Euscorpius

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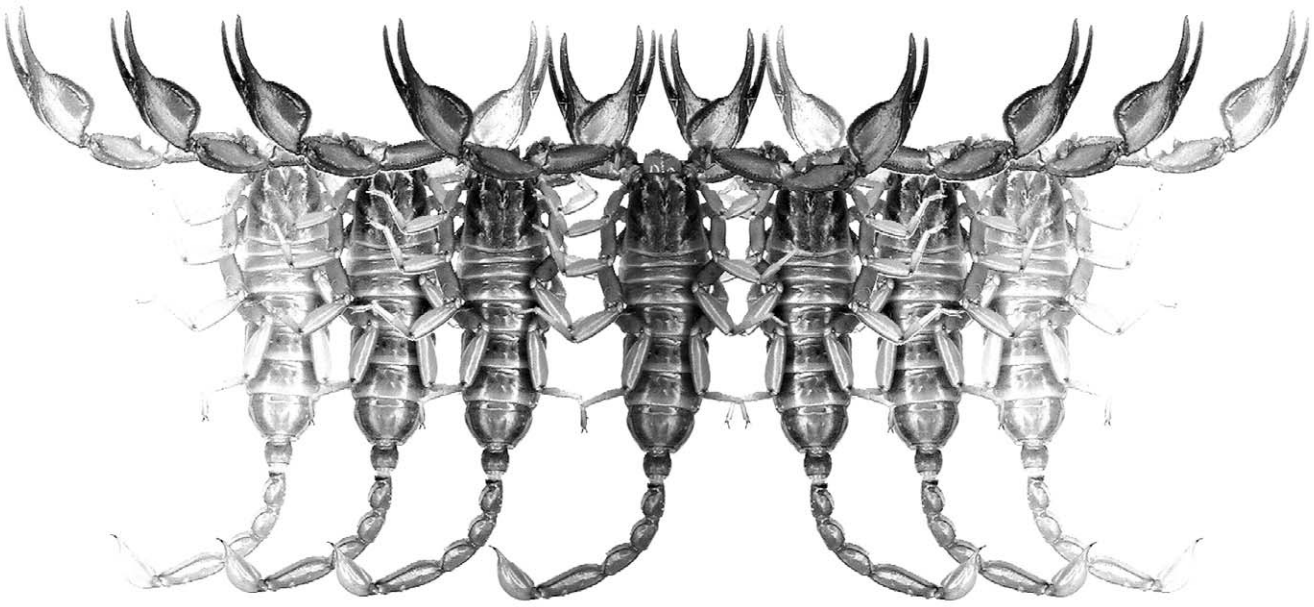

A New Island Species of *Centruroides* Marx, 1890 (Scorpiones: Buthidae) from the Southwestern Caribbean

Rolando Teruel & Brandon Myers

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Euscorpius — Occasional Publications in Scorpiology. 2017, No. 252

A new island species of *Centruroides* Marx, 1890 (Scorpiones: Buthidae) from the southwestern Caribbean

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Summary

Herein we describe a new species of the Buthidae scorpion genus *Centruroides* Marx, 1890. It occurs at least in two small offshore islands of the southwestern Caribbean: Cozumel in Mexico and Guanaja in Honduras, based upon type specimens from the former and photographic evidence from the latter. It belongs in the "gracilis" species-group and is most closely related to both *Centruroides gracilis* (Latreille, 1805) and *Centruroides nigrescens* (Pocock, 1898).

Introduction

The most diverse scorpion genus in Mexico is *Centruroides* Marx, 1890: a total of 44 living species (two of them polytypic, with two subspecies each) are currently accepted to occur in this country, as well as one fossil in amber. It also includes all medically important scorpions of the country, being a true health problem in several States. There is no compilation that can be cited here as a main data source for both subjects, because the literature on this genus represents a true plethora of small papers dealing with the taxonomy and/or toxicity of just one or a few (mostly closely related) species. The papers keep being published every year, thus, the few checklists available (none covering the complete genus) have become outdated quickly, basically as soon as issued.

Its Mexican representatives are a heterogeneous assemblage that has been repeatedly divided into discrete groups, subgroups and/or complexes of species, see e.g., Hoffmann (1932), Ponce-Saavedra & Moreno-Barajas (2005), and Ponce-Saavedra & Francke (2013). One of them is the "gracilis" species-group, represented in Mexico by four species: *Centruroides fulvipes* (Pocock, 1898), *Centruroides gracilis* (Latreille, 1804), *Centruroides nigrescens* (Pocock, 1898) and *Centruroides nigrimanus* (Pocock, 1898). And according to many specimens of all of them examined herein, they are diagnosed by the following combination of characters: **1)** size large to very large (50–140 mm); **2)** coloration uniformly to mostly dark brown to blackish; **3)** pedipalp fingers with nine principal rows of denticles; **4)** high counts of pectinal teeth (24–38). Except for *C. gracilis*, which is widespread across tropical America (including insular Caribbean) and has been accidentally introduced in Europe, Africa and Asia, the other three species are endemic from Mexico. Two additional members of this group occur all over Central America, but not in Mexico: *Centruroides bicolor* (Pocock, 1898) and *Centruroides limbatus* (Pocock, 1898).

In the present paper, a new member of this species-group is described from the Caribbean island of Cozumel, offshore Yucatán Peninsula, Mexico. It is also recorded from another Caribbean island: Guanaja, in Islas de la Bahía Archipelago, Honduras.

Methods & Material

Specimens were studied under a Zeiss Stemi 2000-C stereomicroscope, equipped with a line scale for measurements and a Canon PowerShot A620 digital camera for micro-photographs: a variable series of consecutive-plane shots was taken depending on the field depth (i.e., the bulkiest the structure, the largest number of photographs needed) and afterwards, all images of the same structure were assembled into a single fully-focused image using the free software CombineZP. Habitus photographs were taken with a Nikon Coolpix S8100 digital camera. Photographs of live individuals were taken with a Nikon D3300 digital camera, equipped with a Tamron 90mm F/2.8 macro lens. All images were processed with Adobe Photoshop CS5 only slightly, i.e., bright/contrast optimization, removal of artifacts and unnecessary details from background and assemblage of plates.

Nomenclature and measurements follow Stahnke (1971), except for trichobothriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977), pedipalp chela carinae (Acosta et al., 2008, as interpreted by Armas et al., 2011), and sternum (Soleglad & Fet, 2003). Unless otherwise noted, all morphologically diagnostic characters mentioned in the diagnoses and comparisons refer to adults of both sexes.

Specimens studied herein are preserved in 80% ethanol and deposited in the personal collection of the first author (RTO), with labels laser-printed in Spanish but transcribed into English here for text-coherence.

Systematics

Family Buthidae C. L. Koch, 1890
Genus *Centruroides* Marx, 1836

Centruroides caribbeanus Teruel et Myers, **sp. n.**
(Figures 1–11; Table 1)
http://zoobank.org/urn:lsid:zoobank.org:act:6AF155D2-EDE4-4D87-868F-364BD3F1A975

TYPE DATA. MEXICO, Quintana Roo State, Yucatán Peninsula, Cozumel Island, Ruinas de San Gervasio, 20°30'01.27"N – 86°50'53.87"W, 10 m a.s.l., 19 June 2017, under rocks in the forest, M. Casey, 1♂ holotype (RTO). Grand Park Royal Hotel, 15/June/2016, at night, on perimeter wall, M. Casey, 1♀ paratype (RTO).

ADDITIONAL MATERIAL EXAMINED (not types). Same data as holotype, 1♂, 2♀♀. Same data as paratype, 1♂, 1♀. Same data as paratype except 15 June 2017, 2♀♀. Same data as paratype except 21/June/2017, 2♀♀ 1 juvenile. **Notes.** These specimens are kept alive to study the species' reproductive biology, e.g., mating and postembryonic development. As their preservation cannot be warranted (e.g., escape, cannibalism and decay after death may occur), all were intentionally excluded from the type series.

ETYMOLOGY. The selected epithet is a Latinized adjective that alludes to the region where this species is known to occur: the Caribbean.

DIAGNOSIS. A member of the "gracilis" species-group. Adult size large (male 112 mm, female 94 mm) for the group. Coloration uniform black to unaided eye. Pedipalps standard-sized and with ordinary setation; manus robust, oval (length/width ratio 1.82 in male, 1.68 in female), much wider than patella in male (ratio 1.26) but only slightly in female (ratio 1.06), with carinae very weakly granulose to obsolete, internal surface with minute granules scattered; fixed/movable fingers with 9/9 principal rows of denticles, respectively, basal lobe/notch combination strong. Carapace and tergites with intercarinal tegument coriaceous, with few medium-sized granules scattered. Pectines with tooth count 31–32 in males, 27–30 in females; basal plate smooth, entirely lacking any pit or depression. Sternite V with the smooth patch large, triangular, wider than long, flat and whitish in male, absent in female; spiracles very long, slit-like. Metasoma long, slender (much more so in male) and parallel-sided, with 10/8/8/8/5 complete but weak carinae (stronger in female); dorsal lateral carinae on segments II–III with terminal denticle not enlarged; intercarinal spaces coriaceous. Telson vesicle oval, elongate and essentially smooth (male), to short and vestigially granulose (female), laterodistal swellings obsolete (male) to absent (female); subaculear tubercle minute and adjacent to the aculeus, which is very long.

DESCRIPTION (adult male holotype). **Coloration** (Fig. 1) entirely and uniformly black, except as follows: intersegmental membranes gray to whitish, chelicerae dark brown with very dense black reticulation, ventral region of prosoma and sternites diffusely marbled with yellowish-brown, smooth patch of sternite V yellowish-white, and pectines whitish to pale grey with heavy infuscation.

Chelicerae (Fig. 2b). With dentition typical for the genus, teeth relatively large and sharp. Tegument glossy but with minute granulation and punctures scattered on distal half, dorsodistal portion of manus with coarse, glossy, partially anastomosed granules irregularly arranged transversally, defining a depressed area. Setation very dense ventrally, but essentially lacking dorsally, except for five rigid macrosetae (the innermost one thicker and dark, the others thinner and pale) around depressed area of manus.

Pedipalps (Fig. 2a). Moderately large for the group, sparsely setose. Orthobothriotaxic A-α, but with chelal trichobothria *est-et-db-et* placed in distal third of finger. Femur almost straight and moderately hirsute (setae of various size and color, longer and denser on internal surface); all carinae moderate to strong, coarsely denticulate; intercarinal tegument coriaceous, with abundant minute granules scattered on dorsal surface only; space delimited by internal (*i*) trichobothria with two medium-sized conical tubercles, the largest located between i_1 and i_2. Patella straight and sparsely hirsute (setae short and white, denser on internal and external surfaces); all carinae weak to moderate, granulose to subcostate; intercarinal tegument coriaceous, internally with abundant conical tubercles. Chela robust and sparsely setose (setae short and white, denser on internal and external surfaces of manus and fingers); manus robust, oval (1.82 times longer than wide), much wider than patella (ratio 1.26), and with the distal half markedly wider, all carinae very weakly granulose to obsolete, intercarinal tegument coriaceous, with abundant minute granules

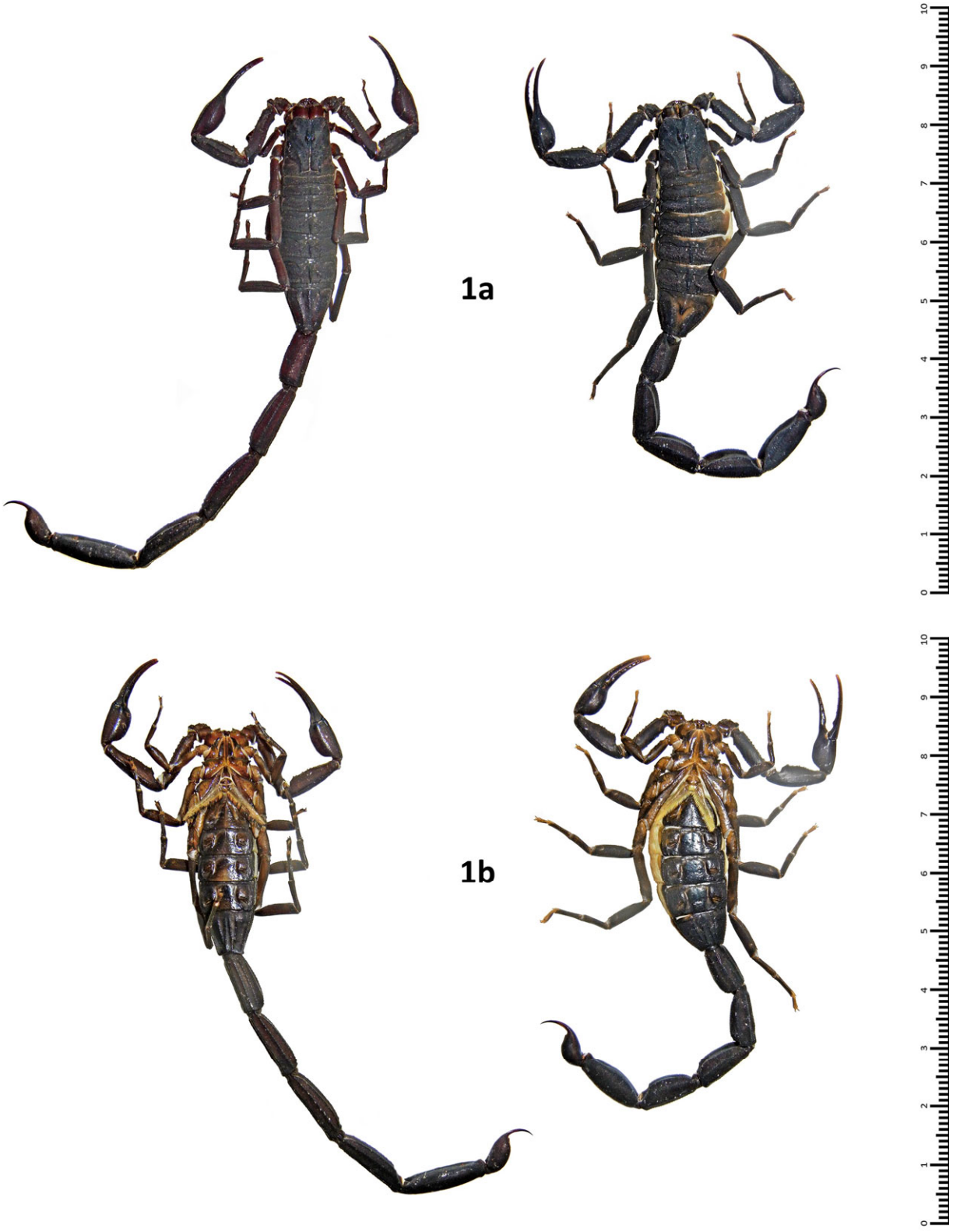


Figure 1: Male holotype (left) and female paratype (right) of *Centruroides caribbeanus* **sp. n.**, full-body views: **a)** dorsal; **b)** ventral. Scale bar in centimeters, with millimeter subdivisions.

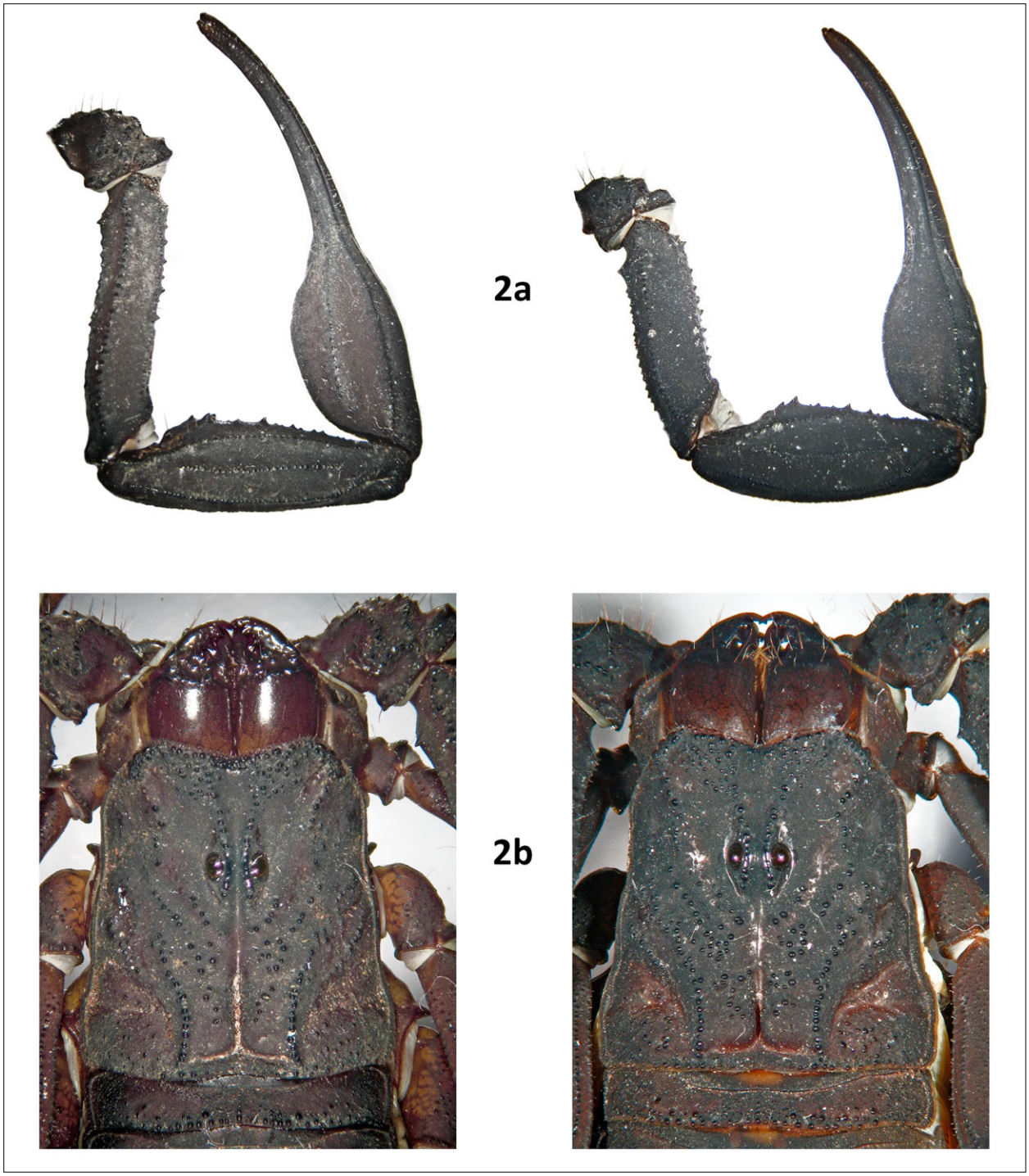


Figure 2: Male holotype (left) and female paratype (right) of *Centruroides caribbeanus* **sp. n.**, close-ups in dorsal view: **a)** pedipalp; **b)** chelicerae, carapace and tergite I.

scattered on all surfaces (sharper internally); fingers very long (movable finger 1.52 times longer than underhand), evenly curved and with tegument coriaceous; fixed finger with 9/9 principal rows of denticles, movable finger with 9/9 plus an apical subrow of four denticles and a large internal accessory denticle (large terminal denticle not included), basal lobe/notch combination strong.

Carapace (Fig. 2b). Trapezoidal and longer than wide; anterior margin rough and widely V-shaped, with

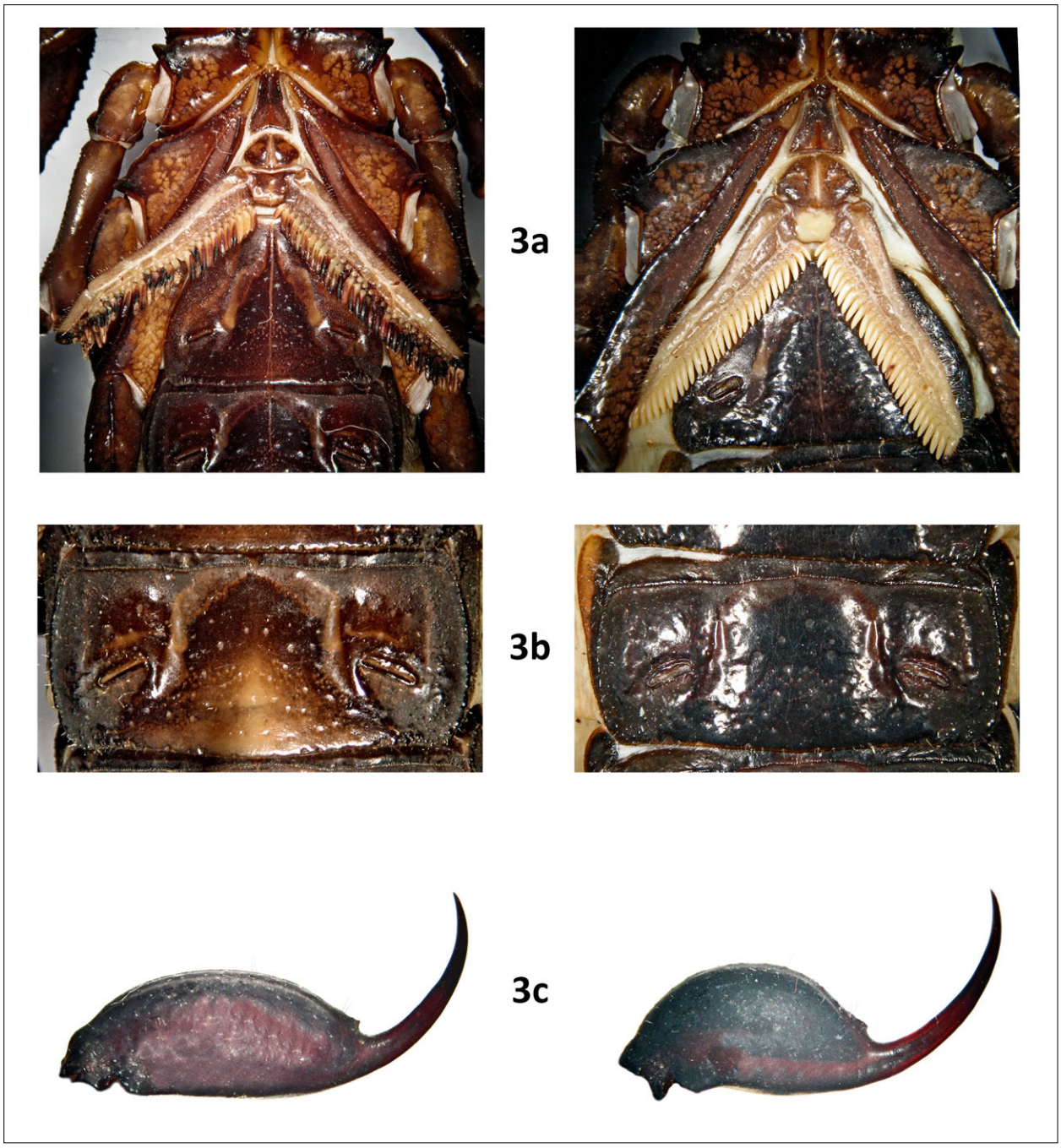


Figure 3: Male holotype (left) and female paratype (right) of *Centruroides caribbeanus* **sp. n.**, close-ups: **a)** sternopectinal region, ventral view; **b)** sternite V, ventral view; **c)** telson, lateral view.

scattered setation. Carination greatly reduced: the only definable carinae are the irregularly fused anterior medians and superciliaries (moderately granulose), and the also irregularly fused central medians and posterior medians (moderately granulose). Furrows: anterior median, median ocular, central median, posterior median and posterior marginal fused, narrow and deep (especially on posterior half of the plate), posterior laterals and posterior transverse long, wide and shallow, other furrows indistinct. Tegument coriaceous, with many minute and abundant medium-sized, glossy granules scattered, coarser and denser in ocular triangle and posteromedian region. Median eyes standard-sized and separated by about one ocular diameter, lateral eyes much smaller.

Sternum (Fig. 3a). Standard for the genus: type 1, medium-sized, markedly longer than wide and subtriangular, with 3–4 pairs of macrosetae. Tegument coriaceous to irregularly granulose.

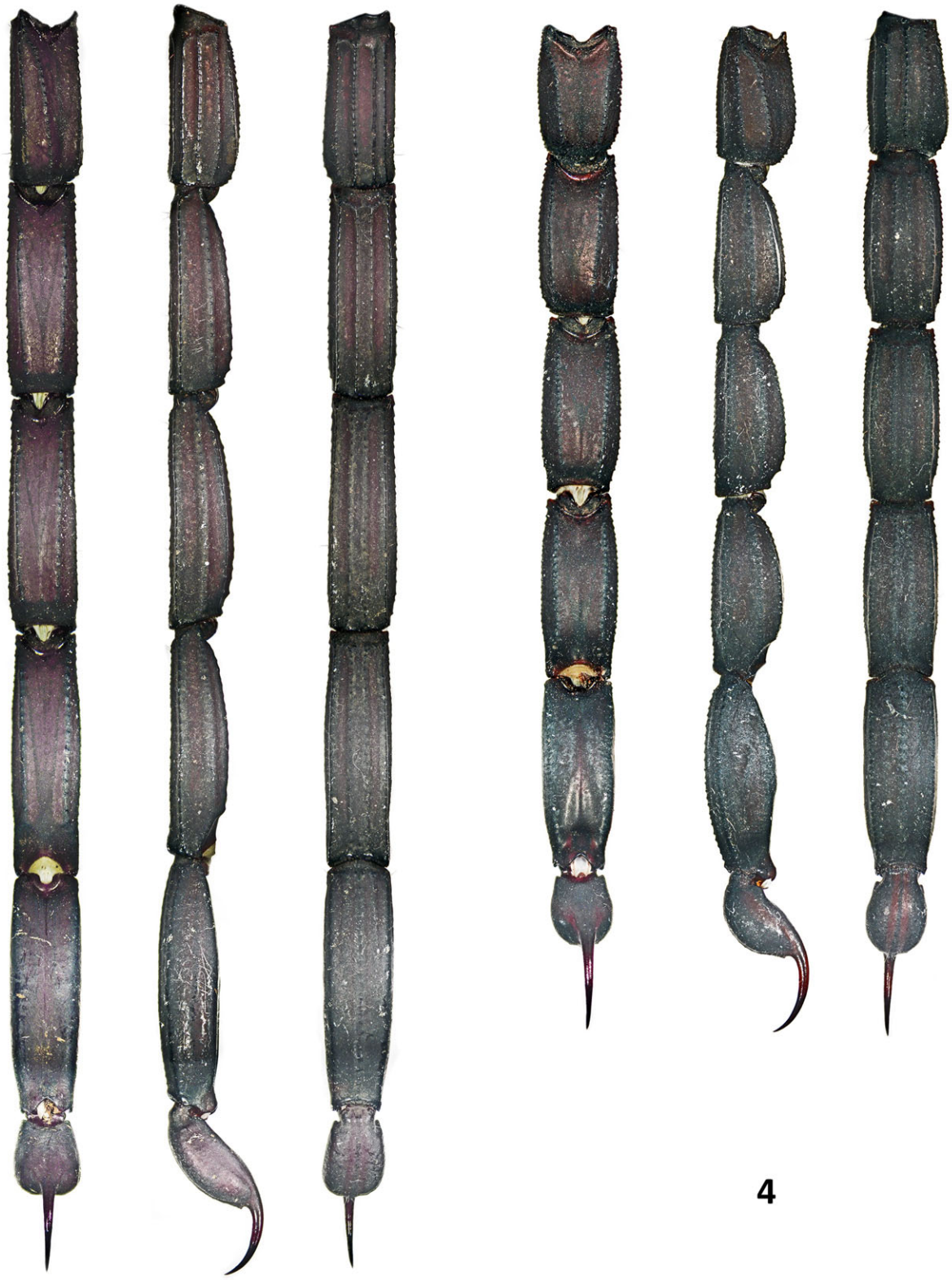


Figure 4: Male holotype (left) and female paratype (right) of *Centruroides caribbeanus* sp. n., close-up of metasoma and telson in dorsal, lateral and ventral views.

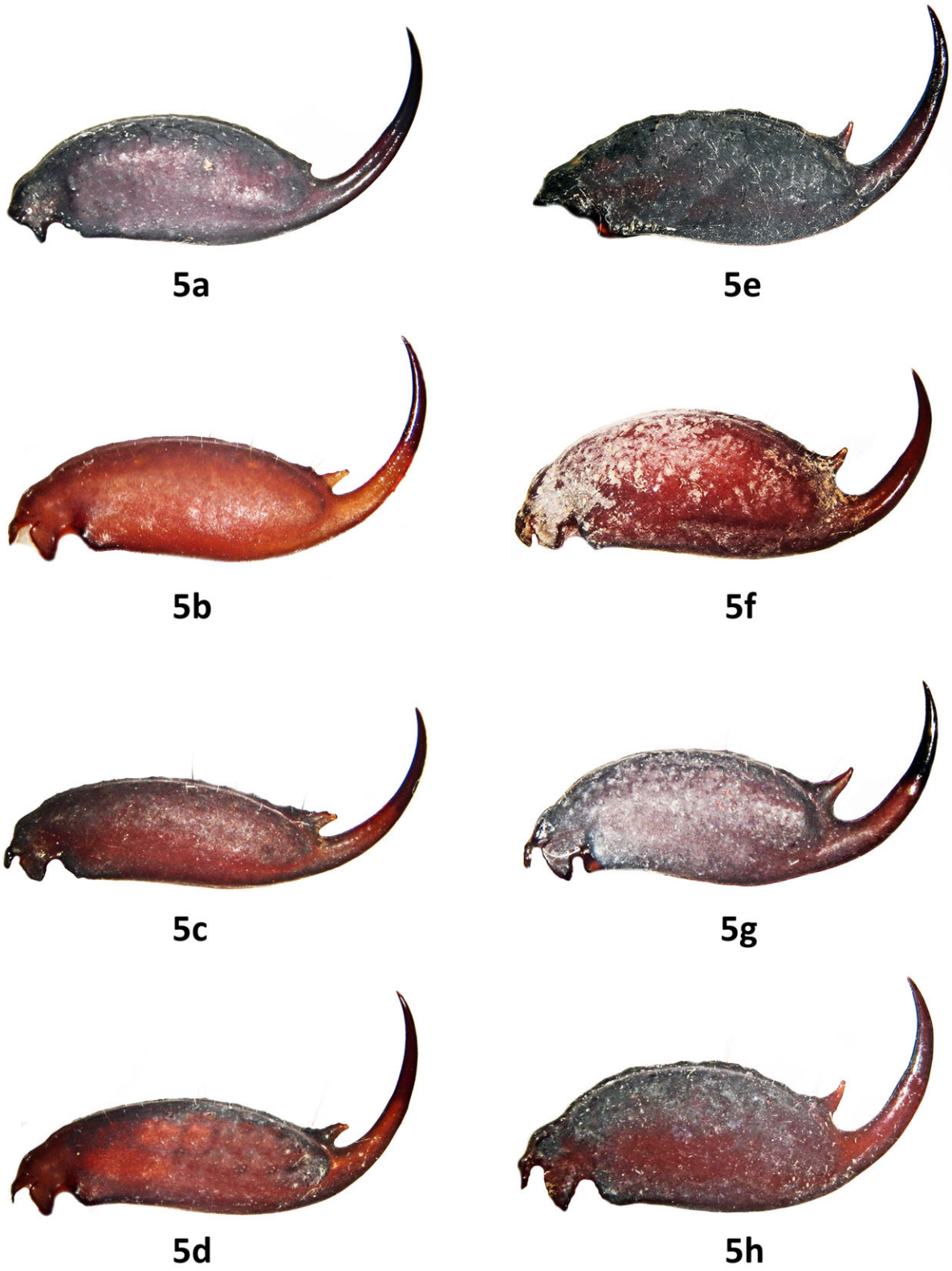


Figure 5: Adult male telson of all members of the "gracilis" species-group, close-up in lateral view (all images rescaled to same size for easier comparison of shape and proportions): **a)** *Centruroides caribbeanus* **sp. n.**, holotype; **b)** *Centruroides fulvipes*, Mexico, Oaxaca, Pinotepa Nacional; **c)** *Centruroides nigrescens*, Mexico, Guerrero, Ixtapa; **d)** *Centruroides nigrimanus*, Mexico, Oaxaca, Mixes; **e)** *Centruroides bicolor*, Costa Rica, Puntarenas, Estación Agujas; **f)** *Centruroides gracilis*, Mexico, Veracruz, Catemaco; **g)** *Centruroides gracilis*, Cuba, Santiago de Cuba, San Juan; **h)** *Centruroides limbatus*, Costa Rica, Limón, Puesto Agua Fría.

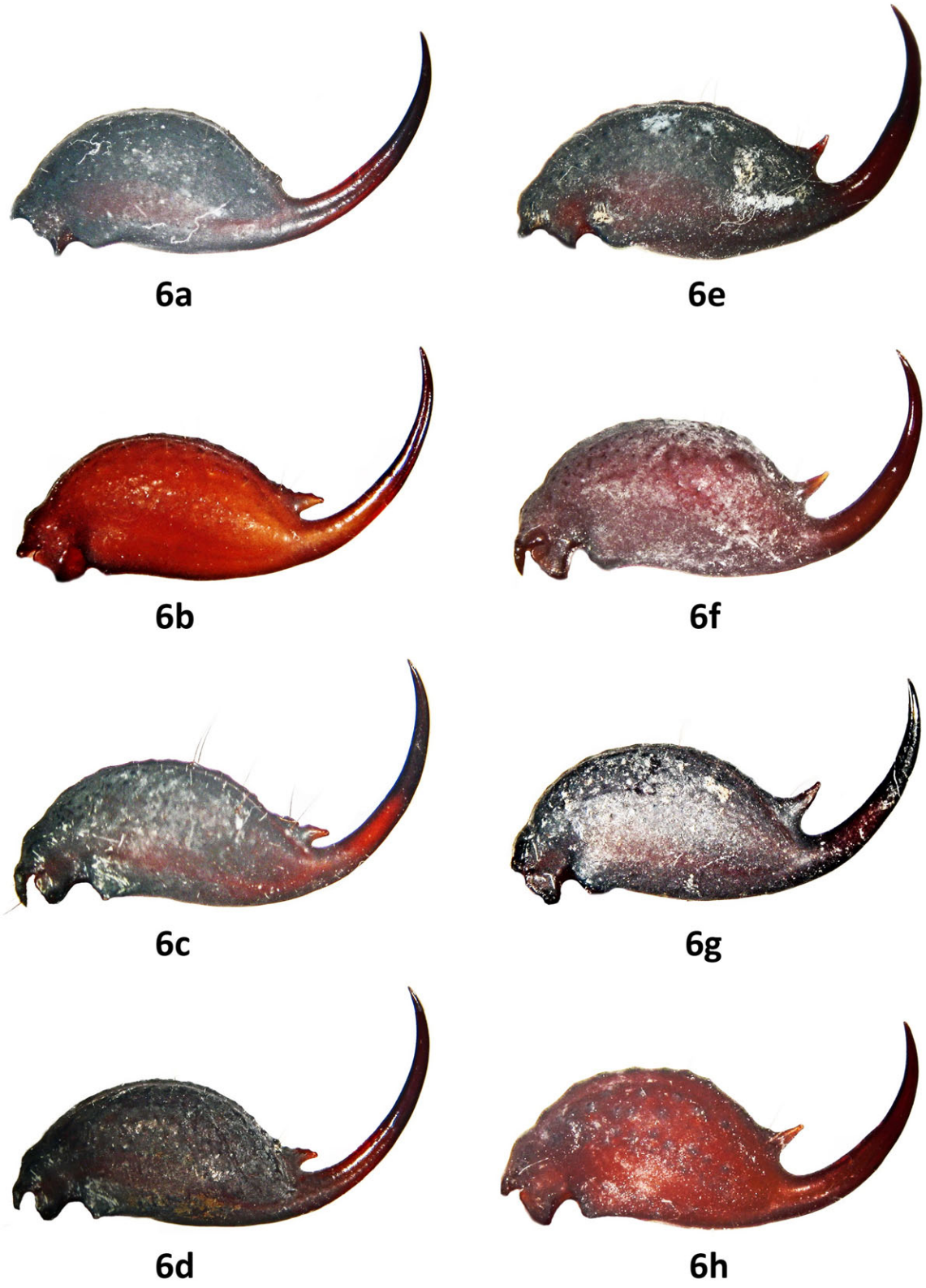


Figure 6: Adult female telson of all members of the "gracilis" species-group, close-up in lateral view (all images rescaled to same size for easier comparison of shape and proportions): **a)** *Centruroides caribbeanus* **sp. n.**, paratype; **b)** *Centruroides fulvipes*, Mexico, Oaxaca, Pinotepa Nacional; **c)** *Centruroides nigrescens*, Mexico, Guerrero, Ixtapa; **d)** *Centruroides nigrimanus*, Mexico, Oaxaca, Mixes; **e)** *Centruroides bicolor*, Costa Rica, Puntarenas, Buenos Aires; **f)** *Centruroides gracilis*, Mexico, Veracruz, Catemaco; **g)** *Centruroides gracilis*, Cuba, Santiago de Cuba, San Juan; **h)** *Centruroides limbatus*, Costa Rica, Limón, Puesto Agua Fría.

Dimensions		♂ holotype (Cozumel, Mexico)	♀ paratype (Cozumel, Mexico)
Carapace	L / Wp	9.5 / 8.9	9.8 / 9.6
Mesosoma	L	26.0	23.0
Tergite VII	L / W	8.0 / 8.6	7.0 / 10.0
Metasoma	L	76.3	61.1
Segment I	L / W / D	10.0 / 4.2 / 4.0	8.0 / 4.9 / 4.2
Segment II	L / W / D	12.6 /4.0 / 3.7	9.6 / 4.6 / 4.2
Segment III	L / W / D	13.8 /4.0 / 3.6	10.3 / 4.5 / 4.3
Segment IV	L / W / D	14.0 / 4.1 / 3.5	10.4 / 4.5 / 4.5
Segment V	L / W / D	14.6 / 4.1 / 3.6	11.7 / 4.3 / 4.2
Telson	L	11.3	11.1
Vesicle	L / W / D	6.5 / 3.7 / 3.1	5.8 / 3.1 / 3.4
Aculeus	L	4.8	5.3
Pedipalp	L	40.2	36.0
Femur	L / W	10.2 / 2.3	9.4 / 2.6
Patella	L / W	12.1 / 3.1	10.0 / 3.6
Chela	L	17.9	16.6
Manus	L / W / D	7.1 / 3.9 / 3.8	6.4 / 3.8 / 3.6
Movable finger	L	10.8	10.2
Total	**L**	**111.8**	**93.9**

Table 1: Measurements (mm) of the types of *Centruroides caribbeanus* **sp. n.** Abbreviations: length (L), width (W), posterior width (Wp), depth (D), left (L), right (R). Telson is included in length of metasoma and total.

Genital operculum (Fig. 3a). Relatively small, halves slightly separated and roundly subtriangular in shape, with many setae scattered; tegument smooth and glossy. Genital papillae present but not protruding. Pectinal plate moderately sclerotized and widely crescent-shaped, with a large transverse depression.

Pectines (Fig. 3a). Size and shape standard for the group: long and narrow (clearly surpassing leg IV coxa-trochanter articulation), subrectangular and densely setose. Tooth count 31/32, teeth moderately long, straight and only slightly swollen. Basal middle lamella unmodified. Basal plate highly sclerotized, wider than long and with a wide, deep median furrow all along; anterior margin with a narrow and moderately deep V-shaped anteromedian notch, posterior margin shallowly convex; tegument smooth and glossy.

Legs. Long and slender, with all carinae finely serrate to granulose; intercarinal tegument coriaceous, with abundant minute and small granules scattered. Prolateral and retrolateral pedal spurs long and thick. Ventral surface of telotarsi round and with many thick, dark setae irregularly arranged into a single V-shaped dense row. Claws short and strongly curved.

Mesosoma (Figs. 2c, 3a–b). Tergites coriaceous, with coarse and rough granulation scattered; I–VI with a single longitudinal carinae which is well defined, long, strong, straight, crenulate and formed by partially anastomosed, medium-sized granules that project clearly over posterior margin; VII with the standard five carinae which are long, strong, serratocrenulate and formed by partially anastomosed, medium-sized granules. Sternites III–VI smooth, glossy medially, finely and densely granulose laterally, sparsely punctate; VII coriaceous, with abundant minute granules scattered; spiracles oblique, very long and slit-like; posterior margin of III–IV almost straight, of V shallowly convex, and of VI–VII shallowly concave; smooth patch of V poorly defined, large, triangular, wider than long, flat and whitish.

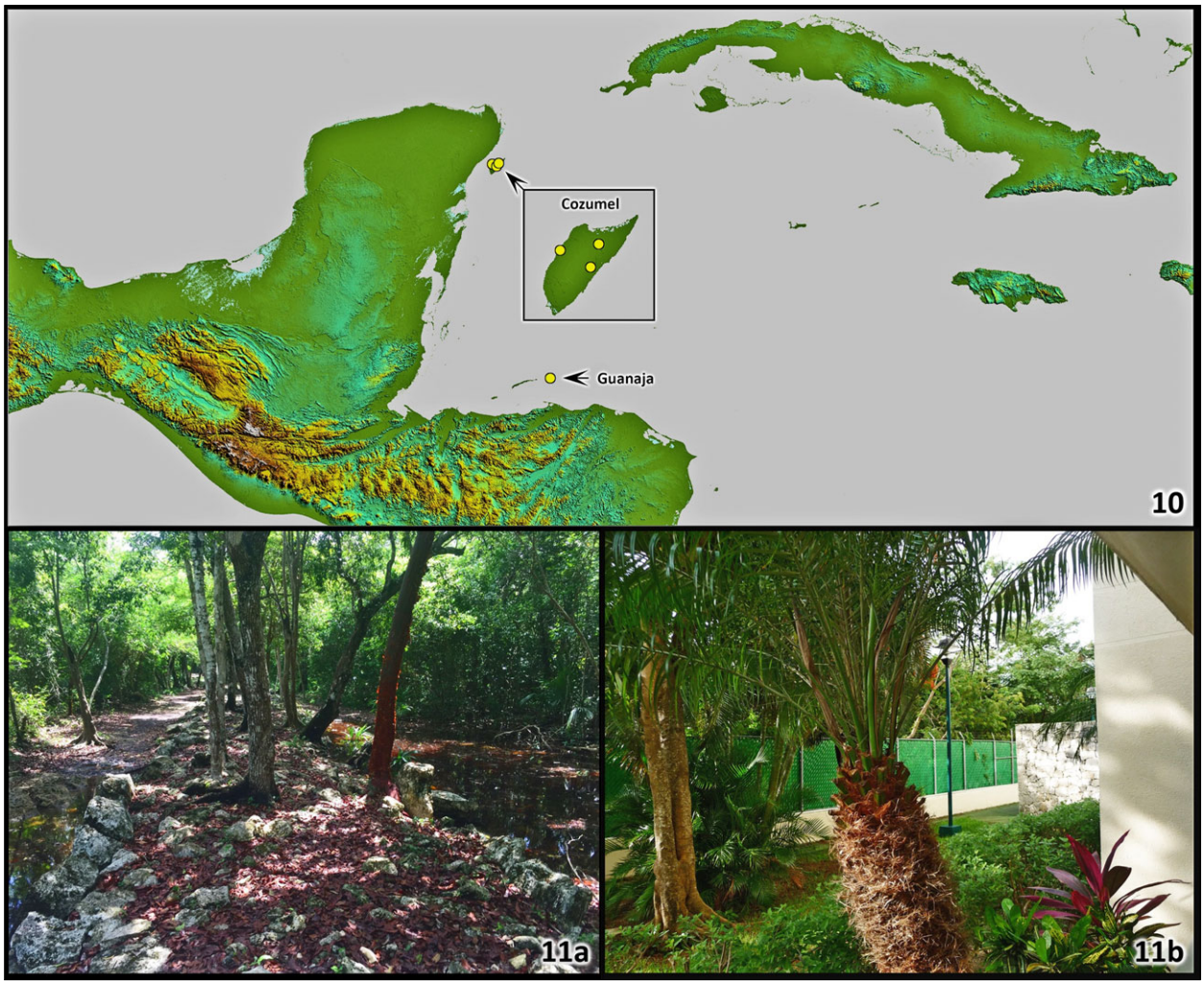
Metasoma (Fig. 4). Long, slender and essentially parallel-sided. Segment I with ten complete carinae, II–

Figure 7: Comparison of live females and their litters, photographed in captivity: **a–b)** *Centruroides caribbeanus* **sp. n.** from type-locality, first and second instars; **c–d)** *Centruroides gracilis* from Cuba, Santiago de Cuba City, Quintero, first and second instars; **e)** *Centruroides fulvipes* from Mexico, Guerrero, Santa Bárbara, first instar; **f)** *Centruroides nigrescens* from Mexico, Guerrero, La Majahua, second instar.

IV with eight, V with three, all weak, fine and defined mostly by the raised, angulose tegument: dorsal laterals weakly serrate on I–II, very weakly subserrate on III, vestigially subserrate on IV, absent on V, with terminal denticle not enlarged in any segment; lateral supramedians weakly serrate on I–II, very weakly subserrate on III, vestigially subserrate on IV, obsolete on V (composed of minute, isolate granules); lateral infra-

Figures 8–9: Live individuals of *Centruroides caribbeanus* **sp. n. Fig. 8**, from Cozumel, photographed in captivity: **a)** adult male; **b)** adult female; **c)** fourth instar juvenile; **d)** fifth instar juvenile, after molt, with its exuvium. **Fig. 9**, from Guanaja, photographed in captivity: **a)** male (on top) and four females; **b)** female; **c)** female with second instar litter. Photos courtesy Mike Jones.

medians weakly serrate on I, absent on III–V; ventral laterals weakly serrate on I–III, very weakly to vestigially subserrate on IV, obsolete on V (composed of minute, isolate granules); ventral submedians weakly serrate on I–III, very weakly to vestigially subserrate on IV, absent on V; ventral median absent on I–IV, obsolete on V (composed of minute, isolate granules). Intercarinal tegument moderately concave on I–VI and convex



Figures 10–11: Fig. 10. Western Caribbean, showing geographical distribution of *Centruroides caribbeanus* **sp. n.** (yellow symbols); the small inset depicts precise records in Cozumel: the type locality corresponds to the easternmost symbol. Frame equals to 2,400 x 1,100 km in the complete image and 50 x 50 km in the inset. **Fig. 11.** Habitat and microhabitat of *Centruroides caribbeanus* **sp. n.** at collection sites in Cozumel: **a)** Ruinas de San Gervasio, the type locality; **b)** Grand Park Royal Hotel. Photos courtesy Matt Casey.

on V, coriaceous; dorsal furrow complete, moderately narrow and shallow on all segments; setation sparse, with two pairs of large ventrolateral macrosetae on I–V.

Telson (Figs. 3c). Vesicle elongate-oval (1.76 times longer than wide, 1.19 times wider than deep) and with some setae of different sizes scattered, laterodistal swellings obsolete; tegument coriaceous, with few minute granules scattered on all surfaces except dorsally; ventral median carina vestigially granulose, raised gradually into the subaculear tubercle which is minute (a blunt granule), smooth and located very close to the aculeus base. Aculeus very long, thin, sharp and shallowly curved.

FEMALE (paratype: Figs. 1–4, 6a, 7a–b, 8b; Table 1). Similar to male, but with well-marked sexual dimorphism: **1)** size slightly smaller; **2)** pedipalps manus shorter and more slender; **3)** genital operculum with papillae absent; **4)** mesosoma wider and convex-sided; **5)** carapace and tergites with carinae and intercarinal granulation stronger; **6)** pectines with lower counts of teeth, which are also slightly shorter and have basal plate larger; **7)** smooth patch of sternite V indistinct; **8)** metasoma and telson conspicuously shorter and less slender.

VARIATION. All available specimens of *C. caribbeanus* **sp. n.** from both islands are remarkably homogeneous in size, coloration, degree of attenuation of pedipalps and metasoma, sculpture and carination of the tegument, and number of principal rows of denticle in pedipalp fingers. Pectinal tooth counts in the nine additional adults from Cozumel (not part of the type-series), varied as follows: two males with 31/31, two

females with 28/28 and one female each with 27/28, 29/27, 29/28 and 29/29.

COMPARISONS. Two diagnostic characters easily distinguish *C. caribbeanus* **sp. n.** from all other members of the entire "gracilis" species-group:

1. The extreme reduction of the subaculear tubercle (Figs. 5–6). In the other members of the group it is large, spiniform and quite different-shaped: **a)** smooth, curved downwards so it runs essentially parallel to aculeus, and located far from its base (*C. bicolor*, *C. gracilis* and *C. limbatus*); **b)** granulose, straight to curved upwards so it points towards the basal part of aculeus, and located closer to its base (*C. fulvipes*, *C. nigrescens* and *C. nigrimanus*).

2. The black monochrome coloration of first and second instar juveniles (Fig. 7). With one exception, in all other members of the group the pulli and nymph I have yellowish to orange pedipalps, tergite VII, metasomal segments I–IV (sometimes also V) and telson. The single exception is the blackish morph of *C. gracilis* (the other morphs match the same described coloration), which anyway always has bright red pedipalp chelae.

On morphological grounds, *C. caribbeanus* **sp. n.** is most closely related to *C. gracilis* and *C. nigrescens*. Apart from the two characters discussed above, it can be further recognized from both as follows. On one hand, *C. gracilis* has stronger carinae of pedipalps and metasoma, telson remarkably shorter in males, at least the pedipalp manus always reddish and conspicuously paler than fingers, and female with a shallow discal depression on pectinal basal plate. On the other, *C. nigrescens* has pedipalps conspicuously more attenuate and with manus much narrower and more strongly carinate, female telson much more slender, and is endemic from the Pacific watershed (coast included) of the Sierra Madre del Sur, in Michoacán and Guerrero States.

DISTRIBUTION (Fig. 10). All examined specimens of *C. caribbeanus* **sp. n.** were collected from two localities in Cozumel Island, where the species seems to be both widespread and common. A color photograph of an adult female from a third site is available online at https: //www. inaturalist.org/ observations /8827264 (misidentified as *C. nigrescens*).

Moreover, high-quality photographs of five adults (one male and four females), kindly sent to us by Mike Jones and one of which is available online at https:// www.fotolog.com/feather61/42641208, revealed that this species also occurs in Guanaja Island (see a selection of these images in Fig. 9 herein). This is the northernmost member of the Islas de la Bahía Archipelago in Honduras, roughly 455 km south-southeast of Cozumel, thus, *C. caribbeanus* **sp. n.** is probably widespread across the southwestern Caribbean.

ECOLOGICAL NOTES. At the type locality (Ruinas de San Gervasio), *C. caribbeanus* **sp. n.** lives syntopically with the much smaller diplocentrine scorpionid *Diplocentrus cozumel* Beutelspacher et Armas, 2000, under rocks in the tropical forest (Fig. 11a). At Grand Park Royal Hotel, it was found at night on the perimeter wall that limits the building from the surrounding forest (Fig. 11b).

REMARKS. The single record of *C. gracilis* from Cozumel (Beutelspacher Baigts, 2000), most likely represents a misidentification of *C. caribbeanus* **sp. n.**, i.e., we have not seen specimens of any other *Centruroides* from this island. Nevertheless, *C. gracilis* is widespread all over mainland Yucatán Peninsula and thus, its potential occurrence in Cozumel cannot be discarded.

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