Revista Ibérica de Aracnología, nº **41** (31/12/2022): 15–36.
Grupo Ibérico de Aracnología (S.E.A.). ISSN: 1576 - 9518.

THE GENUS *BUTHUS* LEACH, 1815 (SCORPIONES: BUTHIDAE) IN THE IBERIAN PENINSULA. PART 5: A NEW PSAMMOPHILE SPECIES FROM NORTHERN SPAIN, A SYNONYMY AND FIRST ALBINISM RECORD IN THE GENUS

Rolando Teruel[1, 2] & Carlos Turiel[3]

[1] Grupo de Sistemática y Ecología de Artrópodos Caribeños. Calle 200 # 3759 entre 37 y 45, Reparto Versalles; La Lisa; La Habana 13500. CUBA. teruelrolando6@gmail.com
[2] Instituto de Ecología y Sistemática (Subdirección de Colecciones Zoológicas), Carretera de Varona # 11835 entre Oriente y Lindero, Reparto Calabazar, Boyeros; La Habana 11900, CUBA.
[3] Niederrheinstrasse 49, 41472 - Neuss, GERMANY. Centruroides@gmx.de

Abstract: The present paper represents the fifth contribution of our taxonomic revision of the genus *Buthus* Leach, 1815 in the Iberian Peninsula. Herein, we describe a new species from the pine forests on siliceous sands of the Duero River in Valladolid, in the core of the Submeseta Norte (northern Spain). This species is remarkable because of its morphology adapted to burrow in sand, and thus it resembles only *Buthus delafuentei* Teruel & Turiel, 2020, endemic from the same habitat type, but along the Cádiz Gulf and the lower basin of the Guadalquivir River (southwestern Spain). Moreover, we clarify the true taxonomic status of *Buthus lusitanus* Lourenço, 2021, by proving that it is actually a junior synonym of *Buthus halius* (C. L. Koch, 1838) and that its original description is wrong, since it is based only on immature specimens. The West European diversity of *Buthus* stays at 17 species, all of them local endemics.
Key words: Scorpiones, Buthidae, *Buthus*, taxonomy, new species, new synonymy, Iberian Peninsula.

El género *Buthus* Leach, 1815 (Scorpiones: Buthidae) en la Península Ibérica. Parte 5: una especie nueva arenícola de España septentrional, una sinonimia y primer registro de albinismo en el género
Resumen: El presente artículo representa la quinta contribución de nuestra revisión taxonómica del género *Buthus* Leach, 1815 en la Península Ibérica. Aquí describimos una especie nueva de los pinares sobre arenas silíceas del río Duero en Valladolid, en el corazón de la Submeseta Norte (España septentrional). Esta especie es notable por su morfología adaptada a excavar en la arena, por lo que se asemeja únicamente a *Buthus delafuentei* Teruel & Turiel, 2020, endémico del mismo tipo de hábitat pero a lo largo del Golfo de Cádiz y la cuenca baja del río Guadalquivir (España suroccidental). También, aclaramos el verdadero estatus taxonómico de *Buthus lusitanus* Lourenço, 2021, demostrando que en realidad constituye un sinónimo posterior de *Buthus halius* (C. L. Koch, 1838) y que su descripción original es errónea, al basarse sólo en especímenes inmaduros. La diversidad de *Buthus* en el Poniente europeo se mantiene en 17 especies, todas endemismos locales.
Palabras clave: Scorpiones, Buthidae, *Buthus*, taxonomía, especie nueva, nueva sinonimia, península ibérica.

Taxonomía/Taxonomy: *Buthus castellano* **sp. n.**, *Buthus halius* (C. L. Koch, 1838) = *Buthus lusitanus* Lourenço, 2021 **syn. n.**

Introduction

The present paper offers the fifth part of our continued taxonomic revision of the genus *Buthus* Leach, 1815 in the Iberian Peninsula. For the main results achieved so far, as well as for the complete history of the research subject, the interested reader must consult the previous parts already published: Teruel & Turiel (2020, 2021a–b, 2022).

In this contribution, we describe another peculiar new species, i.e., the second psammophile member of the genus in Iberia, which occurs in the open pine forest on siliceous sands of Valladolid, in northern Spain. Moreover, we clarify the correct identity of the enigmatic *Buthus lusitanus* Lourenço, 2021, which turned out to be not valid and wrongly described upon immature specimens only.

Methods & Material

See complete information in Teruel & Turiel (2020: 4–5), Teruel & Turiel (2021a: 3–4), Teruel & Turiel (2021b: 3–4) and Teruel & Turiel (2022: 19).

Systematics

1. A NEW PSAMMOPHILE SPECIES FROM NORTHERN SPAIN.

***Buthus castellano* sp. n.**
Figures 1–11, 22, 24, 26. Tables I–III

TYPE DATA. **SPAIN**: CASTILLA Y LEÓN: Valladolid Province: Tudela de Duero Municipality: Pinar de Herrera: 1 km southeast of Herrera de Duero, near road CL-600 (41°33'22.5"N / 4°38'32.1"W / 700 m a.s.l.); 11/August/2022; C. Turiel; 1♂ holotype (RTO), 11♂♂, 7♀♀, 22 juvenile ♂♂, 8 juvenile ♀♀ (paratopotypes - RTO). Valladolid Municipality: Pinar del Esparragal: 1.9 km southwest of Puente Duero, near road CL-610 (41°32'27.4"N / 4°48'38.4"W / 700 m a.s.l.); 12/August/2022; C. Turiel; 1♂, 4♀♀, 14 juvenile ♂♂, 8 juvenile ♀♀ (paratypes - RTO).

ETYMOLOGY. The selected epithet is an indeclinable noun in apposition, i.e., a demonym: the traditional Spanish name for the natives of both Castilla-La Mancha and Castilla y León, the latter including the known distribution of the species.

Table I. Measurements of five adult types of *Buthus castellano* **sp. n.** Abbreviations: length (L), width (W), posterior width (Wp), depth (D).

Dimensions (mm)		♂ paratopotype	♂ holotype	♂ paratopotype	♀ paratopotype	♀ paratopotype
Carapace	L / Wp	6.50 / 6.90	6.81 / 7.90	7.20 / 7.84	7.20 / 8.30	7.50 / 9.80
Mesosoma	L	14.50	17.20	19.85	17.60	20.80
Metasoma	L	33.21	33.86	36.27	31.72	34.70
Segment I	L / W / D	5.15 / 4.58 / 3.90	5.21 / 4.70 / 3.92	5.70 / 5.30 / 4.35	4.80 / 4.70 / 4.12	5.10 / 5.08 / 4.45
Segment II	L / W / D	5.92 / 4.28 / 3.70	6.10 / 4.50 / 3.92	6.60 / 4.90 / 4.30	5.70 / 4.55 / 4.08	6.10 / 4.90 / 4.33
Segment III	L / W / D	6.28 / 4.22 / 3.60	6.45 / 4.38 / 3.90	6.85 / 4.88 / 4.15	5.90 / 4.50 / 4.05	6.50 / 4.80 / 4.40
Segment IV	L / W / D	7.26 / 4.00 / 3.20	7.30 / 4.08 / 3.50	7.92 / 4.50 / 3.80	7.00 / 4.30 / 3.70	7.50 / 4.75 / 3.90
Segment V	L / W / D	8.60 / 3.68 / 2.88	8.80 / 3.70 / 3.00	9.20 / 3.95 / 3.35	8.32 / 4.20 / 3.20	9.50 / 4.50 / 3.50
Telson	L	7.14	7.46	8.25	8.20	8.85
Vesicle	L / W / D	3.90 / 3.24 / 2.83	4.18 / 3.28 / 2.90	4.55 / 3.70 / 3.20	4.25 / 3.70 / 3.18	4.85 / 4.10 / 3.60
Aculeus	L	3.24	3.28	3.70	3.95	4.00
Pedipalp	L	24.22	25.73	27.15	26.48	28.45
Femur	L / W	5.70 / 1.70	5.99 / 1.78	6.50 / 1.88	6.15 / 1.90	6.50 / 2.00
Patella	L / W	6.50 / 2.60	7.00 / 2.70	7.25 / 2.90	7.13 / 2.85	7.40 / 2.95
Chela	L	12.02	12.74	13.40	13.20	14.55
Manus	L / W / D	4.80 / 3.22 / 3.52	4.90 / 3.42 / 3.72	5.20 / 3.60 / 4.00	5.10 / 3.20 / 3.62	5.65 / 3.50 / 3.98
Movable finger	L	7.22	7.84	8.20	8.10	8.90
Total	**L**	**61.35**	**65.33**	**71.57**	**64.72**	**71.85**

DIAGNOSIS. Adult size moderately large for the genus (61–72 mm in males, 65–72 mm in females), male slightly smaller than same size-class females. Coloration with base pale yellow; carapace and tergites with a dark trivittate pattern all along; carapace, tergites and ventral surface of metasoma with all carinae faintly to moderately infuscate; chelicerae, pedipalps and legs with carinae essentially immaculate. Sexual secondary dimorphism moderate in habitus (males slightly smaller and slenderer), moderate in pedipalps (manus oval and wider than patella in both sexes, but shorter and rounder in males) and conspicuous in metasoma (longer, narrower and lower in males). Pedipalp chela with many dark macrosetae scattered all over; manus with all carinae absent to obsolete, smooth; fingers long (movable finger/manus length ratio: 1.50–1.60 in males, 1.58–1.59 in females), fixed and movable fingers with 12–13 (exceptionally 14) principal rows of denticles, basal lobe/notch combination moderate. Pectines with 29–34 teeth (mode 31) in males, 23–28 (mode 25) in females. Metasoma of males slightly longer, narrower and lower than standard for the genus (see ratios in tab. II); dorsal lateral and lateral supramedian carinae weakly to moderately crenulate to subcrenulate on segments II–IV, ventral submedians on II–III raised distally feebly in males, but very strongly in females; intercarinal tegument coriaceous, with many minute to fine granules dorsally and laterally on IV and all over V; setation sparse, with 2–3 pairs of dark macrosetae on almost all carinae (4–5 pairs on lateral supramedians and ventral laterals of V). Telson vesicle not enlarged, subglobose in males and globose in females.

DESCRIPTION (adult male holotype; tabs. I–III; figs. 1, 3, 5, 7, 9, 11a; see also a paratopotype in fig. 22a).

Coloration. Base pale yellow, slightly paler on chelicerae, pedipalp chelae, legs, venter and telson. Chelicerae pale yellow, immaculate. Pedipalps essentially immaculate, only with very faint infuscation along dorsal internal carinae of femur and patella. Carapace with all carinae and only few of coarse granulation infuscate, irregularly connecting adjacent major carinae, but not defining any dark blotch around median ocular tubercle; eyes and ocular tubercles black. Tergites with all carinae and coarse granulation infuscate and with symmetric dark brown spots on lateral areas, defining altogether a clearly trivittate pattern (i.e., a narrow, median solid line plus two broad, irregularly variegated lateral stripes, all three well separated). Sternopectinal region and sternites immaculate. Pectines pale yellowish to whitish, with basal portion and basal plate progressively darker due to heavier sclerotization. Legs essentially immaculate. Metasoma concolor (i.e., no segments conspicuously darker) and essentially immaculate, only with faint to moderate infuscation along carinae of ventral surface as thin dark lines. Telson immaculate, distal half of aculeus blackish.

Chelicerae. With dentition typical for the genus, teeth standard-sized and moderately sharp. Tegument smooth, glossy and minutely punctate, dorsodistal portion of manus with many medium-sized, conical to round, glossy granules around the dorsodistal depression. Setation very dense ventrally, but essentially lacking dorsally except for a patch of macrosetae at fixed finger base plus a large dark macroseta and several translucent setae of various sizes on dorsodistal depression of manus.

Pedipalps. Size standard for the genus (3.78 times longer than carapace). Femur essentially straight (very slightly bent inwards distally) and with setation moderately dense and composed of both dark and pale setae of various sizes, more concentrated along ventrodistal edge; all carinae moderate and serratocrenulate to granulose, formed by medium-sized, isolated, glossy granules; intercarinal tegument coriaceous and minutely punctate on glossier areas. Patella straight and with dark macrosetae scattered all over; all carinae moderate to weak and granulose to subcostate, the former formed by medium-sized, isolated, glossy granules; intercarinal tegument coriaceous to with a satin sheen and minutely punctate on glossier areas, internal surface with some small, weak denticles. Chela with manus short-oval (length/width ratio = 1.43, length/depth ratio = 1.32, median part widest), wider than patella (ratio 1.27) and with dark macrosetae scattered all over, all carinae obsolete (smooth) to absent, intercarinal tegument smooth, glossy and minutely punctate; fingers moderately long (movable 1.60 times longer than underhand), moderately thick, weakly curved and densely setose, fixed finger with 12/12 principal rows of denticles plus 12/12 inner and 12/12 outer accessory denticles (much coarser than principal denticles), movable finger with 13/13 principal rows of denticles plus 11/12 inner and 10/12 outer accessory denticles (much coarser than principal denticles), and the standard apical subrow with 3/3 denticles (large terminal denticle not included), basal lobe/notch combination moderate, long and leaving a conspicuous, elongate basal gap when fingers closed.

Table II. Selected morphometric ratios of the adult types of *Buthus castellano* **sp. n.** and its sibling species *B. delafuentei*. Abbreviations: length (L), width (W), depth (D). To compare it to the other 15 Iberian species, see Teruel & Turiel (2020: 38; tab. XIII), Teruel & Turiel (2021a: 13; tab. III), Teruel & Turiel (2021b: 5; tab. II), Teruel & Turiel (2022: 21; tab. II), Ythier (2021a: 2, 4) and Ythier (2021b: 2–7; tabs. II–III).

Ratios	*B. castellano sp. n.*	*B. delafuentei*
♂ pedipalp L / carapace L	3.73–3.78	3.69–3.72
♀ pedipalp L / carapace L	3.68–3.79	3.57–3.69
♂ pedipalp chela L/W	3.72–3.73	3.51–3.52
♀ pedipalp chela L/W	4.12–4.18	4.69–4.80
♂ pedipalp manus L/W	1.43–1.49	1.41–1.43
♀ pedipalp manus L/W	1.59–1.61	1.76–1.80
♂ pedipalp chela L / movable finger L	1.62–1.66	1.67–1.68
♀ pedipalp chela L / movable finger L	1.63–1.64	1.59–1.60
♂ pedipalp manus W / patella W	1.24–1.27	1.35–1.39
♀ pedipalp manus W / patella W	1.12–1.19	0.96–0.98
♂ metasoma L / carapace L	4.97–5.11	5.05–5.15
♀ metasoma L / carapace L	4.41–4.63	4.37–4.48
♂ metasomal segment I L/W	1.08–1.12	1.16–1.18
♀ metasomal segment I L/W	1.00–1.02	1.06–1.07
♂ metasomal segment I L/D	1.31–1.33	1.33–1.36
♀ metasomal segment I L/D	1.15–1.16	1.18–1.19
♂ metasomal segment IV L/W	1.76–1.81	1.84–1.90
♀ metasomal segment IV L/W	1.58–1.63	1.65–1.71
♂ metasomal segment IV L/D	2.08–2.27	2.20–2.24
♀ metasomal segment IV L/D	1.89–1.92	2.03–2.06
♂ metasomal segment V L/W	2.34–2.38	2.02–2.16
♀ metasomal segment V L/W	1.98–2.11	1.89–1.97
♂ metasomal segment V L/D	2.75–2.99	2.43–2.59
♀ metasomal segment V L/D	2.60–2.71	2.50–2.57
♂ telson L/W	2.20–2.27	2.27–2.32
♀ telson L/W	2.16–2.22	2.31–2.32
♂ telson L/D	2.52–2.58	2.53–2.54
♀ telson L/D	2.46–2.58	2.46–2.55

Table III. Pectinal tooth count variation in *Buthus castellano* **sp. n.** and its sibling species *B. delafuentei*. Abbreviations: number of pectines (N), average (Ave.), standard deviation (SD). To compare it to the other 15 Iberian species, see Teruel & Turiel (2020: 39; tab. XIV), Teruel & Turiel (2021a: 13; tab. IV), Teruel & Turiel (2021b: 5; tab. III), Teruel & Turiel (2022: 21; tab. III), Ythier (2021a: 2, 4) and Ythier (2021b: 4).

Species	Sex	*N*	Pectinal tooth count													Ave.	SD
			23	24	25	26	27	28	29	30	31	32	33	34	35		
B. castellano **sp. n.**	♂♂	106							14	27	43	16	3	3		30.77	± 0.86
	♀♀	56	2	8	24	15	6	1								25.32	± 0.75
B. delafuentei	♂♂	10								1	2	3		2	2	32.00	± 1.32
	♀♀	6				3	1	2								26.83	± 0.90

Carapace. Wider than long (length/width ratio = 0.86). Anterior margin shallowly concave, with 4–5 pairs of dark macrosetae. Carinae with lyre-shaped configuration perfectly defined: anterior medians and superciliaries strong, fused into a spoon-shaped figure and formed by coarse, isolated, glossy granules; central laterals and posterior medians strong, fused into an S-shaped figure and formed by coarse, isolated, glossy granules; lateral oculars and central medians strong, not fused (widely separated) and formed by coarse, isolated, glossy granules; posterior laterals obscured by surrounding coarse granulation. Furrows: posterior laterals deep and wide, other furrows obscured by remarkably depressed areas between adjacent carinae. Tegument coriaceous to with a satin sheen and irregularly covered by dense, variously sized, glossy granules all over (denser on lateral and frontal areas). Median eyes large, separated by about twice the ocular diameter; lateral eyes much smaller and mostly concealed below a granulose carina.

Sternum. Type 1, very small, triangular and convex, with a single pair of thick, dark macrosetae, plus few minor, translucent setae. Tegument coriaceous, with fine and medium-sized granules scattered.

Genital operculum. With about 10 pairs of thick, dark macrosetae and few inconspicuous minor setae. Valves roundly subtriangular, strongly convex and widely separated along posterior half; tegument smooth and glossy, but densely covered by dense, medium-sized, glossy granules along margins except posteriorly and medially. Genital papillae medium-sized, digitiform and not protruding.

Pectines. Long (reaching midpoint of leg IV trochanter) and narrowly rectangular, setation very dense and dark. Tooth count 31/31, teeth not swollen and angulose. Fulcra large and swollen, paraboloid to round. Basal middle lamella narrowly trapezoidal. Pre-pectinal plate heavily sclerotized, very short, wide and folded transversely, crescent-shaped; tegument coriaceous. Basal plate heavily sclerotized, wider than long, with 3–4 pairs of dark macrosetae; anterior margin essentially straight, posterior margin convex; tegument coriaceous, with three conspicuous, deep depressions: one anteromedian (transverse, narrow and progressively much deeper medially to become a pit) and two laterals (large and oval).

Legs. Long and slender, with all carinae weak to moderate and finely subserrate to subcostate except on femur, where moderate to strong and serrate. Intercarinal tegument coriaceous to with a satin sheen and minutely punctate on glossier areas, external surface of femur with few fine granules scattered. Bristlecombs very well developed on I–III; distal part of patella and entire tibia with shape and setation standard for

the genus (i.e., segments not enlarged and setation dense, long and thin). Tibial and pedal spurs very large and thin. Claws very long and shallowly curved.

Mesosoma. Size and shape standard for the genus. Tergites coriaceous and irregularly covered by dense, finely tuberculate granules (more concentrated along lateral areas), lateral margins finely denticulate, posterior margin minutely tuberculate; carinae: median longitudinal straight, progressively longer and stronger backwards and formed by medium-sized, isolated, tuberculate granules, submedians anteriorly divergent, very shallowly arcuate to feebly S-shaped on I–VI, shallowly S-shaped on VII, progressively longer and stronger backwards and formed by medium-sized, isolated, tuberculate (I–VI) to round (VII) granules, laterals absent on I–VI, strong, shallowly S-shaped and formed by medium-sized, isolated, glossy granules on VII. Sternites with long, dark macrosetae scattered all over (denser on III–IV); lateral margins of all sternites minutely serrate, posterior margin minutely denticulate; carinae present only on posterior two-thirds of all segments: submedians vestigial to weak on III–V (smooth, costate and parallel), moderate on VI (subcostate and subparallel), complete and moderately strong on VII (subcrenulate and parallel), laterals vestigial on III, moderately strong on IV–VI (smooth, coarsely costate, sinuose and parallel), moderately strong on VII (subcrenulate and parallel); tegument on III–VII coriaceous to with a satin sheen and minutely punctate; spiracles very long and slit-like; sternite V with median smooth patch inconspicuous, very wide, short, flat and translucent.

Metasoma. Size standard for the genus (4.97 times longer than carapace), but slightly narrower, remarkably narrower and lower distally, with segment V both narrowest and lowest. Segment I with ten complete carinae, II–IV with eight, V with five: dorsal laterals weak and crenulate on I–II, very weak and subcrenulate on III–IV, absent on V; lateral supramedians moderate and crenulate on I–V; lateral inframedians moderate and crenulate, complete on I, present on almost distal half of II–III, absent on IV–V; ventral laterals moderate and crenulate on I, strong and crenulate on II–IV, strong and irregularly serrate to lobate on V (with 4–5 sharp and larger lobes); ventral submedians moderate and subcrenulate on I, moderate to strong, progressively stronger backwards and subcrenulate to crenulate on II–III (freebly raised distally), moderately strong and serratocrenulate on IV, absent on V (but subtly indicated by a pair of incomplete and irregular rows of conical granules on basal two-thirds); ventral median absent on I–IV, strong and coarsely serrate to dentate on V (irregularly bifurcate on distal half). Intercarinal tegument coriaceous, with many minute to fine granules dorsally and laterally on IV and all over V; dorsal furrow complete, wide and very shallow on all segments; setation sparse, with 2–3 pairs of long, dark macrosetae on most carinae (4–5 pairs on lateral supramedians and ventral laterals of V).

Telson. Vesicle not enlarged, subglobose (length/width ratio = 1.27, width/depth ratio = 1.13), with seven pairs of dark macrosetae and many minor translucent setae scattered all over; tegument with satin sheen and minutely punctate, with many weak, glossy granules scattered ventrally and laterally; ventral median carina obsolete, as are two accessory pairs of carinae (ventral laterals and lateral supramedians?), subaculear tubercle absent. Aculeus relatively long, but shorter than vesicle (ratio = 0.78), sharp and shallowly curved.

FEMALE (adult paratopotypes; tabs. I–III; figs. 2, 4, 6, 8, 10, 11c–d, 22b). Sexual dimorphism very conspicuous, differing from described male by: **1)** size slightly larger (64.7–71.8 mm) within the same size-class; **2)** entire body and appendages with setation remarkably denser; **3)** pedipalp manus slightly longer and slenderer (length/width ratio = 1.59–1.61, length/depth ratio = 1.41–1.42); **4)** mesosoma wider, with lateral sides more convex; **5)** pre-pectinal plate reduced to a tiny oval sclerite, invaginated into the membrane to look like a transverse pit; **6)** genital papillae absent; **7)** pectines smaller and narrower, with lower tooth counts (23–27) and teeth more separated; **8)** metasoma relatively shorter, with carinae stronger (especially the ventral submedians on segments II–III, which are more much stronger and coarsely lobate); **9)** telson vesicle globose, with tegument much smoother.

VARIATION. The specimens available from both localities are remarkably homogeneous in morphology, without any noticeably disrupting character (fig. 11). In the pooled sample, adult size (tab. I) varied from 61.3–71.6 mm in males and 74.7–71.8 mm in females. There are apparently three size-classes in males and two in females.

Coloration is quite constant among available specimens and there are only subtle differences in the shade of the base color and the extent of the dark patterns. The former is largely attributable to aging, i.e., older specimens are slightly darker and vice versa. The latter is random, but following the two trends usual for the genus: adult females are slightly darker and more patterned than adult males, and juveniles have base color paler, but fuscous pattern even more developed (in both extension and darkness) than adults of either sex.

The basal lobe/notch combination has the same degree of development among specimens belonging to the same instar: moderate in adults (stronger in males), vestigial to obsolete in subadults and late-instar juveniles, and absent in earlier instars. Within adults of each sex, it follows the same trend, i.e., the largest the adult, the more strongly developed its basal lobe/notch combination.

The number of principal rows of denticles varied from 12–13 in both fingers, with so frequent asymmetries (between both fingers of the same pedipalp, but also between both pedipalps), that no mode can be clearly defined. Exceptional occurrence of 14 rows was detected (four cases), all involving a single finger of each specimen (two fixed and two movable fingers).

Pectinal tooth counts (tab. III) varied from 29–34 in males and 23–28 in females, with a clear mode of 31 in former sex and 25 in the latter. Single-tooth asymmetry was a frequent occurrence, being present in 39 (52%) of the specimens examined, with similar frequency in each sex. Two-tooth asymmetry was not rare, being present in 10 specimens (13%). Four cases of minor pectinal teratology were detected, all in specimens from Puente Duero and consisting in basal-most teeth of one pecten fused at its base. Three of these cases (two left pectines, one right pecten) involved the two basal teeth fused into a single, conspicuously bicuspid tooth, while the other (left pecten) implied the four basal teeth partially fused into a hand-shaped structure. One case similar to the latter was described and illustrated by Armas (1987: 13; fig. 4a), in the Hispaniolan high-mountain buthid scorpion *Tityus quisqueyanus* Armas, 1982.

COMPARISON. Based on its observed life strategy and external morphology, which fulfill all requisites defined by Pren-

dini (2001: 136–137), *B. castellano* **sp. n.** is clearly a psammophile scorpion. It lives exclusively in burrows self-excavated in open sandy substratum, its legs are long and slender, with bristlecombs well developed and claws long and less curved than usual, the metasoma is posteriorly tapered, and the tegument of body and appendages is remarkably smooth and glossy, with heavily reduced carination and granulation.

All these characters make it very easy to distinguish (even to unaided eye) from all other Western European congeners, with the single exception of the only other Iberian psammophile: *Buthus delafuentei* Teruel & Turiel, 2020. The latter can be reliably distinguished from *B. castellano* **sp. n.** as follows: **1)** adult males remarkably larger than same size-class females; **2)** coloration with base slightly darker (vivid yellow to pale yellowish brown), with fuscous pattern more developed (both darker and denser); **3)** pedipalp chela heavier in males, but slenderer in females; **4)** pectinal tooth counts slightly but consistently higher (see table XIV in Teruel & Turiel, 2020: 39); **5)** entire body and appendages with setation sparser, especially on pedipalps and venter); **6)** metasoma larger, but conspicuously less narrower and lower distally (especially segment V); **7)** metasoma with ventral submedian carinae of segments II–III and ventrolateral carinae of segment V, both much finer and only weakly and sharply lobed; **8)** telson vesicle remarkably more globose in males.

Most of the differences mentioned above can be observed even to unaided eye, i.e., by comparing figures 1–11 and 22 herein, to figures 19–20 and 30b in Teruel & Turiel (2020: 50, 57). For morphometric ratios, please compare table II herein to table XIII in Teruel & Turiel (2020: 38).

Moreover, the geographical distribution of these two species is widely allopatric: *B. castellano* **sp. n.** occurs in the core of the Submeseta Norte in northern Spain, while *B. delafuentei* occurs only along the sands of the Cádiz Gulf coast and the lower basin of its tributary Guadalquivir River, in southwestern Spain. Both areas are biogeographically quite distinct and separated from each other by a distance of more than 500 km, which includes the remarkable isolation barriers of some of the most important Iberian mountain systems in between, e.g., the Central System and the Sierra Morena (fig. 26).

DISTRIBUTION (fig. 26). According to our personal data and high-resolution photographs of collaborators, *B. castellano* **sp. n.** is endemic to the pine forests on siliceous sands of the middle part of the Duero River Basin of central Valladolid, in the core of the Submeseta Norte (central Castilla y León), in northern Spain.

ECOLOGICAL NOTES (figs. 22, 24). This is a psammophile scorpion, which digs burrows in siliceous sandy soils, with a variable but small mix of clay and loam, completely devoid or superficial rocks. The vegetation is open pine forest, mixed of *Pinus pinaster* Aiton, 1789 and *Pinus pinea* Linnaeus, 1753, with sparse grass undergrowth.

All specimens of *B. castellano* **sp. n.** were collected during nocturnal searches with ultraviolet light (UV), sitting on the ground or walking near their burrow entrance. The species occurs in high population densities, but it is not homogeneously distributed across the areas due to differences in vegetal cover: the sites with denser pine canopy and thus, colder and more humid, are largely avoided or keep only very low scorpion density. More than half of the specimens observed in each sampling were immatures, but adults were not rare, at least in the sampled dates.

According to AEMET (2012), the climate of the area is continental Mediterranean, with hot summers and cold winters (frost and snow are habitual) and the widest extreme temperature fluctuations (about 18.5°C) of the whole Iberian Peninsula. The historic pluviometric yearly mean is about 400–600 mm, which classifies it as a dry area.

REMARKS. This is the second psammophile species of the genus described from the Iberian Peninsula, as well as the third nominal species confirmed to occur in its northern part.

2. THE TRUE TAXONOMIC IDENTITY OF *BUTHUS LUSITANUS* LOURENÇO, 2021.

Very recently, an enigmatic *Buthus lusitanus* was described by Lourenço (2021) from Manteigas, a village located in the upper Zêzere Valley of the Serra da Estrela, in north-central Portugal. As usual for its author, the paper is loaded with personal attacks and non-scientific statements aimed to discredit one of our previous works (Teruel & Turiel, 2020). We will not waste our valuable time in replying to that, instead, we encourage the interested reader to read both sources and gather his/her own conclusions, while we just focus on the strictly scientific questions.

The original description of *B. lusitanus* was based on three type-specimens, declared by Lourenço (2021: 2) as one adult female holotype and two juvenile male paratypes. Evidently based on the believing that the holotype female is an adult specimen that lacks the basal lobe/notch combination of pedipalp fingers, Lourenço (2021: 1, 3–4) regarded *B. lusitanus* as most closely-related to *Buthus alacanti* Teruel & Turiel, 2020 (misspelled as "*alicanti*" by Lourenço, 2021: 4) and *Buthus occitanus* (Amoreux, 1789).

Such alleged phylogenetic relationship is perplexing and unexpected. First, because both *B. alacanti* and *B. occitanus* belong in a morphologically very compact group of species, characterized by the peculiar armature and sexual dimorphism of the adult pedipalp chela: manus slender and narrower than patella in males *vs.* globose and wider than patella in females, almost always with basal lobe/notch combination of fingers absent to vestigial in both sexes (see Teruel & Turiel, 2020, 2021a–b, 2022).

Second, because there is little in common biogeographically between the occurrence areas of *B. lusitanus* and the other two species. The species group including both *B. alacanti* and *B. occitanus* is widespread along Western Europe, but exclusively along the Mediterranean coast and its adjacent mountains and low tributary basins (e.g., the whole Ebro River), but it is largely absent from the two Iberian great plateaus (Submeseta Norte and Submeseta Sur), as well as from all western mountain ranges to the Atlantic coast. Such "exclusion area", which of course includes all of Portugal, is exclusively and entirely occupied by the opposite group, characterized by pedipalp manus robust and wider than patella in both sexes, but wider in males, almost always with basal lobe/notch combination of fingers well developed in both sexes (see Teruel & Turiel, 2020, 2021a–b, 2022). By the way, the distribution data we discuss herein are supported by the hardest evidence possible: the direct study of over 1,000 specimens we gathered for the present revision, from more than 100 localities across Western Europe.

The only males available for the original description of *B. lusitanus* are both immatures (the two paratypes, even explicitly declared as juveniles by Lourenço, 2021: 2, 5). Thus, it is methodologically wrong to assume what character the adult instar will possess and all phylogenetic relationships elaborated on this base are not scientific deduction, but mere unsupported speculation. Nevertheless, this is a standard procedure by Lourenço that has been widely exposed and severely criticized elsewhere, e.g., see the most recent, thoroughly discussed example in Kovařík & Lowe (2022: 16–19). To make it worse, the morphological description and drawings of *B. lusitanus* clearly indicate that the female holotype is also immature, instead of adult as assumed by Lourenço (2021).

As the MNHN scorpion types are not available to us for study (nor will be while Wilson Lourenço arbitrarily decides that, besides being or not the curator of that supposedly public-access collection), we took the second best approach to solve this question, i.e., to collect a fresh, representative series of specimens in the type-locality of *B. lusitanus*, i.e., multiple adults and juveniles of both sexes, of as many instars as possible. It must be mention here that sampling was carefully designed to cover the whole area in and around the published type-locality, in an altitude range from below through above the declared altitude of the collecting site, and using also the most efficient scorpion collecting technique, i.e., night search with the aid of UV light. This effort yielded the expected results: a pooled sample of 27 topotypes, including nine adult males, eight adult females and ten juveniles (five of each sex, from second instars through subadults).

The study of this sample demonstrated beyond any reasonable doubts, first, that all specimens are conspecific. Then, that the holotype is immature and thus, the most important character used by Lourenço (2021) to associate it to both *B. alacanti* and *B. occitanus* (the alleged absence of the basal lobe/notch combination in pedipalp fingers), was false and directly caused by its immaturity. Despite the size of the specimens, the basal lobe/notch combination is always well developed in all adults of both sexes, but vestigial in mid- to late-instar immatures and absent in the earlier instars. In figures 18–21 herein, we illustrate the complete range of sexual and eval variation in development of this character, from immatures to adults of both sexes, including different size-classes of females. It is noteworthy to mention here that the small adult female depicted in our figure 20 is slightly less than 60 mm long, roughly the same size as the holotype, which corresponds obviously to a subadult of the same size-class of the female depicted in our figure 19 (ca. 85 mm long).

Once defined that a single species of *Buthus* occurs at the type locality of *B. lusitanus* and that the original diagnosis, description and phylogenetic relationships given by Lourenço (2021) are all flawed due to the immature condition of the types, the last step remained to determine if it was still a valid species, or not. Thus, we carefully compared all topotypes of *B. lusitanus* to the types and/or topotypes of the remaining 17 Western European species of the genus. The conclusion is that the specimens from Manteigas are indistinguishable from another nominal species, which is also its nearest neighbor: *Buthus halius* (C. L. Koch, 1838), almost simultaneously resurrected by us (Teruel & Turiel, 2021a), with redescription and neotype designation included. The perfect match in all morphological characters currently diagnostic as species-level in the genus (size, coloration, shape, carination, granulation and setation of body and appendages), is evident in the figures 12–17 herein provided and leave no doubt that both taxa are conspecific.

Thus, we enter herein the following formal synonymy: *Androctonus halius* C. L. Koch, 1838 [currently *Buthus halius* (C. L. Koch, 1838)] = *Buthus lusitanus* Lourenço, 2021 **new synonym**.

REMARKS. With the present synonymy, the known distribution area of *B. halius* expands to cover most of the mountain ranges of the northern half of Portugal (fig. 26). We in a forthcoming part of this same series will present additional Iberian records for this moderately widespread species.

Amongst the 23 specimens of *B. halius* collected in 2022 at Manteigas, one adult male, one adult female and one late-instar juvenile (see figs. 23c–e) are albino and represent the first cases ever recorded for the genus *Buthus*. Moreover, as far as we know, these are also the first for the whole Buthidae family and among European scorpions. The juvenile is translucent whitish and the adults are translucent pale yellowish, but all are clear cases of albinism: all pigments are entirely absent (including the melanic ocular pigment) and the yellowish hue of adults is an optical artifact caused by the much thicker and heavily sclerotized exoskeleton. All of the few other darker areas in the three albino specimens also imply the same cause, e.g., the pedipalp and cheliceral dentition, distal half of aculeus, coarser carinae, granules and denticles, and macrosetae.

MATERIAL EXAMINED (32 specimens: 10♂♂, 10♀♀, 6 juvenile ♂♂, 6 juvenile ♀♀). **PORTUGAL**: NORTE: Bragança District: Vila Flor Municipality: Freixiel Parish: Abreiro train station in Tua riverbank, west of Quinta do Carvalhinho (41°20'44"N 07°16'50"W 180 m a.s.l.); 26/July/2006; P. R. de Sousa; 1 juvenile ♂ (CIBIO-Sc092). Vila Real District: Alijó Municipality: Amieiro Parish: Tua riverbank facing Santa Luzia train station (41°16'58"N 07°23'34"W 164 m a.s.l.); 23/July/2006; P. R. de Sousa; 1♂ (**neotype of *B. halius*** - IES, *ex* CIBIO-Sc094), 1♀ (**topotype of *B. halius*** - RTO, *ex* CIBIO-Sc087). São Mamede de Ribatua Parish: Tua riverbank along Quinta da Ribeira (41°13'40"N 07°25'09"W 141 m a.s.l.); 26/July/2006; P. R. de Sousa; 1♀ (RTO, *ex* CIBIO-Sc093), 1 juvenile ♀ (CIBIO-Sc091). CENTRO: Guarda District: Serra da Estrela: Vale do Zêzere: Manteigas Municipality: São Pedro Parish: south of Manteigas, along Caminho das Lameiras (40°23'08.3"N 7°32'45.5"W 820–880 m a.s.l.); 29/September/2021; C. Turiel; 2♀♀, 2 juvenile ♀♀ (**topotypes of *B. lusitanus*** - RTO). South of Manteigas, Abrigo do Faíscas on road N338 (40°22'21.5"N 7°32'57.5"W 1,000 m a.s.l.); 5/August/2022; C. Turiel; 9♂♂, 6♀♀, 5 juvenile ♂♂, 3 juvenile ♀♀ (**topotypes of *B. lusitanus*** - RTO).

Acknowledgments

See complete information in Teruel & Turiel (2020: 32), Teruel & Turiel (2021a: 11), Teruel & Turiel (2021b: 10) and Teruel & Turiel (2022: 23). In addition to that, we thank Slaven Divković (Dormagen, Germany) for the technical assistance during the photographic work, as well as Mark and Britta Stockmann (Hörstel, Germany), for the new samples supplied and the opportune transportation of the samples to Havana for study. Also, to Alexander Ulrich (Munich, Germany) for calling the first albino specimens of *B. halius* to our attention, and kindly sharing to us their origin data.

References

See a complete list in Teruel & Turiel (2020: 32–33), complemented by Teruel & Turiel (2021a: 12; 2021b: 11), Teruel & Turiel (2021b: 11) and Teruel & Turiel (2022: 23). Only those sources not listed therein and cited here follow:

AGENCIA ESTATAL DE METEOROLOGÍA [AEMET]. 2012. *Guía resumida del clima en España (1981-2010).* Ministerio de Agricultura, Alimentación y Medio Ambiente, Madrid.

ARMAS, L. F. DE 1987. Morfometría de *Tityus quisqueyanus* (Scorpiones: Buthidae) con notas sobre su historia natural. *Poeyana*, **338**: 1–17.

KOVAŘÍK, F. & G. LOWE 2022. Scorpions of the Horn of Africa (Arachnida, Scorpiones). Part XXVIII. Scorpions of Djibouti. *Euscorpius*, **357**: 1–31.

LOURENÇO, W. R. 2021. Une nouvelle espèce appartenant au genre *Buthus* Leach, 1815 (Scorpiones : Buthidae) collectée dans le Parc Naturel de la "Serra da Estrela" au Centre du Portugal. *Faunitaxys*, **9**(13): 1–7.

PRENDINI, L. 2001. Substratum specialization and speciation in southern African scorpions: the Effect Hypothesis revisited. Pp. 113–138 in: "*Scorpions 2001: In Memoriam Gary A. Polis*" (V. Fet & P. A. Selden, eds.), British Arachnological Society, Burnham Beeches, Bucks, xi + 404 pp.

TERUEL, R. & C. TURIEL 2020. The genus *Buthus* Leach, 1815 (Scorpiones: Buthidae) in the Iberian Peninsula. Part 1: four redescriptions and six new species. *Revista Ibérica de Aracnología*, **37**: 3–60.*

TERUEL, R. & C. TURIEL. 2021a. The genus *Buthus* Leach, 1815 (Scorpiones: Buthidae) in the Iberian Peninsula. Part 2: two more redescriptions. *Revista Ibérica de Aracnología*, **38**: 3–20.*

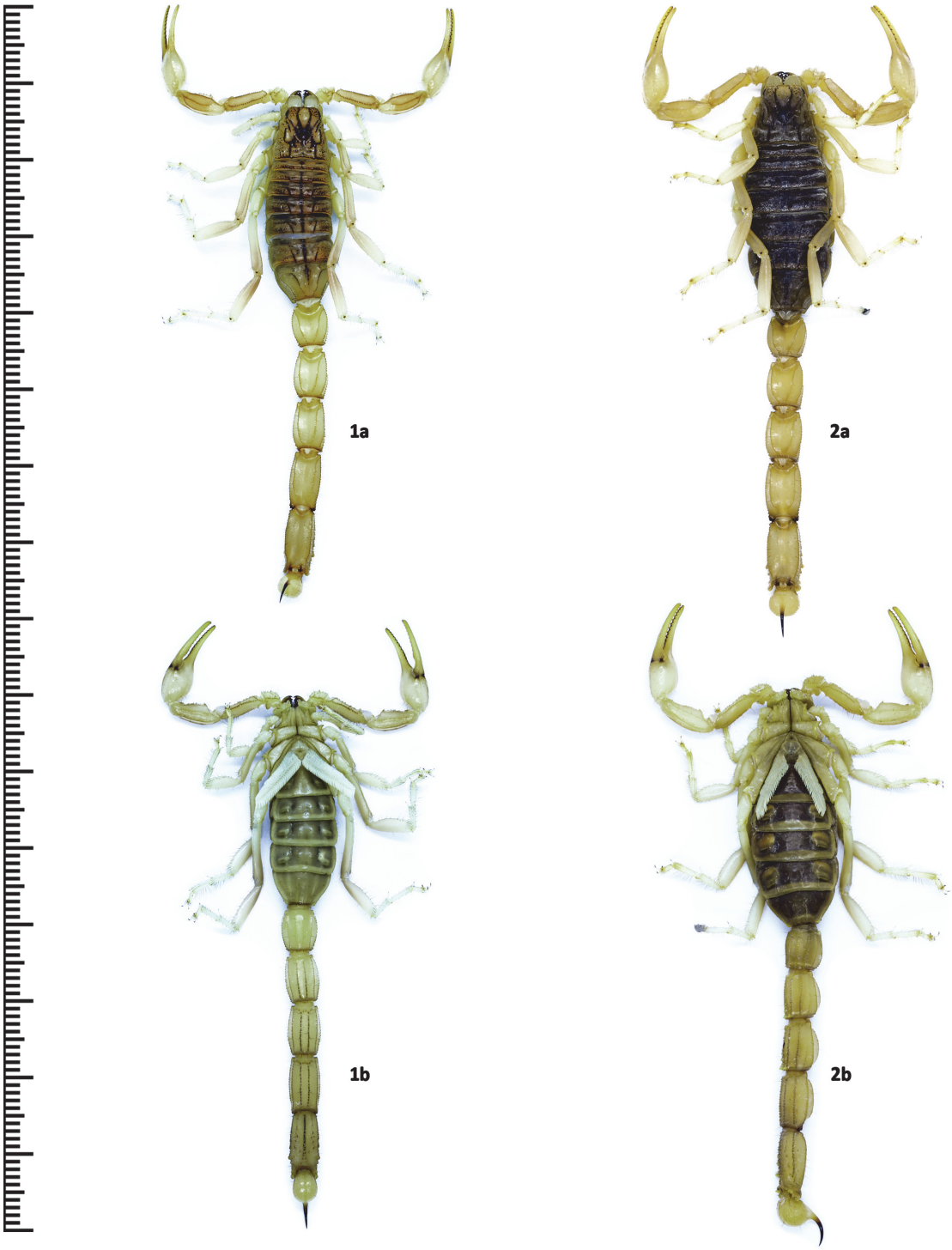
TERUEL, R. & C. TURIEL. 2021b. The genus *Buthus* Leach, 1815 (Scorpiones: Buthidae) in the Iberian Peninsula. Part 3: a new species from central Spain and new records. *Revista Ibérica de Aracnología*, **39**: 3–11.*

TERUEL, R. & C. TURIEL. 2022. The genus *Buthus* Leach, 1815 (Scorpiones: Buthidae) in the Iberian Peninsula. Part 4: a new species from southern Spain. *Revista Ibérica de Aracnología*, **40**: 19-29.*

YTHIER, E. 2021a. The southwesternmost **[*sic*]** scorpion species in Europe: *Buthus gabani* sp. n. from Cape St. Vincent, Algarve, Portugal (Scorpiones: Buthidae). *Faunitaxys*, **9(25)**: 1–6.

YTHIER, E. 2021b. The genus *Buthus* Leach, 1815 (Scorpiones: Buthidae) in France with description of a new species from the Eastern Pyrenees. *Faunitaxys*, **9**(38): 1–10.

* Reference available at www.sea-entomologia.org



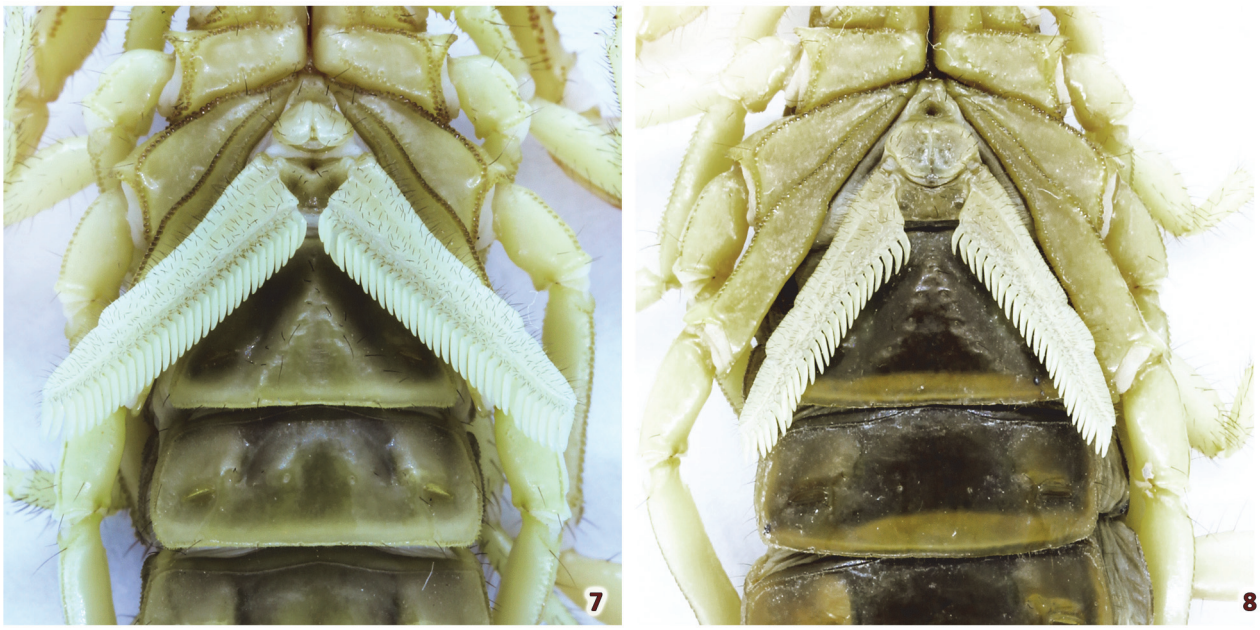
Figs. 1–2. *Buthus castellano* **sp. n.**, adult male holotype (1) and adult female paratopotype (2), habitus: **a)** dorsal; **b)** ventral. Scale bar in millimeters.



Figs. 3–4. *Buthus castellano* **sp. n.**, adult male holotype (3) and adult female paratopotype (4): **a)** pedipalp, dorsal; **b)** pedipalp chela, dorsal; **c)** pedipalp chela, external.



Figs. 5–6. *Buthus castellano* **sp. n.**, adult male holotype (5) and adult female paratopotype (6), carapace and tergites.



Figs. 7–8. *Buthus castellano* **sp. n.**, adult male holotype (7) and adult female paratopotype (8), sternopectinal region.



Figs. 9–10. *Buthus castellano* **sp. n.**, adult male holotype (9) and adult female paratopotype (10), metasoma: **a)** dorsal; **b)** lateral; **c)** ventral.

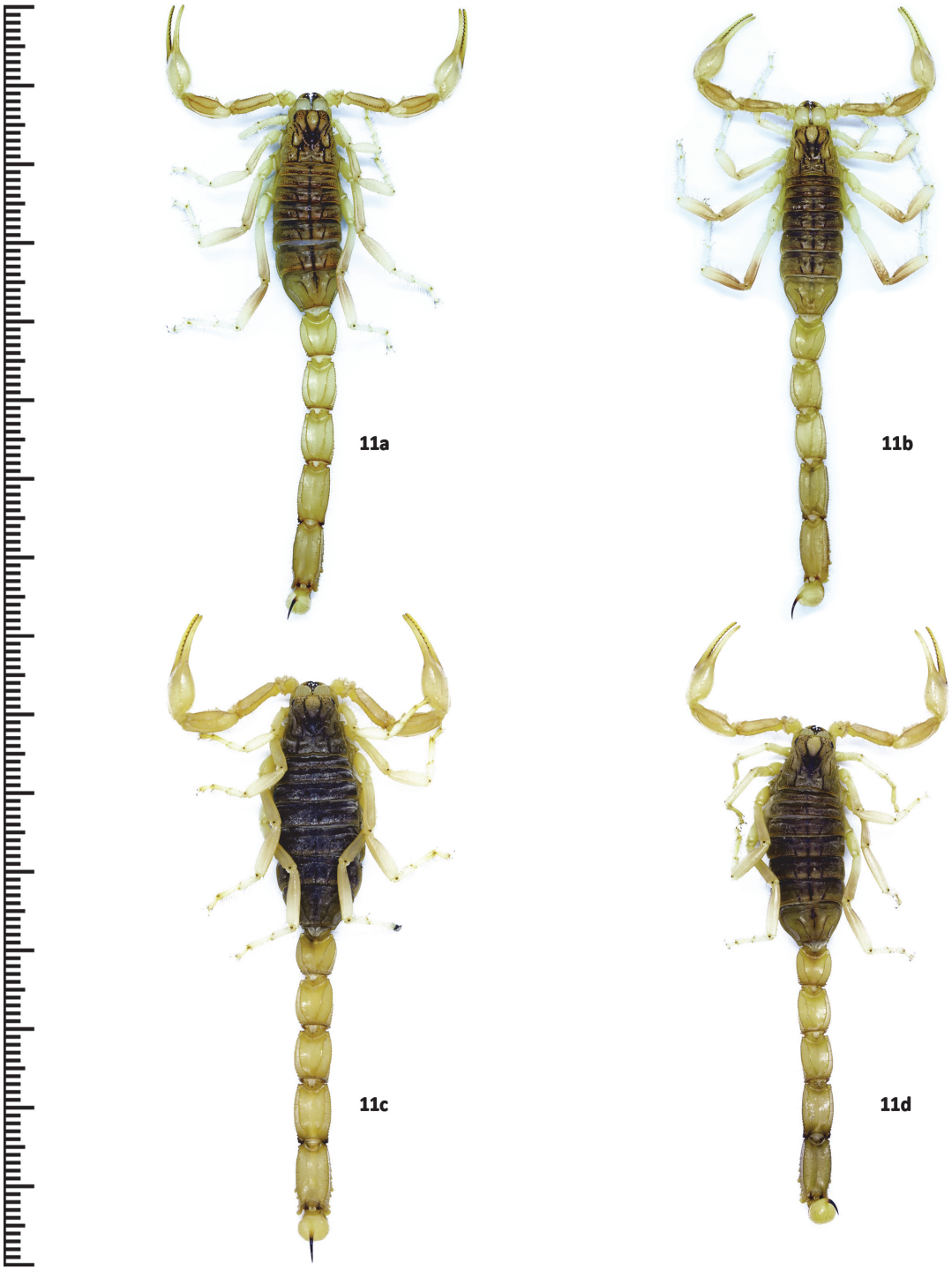


Fig. 11. *Buthus castellano* **sp. n.**, dorsal habitus of two adult males **(a:** holotype, **b:** paratopotype**)** and two adult females **(c–d:** paratopotypes**)**, showing variation in size and coloration. Scale bar in millimeters.

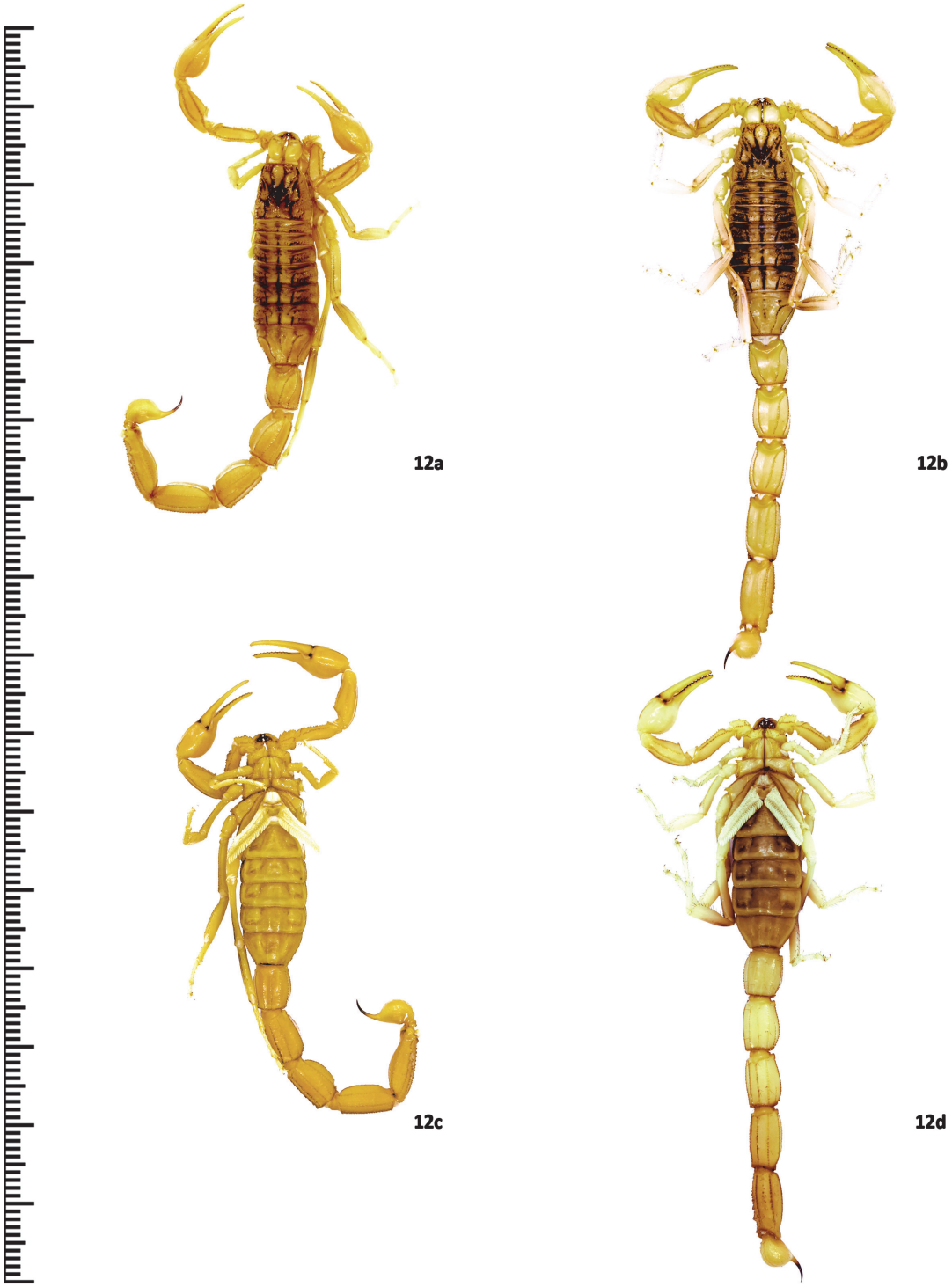


Fig.12. *Buthus halius*, dorsal habitus of two adult males in dorsal **(a–b)** and ventral **(c–d)** views, showing evident match that demonstrates both populations as conspecific. The specimens are the neotype (**a, c**) and a topotype of its junior synonym *Buthus lusitanus* **syn. n.** (**b, d**); see the latter is freshly preserved, as opposite to the former. Scale bar in millimeters.

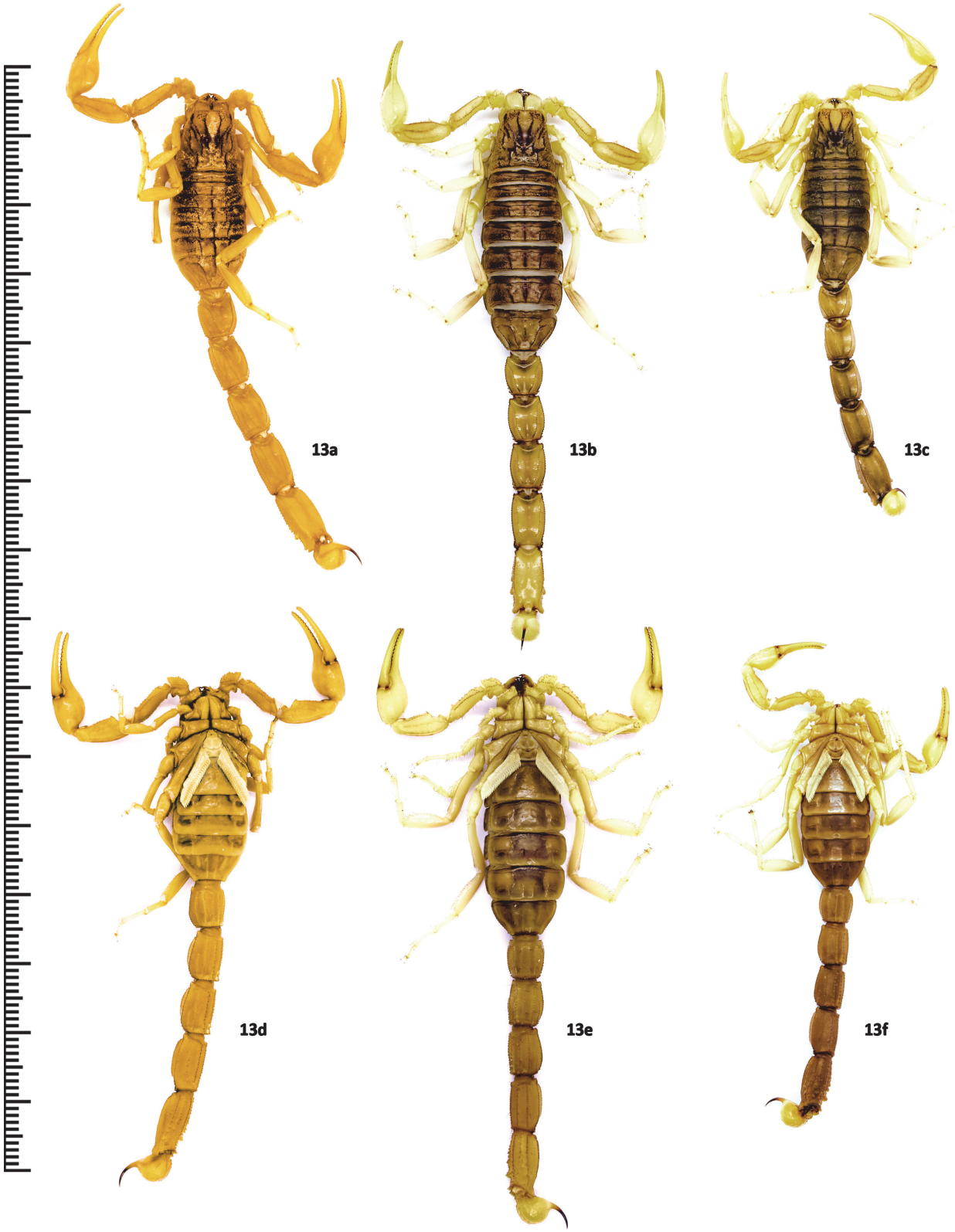
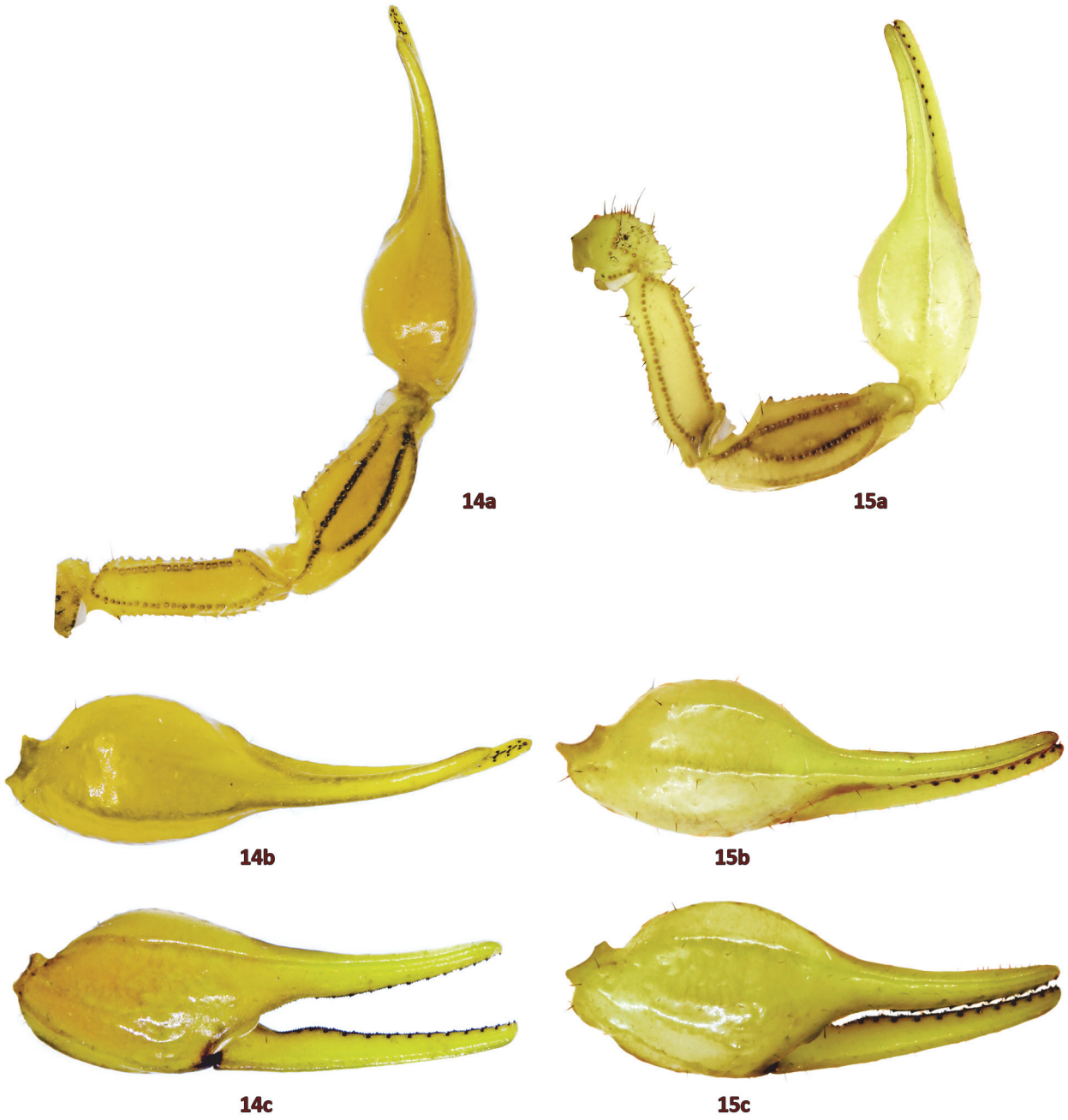


Fig. 13. *Buthus halius*, dorsal habitus of three adult females in dorsal **(a–c)** and ventral **(d–f)** views, showing evident match that demonstrates both populations as conspecific. The specimens are a topotype (**a, d**) and two different-sized topotypes of its junior synonym *Buthus lusitanus* **syn. n**. (**b–c, e–f**); see the latter are freshly preserved, as opposite to the former. Scale bar in millimeters.



Figs. 14–15. *Buthus halius*, adult male neotype (14) and adult male topotype of its junior synonym *Buthus lusitanus* **syn. n.** (15): **a)** pedipalp, dorsal; **b)** pedipalp chela, dorsal; **c)** pedipalp chela, external. The images show the evident match that demonstrates both populations are conspecific.



Figs. 16–17. *Buthus halius*, adult female topotype (16) and adult female topotype of its junior synonym *Buthus lusitanus* **syn. n.** (17): **a)** pedipalp, dorsal; **b)** pedipalp chela, dorsal; **c)** pedipalp chela, external. The images show the evident match that demonstrates both populations are conspecific.



Figs. 18–21. *Buthus halius*, adult male (18), two different-sized adult females (19–20) and immature female (21), all topotypes of its junior synonym *Buthus lusitanus* **syn. n.**: **a)** habitus, dorsal; **b)** pedipalp chela, dorsal; **c)** pedipalp chela, external. The images show the complete range of variation of pedipalp chela shape, especially the degree of development of the basal lobe/notch combination of pedipalp fingers (see the latter is obsolete to vestigial in immatures, but always well developed in adults). Scale bar in millimeters for habitus views; chelae are off-scale, but were carefully represented at their real relative size with respect to each other.



Fig. 22. *Buthus castellano* **sp. n.**, live paratopotypes photographed when found at the type-locality: **a)** adult male; **b)** adult female. See the loose sandy substratum, with pine needles.

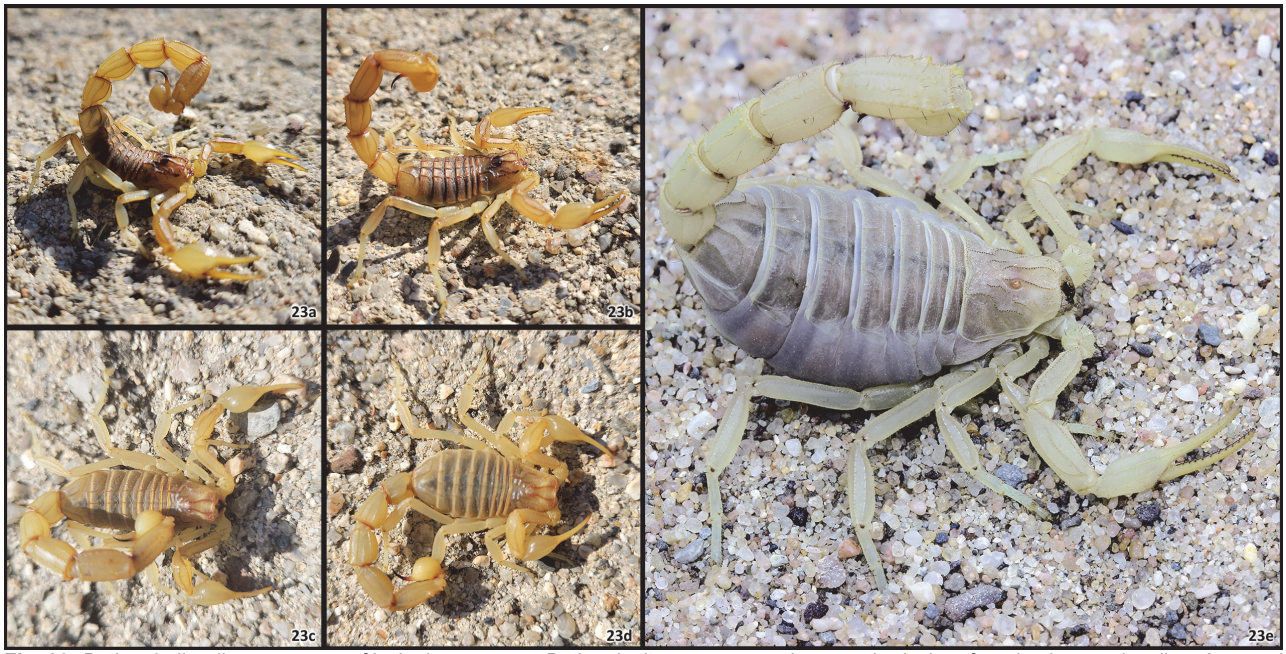


Fig. 23. *Buthus halius*, live topotypes of its junior synonym *Buthus lusitanus* **syn. n.**, photographed when found at its type-locality: **a)** normal adult male; **b)** normal adult female; **c)** albino adult male; **d)** albino adult female; **e)** albino mid-instar juvenile. See the complete absence of any melanic pigment (especially in eyes and carinae) in **c–e**.



Fig. 24. *Buthus castellano* **sp. n.**, two views of the habitat at the type-locality. See the loose sandy soil, with open pine forest and sparse, short grass cover.



Fig. 25. *Buthus halius*, three views of the habitat at the type-locality of its junior synonym *Buthus lusitanus* **syn. n.**: **a)** Serra da Estrela at Zêzere River Valley, with Manteigas town visible in background; **b)** west bank slope of Zêzere River, coming up from Manteigas; **c)** east bank slope of Zêzere River, at Abrigo do Faíscas above Manteigas.



Fig. 26. The Iberian Peninsula, showing the geographical distribution of the 17 species of *Buthus* recognized to occur there. For each species with multiple topographic records, the type locality is marked in red; in the case of *Buthus elongatus*, it corresponds to a large area and thus, we marked a central point for visual orientation. For *Buthus halius*, the southernmost record corresponds to Manteigas, the type-locality of its junior synonym *Buthus lusitanus* **syn. n.**