Revista Ibérica de Aracnología, nº **27** (31/12/2015): 81–89.
Grupo Ibérico de Aracnología (S.E.A.). ISSN: 1576 - 9518. http://www.sea-entomologia.org

REDESCRIPTION OF *CENTRUROIDES ORNATUS* POCOCK, 1902 (SCORPIONES: BUTHIDAE), A MONTANE SCORPION FROM CENTRAL MEXICO

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Abstract: The scorpion *Centruroides ornatus* Pocock 1902, is herein redescribed based upon 17 topotype specimens collected north of the Santiago river, Jalisco, México.
Key words: Scorpiones, Buthidae, scorpions, taxonomy, topotypes, Mexico, Jalisco.

Redescripción de *Centruroides ornatus* Pocock, 1902 (Scorpiones: Buthidae), un escorpión de montaña de Méjico central
Resumen: Se redescribe *Centruroides ornatus* Pocock 1902, en base a 17 ejemplares topotípicos colectados al norte del río Santiago, Jalisco, México.
Palabras clave: Scorpiones, Buthidae, alacranes, taxonomía, topotipos, México, Jalisco.

Introduction

The family Buthidae has 91 genera and 1044 species worldwide. The genus *Centruroides* Marx, 1890 includes 85 species native to the New World, and 42 of them (two with subspecies-rank taxa) occur in Mexico (Ponce-Saavedra & Francke, 2013; Rein, 2015; Teruel *et al*., 2015, in press). These are distributed from the southern United States to northern South America, including the Galapagos Islands and the Antilles (Fet & Lowe, 2000). In Mexico, *Centruroides* is the only genus of medical importance and it has been studied mainly from the point of view of toxicological and epidemiological concerns. However, there are large gaps in knowledge in terms of diversity, distribution and associated factors of this genus (Miranda, 2001; Hernández, 2002; Ponce-Saavedra, 2003).

The family Buthidae has an extensive distribution in Mexico, with species found in different types of vegetation and some with wide known geographical distribution, such as *C. limpidus* (Karsch, 1879) in the Balsas River Depression, *C. infamatus* (C. L. Koch, 1844) in the centre of the country, *C. gracilis* (Latreille, 1804) towards the Southeast, *C. exilicauda* (Wood, 1863) in the Baja California Peninsula, and *C. vittatus* (Say, 1821) in the northeast of the country and the U. S. A. (Beutelspacher-Baigts, 2000; Gonzalez-Santillan, 2001; Ponce–Saavedra & Moreno–Barajas, 2005; Ponce-Saavedra & Francke, 2013).

The genus *Centruroides* is by far the most common and diverse of the family Buthidae in Mexico. The only other genus of this family confirmed to occur in the country is *Chaneke* Francke, Teruel & Santibáñez-López, 2014, which currently includes only two species: one in southeastern Guerrero State and another in the Isthmus of Tehuantepec, Oaxaca.

The taxonomy of some species of *Centruroides* is problematic. Several described species are morphologically very similar altogether and remain incorrectly diagnosed, to the extent that their separation is difficult. This has led to repeated misidentifications and erroneous reports of wide distributions, while actually distinct and not so cryptic species have been lumped into a "highly variable" single taxon (Miranda, 2001; Hernández, 2002; Towler *et al*., 2001; Ponce-Saavedra & Vázquez, 2007). One of those problematic species is *Centruroides ornatus*, which was described by Pocock (1902) from at least two specimens collected by the well-known German botanist Karl Moritz Schumann in a locality vaguely indicated as "Mexico, Jalisco, north of the Rio de Santiago" [sic]. In the original description, Pocock (1902) explicitly regarded *C. ornatus* as closely related to *Centruroides elegans* (Thorell, 1876), but Hoffmann (1932) downgraded it to a subspecies of *C. infamatus* based on the color pattern of carapace, size, and geographical distribution. This taxonomic arrangement was kept by Fet & Lowe (2000), but Beutelspacher-Baigts (2000) treated *C. infamatus ornatus* as merely a "form" of *C. infamatus*, without formal taxonomic recognition. Both Miranda (2001) and Ponce-Saavedra (2003), who studied this taxonomic problem, concluded that *C. ornatus* must be regarded as a valid species; nevertheless, such nomenclatural change was not formally introduced until Armas and Martín-Frías (2008). The genetic divergence reported by Towler *et al.* (2001), as well as the morphological and morphometric differences exposed by Ponce-Saavedra (2003) and Ponce-Saavedra & Moreno-Barajas (2005), all supported such change.

It must be mentioned here, however, that none of those studies actually revised Pocock's original syntypes, nor topotypic specimens of *C. ornatus*, a couple of handicaps that cast some doubts about the accuracy of those results. For this reason, we decided to track the locality declared in the original description by Pocock (1902), and succeeded in obtaining a good series of topotypes that allowed us to prepare a complete redescription of *C. ornatus* and define its correct diagnosis against its close-relative *C. infamatus* and other similar species.

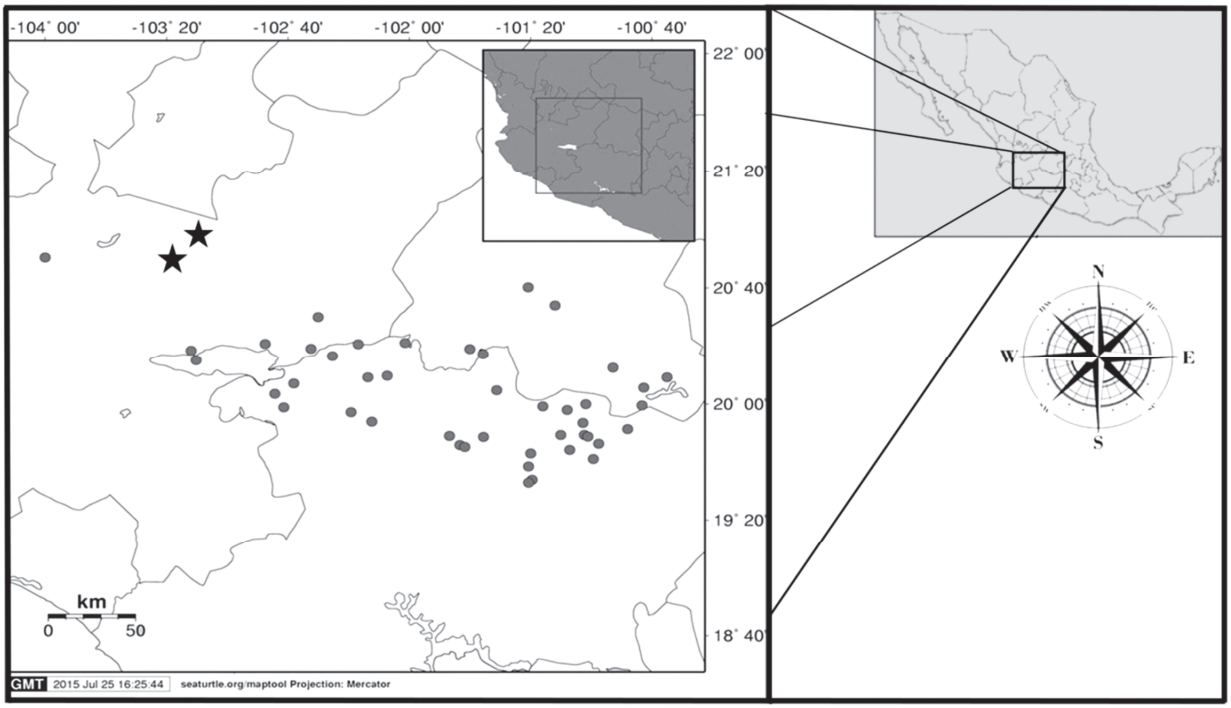


Figure 1. Geographical distribution of *Centruroides ornatus* corrected and updated according to the present data. Type localities ★.

Taxonomic problems in scorpions have long been solved using the traditional characters of morphology, mainly by comparing specimens directly to the types of described taxa; although more recently, multivariate statistical analysis have also been incorporated. Morphometric analysis represents a useful tool for the recognition of differences between populations and the possible presence of two or more cryptic taxa in a determined region (Ponce-Saavedra, 2003; Ponce-Saavedra *et al*., 2009; Santibáñez-López & Ponce-Saavedra, 2009; Miranda, 2012; Baldazo-Monsivaiz *et al.*, 2013, and multivariate morphometric analyses have been incorporated into the present study.

Methods and Material

In total, 17 topotypic specimens (3 males, 7 females, 7 juveniles) are used for the redescription of *Centruroides ornatus*. These were collected by diurnal search under bark, rocks, and dead stumps from one locality north of the Santiago River in Jalisco, Mexico. Although imprecise in the original description (Pocock, 1902: 26), we narrowed down the search for this type-locality area by consulting available maps of the routes and paths available by the time the type-series was collected by Schumann (date not specified, but obviously earlier than 1902, which is the species publication year).

These specimens were directly compared to all other samples previously identified as *C. ornatus* from the following arachnid collections: CAFBUM (Laboratorio de Entomología "Biol. Sócrates Cisneros Paz", Facultad de Biología, Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán, México), CNAN (Colección Nacional de Arácnidos, Instituto de Biología, Universidad Nacional Autónoma de México), and RTO (personal collection of Rolando Teruel, in Centro Oriental de Ecosistemas y Biodiversidad (BIOECO), Santiago de Cuba). During the present study, additional samples were obtained from other localities where *C. ornatus* had been recorded but no specimens were available to us; the collections were made by both diurnal search (see above) and night sampling with standard commercial UV lamps (approx. 360 nm wavelength).

The localities of the populations previously identified as *C. ornatus* were plotted on a map with Seaturtle.org's Maptool and the distribution pattern analyzed (fig. 1).

Systematics

***Centruroides ornatus* Pocock, 1902**

Figures 2-5; Tables I-II.

Centruroides ornatus Pocock 1902: 20–21, 26, 69; pl. 6, fig.3, 3a–b. Ewing, 1929: 21. Armas & Martín-Frías, 2008: 14, 15. Ponce-Saavedra & Francke, 2013a: 59; Ponce-Saavedra & Francke, 2013b: 77; Ponce-Saavedra & Francke, 2013c: 813-815; Quijano-Ravell & Ponce-Saavedra, 2014: 18, 19; Ponce *et al.*, 2015: 67, 69.

Centruroides infamatus ornatus Hoffmann, 1932: 308, 329, 334–335, 337, 345; figs. 90–91. Díaz-Nájera, 1964: 19, 24, 25, 27; Díaz-Nájera, 1966: 111, 115; Díaz-Nájera, 1975: 3, 26, 27; Stahnke & Calos, 1977: 118.Francke, 1984: 98; Kovařík, 1998: 107; Fet *et al*., 2000: 401; Lourenco & Sissom, 2000: Appendix 5.1, 133; Martín-Frías & Armas, 2001: 313, 315; table 1; Armas *et al.*, 2003: 6-7; González-Santillán, 2004: 26; Ponce-Saavedra & Moreno-Barajas, 2005: 48, 49.

Centruroides infamatus f. *ornatus*: Beutelspacher-Baigts, 2000: 5–6, 16, 18, 29. Ponce-Saavedra & Beutelspacher-Baigts, 2001: 28, 35, 38, 46, 84.

Rhopalurus testaceus ornatus: Meise, 1934: 31.

Centrurus infamatus ornatus: Díaz-Nájera, 1966: 115.

Table I. Measurements of five topotypes of *Centruroides ornatus*.
Abbreviations: length (L), width (W), posterior width (Wp), depth (D).

Dimensions(mm)		♂	♂	♀	♀	♀
Carapace	L/Wp	4.40/4.40	4.30/4.30	5.80/6.10	5.90/5.90	5.70/5.70
Mesosoma	L	12.20	10.90	13.20	15.90	17.20
Tergite VII	L/W	3.20 / 4.00	3.20/4.00	4.40/6.10	4.90/6.50	4.40/6.10
Metasoma	L	30.80	28.80	32.90	31.90	31.40
Segment I	L/W/H	4.00/2.20/1.80	3.30/2.20 /1.90	4.10/3.10/2.60	4.00/3.10/2.70	4.00/3.00/2.60
Segment II	L/W/H	4.80/2.10/1.70	4.50/2.10/1.80	5.00/3.00/2.50	4.70/3.00/2.70	4.70/2.90/2.60
Segment III	L/W/H	5.20/2.00/1.70	5.00/2.00/1.80	5.40/3.00/2.60	5.10/3.00/2.70	5.00/2.90/2.60
Segment IV	L/W/H	5.80/2.00/1.70	5.50/2.00/1.80	5.90/2.90/2.60	5.70/2.80/2.70	5.60/2.70/2.60
Segment V	L/W/H	6.40/2.00/2.00	6.10/2.00/1.90	6.70/2.70/2.70	6.50/2.80/2.80	6.40/2.70/2.60
Telson	L	4.60	4.40	5.80	5.90	5.70
Vesicle	L/W/H	2.90/1.60/1.50	2.70/1.50/1.50	3.30/2.10/2.00	3.40/2.20/2.20	3.20/2.00/2.00
Aculeus	L	1.70	1.70	2.50	2.50	2.50
Pedipalp	L	18.20	18.00	22.60	22.10	22.20
Femur	L/W	4.60/1.20	4.50/1.20	5.60/1.70	5.50/1.60	5.50/1.60
Patella	L/W	5.20/1.70	5.10/1.70	6.20/2.30	6.10/2.20	6.00/2.20
Chela	L	8.40	8.40	10.60	10.50	10.70
Hand	L/W/H	3.40/1.70/1.70	3.40/1.70/170	4.30/2.20/2.10	4.10/2.10/2.10	4.20/2.10/2.10
Movable finger	L	5.00	5.00	6.30	6.40	6.50
Pectinal tooth		22-22	22-22	22-23	21-22	21-21
Total	**L**	**47.60**	**44.10**	**51.90**	**53.70**	**54.30**

DIAGNOSIS (emended). Adult size moderate for the genus (males 40–50 mm, females 35–54 mm). Base color light yellowish to reddish brown, carapace densely spotted with blackish brown; tergites with two blackish stripes of variable width that define two dark bands separated by a pale band; pedipalps faintly infuscate; metasoma with all carinae infuscate to blackish. Pedipalps standard-sized and moderately hirsute; manus oval (length/width ratio 2.00–2.12 in males, 1.88–2.00 in females), with carinae weak and feebly granulose, internal surface with many sharp, small granules; fingers with eight principal rows of denticles, basal lobe/notch combination moderate. Metasoma moderately elongate and slender, essentially parallel-sided, with 10/8/8/8/3 (male) to 10/8/8/8/5 (female) complete, moderately to strongly developed carinae; dorsal lateral carinae without conspicuously enlarged terminal denticles; intercarinal spaces coriaceous, with few granules scattered on I only. Telson: incrassate oval; vesicle coriaceous, subaculear tubercle small and conical. Pectines with 19–24 (mode 21) teeth in males and 17–23 (mode 18) in females; female basal plate with posterior margin widely convex to essentially straight, and medially with a shallow transverse depression.

DESCRIPTION (adult **male** topotype). Coloration (figs. 2–3a-k, 5a): base color yellowish brown, paler on venter and legs. Chelicerae manus densely reticulate with blackish brown, with the distal part and fingers pale immaculate. Pedipalp trochanter, femur, patella, and external surface of manus densely infuscate, fingers vestigially infuscate. Carapace densely and symmetrically spotted with blackish brown, especially on posterolateral areas and on both sides of median axis as two very broad, irregular dark stripes. Tergites with two broad, irregular, dark longitudinal stripes, separated by a pale stripe only partially (faintly connected along posterior part of every tergite). Venter essentially immaculate, only with lateral areas of every sternite and posterior region of VII diffusely infuscate, sternite VII with submedian and lateral carinae deeply infuscate; pectines pale yellowish. Legs dorsally infuscate. Metasoma with all segments same-colored, with all carinae moderately to deeply infuscate, and intercarinal spaces diffusely and irregularly spotted with dark brown. Telson with distal half of vesicle diffusely stained with dark brown, aculeus infuscate with the distal half dark reddish.

Chelicerae (fig. 3g) with dentition typical for the genus, teeth sharp. Tegument smooth, dorsodistal portion of manus with coarse and glossy granules arranged transversally, defining a flat area. Setation very dense ventrally, but essentially lacking dorsally, except for seven rigid macrosetae around flat area of manus.

Pedipalps: size proportionate to body (i.e. not particularly slender or robust), orthobothriotaxic A-α. Trochanter densely setose, with ≈ 20 macrosetae along anterior margin. Femur (fig. 3d) slightly curved inwards distally, internal margin with ≈ 20 setae of various sizes, all carinae strong, coarsely granulose to subdentate. Intercarinal spaces coriaceous, except dorsally finely granulose. Patella (fig. 3e) straight, with all carinae moderate to strong, granulose to subcrenulate except for those on the internal surface, which are subtly dentate; intercarinal spaces finely and densely granulose. Chela (fig. 3f) moderately elongate and setose, manus as wide as patella (ratio 1.00), oval (2.00 times longer than wide), with all carinae weak and subgranulose, intercarinal spaces coriaceous except on internal surface which possesses abundant small, conical granules. Fingers long and evenly curved, moderately setose, with apices remarkably narrow and curved, and the basal lobe/notch combination moderate; fixed finger with eight principal denticle rows; movable finger with 7–8 (the two —basal most rows are irregularly fused), plus an apical subrow of four denticles basal to terminal denticle.

Carapace (fig. 3a): trapezoidal and as long as wide; anterior margin widely V-shaped, smooth, with three pairs of macrosetae, posterior margin with medium to large granules all along, lateral margins finely granulose. Carination essentially absent: the only clearly distinguishable carinae are the superciliary–strong, formed by coarse, irregularly fused granules, and the central medians and posterior medians irregularly fused, strong, formed by isolate, coarse granules. Intercarinal spaces very finely and densely granulose, with abundant coarse granules scattered all over dark areas.

Sternum (fig. 3j): standard for the genus: type 1, relatively small, longer than wide, and triangular in shape, with two pairs of macrosetae; tegument finely and densely granulose.

Genital operculum (fig. 3j): relatively small, each valve subtriangular in shape, with three pairs of macrosetae,

Table II. Pectinal tooth count variation in topotypes of *Centruroides ornatus*. Abbreviations: number of pectines (N).

Sex	N	Pectinal tooth count								Mode
		17	18	19	20	21	22	23	24	
♂♂	110	–	–	5	20	50	29	5	1	21
♀♀	90	4	37	25	7	12	4	1	–	18

tegument smooth and glossy. Genital papillae slightly exposed.

Pectines (fig. 3j): standard-sized for the genus (slightly extending beyond leg IV trochanter), subrectangular and moderately setose; tooth count 22/22. Basal plate rectangular, much wider than long (Table I); anterior margin with a deep, narrow anteromedian notch; posterior margin essentially straight; tegument smooth and glossy.

Legs: slender, with all carinae finely subserrate to costate; intercarinal tegument coriaceous except on dorsal surface of trochanter and femur (densely covered by medium to small granules). Tibial spurs absent, prolateral and retrolateral pedal spurs well developed on all legs. Ventral surface of all telotarsi very densely covered by long, dark macrosetae not arranged into rows, without median row of spinules. Claws long, strongly curved.

Mesosoma (fig. 3b): tergites with the same sculpture as on carapace; median longitudinal carina strong, coarsely granulose to subserrate, II–VI with irregular traces of an accessory pair of submedian carinae, VII with submedian and lateral carinae long, strong, coarsely granulose. Sternites (fig. 3c) sparsely setose; III–VI acarinate and glossy but minutely and densely punctate and granulose, especially on lateral areas; spiracles relatively long, slit-like; V with smooth patch vestigial and translucent; VII with submedian and lateral carinae long but not reaching anterior or posterior margins, slightly granulose; intercarinal tegument very finely and densely granulose.

Metasoma (fig. 3h-i): moderately elongate and essentially parallel-sided (width of segment I > II > III = IV = V), sparsely setose. With 10/8/8/8/3 complete to essentially complete carinae: dorsal lateral carinae strongly subserrate to subdenticulate on I–III, weaker on IV, absent on V; lateral supramedian carinae strongly subserrate on I–III, weakly subserrate on IV, essentially absent on V (barely indicated by a smooth basal edge); lateral inframedian carinae strongly serrate on I, absent on II–V; ventral lateral carinae strongly subcrenulate on I–IV, very weakly subgranulose on V; ventral submedian carinae strongly serrate to subserrate on I–III, weakly subserrate on IV, absent on V; ventral median carina absent on I–IV, weakly subgranulose on V. Intercarinal tegument coriaceous, with small and medium-sized granules scattered on I only. Dorsal furrow moderately deep in all segments. Two pairs of ventrolateral macrosetae, plus some inconspicuous microsetae scattered over all carinae.

Telson (fig. 3k): moderately setose. Vesicle incrassate oval (1.81 times longer than wide, 1.07 times wider than deep), tegument coriaceous; ventral median carina vestigial, ending in a subaculear tubercle–small, widely conical, not particularly close nor separated from base of aculeus. Aculeus strongly curved, shorter than vesicle.

Female (topotype: figs. 4a-k; 5b, 5d; Tables I, II). In general, similar to the male, but sexual dimorphism is evident by: **1)** pedipalp manus shorter and more round in shape; **2)** genital papillae absent; **3)** pectines somewhat narrower and shorter (not reaching the coxa-trochanter joint of leg IV), with slightly lower tooth count; **4)** basal pectinal plate larger, with a shallow transverse central depression; **5)** mesosoma markedly wider, with sides strongly convex; **6)** metasomal segments and telson somewhat shorter and more robust; **7)** metasomal segments with better developed carinae, especially on IV–V.

Centruroides ornatus as species

DISTRIBUTION (fig. 1): The precise distribution of *C. ornatus* was controversial and not satisfactorily clarified as a clear geographic pattern, because of the prevailing taxonomic confusion concerning the different populations of this species and its close relatives such as *C. infamatus*. It now becomes clear that this species is widespread but endemic from the central high plateau of the Transverse Volcanic Belt, along the northern part of the states of Michoacán and the adjoining parts of eastern Jalisco and southern Guanajuato. It is likely to occur also in bordering parts of the states of Querétaro and México, but we have not examined samples from these regions, despite recent searches.

VARIATION. Adult size varied from 40.4–49.8 mm in males and 35.1–54.3 mm in females. The samples examined contain up to three size-classes among adults of each sex in every population, and inside each size-class males are slightly longer than females (Table I), meeting the standard for most *Centruroides* spp. As usually observed amongst scorpions, smaller adults invariably exhibit the weaker expression of secondary sexual dimorphic characters such as carination development and morphometric ratios of pedipalps and metasoma, i. e., small males are more similar to standard females and small females can be confused with subadults.

The coloration is also somewhat variable (as expected for a widely distributed scorpion), but affects only shades and extension of spots, not the color pattern itself, i.e., there are no disruptive patterns (fig. 5a-d). The coloration is remarkably homogeneous across all populations that inhabit the highlands of the Transverse Volcanic Belt above 1,500 m altitude: base ferruginous yellow, spots blackish and very compact, all metasomal carinae blackish (fig. 5a-b). But as altitude decreases and climate turns hotter and drier (e.g., towards the type locality), coloration becomes unstable: the base color varies from light yellowish to grayish-yellow, and the spotted pattern (including metasomal carinae infuscation) is denser and goes from dark brown to pitch black, with the entire scorpion looking melanic to unaided eye (fig. 4c-d); all this variation can be found even in a single population, such as the type locality itself (fig. 5a-d).

The character of tergites having “the two dark stripes compact and conspicuously wider than intermediate pale stripe", traditionally used to diagnose *C. ornatus* against *C. infamatus*, is no longer valid: according to our personal unpublished data, there is high variability both within and between populations of both species.

Pectinal tooth counts varied in the pooled sample as follows (Table II): 19–24 in males, 17–23 in females, with a defined mode of 21 in males and 18 in females; as usual for buthids, males are remarkably less variable than females for this character. Amongst different populations, we found evidence of a geographic continuous variation (= cline); the lowest counts are found roughly in the center of the distributional range, and progressively increase towards both western and eastern extremes. This confirms the data taken by Hoff-

mann (1932: 334–335) from specimens collected mostly at Chapala: 20–22 in males, 19–21 in females.

Related to this, the pectinal basal plate also varies in both sexes. In males, the posterior margin of the plate is always essentially straight, but the anterior margin varies from shallowly to deeply notched. In females, the posterior margin varies from widely convex to essentially straight. Both examples of variation are present within the same populations. Thus, the shape of this structure, which is frequently used to distinguish between closely-related species of Mexican *Centruroides*, lacks any diagnostic value for *C. ornatus*.

The number of principal rows of denticles in pedipalp fingers is predominantly eight in both fingers. Nevertheless, the condition herein described for the topotype male (two basal most rows irregularly fused, yielding an imprecise count of 7–8) is very frequent in all populations, and even it is common to find individuals with asymmetric counts between both pedipalps. The apical subseries of movable finger are usually composed of four granules, but we observed casual reduction to three in some specimens scattered all over the geographical range of the species.

The subaculear tubercle is another variable structure, *i.e.* it covers the entire range from very small to strong, even though it is never long, slender spiniform.

Ecological Notes. This species seems to be a medium-altitude scorpion. In accordance with our personal captures and collection samples with reliable data, all known populations occur from altitudes of 970 m at the type locality up to 2,430 m at the Cerro de Quinceo (Morelia, Michoacán).

It is usually very common in semi natural to undisturbed habitats such as pine-oak forests and tropical deciduous forests, where it occurs on the ground under and inside rocks and fallen logs. Further, it also inhabits secondary grasslands where it hides almost exclusively under bark of dry, dead tree stumps.

Without being a strictly synanthropic scorpion, it readily colonizes human habitations in small towns and villages, but also in the peripheral, expanding neighborhoods of large cities such as Irapuato (Guanajuato), Morelia, and La Piedad (Michoacán).

Remarks. Hoffmann's (1932) interpretation of *C. ornatus* seems to have been mostly accurate: his description and photographs are consistent with our specimens, and the locality he selected to represent the species (Isla de los Alacranes, Jalisco) was sampled by us and found to be inhabited only by *C. ornatus* and an undescribed Vaejovidae of the genus *Thorellius* Soleglad & Fet, 2008. Nevertheless, Hoffmann (1932: 335) also mentioned that this scorpion is common in Atenguillo, which is located also in Jalisco but more than 130 km west of the nearest records of *C. ornatus* confirmed by us, thus, we regard this record as verification-pending.

Interestingly, despite the confusion prevailing on the identity of *C. ornatus*, one of its oldest literature records proved to be correct: Ewing (1929) mentioned to have studied a single specimen from Atotonilco (Jalisco) in Baerg's historical collection, and we positively identified additional samples from this locality (see below).

Annually, many scorpion stings are recorded in the study area causing various symptoms that threaten health and sometimes even produce death; for example, in the period 2011-2012 were reported approximately 7,000 cases of scorpion stings in areas where *C. ornatus* inhabits in the state of Michoacán, and there were 4 children deaths; this species is recognized as a median to highly toxic species for humans (Ponce-Saavedra & Francke, 2013c; Ponce-Saavedra *et al.* 2015).

Material Used for Redescription. MEXICO: **Jalisco:** Ixtlahuacán del Río Municipality: Xalitla: El Ancón, north of Santiago River; 20.83°N - 103.32°W; 975m a.s.l.; August 9, 2014; coll. J. Ponce-Saavedra, R. Teruel, A. F. Quijano, E. Oliveros; 1♂, 3♀♀ topotypes (CAFBUM), 2♂♂, 4♀♀, 7 juvenile topotypes (RTO).

Other Material Examined. MEXICO: **Jalisco:** Atotonilco Municipality: km 7 of road Atotonilco-Tototlán; 20.5°N -102.5°W; 1,450m a.s.l.; June 6, 2014; coll. J. Ponce, A. F. Quijano, E. Oliveros; 2♂♂ (CAFBUM). Chapala Municipality: Chapala; 2010 [without further data]; 6♂♂, 5♀♀, 2 juveniles (RTO: Sco-0501). Mesa del Ocote; 20.307706°N -103.197772°W; 1548m a.s.l.; August 7, 2012; coll. M. Vázquez, J. Ascencio; 2♂♂, 2♀♀ (CNAN). Isla de los Alacranes; 20.251389°N -103.171944°W; 1528m a.s.l; December 6, 2012; coll. J. Ponce, A. F. Quijano, V. Guzmán; 2♂♂, 5♀♀ (CAFBUM). Ixtlahuacán del Río Municipality: km 3 crossroads of the town; 21.0002768°N -103.166794°W; 1872m a.s.l.; July 7, 2005; coll. O. Francke; 1♀ (CNAN-503420). La Barca Municipality: La Barca; 20.319722°N -102.539297°W; 1536 m a.s.l.; June 6, 2014; coll. J. Ponce, A. F. Quijano, E. Oliveros; 1♂, 1♀ (CAFBUM). Poncitlán Municipality: Environs of Celanese Hunting Club, km 2.8 of road Poncitlán-Ocotlán; 20.346047°N - 102.790816°W; 1,560–1,605m a.s.l.; August 10, 2014; coll. J. Ponce, R. Teruel, A. F. Quijano, E. Oliveros; 1♂, 2♀♀ (CAFBUM); 2♂♂, 1♀ (RTO). Zapopan Municipality: Ixcatan: Mirador El Oasis; 20.84°N -103.399999°W; 1151 m a.s.l.; August 9, 2014; coll. J. Ponce, R. Teruel, A. F. Quijano, E. Oliveros; 1♂, 2♀♀, 1 juvenile (CAFBUM); 1♀, 1 juvenile (RTO). **Guanajuato**: Acámbaro Municipality: Sierra de los Agustinos; 20.154167°N -100.583333°W; 2096 m a.s.l.; June 16, 2007; coll. J. Ponce, A. F. Quijano, J. J. Torres; 2♂♂, 2♀♀ (CAFBUM). Irapuato Municipality: Irapuato; 20.671667°N -101.346666°W; 1730 m a.s.l.; 2013–2014; coll. I. Corral; 4♂♂, 1♀ (RTO). Pénjamo Municipality: San Isidro; 20.316925°N -101.666707°W; 1739ma.s.l.; April 17, 2013; coll. A. Quijano, J. Báez, C. Zamora, M. Romero, G. Nájera; 8♂♂, 12♀♀, 4 juveniles (CAFBUM). Salamanca Municipality: Salamanca; 20.567°N -101.2°W; 1716 m a.s.l.; July, 2012; coll. ; M. A. López; 2♂♂, 4♀♀, 2 juveniles (CAFBUM). Salvatierra Municipality: Salvatierra; 20.208889°N -100.881666°W; 1774 m a.s.l.; July, 2012; coll. M.A. López; 2♂♂, 3♀♀, 1 juvenile (CAFBUM). Acámbaro Municipality: Valle Cuauhtémoc; 20.09394°N -100.711277°W; 1996 m a.s.l.; May 18, 2013; coll. J. Ponce; 4♂♂, 4♀♀ (CAFBUM). Yuriria Municipality: 7 km road Yuriria-Salamanca; 19.992062°N - 100.722484°W; 1743m a.s.l.; August 6, 2012; coll. J. Ponce, A. Quijano, J. Báez y G. Nájera; 4♂♂, 5♀♀ (CAFBUM). **Michoacán**: Álvaro Obregón Municipality: Álvaro Obregón; 19.823°N - 101.038°W; 1450m a.s.l.; January, 19, 2013; coll. A. Quijano, V. Guzmán, L. Gaona 8♂♂, 12♀♀ (CAFBUM). El Venado; 19.813883°N -101.019422°W; 1852m a.s.l.; January 19, 2013; coll. A. Quijano, V. Guzmán, L. Gaona; 11♂♂, 36♀♀, 12 juveniles (CAFBUM). Felipe Carrillo Puerto; 19.896069°N -101.046277°W; 1840m a.s.l.; January 19, 2013; coll. A. Quijano, V. Guzmán, L. Gaona; 7♂♂, 12♀♀, 8 juvenile (CAFBUM). Chehuayito; 19.892014°N -101.079593°W; 1450m a.s.l.; May 12, 2014; coll. A. Quijano, E. Oliveros, D. Sánchez; 14♂♂, 32♀♀, 6 juveniles (CAFBUM). Charo Municipality: dirty road to El Vaquerito; 19.686016°N -100.988725°W; 2183m a.s.l.; July 17, 2014; coll. J. Ponce, R. Teruel, L. F. de Armas, A. F. Quijano; 6♂♂, 7♀♀, 1 juvenile (CAFBUM). Churintzio Municipality: Puente Huapamacato, km 32 of highway Guadalajara-Mexico City; 20.162506°N - 102.122139°W; 1774m a.s.l.; August 10, 2014; coll. J. Ponce, R. Teruel, A. F. Quijano, E. Oliveros; 1♂, 1♀ (CAFBUM); 1♂ (RTO). Coeneo Municipality: Coeneo; 19.812433°N -101.592283°W;

2081m a.s.l.; January 24, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 5♂♂, 8♀♀, 2 juveniles (CAFBUM). La Carataacua; 19.765°N -101.723333°W; 2065m a.s.l.; January 24, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 9♂♂, 11♀♀ (CAFBUM). Comanja; km 66, campo de tiro; 19.753816°N -101.695433°W; 2097m a.s.l.; January 24, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 7♂♂, 5♀♀, 3 Juveniles (CAFBUM). Cuitzeo Municipality: Cuitzeo; 19.966666°N -101.133344°W; 1860m a.s.l.; March, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 1♂, 2♀♀ (CAFBUM). Ecuandureo Municipality: Cerro de la Virgen; 20.155833°N -102.2272°W; 1561m a.s.l.; January 25, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 9♂♂, 11♀♀ (CAFBUM). Indaparapeo Municipality: Indaparapeo; [without further data]; March, 2003; [without further data]; 9♂♂, 11♀♀ (CAFBUM). Pueblo Viejo; 19.773003°N -100.958832°W; 1928m a.s.l.; January 19, 2013; coll. A. Quijano, V. Guzmán, L. Gaona; 4♂♂, 6♀♀ (CAFBUM). Jacona Municipality: Colonia El Realejo; 19.952583°N -102.320116°W; 1580m a.s.l.; January 26, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 1♂, 2♀♀ (CAFBUM). Jiquilpan Municipality: Fraccionamiento Loma Dorada; 19.980867°N -102.68905°W; 1579m a.s.l.; January 26, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 5♂♂, 8♀♀ (CAFBUM). La Piedad Municipality: Puente Santa Ana Pacueco; 20.352619°N -102.023005°W; 2058m a.s.l.; November 2, 2010; coll. U. Torre; 4♂♂, 6♀ (CAFBUM). Morelia Municipality: Noriega; 19.565356°N -101.326142°W; 2034m a.s.l.; May 23, 1992; coll. L. Chávez; 2♂♂, 4♀♀ (CAFBUM). Tiripetío; 19.549333°N -101.345761°W; 2023m a.s.l.; March 28, 1992; coll. L. Chávez; 4♂♂, 6♀♀ (CAFBUM). Cuto de la Esperanza; 19.716917°N -101.333416°W; 2169m a.s.l.; March 7, 2013; coll. L. Chávez; 7♂♂, 10♀♀ (CAFBUM). Cuanajillo; Cerro El Águila; 19.642672°N -101345224°W; 2247m a.s.l.; July16, 2014; coll. J. Ponce, R. Teruel, A. F. Quijano; 6♂♂, 15♀♀, 3 juveniles (CAFBUM). Atapaneo; 19.738108°N -101.118844°W; 1889m a.s.l.; April 11, 1992; coll. L. Chávez; 3♂♂, 2♀♀ (CAFBUM). Huandacareo Municipality: Huandacareo; 19.987219°N -101.266677°W; 1854m a.s.l.; April 3, 2009; coll. I. Chavez; 1♂ (CAFBUM). Puruándiro Municipality: Puruándiro; 20.079167°N -101.519569°W; 2077m a.s.l.; June 15, 1990; coll. M. G. Banderas; 1♂; (CAFBUM). Pastor Ortiz Municipality: Colonia Lázaro Cárdenas; 20.286633°N -101.5937°W: 1688m a.s.l.; April 18; 2013; coll. A. Quijano, J. Báez, C. Zamora, M. Romero, G. Nájera; 1♂ (CAFBUM). Sahuayo Municipality: Sahuayo; 20.05595°N -102.738466°W; 1638m a.s.l.; January 25, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 2♂♂, 2♀♀, 1 juvenile (CAFBUM). Santa Ana Maya Municipality: Santa Ana Maya; 20.000149°N -101.031175°W; 1839m a.s.l.; November 12, 2014; coll. A. Quijano, E. Oliveros, J. L. Espinoza; 1♂, 2♀♀ (CAFBUM). Tangancícuaro Municipality: Lago de Camécuaro: Cerro de la Cruz; 19.899783°N -102.206983°W; 1699m a.s.l.; January 24, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 7♂♂, 11♀♀, 6 juveniles (CAFBUM). Tarímbaro Municipality: Mesón Nuevo; 19.822358°N -101168555°W; 1934m a.s.l.; October 11, 2003; [without further data]; 6♂♂, 8♀♀ (CAFBUM). Venustiano Carranza Municipality: San Pedro Caro; Balneario El Grande; 20.117683°N -102.6339°W; 1548m a.s.l.; January 26, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 6♂♂, 9♀♀ (CAFBUM). Vista Hermosa Municipality: Rancho La Rosa; 20.2755°N -102.422733°W; 1554m a.s.l.; January 25, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 1♂, 1 juvenile (CAFBUM). Yurécuaro Municipality: Yurécuaro; 20.343928°N -102.280905°W; 1539m a.s.l.; May 25, 1994; coll. A. García; 1♂ (CAFBUM). Zacapu Municipality: railroad trail Zacapu; 19.81665°N -101.779266°W; 1968m a.s.l.; January 24, 2013; coll. A. Quijano, V. Guzmán, L. Gaona, E. Castillo; 5♂♂, 2♀♀ (CAFBUM). Zinapécuaro Municipality: km 4 of road to San José del Rincón; 19.856361°N -100.800633°W; 2068m a.s.l.; August 16, 2011; coll. J. Ponce, A. Quijano, L. Alonso, G. Nájera; 3♂♂, 6♀♀ (CAFBUM).

Acknowledgments

We are grateful to Coordinación de la Investigación Científica de la Universidad Michoacana de San Nicolás de Hidalgo for the economic support for field work.

The second author thanks to the Consejo Nacional de Ciencia y Tecnología (CONACyT) for financially supporting her graduate studies.

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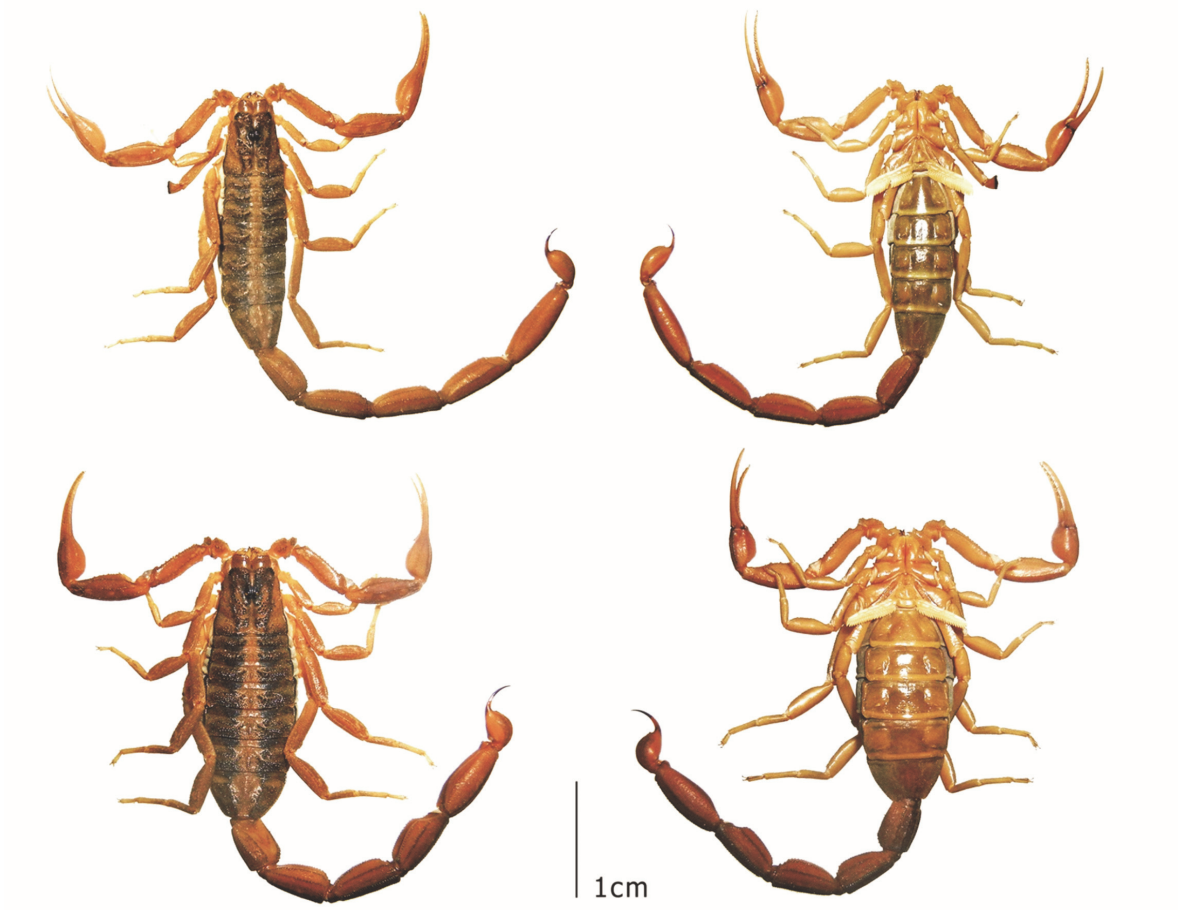


Figure 2. *Habitus* of male and female topotypes of *Centruroides ornatus*: dorsal and ventral.

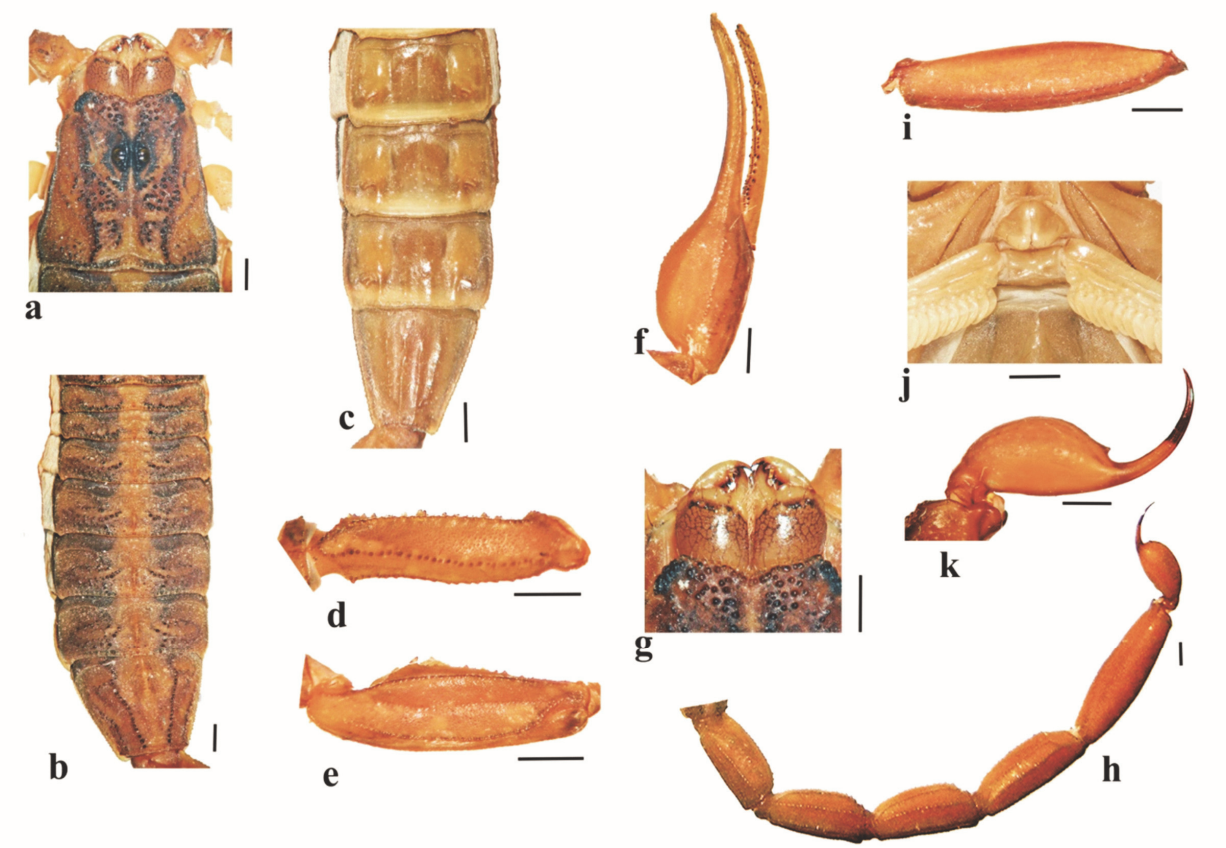


Figure 3. Morphology of male topotype of *Centruroides ornatus*: carapace (**a**); tergites (**b**); sternites IV–VII (**c**); femur pedipalp, dorsal (**d**); patella pedipalp dorsal (**e**);chela pedipalp dorsal (**f**); chelicerae (**g**); metasomal segments I–V, lateral (**h**); metasomal segments V (**i**); pectinal plates (**j**); telson, lateral close-up (**k**).

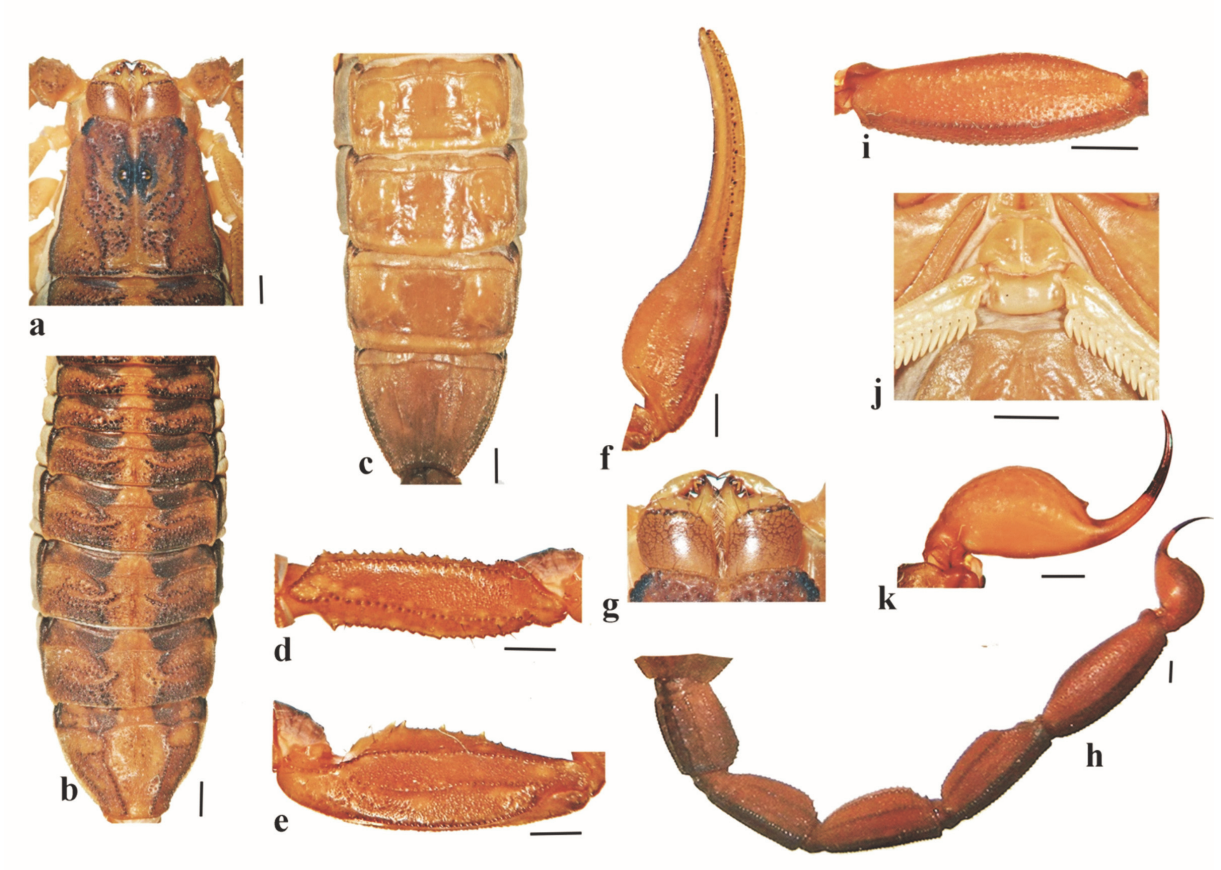


Figure 4. Morphology of female topotype of *Centruroides ornatus*: carapace (**a**); tergites (**b**); sternites IV–VII (**c**); femur pedipalp, dorsal (**d**); patella pedipalp dorsal (**e**); chela pedipalp dorsal (**f**); chelicerae (**g**); metasomal segments I–V, lateral (**h**); metasomal segments V (**i**); pectinal plates (**j**) telson, lateral close-up (**k**).



Figure 5. Coloration of live adult topotypes of *Centruroides ornatus*: typical male (**a**) and female (**b**) and melanic male (**c**) and female (**d**).