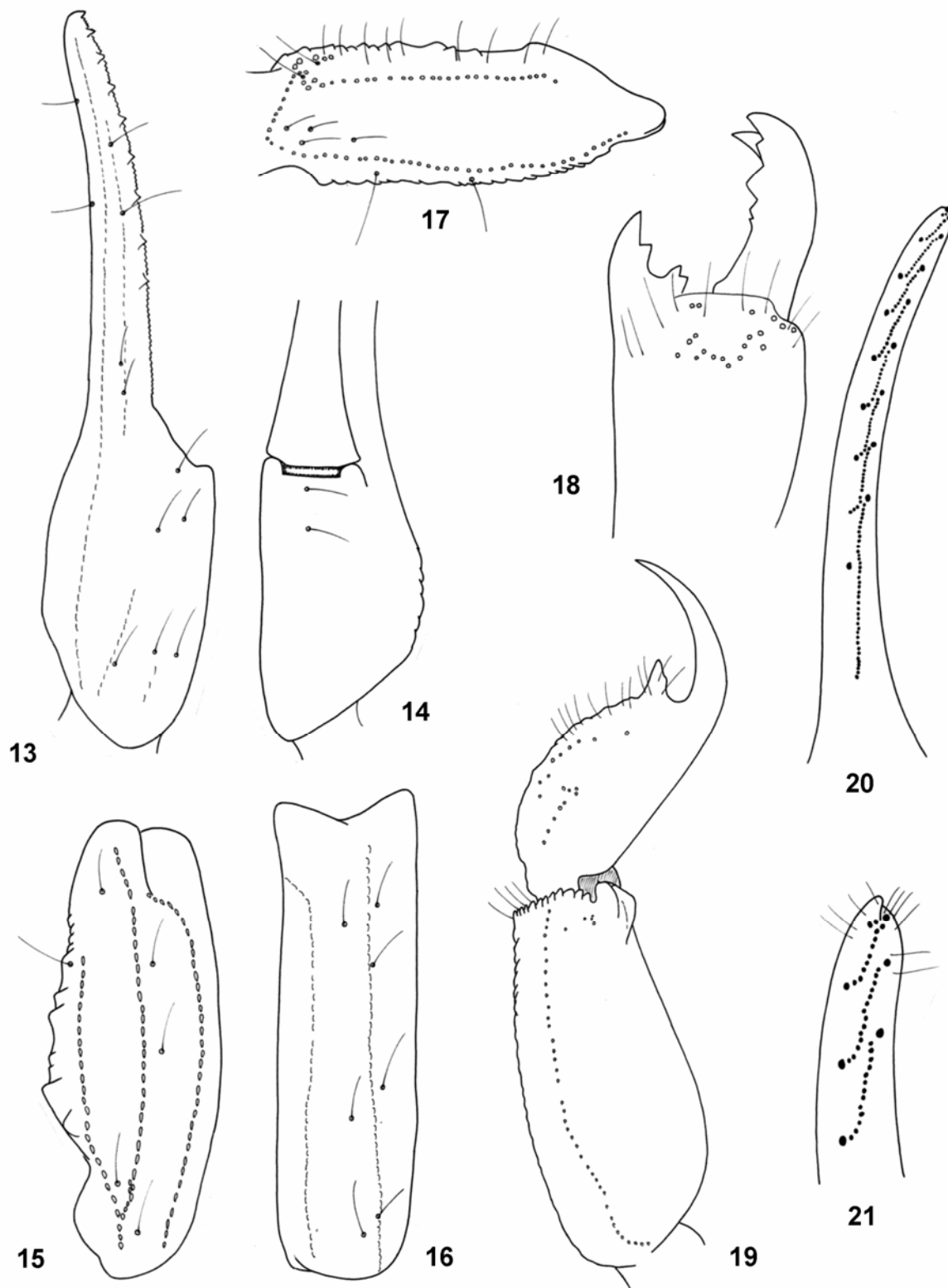
DESCRIPTION BASED ON FEMALE HOLOTYPE.  
Morphometric measurements in Table I.

Coloration. Basically yellowish to reddish-yellow. Prosoma: carapace yellowish to slightly reddish; eyes surrounded by black pigment. Mesosoma: yellowish to reddish-yellow. Metasoma: all segments and vesicle yellowish; aculeus yellowish with a reddish tip. Venter pale yellow. Chelicerae yellowish with reddish variegated pigmentation; fingers and teeth reddish. Pedipalps: yellowish overall. Legs pale yellow.

Morphology. Carapace weakly granular; anterior margin with a weak concavity; carinae weak to obsolete; furrows



**Figs. 1-12.** *Buthus jianxinae* sp. n. Male holotype. **1-8.** Trichobothrial pattern. **1-2.** Chela, dorso-external and ventral aspects. **3-5.** Patella, dorsal, external and ventral aspects. **6-8.** Femur, dorsal, external and internal aspects. **9-11.** Chelicera, dorsal, dorso-internal and ventral aspects. **12.** Metasomal segment V and telson, lateral aspect.



**Figs. 13-21.** *Babycurus solegladi* sp. n. Female holotype. **13-17.** Trichobothrial pattern. **13-14.** Chela, dorso-external and ventral aspects. **15-16.** Patella, dorsal and external aspects. **17.** Femur, dorsal aspect. **18.** Chelicera, dorsal aspect. **19.** Metasomal segment V and telson, lateral aspect. **20.** Disposition of the granulation over the dentate margin of the movable finger. **21.** Extremity of the movable finger in detail.

weak. Median ocular tubercle anterior to the centre of carapace; median eyes separated by one and half ocular diameters. Three pairs of lateral eyes. Sternum triangular. Mesosoma: tergites with a very weak granulation, almost smooth. Median carina weak to moderate in all tergites.

Tergite VII pentacarinata, but all carinae moderately marked. Venter: genital operculum divided longitudinally, forming two oval plates. Pectines: pectinal tooth count 21-21; basal middle lamellae of each pecten very weakly dilated. Sternites smooth with elongate spiracles; VII with

**Table I. Morphometric values (in mm) of the holotypes of the described species.**

	<i>Buthus jianxinae</i> sp.n.	<i>Babycurus solegladi</i> sp. n.	<i>Neobuthus sudanensis</i> sp. n.
Total length	39.8	47.1	26.3
Carapace:			
- length	5.4	6.2	3.3
- anterior width	3.8	4.3	2.3
- posterior width	6.2	6.7	4.3
Metasomal segment I:			
- length	4.2	3.8	2.1
- width	3.8	3.5	2.5
Metasomal segment V:			
- length	6.7	6.5	3.8
- width	2.8	3.0	1.9
- depth	2.3	2.7	1.8
Vesicle:			
- width	2.3	2.2	1.6
- depth	2.3	2.0	1.4
Pedipalp:			
- Femur length	4.4	5.4	2.1
- Femur width	1.5	1.9	0.9
- Patella length	5.2	6.2	2.9
- Patella width	2.1	2.2	1.2
- Chela length	8.4	10.2	3.6
- Chela width	1.7	2.0	0.8
- Chela depth	2.1	2.0	0.8
Movable finger: length	5.6	6.6	2.4

vestigial carinae. Metasoma: segments I with ten carinae; segments II to IV with eight carinae; segment V with five carinae; all carinae weakly marked. Tegument weakly granular to smooth. Telson with some rough granules ventrally; other surfaces smooth; aculeus shorter than the vesicle, and strongly curved. Subaculear tooth very strong and spinoid. Cheliceral dentition characteristic of the family Buthidae (Vachon, 1963); basal teeth on movable finger small but not fused; ventral aspect of both finger and manus with long dense setae. Pedipalps: femur pentacarinata but weakly crenulate; patella with seven carinae, very weakly crenulated; chela with some vestigial carinae; all faces smooth. Fixed and movable fingers with 8-8 almost linear rows of granules. Trichobothriotaxy; A- $\beta$ , orthobothriotaxy (Vachon, 1974, 1975). Legs: tarsi with numerous fine setae ventrally. Tibial spurs reduced on legs III and IV; pedal spurs present on all legs.

### Genus *NEOBUTHUS* Hirst, 1911

*Neobuthus sudanensis* sp. n. (Figs. 22-30; 34)

TYPE MATERIAL: Sudan, Southern region, Loka, 12/VII/1950 (D. J. Lewis). 1 female holotype. Deposited in the Museum national d'Histoire naturelle, Paris.

ETYMOLOGY: The specific name makes reference to the country (Sudan) where the new species was collected.

DIAGNOSIS: Small scorpions, reaching a total length of only 26 mm. General coloration yellow to pale yellow. Anterior margin of carapace straight. Latero-ventral carinae of metasomal segment V with 2/3 lobes. Fixed and movable fingers with 5-6 rows of granules. Pectines with 18-17 teeth. Trichobothrium  $d_2$  of patella absent.

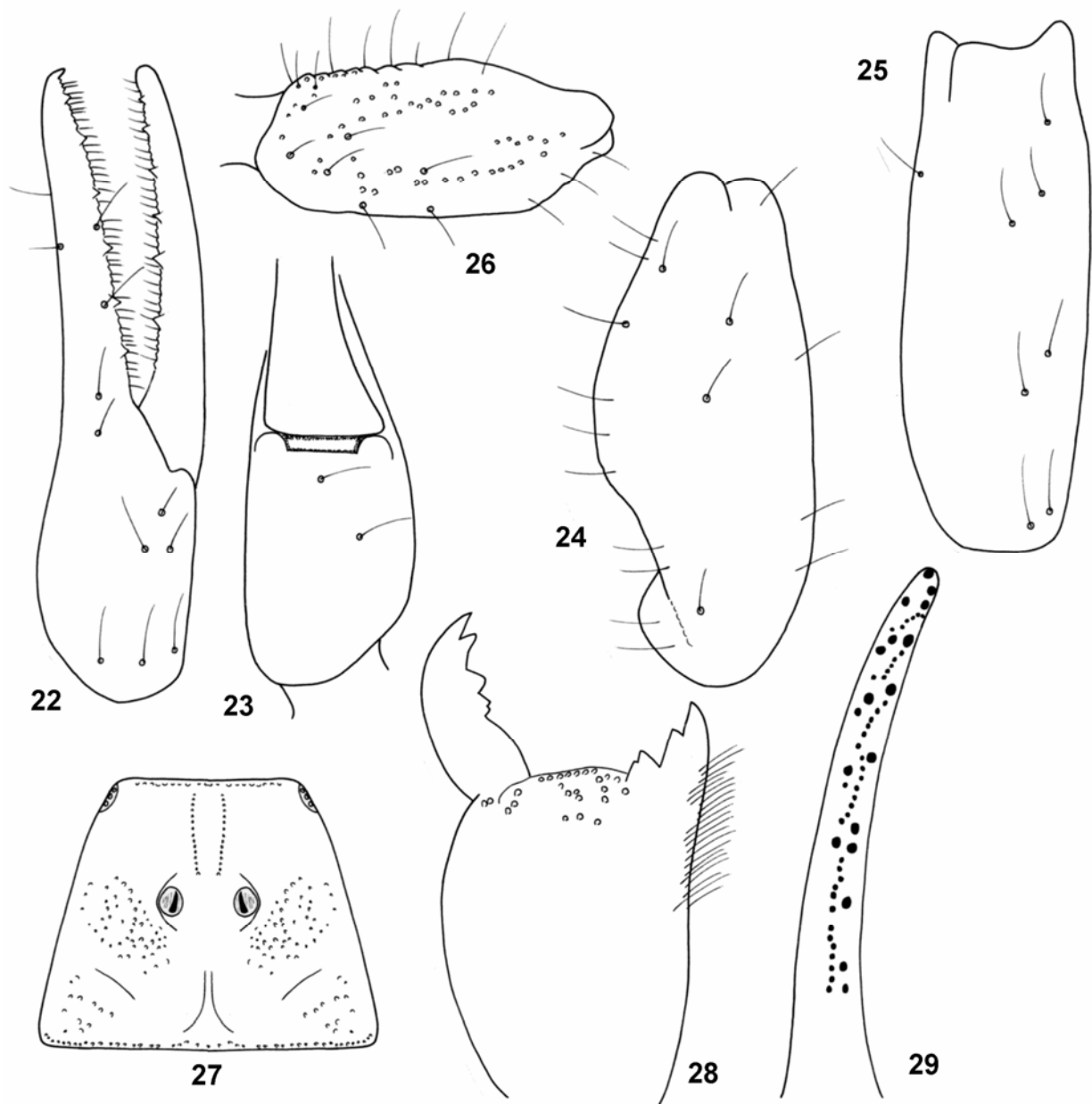
RELATIONSHIPS: *Neobuthus sudanensis* sp. n. can be distinguished from the other species of *Neobuthus* by the following characters: (i) a distinct pattern of yellowish coloration overall, without any spots, (ii) absence of trichobothrium  $d_2$  of patella.

DESCRIPTION BASED ON FEMALE HOLOTYPE.

Measurements in Table I.

Coloration. Basically yellowish without any spots. Prosoma: carapace yellowish; median and lateral eyes surrounded with black pigment. Mesosoma: yellowish. Metasoma: all segments and vesicle yellowish; aculeus yellowish with a reddish tip. Venter pale yellow; pectines, genital operculum, sternum and coxapophysis pale yellow. Chelicerae yellowish, without spots; fingers yellow. Pedipalps and legs yellowish without spots.

Morphology. Carapace moderately granular; anterior margin straight, without any median concavity or convexity. Carinae and furrows all very weak. Median ocular tubercle slightly anterior to the centre of the carapace; median eyes separated by a little more than one ocular diameter. Four pairs of lateral eyes; the fourth pair reduced. Sternum subtriangular, larger than long. Mesosoma: tergites with very weak granulation; median carina moderate to weak in all tergites. Tergite VII pentacarinata, but the carinae are obsolete. Venter: genital operculum large, divided longitudinally into two subtriangular plates. Pectines: pectinal tooth count 18-17; basal middle lamellae of each pecten not dilated. Sternites smooth with small slit-like spiracles; VII with four carinae almost obsolete. Metasoma: segments rounded, with carinae and granulations moderately marked; segment I with ten carinae; II to IV with eight carinae; the dorsal carinae obsolete; segment V with one ventral carina weakly marked, and the latero-ventral carinae with two large lobes in the distal region. Intercarinal spaces weakly granular dorsally; moderately to strongly granular laterally and ventrally. Telson smooth with punctuations; aculeus shorter than the vesicle and moderately curved; subaculear tooth vestigial to absent. Cheliceral dentition characteristic of the family Buthidae (Vachon, 1963); movable finger with two basal teeth, very small but distinct; ventral aspect of both finger and manus with setae. Pedipalps: femur with five vestigial carinae, weakly granular; patella and chela without carinae,



**Figs. 22-29.** *Neobuthus sudanensis* sp. n. Female holotype. **22-26.** Trichobothrial pattern. **22-23.** Chela, dorso-external and ventral aspects. **24-25.** Patella, dorsal and external aspects. **26.** Femur, dorsal aspect. **27.** Carapace. **28.** Chelicera, dorsal aspect. **29.** Disposition of the granulation over the dentate margin of the movable finger.

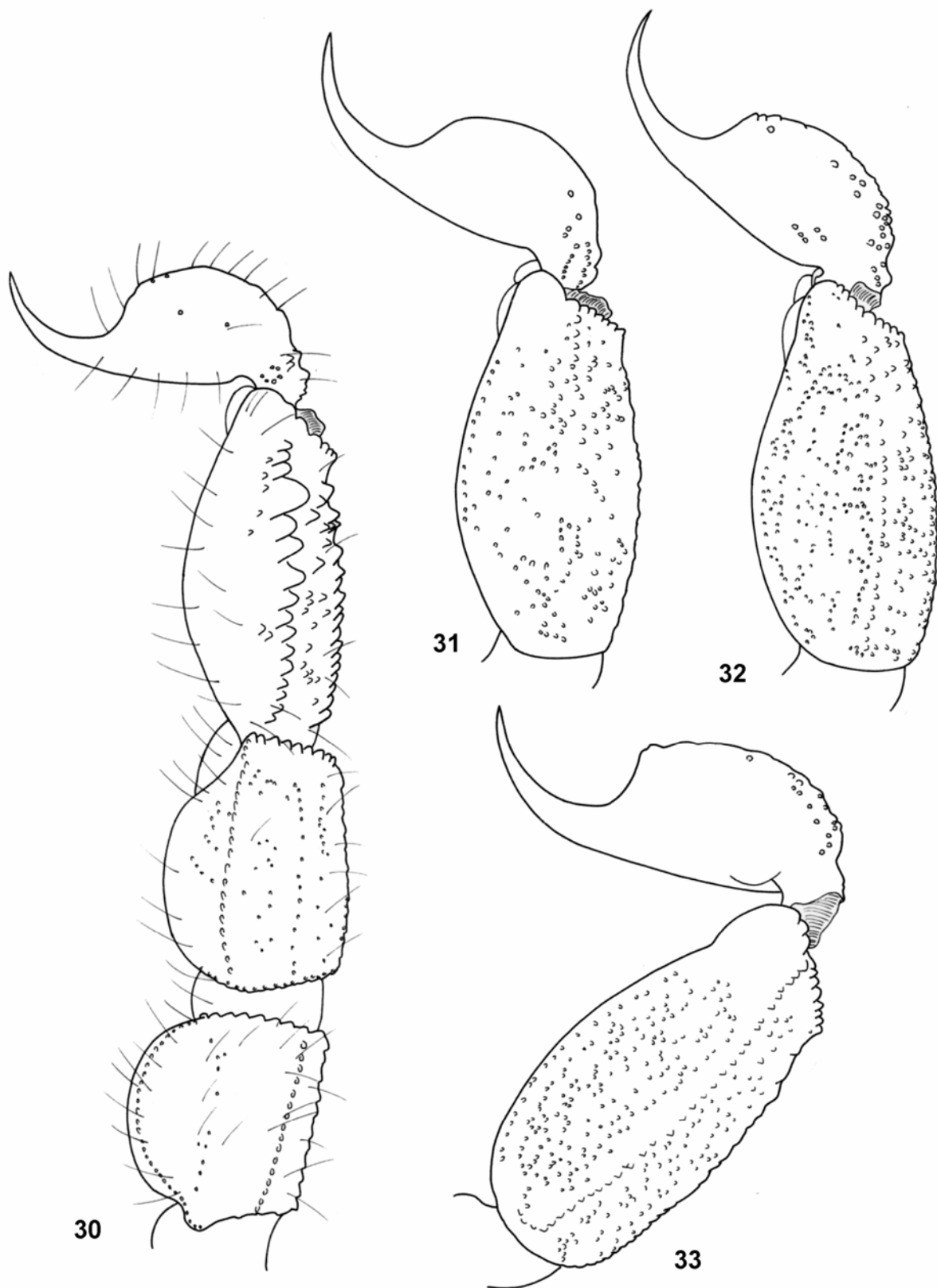
smooth. Fixed and movable fingers with 5-6 rows of granules. Trichobothriotaxy: neobothriotaxy A-β; trichobothrium d<sub>2</sub> absent of patella (Vachon, 1974, 1975). Legs: tarsus with two rows of fine setae ventrally. Tibial and pedal spurs moderately to weakly marked.

#### **Taxonomic comments on the genera *Butheolus*, *Nanobuthus* and *Neobuthus***

In a recent publication (Lourenço, 2001), I have attempted to clarify the taxonomic position of the genera *Butheolus*, *Nanobuthus* and *Neobuthus*. For this purpose, I listed a table of characters useful for the definition of these genera. Some of these characters may not be totally stable, such as the number of lateral eyes or the number of rows of granules in fixed and movable fingers of the pedipalps, but other cer-

tainly are. Two of these characters have been consecutively tested, namely the morphology of the anterior margin of the carapace, and structure of the latero-ventral carinae of metasomal segment V. In all cases these prove to be constant for the three genera. *Butheolus* has a slightly convex anterior margin to the carapace and the latero-ventral carinae of metasomal segment V are covered with granules, in some cases, slightly spinoid. In contrast, in *Nanobuthus* and especially in *Neobuthus*, the anterior margin of the carapace is straight and the latero-ventral carinae of metasomal segment V present either small lobes or two to five conspicuous lobes. In my previous paper (Lourenço, 2001) these characters were correctly illustrated (Figs. 11 to 14 and 20).

In a very recent publication, Kovarik (2003) severely criticized my approach of 2001, and argued that his own observations on these three genera lead to the conclusion

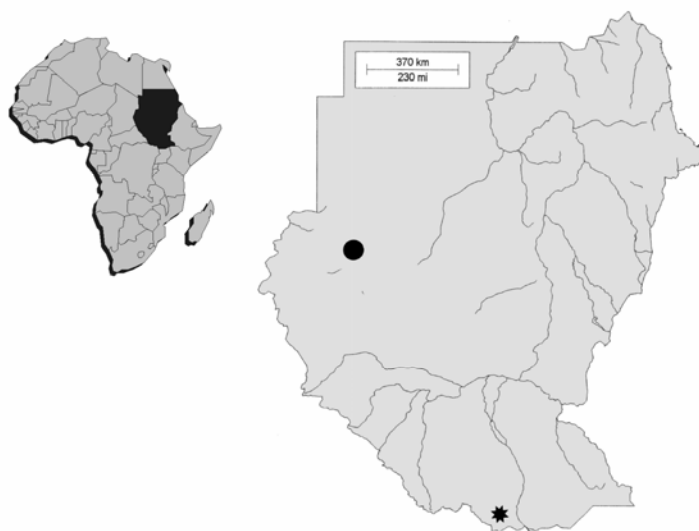


**Fig. 30.** *Neobuthus sudanensis* sp. n. Female holotype. Metasomal segments III to V and telson, lateral aspect. **Figs. 31-33.** Metasomal segment V and telson, lateral aspect in *Butheolus* species: **31.** *Butheolus ferrugineus*, male co-type (det. Kraepelin). **32.** *Butheolus gallagheri*, male holotype. **33.** *Butheolus thalassinus*, male co-type (det. Simon).

that such characters have no taxonomic value. According to this author, the latero-ventral carinae in both *Butheolus* and *Neobuthus* species have conspicuous lobes, and he claims to have observed this in *Neobuthus berberensis*, *Butheolus ferrugineus* and *Butheolus gallagheri*. Also according to

him, *Butheolus ferrugineus* and *B. gallagheri* would have the anterior margin of the carapace straight. The excellent illustrations by M. Gaillard presented in my previous note (Lourenço, 2001), based on the type specimens of *B. thalassinus*, *B. ferrugineus* and *N. berberensis* (figs. 31-33),

**Fig. 34.** Map of Sudan, showing Loka, type locality of the new species (black star), and the type locality of *Buthus brignolii* Lourenço (black circle).



clearly refute Kovarik's observations. Moreover, Kovarik's allegations are not supported by any illustrations at all. I include here new detailed drawings of the metasomal segment V of three species of *Butheolus*, including one of the male holotype of *B. gallagheri*. I doubt whether Kovarik has observed a valid specimen of this species. These drawings clearly show the absence of lobes. In comparison, the new species of *Neobuthus* described here does show very clear lobes on the latero-ventral carinae of metasomal segment V.

Furthermore, at the end of his analysis, Kovarik (2003) rejected the validity of *Neobuthus cloudsleythompsoni* and regarded this species as a 'nomen dubium'. This position is fallacious since *N. cloudsleythompsoni* was properly described and illustrated, and based on three adult specimens that are deposited in the Museum national d'Histoire naturelle, Paris.

I will return to this question of the genus *Butheolus* and also other related buthid groups (e.g. *Orthochirus*) in some other publications, now in preparation.

#### Acknowledgements

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