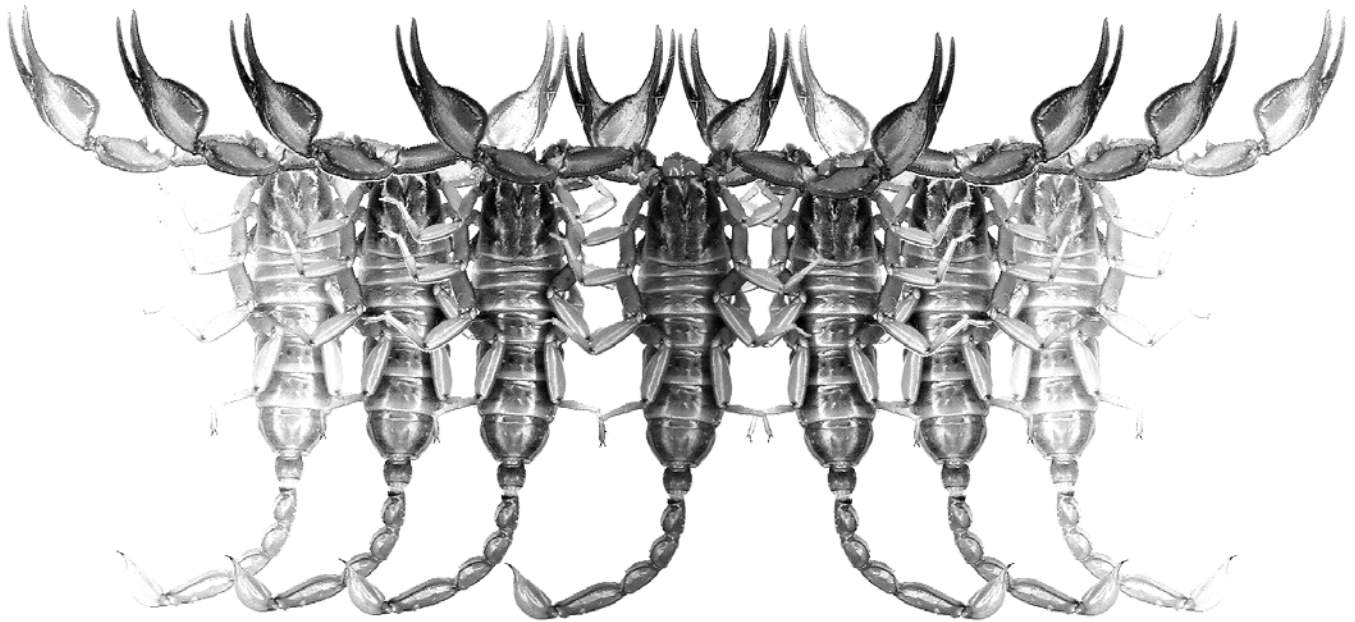


Euscorpius

Occasional Publications in Scorpiology



**Redescription of *Centruroides granosus* (Thorell, 1876)
and Identity of *Centrurus granosus simplex* Thorell, 1876
(Scorpiones: Buthidae)**

Luis F. de Armas, Rolando Teruel and František Kovařík

September 2011 – No. 127

Euscorpius

Occasional Publications in Scorpiology

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Publication date: 13 September 2011

Redescription of *Centruroides granosus* (Thorell, 1876) and identity of *Centrurus granosus simplex* Thorell, 1876 (Scorpiones: Buthidae)

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Summary

Centruroides granosus (Thorell, 1876) is redescribed based on several specimens of both sexes from Panama. We demonstrate that the original description of this species was based on an immature (subadult) male, which is herein designated as the lectotype. We conclude that *Centrurus granosus simplex* Thorell, 1876 is a senior synonym of *Centruroides testaceus arubensis* (Bakker, 1963), and elevate it to species level: *Centruroides simplex* (Thorell, 1876), **comb. nov.**

Resumen

Se redescrive *Centruroides granosus* (Thorell, 1876) sobre la base de varios ejemplares de ambos sexos provenientes de Panamá. Se demuestra que la descripción original de esta especie estuvo basada en un macho inmaduro (subadulto), el cual es aquí designado como lectotipo. También se concluye que *Centrurus granosus simplex* Thorell, 1876 representa un sinónimo anterior de *Centruroides testaceus arubensis* (Bakker, 1963), la cual es elevada a la categoría de especie: *Centruroides simplex* (Thorell, 1876), **comb. nov.**

Introduction

Thorell (1876) described *Centrurus granosus* (now in genus *Centruroides* Marx, 1890) on the basis of one supposedly female specimen and two immatures from San José Island (Archipiélago de las Perlas, Gulf of Panama, Panama). In the same paper, he also described *Centrurus granosus simplex* upon an adult male without precise locality. Pocock (1902) tentatively regarded *C. granosus* as a junior synonym of *C. margaritatus* (Gervais, 1844). Subsequent authors accepted that synonymy as definitive (Lourenço & Méndez, 1984; Armas & Maes, 2000; Fet & Lowe, 2000; Quintero, 2005).

Armas & Trujillo (2010) revalidated *C. granosus* and presented a brief diagnosis based upon two females and one male from Herrera Province, Panama, but they did not examine the type specimens of *C. granosus* or *C. g. simplex*.

In the present contribution, we provide additional taxonomic information on *C. granosus* and *C. g. simplex* after examination of the type specimens of both taxa.

Material and Methods

The studied specimens are deposited in the followings collections:

FKCP: Personal collection of F. Kovařík, Praha, Czech Republic.

IES: Instituto de Ecología y Sistemática, La Habana, Cuba.

NHRS: Naturhistoriska Riksmuseet Stockholm, Sweden.

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); the ventral accessory carina is added, because it is present in several buthid genera. Those nine carinae are defined for buthid scorpions as follows (Fig. 1):

1. Ventral accessory (VA) carina: Extends along the ventral region of the external surface of the manus, and runs between trichobothria *Eb1* and *Eb2*. Short in New World taxa, but in some Old World species it runs along the entire manus (Acosta et al., 2008).

2. External secondary (E) carina: Extends along the external surface of the manus, under the digital carinae and over the ventral accessory.

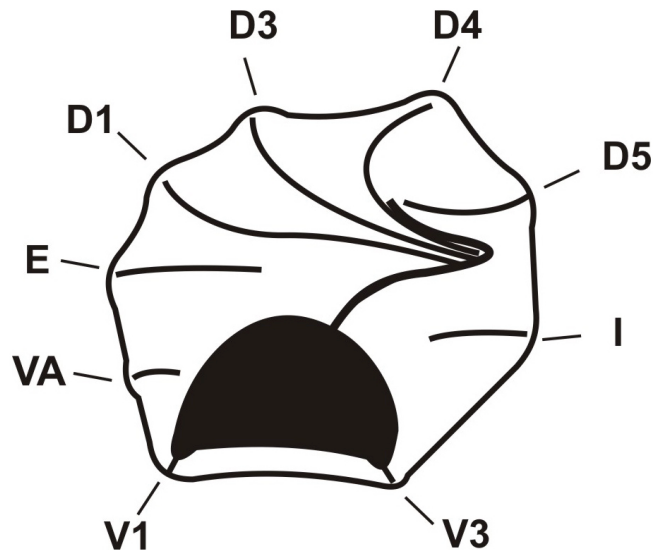


Figure 1: Pedipalp chelal carina nomenclature in buthid scorpions, showing nine fundamental carinae (modified from Sologlad & Sissom, 2001: figs. 43 and 45).

3. Digital (D1) carina: Extended along the length of the chela, and runs under trichobothria *eb* and *esb*, and above *est* and *et*.

4. Dorsal secondary (D3) carina: Extended along whole length of the dorsal surface of the chela, and runs over trichobothria *eb* and *esb*.

5. Dorsal marginal (D4) carina: Extended along the length of the dorsal surface of the chela, and runs between trichobothria *db* and *dt*, separating them.

6. Dorsal internal (D5) carina: Extended along the length of the chela and runs over trichobothrium *i*. Obsolete or vestigial in some taxa. Represents the interior marginal carina in Stahnke's nomenclature.

7. Interomedian (I) carina: Extended along the median area of the internal surface of the manus.

8. Ventrointernal (V3) carina: Extends to the base of the ventrointernal portion of the manus (underhand) to near the internal condyle of the movable finger.

9. Ventroexternal (V1) carina: Extends to the base of the ventroexternal portion of the manus (underhand) to near the external condyle of the movable finger, running near trichobothrium *V*₂.

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

Taxonomy

Centruroides granosus (Thorell, 1876) (Figs. 2A–F, 3A–F, 4A–G, 5; Table 1)

Centruroides granosus Thorell, 1876: 155–157; Kraepelin, 1891: 121, 127–128 (in part); Kraepelin, 1899: 88, 90 (in part).

Centruroides margaritatus: Pocock, 1902: 32 (misidentification: Panama records). Lourenço & Méndez, 1984: 86 (in part?); Fet & Lowe, 2000: 112 (in part); Armas & Maes, 2000: 27 (misidentification: Panama record only); Quintero, 2005: 373 (misidentification: Panama records).

Centruroides granosus: Armas & Trujillo, 2010: 235, 239.

Type data. We examined three syntypes from NHRS: One large but immature male [herein designated as lectotype (Fig. 2A–F)], and two smaller juveniles of unknown sex (herein designated as paralectotypes), “Ins. St. Joseph, Kimberg”, no other data. **Note:** Thorell (1876) identified the lectotype as female, but the specimen is actually a male with 27/28 pectinal teeth (not 26/27 as stated in the original description). Based on the shape of the pectines and genital operculum, and according to its size (56 mm), we suspect the specimen is a subadult. The paralectotypes are 18 and 33 mm long, and have pectinal tooth count of 26/25 and 25/25, respectively.

Distribution. This species is known from Panamanian localities only: Bocas del Toro Province; Archipiélago de las Perlas (Gulf of Panama); Chitré, Herrera Province; Panama City, Panama Province, and Punta Patiño, Darién Province (Fig. 5).

Diagnosis. A moderately large species (60–80 mm in total length). Body dark yellowish brown; legs paler than the body; pedipalps and metasoma with carinae moderately infuscate; chelicerae reticulate with dark brown. Pedipalp only sparsely setose; chela with manus ovate, 1.2–1.3 times wider than patella, with strong carinae on dorsal and external surfaces, most of them subgranulose; fingers with eight rows of denticles, movable finger with a well-developed basal lobe. Pectinal tooth count 24–26 in females, 26–28 in males.



Figure 2: *Centruroides granosus*. Preadult male lectotype. **A**, dorsal aspect; **B**, ventral aspect; **C**, left pedipalp, dorsal aspect; **D**, pectines; **E**, telson, lateral aspect; **F**, labels. Scale in millimeters only for A and B.

Metasoma: segments I–IV with two pairs of ventro-lateral macrosetae; vesicle globose, coriaceous; subaculear spine directed towards approximately the median region of the aculeus.

Female (Fig. 3A–F). General color dark brown; pedipalp femur, tergite VII and metasomal segments I–III, slightly paler; chelicerae strongly reticulated of dark brown; carinae on pedipalp and metasoma darker.

Character	Male	Female	Female
Carapace, L/W	6.25/5.70	7.38/7.55	7.02/7.12
Pedipalp, L	23.48	25.88	24.65
Femur, L/W	6.08/1.56	6.75/1.98	6.50/1.87
Patella, L/W	6.60/2.13	7.23/2.60	6.95/2.40
Chela, L	10.80	11.90	11.20
Manus, L/W/H	4.68/2.81/2.86	4.95/3.07/3.12	4.73/3.17/3.12
Movable finger, L	6.24	7.65	7.28
Mesosoma, L	18.32	19.27	18.93
Tergite VII, L/W	4.80/5.60	5.20/7.20	4.95/7.20
Metasoma, L	40.44	39.36	39.46
I, L/W/H	5.20/3.22/2.55	4.95/3.90/3.42	5.04/3.85/3.12
II, L/W	6.76/3.12	6.13/3.85	6.24/3.85
III, L/W	7.28/3.17	6.75/3.80	6.55/3.85
IV, L/W	7.55/3.33	7.18/3.80	7.18/3.95
V, L/W/H	8.05/3.33/2.91	8.05/3.80/3.22	7.85/3.80/3.17
Telson, L	5.60	6.30	6.60
Vesicle, L/W/H	3.95/2.50/2.29	4.10/2.70/2.60	4.21/2.81/2.50
Total L	64.71	66.01	65.41

Table 1: Measurements (mm) of *Centruroides granosus* from Chitré, Herrera Province, Panama. H, height; L, length; W, width.

Carapace very strongly granulose; superciliary and posterior median carinae strong, granulose. Anterior median furrow wide, moderately deep; posterior median furrow narrow, deep; posterior marginal furrow narrow, deep. Pectines with 24–26 teeth; basal plate rectangular in shape, without central pit or depression. Sternites III–VI coriaceous, with a whitish lustrous posterior area on V; VI with two obsolete submedian carinae; VII finely granular, with two pairs of strong, smooth carinae.

Metasoma with 10-8-8-8-5 carinae, intercarinal spaces mostly coriaceous, with scarce fine granules, mainly on dorsal surface; segment V finely granulose, mainly on lateral and ventral surfaces; I–IV with two pairs of ventrolateral macrosetae, and three pairs of ventral submedian macrosetae. Carinae: dorsal, lateral supramedians, and lateral inframedians strong and serrate on I–III; ventrolateral I–IV subserrate; ventral submedians strong and smooth on I, but subserrate on II–IV. Segment V: surfaces finely and scarcely granulose, carinae poorly developed, with traces of submedian carinae on basal one-half of the segment. Telson globose, mostly coriaceous, with rudimentary granules, and a conic, spinoid subaculear tooth. Measurements are given in Table 1.

Pedipalp only sparsely hirsute, orthobothriotaxic A. Femur with surfaces very finely granulose; dorsal carinae crenulated, with moderate granules; ventral external carina subserrate, with larger granules. Patella with surfaces very finely granulose; dorsal carinae crenulated, with moderate granules; ventral external carina strong, rim-like. Chela: dorsal, external and ventral surfaces coriaceous; internal surface very finely granulose. Carinae: dorsal internal obsolete; dorsal mar-

ginal moderate, subgranulose; dorsal secondary strong, mostly smooth, with some vestigial granules on its basal portion; digital moderate, weak and subgranulose on the first one-half of the hand, being smooth on the last one-half; ventroexternal strong, smooth; ventrointernal indistinct. Fixed finger with eight rows of denticles; basal notch conspicuous. Movable finger with eight rows of denticles more a distal subrow composed by four granules; basal lobe strong.

Male (Fig. 5A–G). Differs from female by the following characters: Mesosoma slender, pectines with higher pectinal tooth counts (27–28 vs. 24–26 in females) and basal plate shorter; metasoma elongate (ratio segment III length/width = 2.3 in male and 1.7–1.8 in females); sternite V with the whitish area more definite. Measurements are given in Table 1.

Comparisons. *Centruroides granosus* clearly differs from *C. margaritatus* by having two pairs of ventrolateral macrochaetae on metasomal segments II–IV, and a globose telson in both sexes (*C. margaritatus* has four pairs of ventrolateral macrochaetae on metasomal segments II–IV, and male with an elongate telson).

Natural history. This is a synanthropic species, common indoor houses, as well as in yards and other anthropic areas. It is the most common scorpion in Panama City, and other urban areas (Quintero, 2005).

Variation. Pectinal tooth count varied as follows: females = 24/24, 24/24, 26/23; males = 28/26, 27/28 (lectotype), 27/27, 26/26. Morphometric data of two females from Chitré in Table 1.

Comments. The lectotype of *C. granosus* has left pedipalp chela slightly narrower than patella, but right

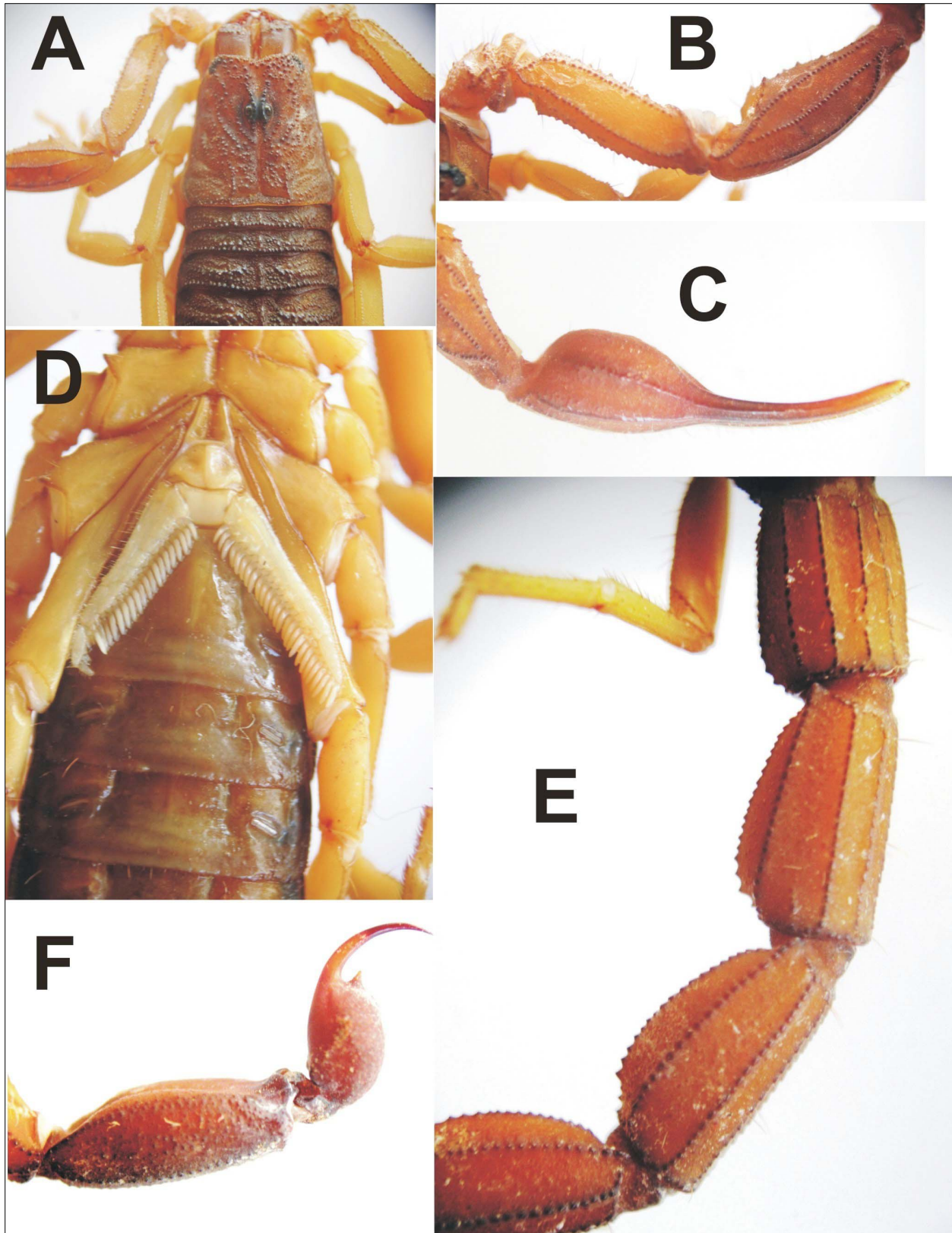


Figure 3: *Centruroides granosus*. Female from Chitré. **A**, prosoma and first tergites; **B**, femur and patella of pedipalp, dorsal aspect; **C**, pedipalpal chela, dorsal aspect; **D**, coxasternal area and first abdominal sternites; **E**, metasomal segments I–IV, ventrolateral aspect; **F**, metasomal segment V and telson, lateral aspect.

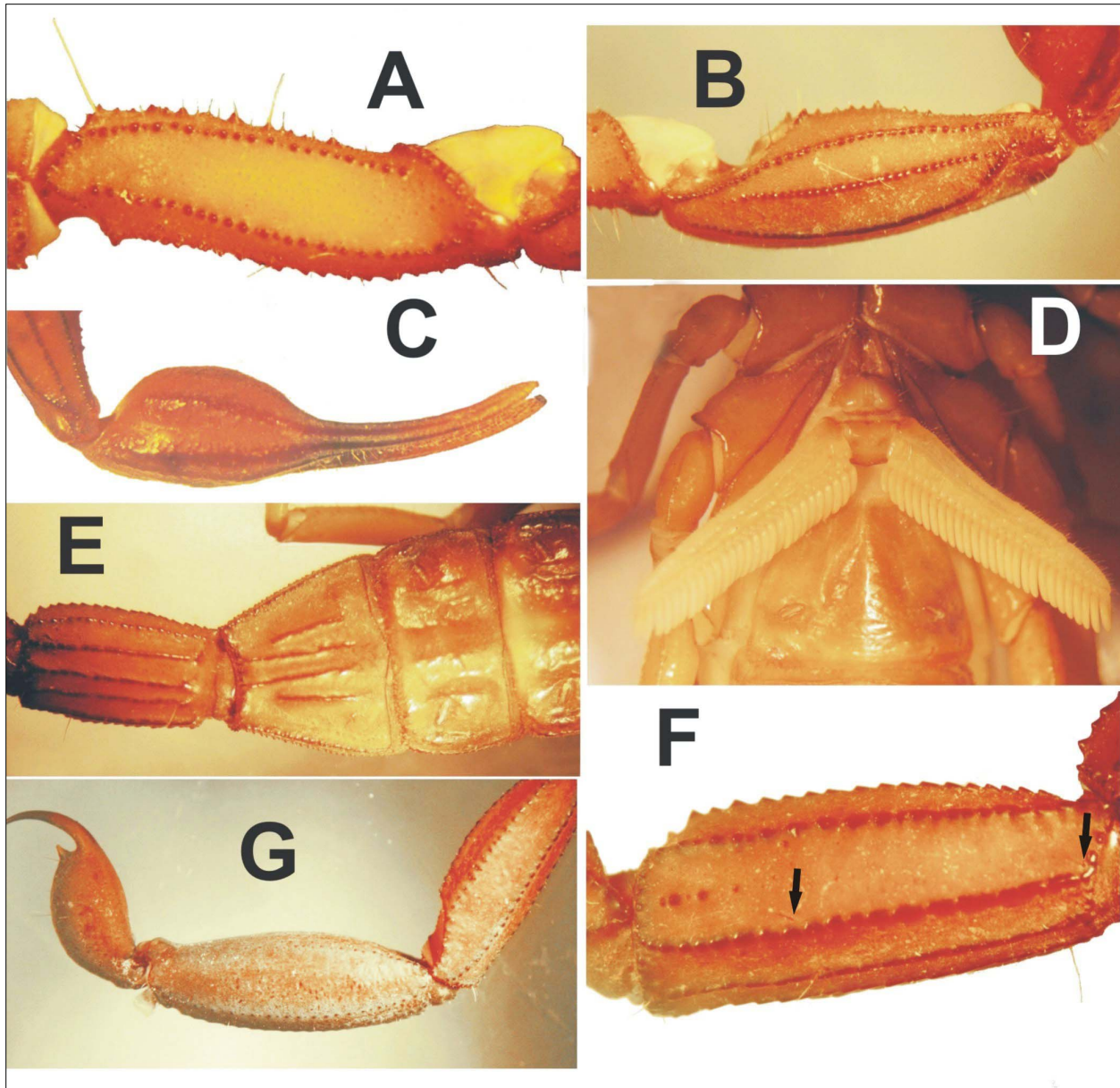


Figure 4: *Centruroides granosus*. Male from Chitré. A–C, pedipalp, dorsal aspect: A, femur; B, patella; C, chela. D, pectines; E, sternites V–VII and metasomal segment I; F, metasomal segment II, ventrolateral aspect, showing two pairs of ventrolateral macrochaetae (arrows); G, metasomal segments IV–V and telson, lateral aspect.

chela is slightly wider. According to available data, this specimen seems to be a preadult (ultimate immature instar).

Masi (1912: 108) recorded *C. margaritatus* from Taboga Island, Gulf of Panama. We suspect his material corresponds to *C. granosus* because Taboga is only 15 km SW of Panama City. A similar situation is that of the specimens recorded by Lourenço & Méndez (1984: 86), and Quintero (2005), most of which are from Panama City and neighboring localities.

Other material examined. PANAMA: Two females, one male (IES), “Depósito de Vectores Chitré” [Chitré District (7°57'59"N 80°26'00"W), Herrera Province], March 10, 2006, collected by Vector Control staff; identified as *Centruroides margaritatus* by an unknown person. One female and one male (FKCP), Punta Patiño (near Colombian border), Darien Province, January 17, 1995, leg. Bužga. One female and two males (FKCP), Bocas del Toro, November 2000, no other data. Additional specimens from additional Panamanian local-



Figure 5: Geographical distribution of *Centruroides granosus*, including type locality (red square).

ities (most of them from Panama City), were examined by LFA during his visit to the Gorgas Institute, in September 2009.

Identity of *Centruroides granosus simplex* Thorell, 1876

As mentioned above, Pocock (1902) regarded *C. granosus* as a potential junior synonym of *C. margaritatus*, but he explicitly did not refer to *C. g. simplex*.

The holotype of *C. g. simplex* is a dry mounted, very fragile specimen deposited at NHRS (G. Lindsay, e-mail to F. Kovařík, on February 02, 2011). We received a series of high-resolution color photos of this specimen (Figs. 6A–C), from which we were able to recognize it as an adult male conspecific with *Centruroides testaceus arubensis* (Bakker, 1963). For such reason, we propose the following nomenclatural actions:

***Centruroides simplex* (Thorell, 1876), comb. nov. & status nov.**
(Fig. 5, 6A–C, 7B, D, Table 2)

Centruroides granosus simplex Thorell, 1876: 155, 157.

Centruroides granosus: Werner, 1925: 540 (misidentification).

Rhopalurus hasethi: Hummelinck, 1940: 140, 141, 142, fig. 17, tab. 21 (misidentification: Aruba records only).

Rhopalurus hasethi arubensis Bakker, 1963: 107, 109–110, 111, 116, 117, fig. 19–22, tab. 13–15.

New synonymy.

Centruroides hasethi arubensis: Stahnke & Calos, 1977: 118; Armas, 1988: 53–54.

Centruroides testaceus arubensis: Sissom, 1991: 70; Kovařík, 1998: 108; Fet & Lowe, 2000: 120–121.

Type data. Male holotype (NHRS), without data (Fig. 6A–C). (examined via digital photographs).

Distribution. Known only from Aruba, Lesser Antilles.

Diagnosis. A medium-sized species (female 33–65 mm; male 44–51 mm), light yellowish-brown, immaculate. Carapace finely and densely granulose; anterior margin weakly emarginate; superciliary carinae and posterior median carinae strong, granulate. Pedipalp orthobothriotaxic A; intercarinal spaces finely granulate; femur and patella with strong, crenulate dorsal carinae; chela with digital, dorsal secondary and dorsal marginal carinae moderate to strong, crenulate; ventral external carina strong, smooth. Pectines with 20–24 teeth in females, and 22–26 in male; basal plate rectangular, with a slight transversal depression in the central area. Sternites III–V coriaceous; VI–VII finely granulose, more so on VII; sternite VII with two pairs of strong, granulose carinae. Metasoma with 10-8-8-8-5 carinae, which are strong and subserrate, except the dorsal lateral carinae V, which is feeble and subdentate; intercarinal spaces finely granulose. Telson globose, with vestigial small granules; subaculear tubercle obsolete. Measurements in Table 2.

Centruroides simplex clearly differs from *C. testaceus* (De Geer, 1778) by its smaller size (60–80 mm in *C. testaceus*), lower pectinal tooth count (female 23–29, and male 25–31 in *C. testaceus*), pedipalp chela narrower (Fig. 7A–B), and a more globose telson (Figs. 7C–D). This species also differs from *C. pococki* Sissom & Francke, 1983, by having higher pectinal tooth counts (19–22 in females and 20–23 in males of *C. pococki*), pedipalp chelae more finely granulose, and male with

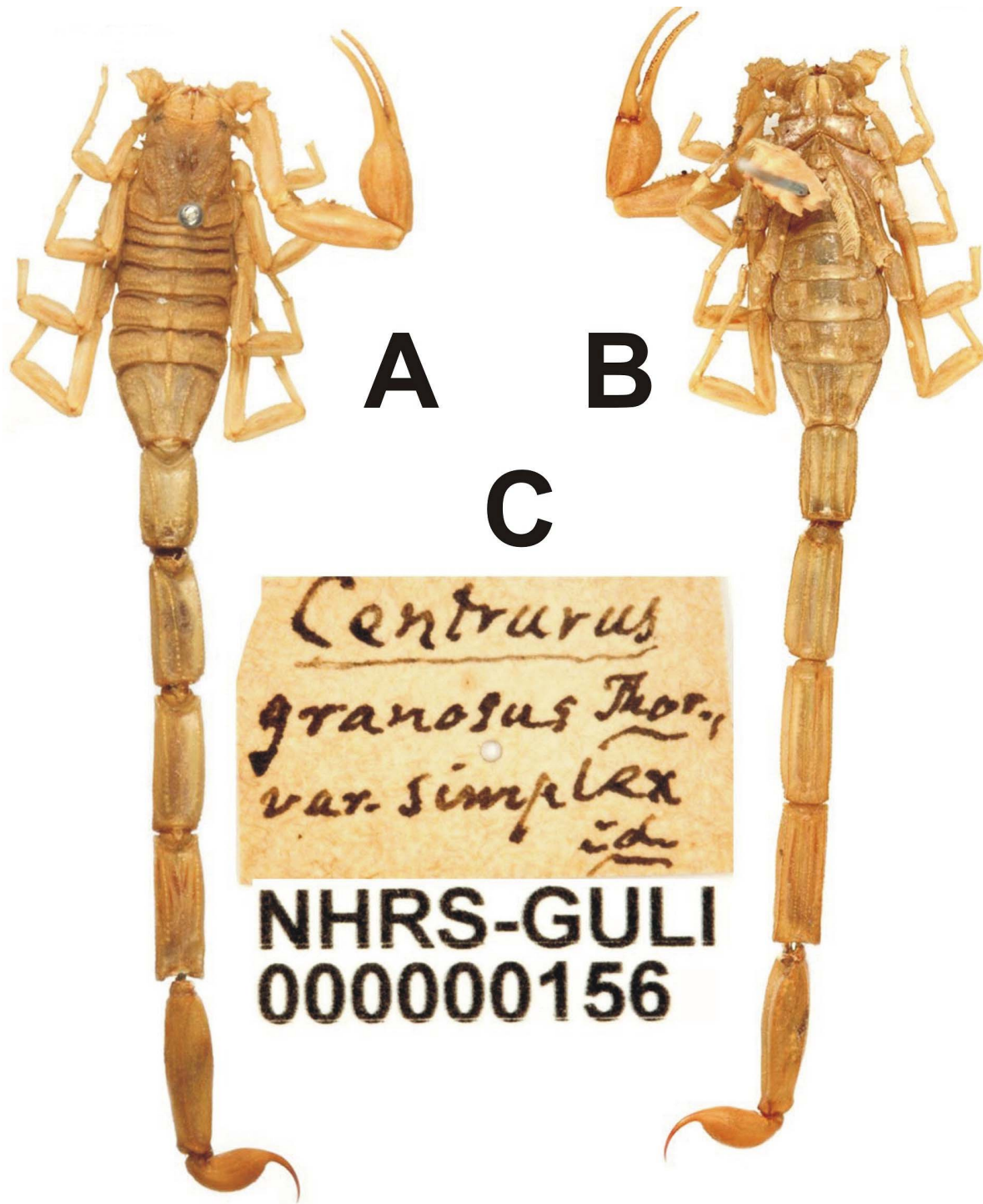


Figure 6: *Centruroides simplex*. Male holotype, dorsal (A), and ventral aspects (B); C, labels from Naturhistoriska Riksmuseet Stockholm, Sweden. Photos courtesy of G. Lindberg.

shorter metasoma (ratio length/width segment III = 1.8–2.0 in *C. simplex*, and 3.2 in *C. pococki*). These three species seems to be closely related taxa.

Comments. Bakker (1963) differentiated the Aruba population from those of Bonaire and Curaçao mainly

on the basis of meristic (pectinal tooth counts) and morphometric characters, overlooking the morphological ones (*v. gr.*: cuticular granulation and telson shape).

Additional specimen examined. One female and one male, one preadult female, and one preadult male,

Character	<i>C. simplex</i>		<i>C. testaceus</i>	
	Male	Female	Female	Male
Carapace, L/W	4.95/5.00	6.00/5.70	6.50/6.80	6.50/6.50
Pedipalp, L	19.20	19.90	23.20	24.80
Femur, L/W	4.70/1.30	4.90/1.50	5.75/1.30	6.50/1.65
Patella, L/W	5.40/1.85	5.45/2.10	6.75/2.60	7.00/2.35
Chela, L	9.10	9.55	10.70	11.30
Manus, L/W/H	3.65/2.30/2.05	3.55/2.25/2.00	4.30/2.90/2.60	4.75/2.85/2.70
Movable finger, L	5.45	6.00	7.15	7.00
Mesosoma, L	12.45	14.35	16.70	17.60
Tergite VII, L/W	3.90/4.90	4.05/5.45	4.80/6.25	5.20/5.55
Metasoma, L	30.05*	28.85	37.70	44.10
I, L/W/H	4.05/2.85/2.30	3.75/3.10/2.55	4.90/3.80/3.00	5.70/3.65/2.85
II, L/W	5.20/2.70	4.50/2.90	5.90/3.50	7.00/3.35
III, L/W	5.40/2.60	4.70/2.85	6.25/3.40	7.55/3.30
IV, L/W	5.70/2.50	5.20/2.70	6.75/3.40	8.05/3.10
V, L/W/H	6.35/2.40/2.20	5.70/2.60/2.40	7.15/3.10/2.85	8.95/3.00/2.70
Telson, L	–	5.00	6.75	6.85
Vesicle, L/W/H	3.35/2.05/1.70	3.20/2.10/2.00	3.90/2.35/2.35	4.40/2.55/2.20
Total L	47.45*	49.20	60.90	68.20

* Without aculeus.

Table 2: Measurements (mm) of *Centruroides simplex* from San Nicolas, Aruba, and *C. testaceus* from Hato, Curaçao. H, height; L, length; W, width. All the specimens are deposited at the IES.



Figure 7: Pedipalp chela (dorsal) and telson (lateral) of females of *Centruroides testaceus* (A, C) and *C. simplex* (B, D). Scale (mm): A–B, 2.3; C–D, 1.7.

one nymph III female and one nymph III male, one nymph II (IES), San Nicolas, Aruba, ca. December 1953, Y. G. v.d. Bergh, leg., via Schoolkinderen.

Acknowledgments

We are grateful to Gunvi Lindberg and Julio Ferrer (NHRS) who loaned the type specimen of *C. granosus*, and provided photos of *C. g. simplex*. Roberto Miranda and Sergio Bermúdez (Instituto Conmemorativo Gorgas de Estudios de la Salud, Panama City) assisted LFA during his visit to Panama in September 2009. Elise-Anne Leguin (MNHN) kindly provided photos of the female holotype of *C. margaritatus*. Specimens of *C. testaceus* and *C. simplex* were donated to the IES by P. Wagenaar Hummelinck (Utrecht, Netherlands). Benjamin Nitsche and Jason A. Dunlop (ZMHB) loaned *C. margaritatus* from Guayaquil deposited at his museum. Alberto Chiarle and Lisa Levi (MRNS) loaned other specimens of *C. margaritatus* from Guayaquil and other Ecuador localities. Ricardo Botero Trujillo (Pontificia Universidad Javeriana, Bogotá, Colombia) made 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 the present study, as well to two anonymous referees for their criticism and careful revision of the manuscript.

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