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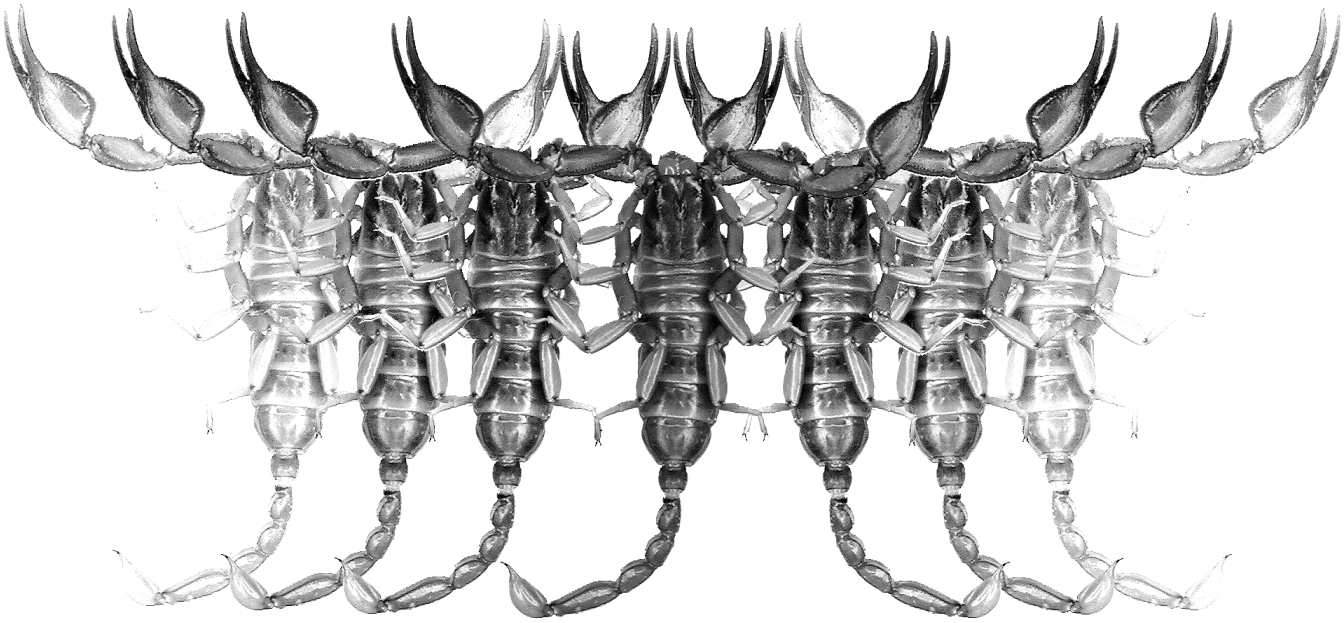

On *Centruroides margaritatus* (Gervais, 1841) and Closely Related Species (Scorpiones: Buthidae)

Luis F. de Armas, Rolando Teruel and František Kovařík

November 2011 – No. 132

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Publication date: 16 November 2011

Euscorpius — Occasional Publications in Scorpiology. 2011, No. 132

On *Centruroides margaritatus* (Gervais, 1841) and closely related species (Scorpiones: Buthidae)

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Summary

Centruroides edwardsii (Gervais, 1843) **comb. nov**. is restored as a valid species, and a male neotype from Riohacha, La Guajira Department, Colombia is herein designated; this species ranges from Mexico through Colombia, but there are no reliable records from Guatemala, Belize, and Panama; introduced populations also occur in Cuba (West Indies) and Senegal (Africa). We regard the following species as its junior synonyms: *Scorpio* (*Atreus*) *degeerii* Gervais, 1844, *Centrurus gambiensis* Karsch, 1879, *Centruroides margaritatus septentrionalis* Hoffmann, 1932, and *Rhopalurus danieli* Prado et Rios-Patiño, 1940. We also consider *Centruroides margaritatus morenoi* Mello-Leitão, 1945 as a junior synonym of *Centruroides margaritatus* (Gervais, 1841). After these taxonomic changes, the confirmed distribution of *C. margaritatus* includes northwestern South America (Peru, Ecuador, and Colombia), and the West Indies (introduced in Cuba and Jamaica).

Resumen

Centruroides edwardsii (Gervais, 1843) **comb. nov**. es restituida como especie válida y se designa un macho neotipo de Riohacha, departamento La Guajira, Colombia; esta especie se extiende desde México hasta Colombia, aunque no existen registros confiables de Guatemala, Belice y Panamá; también existen poblaciones introducidas en Cuba (Antillas Mayores) y Senegal (África). Las siguientes especies son relegadas como sus sinónimos más modernos: *Scorpio* (*Atreus*) *degeerii* Gervais, 1844, *Centrurus gambiensis* Karsch, 1879, *Centruroides margaritatus septentrionalis* Hoffmann, 1932 y *Rhopalurus danieli* Prado et Rios-Patiño, 1940. *Centruroides margaritatus morenoi* Mello-Leitão, 1945 es relegado como un sinónimo más moderno de *Centruroides margaritatus* (Gervais, 1841). Tras estos cambios taxonómicos, la distribución confirmada de *C. margaritatus* abarca únicamente el noroeste de Sudamérica (Perú, Ecuador y Colombia) y las Antillas (introducida en Cuba y Jamaica).

Introduction

As currently defined, the scorpion *Centruroides margaritatus* (Gervais, 1841) ranges from Mexico to Peru, including introduced populations in Africa (Sissom & Lourenço, 1987; Kovařík, 1998; Fet & Lowe, 2000), Cuba (Teruel, 2002), and Japan (Kovařík, 1997), plus additional records from Guatemala (Pocock, 1902), Dominican Republic (Armas, 1981), Bonaire (Fet & Lowe, 2000), Trinidad & Tobago (Kovařík, 1998), Venezuela (Sissom & Lourenço, 1987), Bolivia (Sissom & Lourenço, 1987), Brazil (Sissom & Lourenço, 1987), Paraguay (Sissom & Lourenço, 1987), Argentina (Werner, 1939), and Chile (Sissom & Lourenço, 1987), most of which have already been questioned (i.e., Sissom & Lourenço, 1987). It also has a long list of synonyms, some of which have recently been restored as valid taxa (Armas & Trujillo, 2010; Armas et al., 2011).

Hoffmann (1932) recorded *C. margaritatus* from Mexico, but assigned all populations from this country to three subspecies described by him: *C. margaritatus chiapanensis* Hoffmann, 1932, *C. m. tapachulaensis* Hoffmann, 1932, and *C. m. septentrionalis* Hoffmann, 1932. The first two taxa have been recognized as separate species (Armas et al., 1995, 2004), while the third was synonymized under *C. m. margaritatus* by Armas et al. (1995).

Moreno (1939, 1940) recorded *C. margaritatus* from Trinidad village, Cuba. Mello-Leitão (1945) described this population as a new subspecies: *C. margaritatus morenoi* Mello-Leitao, 1945. Armas (1977) recorded this taxon from Jamaica, whereas Armas & Maes (2000) raised it to species level, although they do not discussed their criteria respect such action. At the present, *C. morenoi* is a poorly known taxon.

Another conflictive situation refers to the taxonomic identity of some South American populations, identified

by Sissom & Lourenço (1987:13) as *C. margaritatus*, whereas Lourenço & Flórez (1990a: 122) recognized them as *Centruroides gracilis* (Latreille, 1804).

The purpose of this contribution is a revision of *C. margaritatus* and some of its closely related species.

Material and Methods

The specimens studied are deposited in the followings collections:

- FKCP: Personal collection of F. Kovařík, Praha, Czech Republic.
- IES: Instituto de Ecología y Sistemática, La Habana, Cuba.
- IJKJ: Institute of Jamaica, Kingston, Jamaica.
- MNHN: Muséum National d'Histoire Naturelle, Paris, France.
- MRSN: Museo Regionale di Scienze Naturali, Turin, Italy.
- USNM: US National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA
- RTO: Personal collection of R. Teruel, Santiago de Cuba, Cuba.
- ZMHB: Zoologisches Museum, Humboldt-Universität, Berlin, Germany.

Nomenclature and measurements follow Stahnke (1970), except for trichobotriotaxy (Vachon, 1974), and metasomal carinae (Francke, 1977). For pedipalp chela carinae we follow Stahnke (1970) modified by Prendini (2000), but we recognize nine carinae instead of eight, as originally illustrated by Vachon (1952: 62, fig. 69) and pointed out by Acosta et al. (2008: 492–493, fig. 14).

Measurements are given in millimeters. For each species, references are not exhaustive, but include those dealing with revisions and relevant catalogues.

Taxonomy

Centruroides margaritatus (Gervais, 1841)

(Figs. 1A–F, 2A–F, 3)

Scorpio margaritatus Gervais, 1841: 281–282, pl. II, fig. 13–17; Kraepelin, 1899: 89, 93 (in part).

Centrurus degeerii: Kraepelin, 1891: 133 (misidentification).

Centrurus margaritatus: Pocock, 1893: 386–387.

Centruroides margaritatus: Pocock, 1902: 30–32 (in part); Moreno, 1939: 71–72, lám. 6, figs. 4, 5; Moreno, 1940: 99–101, láms. 28, 29, figs. 1–5; Roewer, 1943: 218; Mello-Leitão, 1945: 251, 260–265 (in part); Stahnke & Calos, 1977: 117 (in part); Stahnke, 1978: 279 (in part); Lourenço, 1991: 29–32, fig. 1, tab. 1 (misidentification?); Armas, 1988: 55–56; Armas, 1982: 6; Sissom & Lourenço, 1987: 15–22, table 1 (in part); Flórez, 1990: 119 (in part; records from Valle only); Kovařík, 1998: 108; Teruel, 2002: 87 (in part); Escobar & Ochoa, 2003: 52; Escobar et al., 2003: 218–220; Teruel, 2011: 61–66 (in part).

Centruroides margaritatus morenoi Mello-Leitão, 1945: 261–262; Stahnke & Calos, 1977: 119; Armas, 1977: 4; Armas, 1981a: 8; Armas, 1981b: 53, 54, table 1; Armas, 1982: 6; Armas, 1988: 55–56; Fet & Lowe, 2000: 114. **New synonymy**.

Centruroides gracilis: Lourenço & Flórez, 1990a: 122, 133, fig. 19 (misidentification) ; Lourenço & Flórez, 1990b: 68, 69, fig. 2 (misidentification); Lourenço, 1997: 67 (misidentification: records from Valle Department).

Centruroides morenoi: Armas & Maes, 2000: 27; Armas, 2001: 246, table 1; Armas et al., 2009: 142.

Type data. Holotype adult ♀ (MNHN, RS 1051), Isla Puná, Guayaquil Gulf, Ecuador. We have seen excellent digital photos of this specimen (Figs. 1A–E). The bottle contains seven labels (Fig. 1 F), the most modern of which has obviously erroneous locality data, *i. e.*: "Cordillière des Andes, La Puna" [Gervais (1841) stated that "Il habite l'île de la Puna, dans la rivière de Guayaquil"]. Sissom & Lourenço (1987) gave a complete redescription, drawings, and measurements of this specimen.

Distribution. According to the material and supplementary data available to us, *C. margaritatus* occurs only in north-western South America (Colombia, Ecuador, Peru), but it has been introduced in the Greater Antilles (Jamaica and Cuba).

Diagnosis (emended). A large species (65–100 mm). Carapace and tergites dark yellow-brown with underlying fuscous pattern; tergite VII lighter than I–VI, similar in colour to basal metasomal segments (Fig. 2 A). Carinae and granulation dark brown. Sternites yellow-brown with dark brown shade. Metasomal segments I–IV yellow-brown, darker on IV; V and telson dark reddish brown. All the segments are ventrally darker than dorsally or laterally. Pedipalp femur and patella are yellow-brown, lighter than body; chela reddish brown. Carapace with superciliary and posterior median carinae strong, crenate. Anterior median furrow wide and moderately deep; posterior median furrow narrow, deeper posteriorly. Tergites I–VI moderately granulose. Pectines with 25–27 teeth in ♀♀ (n = 51 combs) and 27–30 in ♂♂ (n = 24 combs); basal plate rectangular. Pedipalp orthobothriotaxic A, only sparsely hirsute; chela ovate, 1.1–1.2 times wider than patella, with dorsal marginal carinae nearly smooth, not pilose (Fig. 2 D–E); fixed finger with eight rows of denticles; movable finger with a well-developed basal lobe. Metasomal segments with 10-8-8-8-5 well developed crenulate carinae; ventral submedian carinae on I mod-

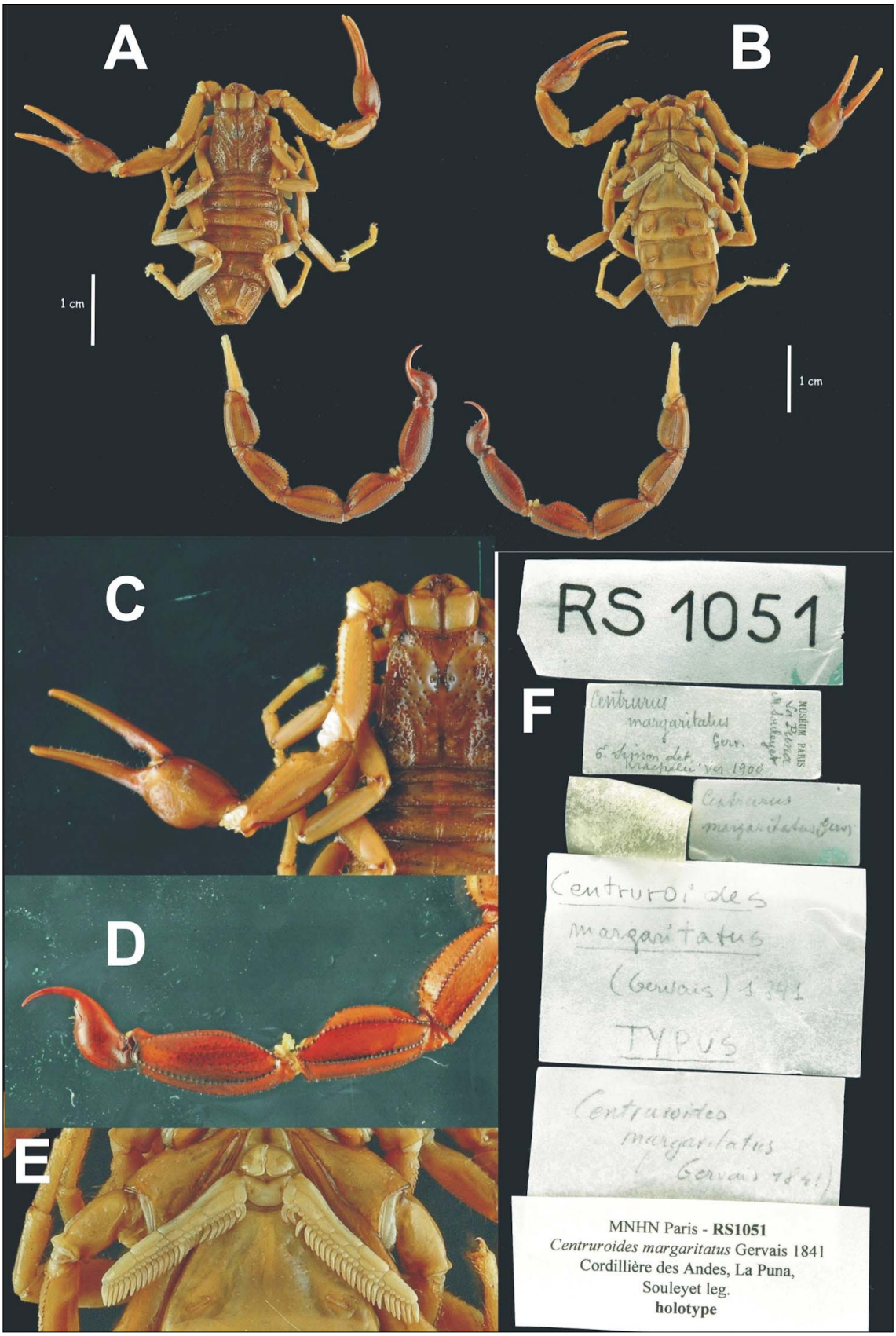

Figure 1 : *Centruroides margaritatus*. Female holotype. **A**, dorsal; **B**, ventral; **C**, detail of dorsal aspect of carapace; **D**, last segments of the metasoma and telson, lateral aspect; **E**, pectines; **F**, labels. Scale (A, B) = 10 mm. Photos courtesy of E.-A. Leguin.

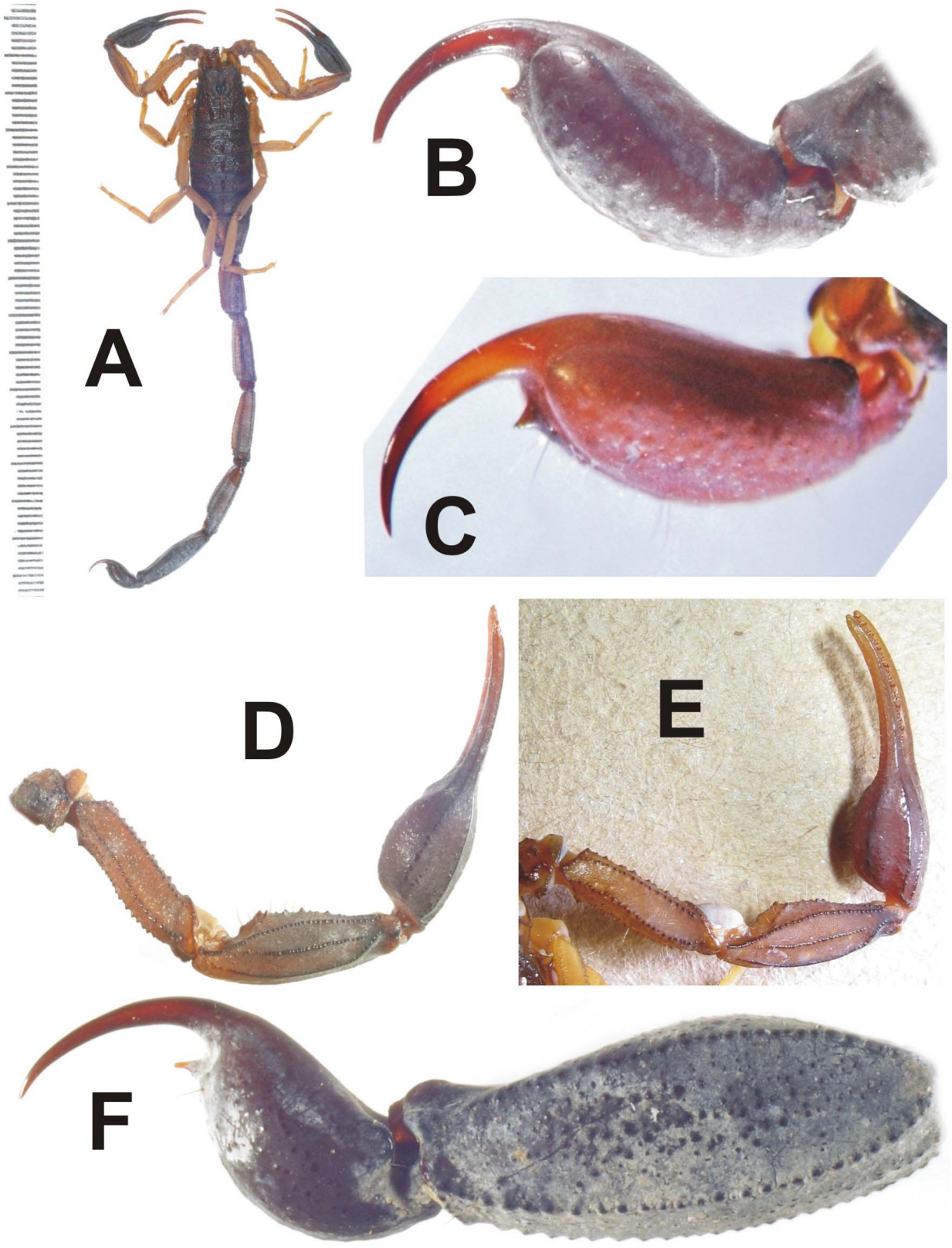

Figure 2: *Centruroides margaritatus* from Guayaquil (A–B, D, F) and Loja (C, E), Ecuador. **A–C**, male: **A**, habitus, dorsal; **B–C**, telson, lateral aspect. **D–F**, female: **D–E**, pedipalp, dorsal aspect; **F**, metasomal segment V and telson, lateral aspect. Scale (in mm) is only for figure A. Photos C and E, courtesy of J. A. Ochoa Camara.

erate, finely crenulated; dorsolateral carinae on V moderate; intercarinal spaces with spread fine granules. Telson ovate in the female and oblong on the male (Fig. 2 B–C, F), with moderate, spinoid subaculear tooth, directed towards apical one-third of aculeus.

Comparisons. With respect to its closest relatives, *Centruroides margaritatus* can be distinguished as follows: **(1)** *Centruroides hirsuticauda* Teruel, 2011 is remarkably smaller (♀♀ 53–57 mm, ♂♂ 69–74 mm), and has pedipalps and metasoma remarkably less slender and very densely hirsute (Teruel, 2011); **(2)** *Centruroides exilimanus* Teruel et Stockwell, 2001 is remarkably larger (♀♀ 98–116 mm, ♂♂ 89–150 mm), it has higher pectinal tooth counts (♂♂ 31–34, ♀♀ 30–32), and females have a deep discal pit in the basal plate of the pectines (Teruel & Stockwell, 2001; Víquez & Armas, 2005); **(3)** *C. chiapanensis* Hoffmann, 1932 has more slender pedipalp chelae, very attenuate telson, and higher pectinal tooth count (♀♀ 23–32, ♂♂ 25–34) (Hoffmann, 1932; Armas et al., 1995); **(4)** *C. tapachulaensis* Hoffmann, 1932 has blackish, more attenuate pedipalps with pale fingers, attenuate telson, and lower pectinal tooth count (♀♀ 21–26, ♂♂ 23–28) (Armas et al., 1995, 2010); **(5)** *C. fallassisimus* Armas et Trujillo, 2010 is remarkably yellowish (mainly in immatures), pedipalp chelae with dorsal secondary carina minutely granulose, male has telson with attenuate vesicle (Armas & Trujillo, 2010). For *C. edwardsii* **comb. nov.**, see a detailed comparison below.

Comments. We have examined the syntypes of *Centruroides margaritatus morenoi* Mello-Leitão, 1945, as well as a representative series of additional specimens from Trinidad village (type locality) and Jamaica, but we have not found any characters which consistently allow their distinction as a different subspecies or species. Thus, the following nomenclatural change is proposed: *Centruroides margaritatus* (Gervais, 1841) = *Centruroides margaritatus morenoi* Mello-Leitão, 1945, **new synonym**. This taxon had been elevated to species level by Armas & Maes (2000), because it was found to be clearly not conspecific with all samples available to them and identified as *C. margaritatus* (mostly from IES collection); nevertheless, none of these specimens actually belonged to *C. margaritatus*, but *C. edwardsii* (see below). Moreno (1939) mentioned to have studied more than eight specimens from Trinidad, and this entire sample was explicitly declared as types by Mello-Leitão (1945); nevertheless, only three of these specimens could be located at IES collection (one ♂ and two ♀♀). We also discovered that the photo presented by Moreno (1940: pl. XXVIII) as an adult female, is actually a composite of two of the specimens studied by us: the entire metasoma belongs to one of the females, but the trunk and appendages (plus the partial metasoma also included in that plate) all belong to the male.

Sissom & Lourenço (1987: 16) examined the type-specimen of *C. argentinus* Werner, 1939 and determined it as a subadult female of C. *margaritatus*, but at this moment is not possible to confirm such synonymy without examination of that specimen.

As result of the present revision, *C. margaritatus* has turned out to be the most poorly known species among the South American members of the genus *Centruroides*. It remains to be seen which of the many published records of "*C. margaritatus*" do actually belong to this taxon, especially those from the USA (Comstock, 1912; Pocock, 1902), Guatemala (Pocock, 1902), Bonaire (Fet & Lowe, 2000), Trinidad & Tobago (Kovařík, 1998), Venezuela (Sissom & Lourenço, 1987), Bolivia (Sissom & Lourenço, 1987), Brazil (Sissom & Lourenço, 1987), Paraguay (Sissom & Lourenço, 1987), Argentina (Werner, 1939), Chile (Sissom & Lourenço, 1987), Sierra Leone (Kovařík, 1998), and Japan (Kovařík, 1997).

On the other hand, Lourenço (1991) reported three cases of presumed hybridization between laboratory-reared specimens of "*C. margaritatus*" and "*C. gracilis*", and later he even suggested that both taxa may be conspecific (Lourenço, 1997). Such potential synonymy can be discarded and also the supposed hybridization must be regarded as at least questionable, because of two reasons: (1) *C. margaritatus* and *C. gracilis* are morphologically very distinct from each other, to the point that both have always been placed in separate species-groups (Hoffmann, 1932; Mello-Leitão, 1945; Teruel & Stockwell, 2001; Armas et al., 2004, 2011; Ponce Saavedra & Moreno Barajas, 2005; Armas & Trujillo, 2010; Teruel & Roncallo, 2010; Teruel, 2011), and (2) all Colombian specimens and photos of "*C. gracilis*" that we have seen (i.e., Lourenço, 1997: fig. 4; Gómez & Otero, 2007: fig. 4a; also see below in Material Examined) do involve clearly misidentified specimens of at least three distinct species, two of which are coincidently *C. margaritatus* and its close-relative *C. edwardsii* (see below). This criticism was already addressed by Teruel & Roncallo (2010: 2).

Material examined. ECUADOR: GUAYAS: 3♀♀, 2♂♂, 1 immature ♀ (ZMHB-3031), Guayaquil, no date, leg. Reiss; 4♀♀, 2♂♂, 1 juvenile (MRSN), Guayaquil, no date, leg. L. Campos; 1♀, 1 immature (MRSN), San Pedro, leg. L. Campos; 1♀ (MRSN), El Morro, leg. L. Campos; 1♀ (MRSN), San Vincente, leg. L. Campos; 1♂ (MRSN), Sorgenti del Maira, 1600 m a.s.l., 2 June 2001. LOS RÍOS: 1 immature (MRSN), Baba, leg. L. Campos. COLOMBIA: VALLE DEL CAUCA: 2♀♀, 2♂♂ (FKCP-419–22), Yotoco, Hacienda El Guabal, 17 September 1994, 1000 m (identified as *Centruroides gracilis* by E. Flórez). CUBA: SANCTI SPÍRITUS: Trinidad: 2♀♀ and 1♂, syntypes of *C. margaritatus morenoi* (IES), Trinidad, 10 November 1937, leg. Morte; 2 subadult ♀♀ (IES), Lomas de Trinidad, 15 September

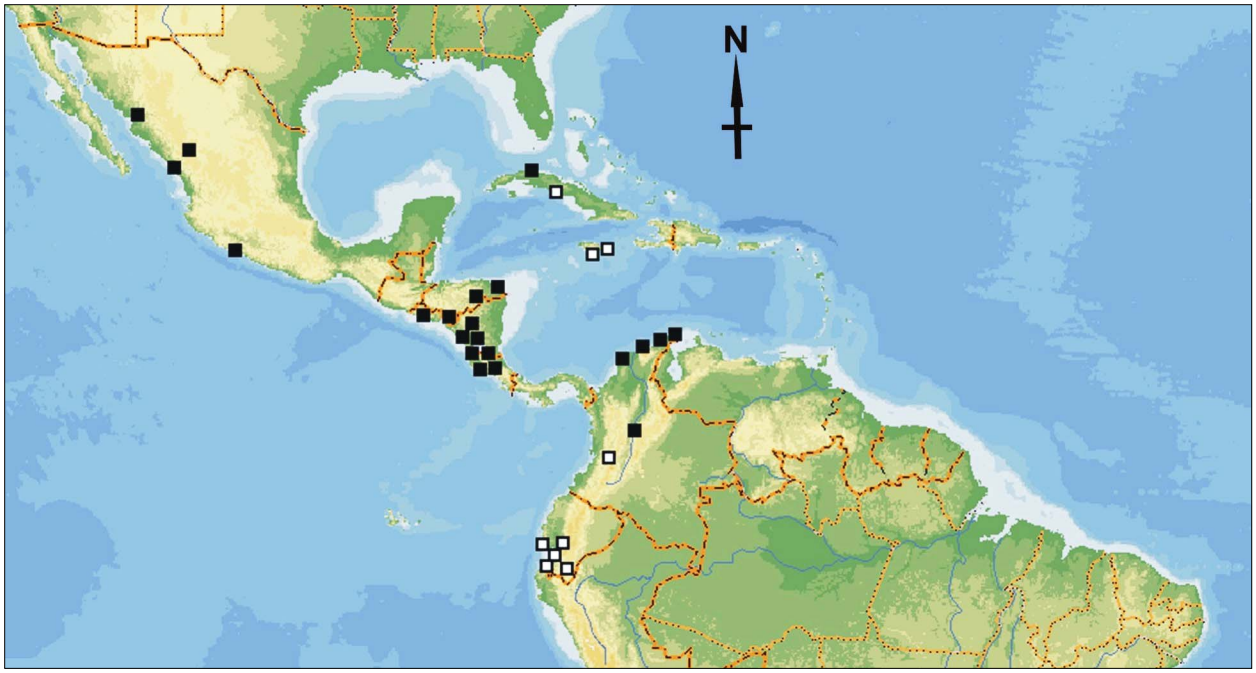

Figure 3: Geographical distribution of *Centruroides edwardsii* (black squares) and *C. margaritatus* (white squares).

1937, leg. Morte; 2♀♀, 2♂♂, two immatures (IES), Trinidad village, August 1978, leg. B. Acosta, in houses; 2♀♀, 1♂ (IES), Trinidad village, December 1976, leg. A. Rankin & B. Acosta, in houses. JAMAICA: ST. CATHERINE: 1♀ (IJKJ), Bushy Pk., 9 February 1947, leg. G. B. Thompson, under rotten log. PORTLAND: 1♂ (IES), 2 km S Long Bay, 25 December 1951, leg. G. Underwood, coconut on the beach. KINGSTON: 1♀ (IJKJ), Tower Street, 19 December 1952, leg. W. P. Jacobson. ST. ANDREW: 1♀ (IJKJ), 20 December 1945, leg. P. B. Caws, in the street; 1♀ (IES), Gordon Town, 29 January 1947, leg. A. Barny; 1♀, 1 juvenile, without data (RTO: Sco-0345).

Centruroides edwardsii (Gervais, 1843), **comb. nov**.

(Figs. 3, 4A–H, 5A–D, 6 A–E; Table 1)

Scorpio (*Atreus*) *edwardsii* Gervais, 1843: 130; Gervais, 1844: 208, 216–217, Pl. XI, figs. 13–15; Gervais, 1859: 41, Pl. I, fig. 1 (in part).

Scorpio (*Atreus*) *degeerii* Gervais, 1844: 217–218, pl. 11, fig. 16–17, **new synonymy. [**Synonymized under *C. margaritatus* by Pocock (1893: 387)].

?*Tityus ducalis* C. L. Koch, 1844: 2–4, pl. CCCLXI, fig. 851 [synonymized under *C. margaritatus* by Hoffmann (1932: 247)].

Centrurus gambiensis Karsch, 1879: 123–124, **new synonymy**. [Synonymized under *C. degeeri* by Kraepelin (1891: 133)].

Centrurus margaritatus: Pocock, 1893: 387 (in part).

Centruroides margaritatus septentrionalis Hoffmann, 1932: 249, 251–258, figs. 44–47, **new synonymy**. [Synonymized under *C. margaritatus* by Armas et al. (1995: 35)].

Rhopalurus danieli Prado et Rios-Patiño, 1940: 42–43. **New synonymy.** [Synonymized under *C. margaritatus* by Sissom & Lourenço (1987: 16)].

Centruroides danieli: Mello-Leitão, 1945: 251, 253–255, figs. 105–106; Flórez, 1990 : 119.

Centruroides margaritatus: Mello-Leitão, 1945: 260–265 (in part); Francke & Stockwell, 1987: 14–17, figs. 3, 39–47, 99 (misidentification); Armas & Hernández, 1989: 2–9 (misidentification); Armas, 1995: 2 (misidentification); Viquez, 1999: 46–47 (misidentification); Teruel, 2002: 87–88, figs. 1–2 (misidentification); Teruel & Stockwell, 2002: 119–120, 126, fig. 10, 21, tables IV, VI (misidentification); Teruel & Roncallo, 2010: 1–2, figs. 1, 10 (misidentification); Teruel, 2011: 61–66, fig. 5 (misidentification).

Centruroides gracilis: Flórez, 1990: 117 (misidentification: records from Antioquia and Cundinamarca); Flórez, 2001: 28 (misidentification: Caribbean slope records); Gómez & Otero, 2007: 53, 54, 56, fig. 4 (misidentification).

Type data. Neotype adult ♂ (BIOECO, Ex–RTO: Sco-0395; herein designated, Fig. 4 A–H): COLOMBIA, LA GUAJIRA, Riohacha City, Calle 6 esquina a Carrera 5, inside a box in house, 25 June 2008, leg. W. Ramos. *Notes:* This specimen was formerly determined

Character	Colombia	Nicaragua: León	
	Male neotype	Male	Female
Carapace, L/W	8.80 / 8.50	7.80 / 7.80	8.60 / 8.85
Pedipalp, L	35.40	30.30	29.65
Femur, L/W	9.20 / 2.30	8.30 / 2.00	7.80 / 2.30
Patela, L/W	10.00 / 3.10	8.60 / 2.55	8.35 / 3.10
Chela, L	16.20	13.40	13.50
Manus, L/W/H	6.70 / 4.20 / 5.00	5.70 / 3.70 / 4.00	5.70 / 4.10 / 4.25
Movable finger, L	9.50	8.70	8.65
Mesosoma, L	24.50	23.40	23.45
Tergite VII, L/W	7.00 / 8.50	6.70 / 7.00	6.50 / 9.35
Metasoma, L	66.70	57.70	47.00
I, L/W/H	9.20 / 4.50 / 4.00	8.00 / 4.05 / 3.40	6.20 / 5.25 / 4.05
II, L/W	11.00 / 4.30	9.70 / 4.00	7.70 / 4.90
III, L/W	12.10 / 4.20	10.80 / 3.90	8.00 / 4.95
IV, L/W	12.30 / 4.20	11.00 / 3.90	8.60 / 4.90
V, L/W/H	12.60 / 4.30 / 3.70	11.20 / 3.90 / 3.40	9.20 / 4.90 / 4.15
Telson, L	9.50	7.00	7.30
vesicle, L/W/H	6.00 / 3.70 / 2.90	4.95 / 3.40 / 2.40	4.90 / 3.50 / 2.80
Total L	**100.00**	**88.90**	**77.05**

Table 1: Measurements (mm) of *Centruroides edwardsii*. H, height; L, length; W, width.

as *C. margaritatus* by R. Teruel, 2008. It has 29/28 pectinal teeth, with one tooth missing for each pecten. All labels are written in Spanish.

Distribution. Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Colombia, and Cuba (introduced) (Fig. 3). It has also been introduced in Senegal, Africa (see Comments below).

Diagnosis. A moderate to large species (60–110 mm). Body brown; pedipalp chelae, carapace, tergites I–VII, metasomal segment V and telson dark reddish brown (rarely, a yellowish longitudinal stripe is present over tergites I–VII, generally in immatures); pedipalp femur and patella, legs and venter yellowish brown; pectines light yellow; carinae on metasoma and pedipalps are dark brown (Figs. 4 C, E, F; 5 A–D, 6 A–B). Prosoma and tergites densely and coarsely granular, with large spiniform granules interspersed. Metasoma coriaceous, with all carinae strongly denticulate; telson with a spiniform subaculear tubercle directed toward the basal portion of the aculeus (Figs. 4 H, 6 C–D); segments II–IV with more than three (usually four) pairs of ventrolateral macrosetae. Pedipalps very densely hirsute; chela wider than patella and very robust in the adults, with dorsal marginal carina almost smooth, pilose (Fig. 4 C–D, 6 E); fingers with eight principal rows of granules, flanked internally and externally by numerous supernumerary granules, basal lobe/notch combination strong. Sexual dimorphism is evident: adult males have less inflated pedipalp chelae and a moderately slender metasoma, whereas adult females have more robust and shorter pedipalps, more inflated chelae, and non-elongate metasomal segments (Figs. 5 A–D, 6 A–B). Pectinal tooth counts 22–30 in ♀♀ (n = 110 combs), 26–34 in ♂♂ (N = 90 combs). Measurements in Table 1.

Comparisons. This species was largely confounded with *C. margaritatus*, from which it clearly differs by having pedipalps profusely pilose, hand with dorsal marginal carina almost smooth and very pilose (Fig. 4 C–D), telson with subaculear tubercle close to aculeus and directed towards its basal one-third (Figs. 4 G, 6 C, D), carinae on the pedipalp femur and patella with smaller and closer granules. Also, when same-sized adults of both species are compared side-by-side, it becomes evident that both sexes of *C. edwardsii* have pedipalps (especially chelae) and metasoma shorter and more robust than in *C. margaritatus* (see our Figs. 1–7).

With respect to its other close relatives, *Centruroides edwardsii* **comb. nov.** can be distinguished as follows: **(1)** *Centruroides hirsuticauda* Teruel, 2011 is remarkably smaller (♂♂ 69–74 mm, ♀♀ 53–57 mm), and has pedipalps and metasoma very densely hirsute (Teruel, 2011); **(2)** *Centruroides exilimanus* Teruel & Stockwell, 2001 is larger (♂♂ 89–150 mm, ♀ 98–116 mm), it has higher pectinal tooth counts (♂♂ 31–34, ♀♀ 30–32), and females have a deep discal pit in the basal plate of the pectines (Teruel & Stockwell, 2001; Víquez & Armas, 2005); **(3)** In *C. chiapanensis* and *C. tapachulaensis*, the pedipalps are attenuate, with chelae not globose, almost glabrous, having dorsal marginal carina granulose; **(4)** *C. fallassisimus* is a paler species, its pedipalp chelae are almost glabrous, with finely granular dorsal marginal carina; subaculear spine is moderately distant from the aculeus base and directed toward the aculeus tip.

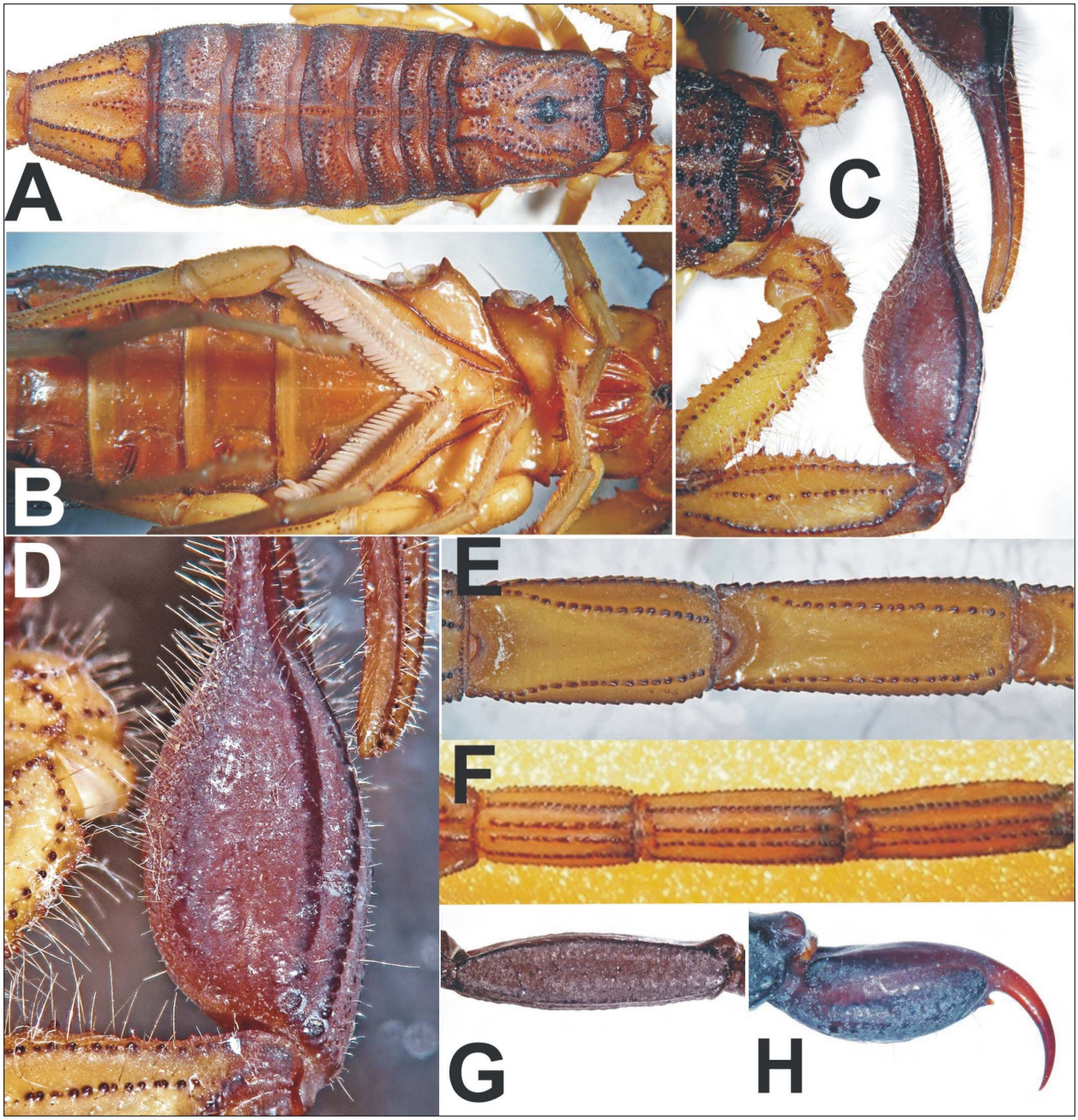

Figure 4: *Centruroides edwardsii*. Male neotype. **A**, carapace and tergites; **B**, prosoma and mesosoma, ventral aspect; **C**, right chela, dorsal aspect; **D**, hand, dorsal aspect; **E–H**, metasoma: **E**, segments I–II, dorsal aspect; **F**, segments I–III, ventral aspect; **G**, segment V, lateral aspect; **H**, telson, lateral aspect.

Comments. Gervais (1843) briefly described *Scorpio* (*Atreus*) *edwardsii* from an unspecified number of syntypes from "Colombia", reportedly deposited at MNHN, but Gervais (1844) provided a more precise description of this species, including an excellent colour figure, and mentioned "Carthagène de Colombie" (p. 217) as the locality of the specimens examined by him.

Gervais (1844) based the original description of *Scorpio* (*Atreus*) *degeerii* upon another unspecified number of syntypes (measurements and figures of at least one adult female were actually given) from Chile and Colombia (Cartagena), also reportedly deposited at MNHN. The descriptions and figures of Gervais (1843, 1844), Hoffmann (1932) and Prado & Ríos-Patiño (1940) clearly show that *Scorpio* (*Atreus*) *degeerii*, *Rhopalurus danieli* and *Centruroides margaritatus septentrionalis* are all conspecific with *Scorpio* (*Atreus*) *edwardsii*, which is the senior synonym by page prece-

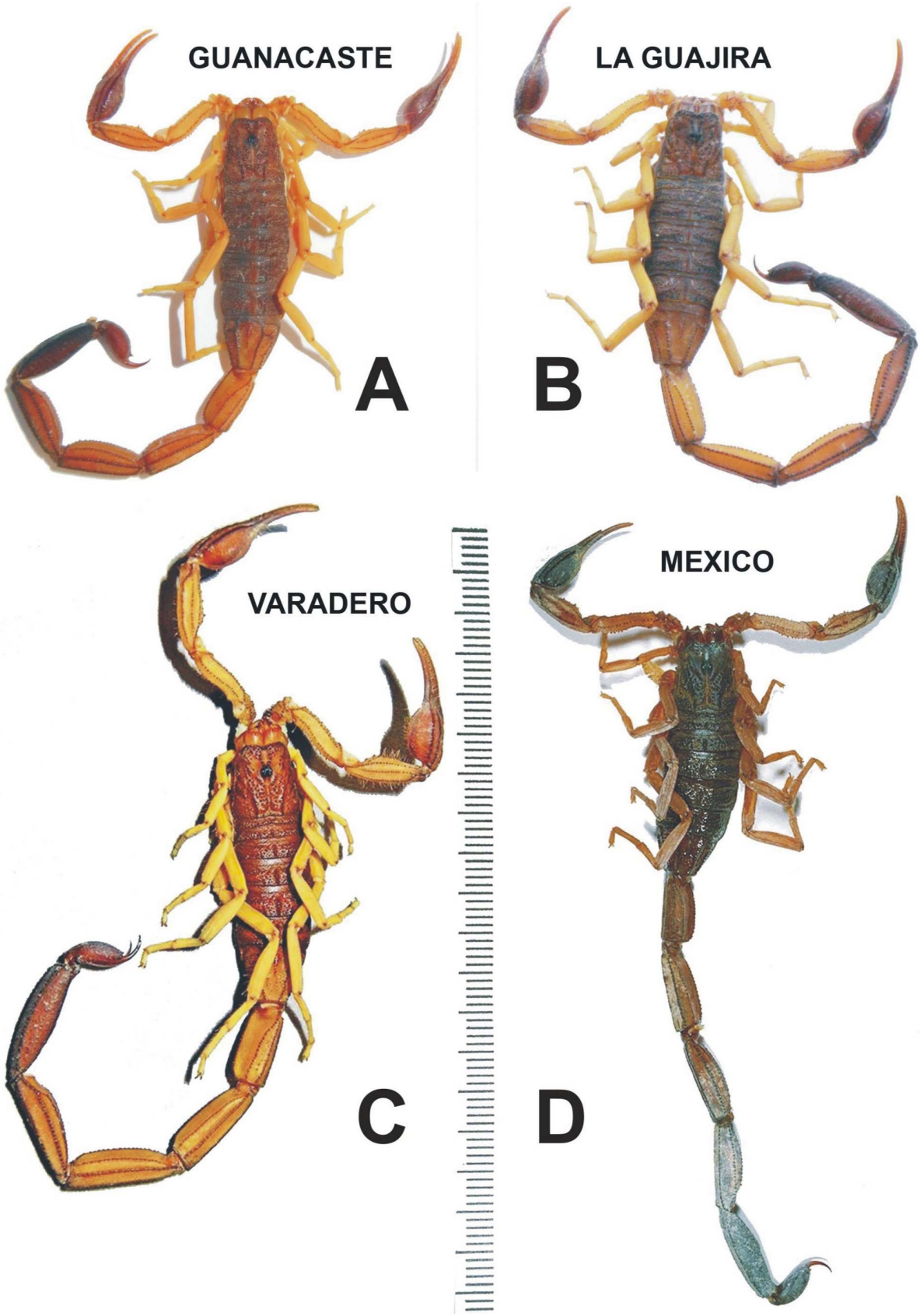

Figure 5: *Centruroides edwardsii*. Males from Guanacaste, Costa Rica (A), La Guajira, Colombia (B), Varadero, Matanzas province, Cuba (C), and Durango, Mexico (D). Scale in millimeters only for D.

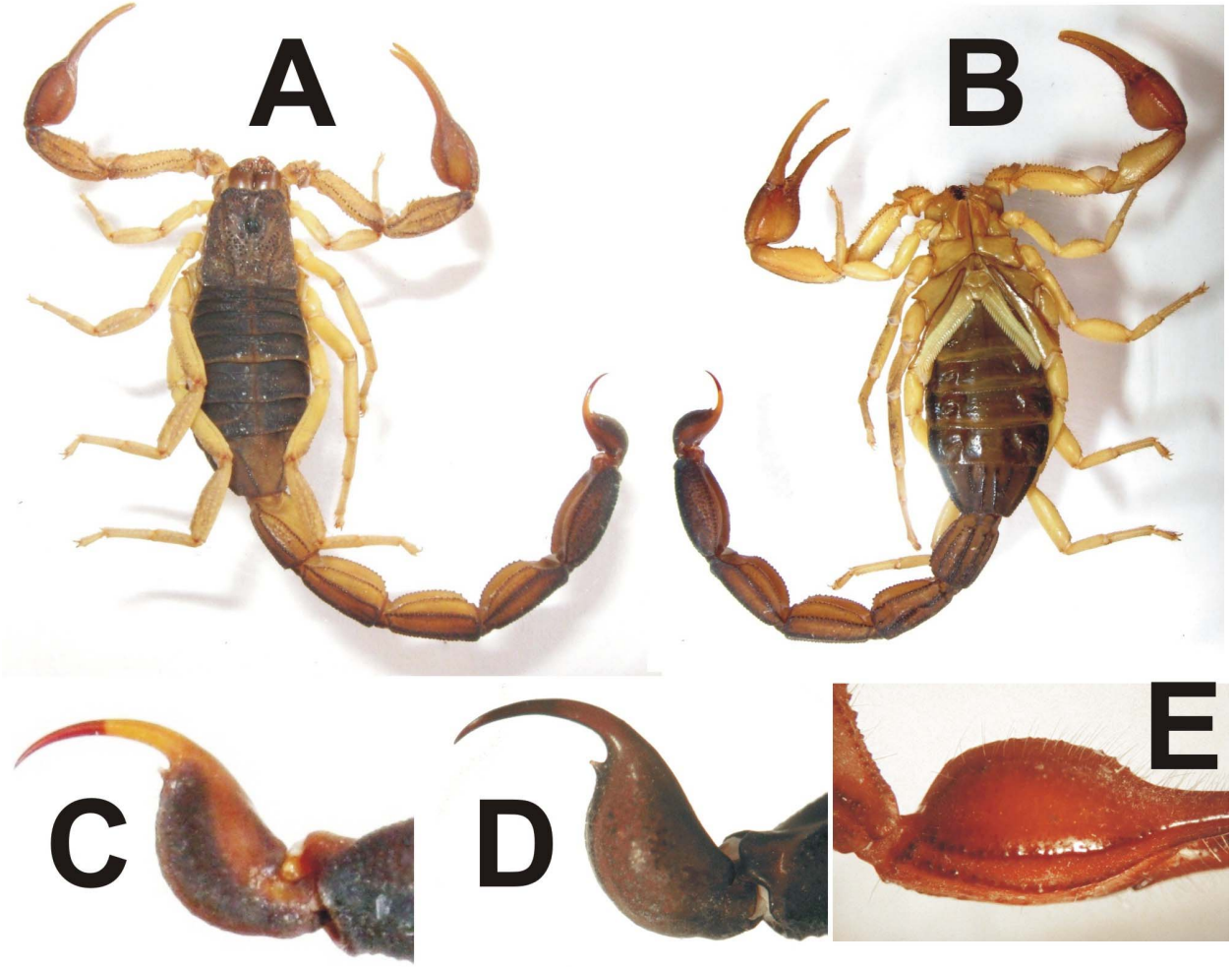

Figure 6: *Centruroides edwardsii*. Female. **A–C** from Sierra de Macuira, La Guajira, Colombia (RTO: Sco-0374); **D–E** from Tilarán, Guanacaste, Costa Rica (MM-S009). **A**, dorsal; **B**, ventral aspect; **C–D**, telson, lateral aspect. **E**, pedipalp chela, dorsal aspect.

dence (CINZ, 2000). *Tityus ducalis* was described from Mexico, but it was synonymized under *C. margaritatus* by Hoffmann (1932); Fet & Lowe (2000: 112) included it with doubt as a junior synonymy of *C. margaritatus*, because the type specimens are lost, and the synonymy cannot be verified (Sissom & Lourenço, 1987: 16).

Sissom & Lourenço (1987: 16) stated that the original types of Gervais (1843, 1844) cannot be positively identified among the MNHN specimens labelled *Centrurus edwardsii* and *Scorpio degeerii*. Because of this reason, plus the fact that only with available name-bearing types the taxonomic status of all members of this very complex group of closely related species can be clarified and stabilized, we have proceeded to designate a neotype for *C. edwardsii*.

Armas (1981a: 1, 8–9) recorded *Centruroides margaritatus* ssp. from Santo Domingo, Dominican Republic, on the basis of a lot of nymphs labelled "Santo Domingo", without additional data and deposited at the Museum of Comparative Zoology, Harvard University, USA. As that species has never been found in Dominican Republic, we think that the correct locality of these immature specimens is Santo Domingo, Heredia Province, Costa Rica, but we are not sure that they belong to *C. edwardsii*.

We have seen excellent photos of the holotype of *Centrurus gambiensis* (Fig. 7 A–D) and concluded that it is actually a junior synonym of *Centruroides edwardsii*, as previously pointed out by Kraepelin (1891) as *Centrurus degeerii*. By the way, the type-locality of *C. gambiensis* has been erroneously stated to be the archipelago (and also independent country) of Cape Verde (i.e., Sissom & Fet, 2000: 113), but this is an incorrect transcription. Two of the original collecting labels accompanying the holotype clearly read "Cap Vert" (see our Fig. 7E), but this toponym (either in

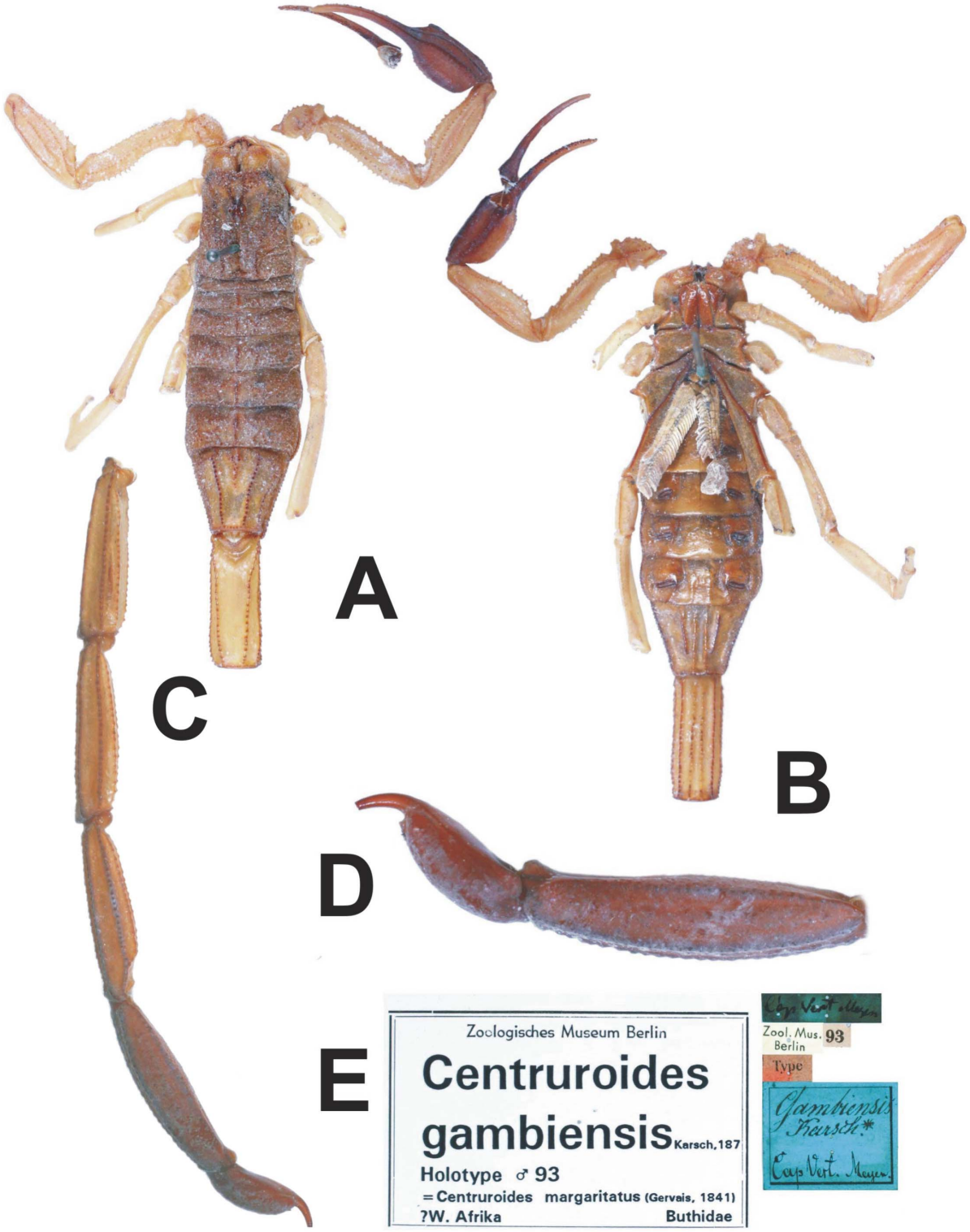

Figure 7: *Centrurus gambiensis*. Male holotype. **A-B**, dorsal (A) and ventral (B) aspect, except metasomal segments II-V and telson); **C**, metasomal segments II-V and telson, dorsolateral aspect; **D**, metasomal segment V and telson, lateral aspect; **E**, labels. Photos courtesy of Anja Friederichs.

German or French) actually corresponds to the Cape Vert peninsula in western central Senegal, mainland Africa (Microsoft Corporation, 2009).

Francke & Stockwell (1987, as *C. margaritatus*) recorded pectinal tooth counts of 26–34 (mode 30) in ♂♂, and 24–33 (mode 28) in ♀♀ from Costa Rica. Nevertheless, Costa Rican populations are apparently composed of two species, which Víquez (1999: 47) referred to as "Central Valley variety" and "forest habitat variety", without any further discussion on this matter. According to the specimens available to us, the most widespread and commonly collected is *C. edwardsii*, but the other taxon cannot be accurately identified yet, mostly because our sample is too small and not well-preserved.

As pointed out by Teruel & Roncallo (2010: 2), the Colombian population of *C. edwardsii* has the base colour of the body and appendages light yellowish, with a more contrasting dark pattern. But apart from this, we have not found any significant morphological differences with respect to the remaining specimens from Mexico, Central America, and Cuba.

Material examined. MEXICO: DURANGO: 2♀♀, 1♂ (IES), Tayoltita, August 1993, leg. R. Herrera. NAYARIT: 1♂ (FKCP), Rosatin (=Rosalía?), 19 August 1975, leg. van den Berghe. HONDURAS: GRACIAS A DIOS: 1♀ (RTO: Sco-0168), 2♀♀ (USNM), Mocorón Army Base, 10 October 1990, leg. S. A. Stockwell; 1♀ (USNM), Puerto Lempira, 25 April 1984; 1♂♂ (IES), León, 1991, leg. J.M. Maes. VALLE: Nacaome: 2♀♀, 3♂♂, 1 juvenile (RTO, *ex* MM-S182), Jícaro Galán, 7–8 May 2000, leg. M. Montoya. NICARAGUA: REGIÓN AUTÓNOMA DEL ATLÁNTICO NORTE: Bosawas, 1♀♀, 2♂♂ (FKCP), 18 km SW Ayapal, Bocay River watershed, Mt. Kum, 500 m, 28–31 May 1999, leg. van den Berghe. ESTELÍ: 2♀♀, 1 juvenile ♀, 1juvenile ♂ (IES), El Rodeito, 16 km W Estelí, December 1985, leg. J. M. Maes. MATAGALPA: 1♂ (IES), Las Tres Ceibas, road Telica to San Isidro Km 168, 21 August 1995, leg. L. F. Armas & J. M. Maes, eating *Didymocentrus krausi* under a stone, at 07:45 hr. LEÓN: 11♀♀, 6♂♂ (IES), Base del volcán Momotombo, 6 August 1995, leg. Maes, Armas & Johnson, under bark in a wired fence post (one of the females carried 104 [one hundred and four – *sic*! – Eds.] offspring). 2♀♀, 1♂, 1 juvenile (IES), Cerro Casitas, 15 August 1995, leg. Maes & Armas, under bark, 600 m; 1♂ (IES), León, March 1990, leg. B. Garcete; 2♂♂ (IES), León, no additional data; 1♀ (IES), León, December 1990, leg. B. Garcete; 1♀ (IES), León, June 1994, leg. Maes & Tellez; 2♀♀ (IES), El Sauce, December 1985, leg. L. R. Hernández. MANAGUA: Laguna Xiloá: 1♀, 1♂, 1 juvenile (RTO: Sco-0178), 1♀, 1♂, 3 subadults (IES), 13 August 1995, leg. L. F. de Armas, J. M. Maes, T. Goodwin; 1♂, 2 subadults (IES), 20 April 1994, leg. E. van den Berghe, under stones; 1♂ (FKCP), 8 December 1994, leg. van den Berghe; 1♂ (FKCP), 10 December 1994, leg. van den Berghe; 1♂ (FKCP), 29 December 1994, leg. van den Berghe; 1♀ (FKCP), 5 December 1995, leg. van den Berghe; 1 ♀♀, 1 juvenile (FKCP), March 1997, leg. van den Berghe; 2♀♀, 1♂ (FKCP), Chocoyero, October 2000, leg. van den Berghe; 1♂ (FKCP), El Crucero, 10 December 1994, leg. van den Berghe; 2♀♀, 1♂ (RTO: Sco-0179), Managua, 2 November 1989, leg. S. Jacobs; 1♂ (IES), Villa Nejapa, old road to León Km 10, October 1985, leg. L. R. Hernández. MASAYA: 2 ♀♀, 1♂, 1 immature (FKCP), Laguna de Apoyo, 1 November 1994, leg. van den Berghe; 1♀ (IES), Mirador del Eco, Volcán Masaya, December 1985, leg. L. R. Hernández. GRANADA: 1♀ (FKCP), Volcán Mombacho, 1100 m, 10 February 2001, leg. van den Berghe; 1 ♂ (FKCP), Reserva Domitila, 15 May 2001, leg. van den Berghe; 3♀♀, 1♂ (FKCP), Domitila Reserve, 27–28 December 2002, leg. van den Berghe. RIVAS: 1♀, 2♂♂ (FKCP), Reserva La Flor, 25–30 January 2003, leg. van den Berghe;2♀♀ (FKCP), Reserva La Flor, 16–18 February 2001, van den Berghe; 3♀♀, 1♂ (FKCP), La Flor vic., 4 September 2003, leg. van den Berghe; 3♀♀, 2 immatures (FKCP), Rancho Santana vic., 6 April 2003, leg. van den Berghe; 1♀, 1♂, 2 immatures (FKCP), Rancho Santana, December 2002, leg. van den Berghe. RÍO SAN JUAN: 1♀ (IES), Solentiname, 30 July 1989, leg. F. Reinboldt. COSTA RICA: GUANACASTE: 1♂, 2 juveniles (RTO: Sco-0174), 1.5 km NE Puerto Carrillo, 11 April 1997, leg. C. Herrera; 2♂♂ (RTO: Sco-0170), 29 September 1997, leg. C. Herrera; Tilarán, 1♀, 1♂ (RTO, *ex* MM-S009), Quebrada Grande, 3 February 1996, O. Araya, leg. I. Sánchez; 1♂, 1juvenile (IES, *ex* MM-S019), 20 February 1996, leg. M. González, I. Sánchez; Tilarán, 1♀ (IES, *ex* MM-S022), Los Ayotes, 10 March 1996, leg. Y. Vargas, I. Sánchez; 1♂ (RTO: Sco-0171), Estación Murciélago, 26 May 1996, leg. F. A. Quesada; Santa Rosa National Park: fire cut to Playa Naranjo: 1♂ (RTO: Sco-0172), around campsite and Piñuelas trail, 6 February [year?]; 1♂ (FKCP), Guanacaste, Santa Rosa National Park, 310 m., June 2004, leg. S. Pokorný; 2♀♀ (FKCP), Boruca, March 2007, leg. V. Šejna & J. Hromadka. HEREDIA: 1♂ (RTO: Sco-0175), San Joaquín de Flores, 200 m N church, 30 March 1996. ALAJUELA: Urbanización Punta del Este: 1 ♂ (RTO: Sco-0176), Desamparados, 15 February–July de 1997, leg. M. Castro. CUBA: MATANZAS: 1♂ (RTO), Varadero, January 2000, leg. L. Velazco. COLOMBIA: MAGDALENA: 1 juvenile (RTO: Sco-0422), Santa Marta, January 2009, leg. J. A. Vargas. LA GUAJIRA: 1♀ (RTO: Sco-0360), Riohacha, 8 November 2006, leg. C. A. Roncallo; 1♂ (RTO: Sco-0375), 25 July 2007, leg. C. A. Roncallo; 1 juvenile (RTO: Sco-0421), 5 October 2008, leg. C. A. Roncallo; 1 ♂ (RTO: Sco-0420), August 2009, leg. C. A.

Roncallo. Serranía de Macuira: 1♀ (RTO: Sco-0374), 3 km W Nazareth, 14 July 2007, leg. J. Echavarría.

Acknowledgments

Elise-Anne Leguin (MNHN) and Anja Friederichs (ZMHB), kindly provided photos of the type specimens of *C. margaritatus* and *C. gambiensis*, respectively. Benjamin Nitsche and Jason A. Dunlop (ZMHB) loaned *C. margaritatus* from Guayaquil deposited at his museum, whereas Oscar F. Francke (Instituto de Biología, UNAM, México, D.F.) donated topotypic specimens of *C. chiapanensis* for comparisons. Alberto Chiarle and Lisa Levi (MRNS) loaned other specimens of *C. margaritatus* from Guayaquil and other Ecuadorian localities. Other people who also supplied important specimens for comparison are César A. Roncallo (Riohacha, La Guajira, Colombia), Carlos Víquez (INBio, Costa Rica), Scott A. Stockwell, Scott Larcher, Jonathan Coddington and David G. Furth (Smithsonian Institution, Washington DC, USA), Jan-Peter Rudloff (Roßlau, Germany), and Tom C. van der Ende (The Netherlands). Ricardo Botero Trujillo (Pontificia Universidad Javeriana, Bogotá, Colombia) make possible data on some Colombian taxa; and José A. Ochoa Camara (Peru) provided photos and bibliography on Peruvian and Ecuadorian populations. We are also indebted to Victor Fet (Marshall University, Huntington, West Virginia, USA) for encouragement and kind assistance during this study, and to two anonymous reviewers for their comments.

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