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TWO NEW SPECIES OF SCORPIONS (SCORPIONES: BUTHIDAE, SCORPIONIDAE) FROM DOMINICAN REPUBLIC, GREATER ANTILLES

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Abstract: Two new species of scorpions are describe herein from Dominican Republic, in the Greater Antillean island of Hispaniola. The buthid *Centruroides altagraciae* **n.sp.** was found in several localities at the eastern tip of the island (La Altagracia province), whereas the diplocentrine *Heteronebo barahonae* **n.sp.** was captured at a single site of the northeastern section of the Bahoruco Range (Barahona province). Both taxa are compared in detail with their closest relatives, with abundant illustrations of habitus, main morphologically diagnostic characters and habitat.
Key words: Scorpiones, Buthidae, Scorpionidae (Diplocentrinae), *Centruroides*, *Heteronebo*, new species, Greater Antilles, Hispaniola.

Dos especies nuevas de escorpiones (Scorpiones: Buthidae, Scorpionidae) de República Dominicana, Antillas Mayores.
Resumen: Se describen aquí dos especies nuevas de escorpiones de República Dominicana, en la isla de La Española, Antillas Mayores. El bútido *Centruroides altagraciae* **n.sp.** fue hallado en algunas localidades del extremo oriental de la isla (provincia de La Altagracia), mientras que el diplocentrino *Heteronebo barahonae* **n.sp.** fue capturado en un único sitio del sector nororiental de la Sierra de Bahoruco (provincia de Barahona). Ambos taxones son comparados en detalle con sus congéneres más parecidos, ilustrándose profusamente sus hábitus, sus principales caracteres morfológicos diagnósticos y el hábitat.
Palabras clave: Scorpiones, Buthidae, Scorpionidae (Diplocentrinae), *Centruroides*, *Heteronebo*, especies nuevas, Antillas Mayores, La Española.

Taxonomy/Taxonomía: *Centruroides altagraciae* **n.sp.**, *Heteronebo barahonae* **n.sp.**

Introduction

In the last three decades, the scorpion fauna of Hispaniola has been the subject of continued work by scorpiologists, which have increased its level of knowledge dramatically: it turned out from being one of the most neglected in the Americas, to the second best known after Cuba; a selection of the most important papers (e.g., revisions, multiple additions, compilations and updates) to be consulted by the interested reader is as follows: Armas (1981, 1999), Armas & Marcano Fondeur (1987, 1992), Teruel (2005), Teruel & Armas (2006), Armas & Teruel (2012), and Kovařík & Teruel (2014).

An important part of the specimens on which such work has been based upon was supplied by local collaborators and friends (especially the late Eugenio de Jesús Marcano Fondeur and Abraham Abud), but most of it was obtained during four intensive field trips conducted by the authors over the entire Dominican Republic: 1987 (LFA), 1999 (LFA), 2005 (RT), and 2014 (RT, FK).

The present paper represents another contribution of this (still ongoing) series. Herein we describe two new species from southern Dominican Republic: one buthid from the extreme eastern tip of the main island (La Altagracia province), and the first diplocentrine known from the northern watershed of the Bahoruco Range (Barahona province). With these additions, the scorpion fauna of Hispaniola reaches a total of 46 species, belonging to the families Buthidae (5 genera / 37 species), Hormuridae (1 / 1) and Scorpionidae (2 / 8).

Material & methods

Nomenclature and measurements follow Stahnke (1970), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), 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).

Specimens studied herein are preserved in ethanol 80% and deposited in the personal collections of the authors, to which the following name-based abbreviations have been applied: Instituto de Ecología y Sistemática, Havana, Cuba (IES), the first author's collection (RTO), the last author's collection (FKCP). In the first two cases, both collecting and identification labels are originally written in Spanish, but have been translated here into English for text coherence.

Unless otherwise noted, all descriptions and figures mentioned for the paratypes of the two new species correspond to those collected at each type-locality.

Table I. Measurements (mm) of four adult types of *Centruroides altagraciae* sp.n., from RTO collection. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), heigth (H).

Dimensions		Bayahibe ♂ Holotype	Boca de Yuma ♂ Paratype	Bayahibe ♀ Paratype	Guaraguao ♀ Paratype
Carapace	L / W	4.14 / 3.90	4.50 / 4.43	4.00 / 3.88	4.80 / 4.84
Mesosoma	L	10.30	12.80	9.70	12.80
Tergite VII	L / W	3.07 / 3.50	3.60 / 3.96	2.78 / 3.70	3.40 / 4.70
Metasoma + Telson	L	31.47	37.31	23.60	29.60
Segment I	L / W / H	4.20 / 2.00 / 1.78	4.85 / 2.20 / 1.85	2.95 / 2.07 / 1.78	3.60 / 2.50 / 2.20
Segment II	L / W / H	5.20 / 1.90 / 1.80	6.10 / 2.12 / 1.90	3.50 / 2.00 / 1.78	4.70 / 2.45 / 2.20
Segment III	L / W / H	5.70 / 1.90 / 1.78	6.88 / 2.20 / 1.85	3.80 / 2.03 / 1.80	5.05 / 2.50 / 2.25
Segment IV	L / W / H	5.92 / 2.00 / 1.73	7.00 / 2.20 / 1.85	4.30 / 2.05 / 1.80	5.30 / 2.50 / 2.22
Segment V	L / W / H	5.83 / 2.10 / 2.00	6.98 / 2.32 / 2.25	4.55 / 2.00 / 1.90	5.60 / 2.55 / 2.40
Telson	L	4.62	5.50	4.50	5.35
Vesicle	L / W / H	2.30 / 1.72 / 1.55	3.00 / 2.10 / 1.87	2.00 / 1.50 / 1.30	2.40 / 1.90 / 1.70
Aculeus	L	2.32	2.50	2.50	2.95
Pedipalp	L	16.64	18.94	15.25	18.26
Femur	L / W	4.00 / 1.20	4.62 / 1.20	3.57 / 1.11	4.20 / 1.30
Patela	L / W	4.52 / 1.68	5.02 / 1.85	4.10 / 1.67	5.00 / 2.00
Chela	L	8.12	9.30	7.58	9.06
Manus	L / W / H	3.52 / 2.11 / 2.00	4.10 / 2.37 / 2.20	3.00 / 2.10 / 1.80	3.70 / 2.60 / 2.45
Movable finger	L	4.60	5.20	4.58	5.36
Total	**L**	**45.91**	**54.61**	**37.30**	**47.20**

Systematics

Family Buthidae C. L. Koch, 1837

***Centruroides altagraciae*, new species**

Figures 1–35. Tables I–III.

Centruroides nitidus: Armas, 2002: 65 [misidentification: specimens from La Altagracia province].

Centruroides nitidus nitidus: Armas & Marcano Fondeur, 1987: 65 [possible misidentification: specimens from La Altagracia province].

Holotype. ♂ (RTO). **La Altagracia Province**: San Rafael del Yuma Municipality: approx. 4 km north of Bayahibe; 18°23'18.8"N - 68°50'18.6"W; 48 m a.s.l.; March 1, 2005; nigh UV search, on trees and bushes, dry semicaducifolious forest on karstic terrain; R. Teruel, F. Kovařík, P. Kindl.

Paratypes (24 specimens: 9♂♂, 7♀♀, 8 juveniles). **La Altagracia Province**: San Rafael del Yuma Municipality: Botijuela; February 3, 1987; A. Abud, E. J. Marcano; 2♂♂ (IES). Same data as holotype; 1♀, 1 juvenile (RTO), 3♂♂, 3♀♀, 4 juveniles (FKCP, two of the males born and raised to adulthood in captivity). Guaraguao; January 4, 1987; in logs; R. Marcano; 2♂♂, 2 juveniles (IES). Same locality; January 15, 1987; under bark; L. F. de Armas, A. Abud; 1♀ (RTO). Approx. 4 km southwest of Boca de Yuma; 18°21'47.7"N - 68°37'05.8"W; 23 m a.s.l.; March 2, 2005; under barks of trees and fence posts, semicaducifolious forest on karstic terrain; R. Teruel, F. Kovařík, P. Kindl; 2♂♂, 1♀, 1 juvenile (RTO), 1♀ (FKCP).

Etymology. The selected epithet is a Latinized noun in genitive case, taken from the name of the province where the new species occurs. The province's name alludes to La Altagracia Virgin, the highly venerated Catholic godmother and spiritual protector of the Dominican Republic people, to whom we honor this way as a sign of respect to the native traditions.

Diagnosis. Adult size medium for the genus (46–55 mm in males, 37–47 mm in females). Coloration basically light to pale yellow, sparsely spotted with medium to dark brown over the body and appendages; carapace predominantly pale, with irregularly defined dark interocular triangle, tergites with two irregular, narrow dark stripes; pedipalp chelae with fingers much darker than manus. Pedipalps large, robust, and essentially bare; manus oval (length/width ratio 1.67–1.73 in males, 1.42–1.43 in females), with carinae weakly costate to subcostate, internal surface with many scattered conical granules; fingers with eight principal rows of denticles, basal lobe/notch combination moderate. Carapace and tergites with intercarinal tegument very finely and densely granulose, with many slightly coarser granules scattered. Sternite V with the smooth posterior patch obsolete, densely punctate and setose. Metasoma moderately long and slender, progressively wider and higher distally in males, with 10/8/8/8/3 complete, moderately to poorly developed carinae; intercarinal spaces smooth and glossy, with scattered minute granules and punctures; segments II–IV with two pairs of ventrolateral macrosetae. Telson very short oval, globose (only slightly longer and more bulbous in male), vesicle smooth, with vestigial laterodistal swe-llings in adult males, subaculear tubercle obsolete to very small, coarsely crest-like and not too close to the base of aculeus. Pectinal tooth count 19–21 (mode 20) in males, 18–20 (mode 19) in females; female basal plate with a large and somewhat deep, transverse central depression.

Description (adult male holotype unless otherwise noted). **Coloration** (fig. 1–2, see also paratypes in fig. 3–6). Base color pale yellow, slightly paler on legs and venter, becoming slightly darker and with orange overtones on metasomal segment V and telson. Chelicerae with manus densely reticulate with dark brown, in a pattern essentially uniform all over the segment; fingers deeply infuscate. Pedipalps with coxa, trochanter, femur and patella densely spotted with medium to dark brown except ventrally, remarkably denser and darker over carinae and on internal surface; chela with manus sparsely spotted with medium brown dorsally and externally (internal and ventral surfaces pale immaculate), fingers densely spotted with dark brown, much darker than manus. Carapace very sparsely and symmetrically spotted with dark brown, spots entirely concentrated inside the interocular triangle and under carinae; eyes, ocular tubercles and lateral margins blackish. Tergites only with lateral margins irregularly infuscate and with two narrow, discontinuous and irregular dark submedian stripes. Coxosternal region and genital operculum pale immaculate. Pectines pale yellowish, with basalmost

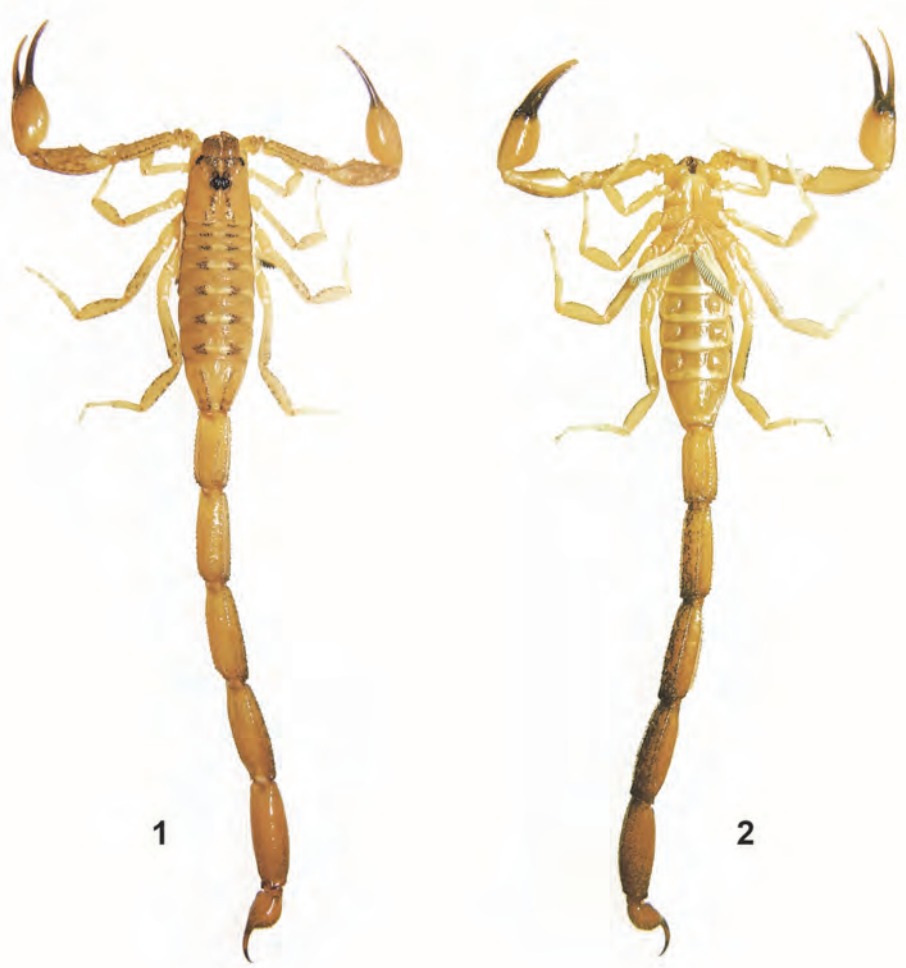

Fig. 1–2. Male holotype of *Centruroides altagraciae* **n.sp.**: entire dorsal (1) and ventral (2) views.

portion and basal plate slightly darker due to heavier sclerotization. Sternites III–VI pale immaculate, VII with traces of two submedian dark spots; V with the smooth posterior patch indistinct, translucent. Legs moderately speckled with dark brown dorsally and externally. Metasoma with base color becoming slightly darker and with orange overtones distally, densely variegated with medium to dark brown on all surfaces, conspicuously darker and denser laterally and ventrally, especially between ventral submedian carinae as an irregular, thin ventral median stripe all along from I through V. Telson with vesicle sparsely infuscate, in an irregular pattern of longitudinal stripes becoming somewhat darker and better defined distally; aculeus deeply infuscate basally, with distal half blackish.

Chelicerae (fig. 26–27 depict female paratype). Dentition typical of the genus; teeth large and sharp. Tegument glossy but with scattered minute granulation, dorsodistal portion of manus with coarse, glossy granules irregularly arranged transversally, defining a depressed area. Setation very dense ventrally, but essentially lacking dorsally, except for 5–6 rigid macrosetae around depressed area of manus.

Pedipalps (fig. 11–15 depict male paratype). Large and robust for the genus, almost glabrous and orthobothriotaxic A-α. Femur straight and very sparsely setose, all carinae strongly denticulate, intercarinal tegument finely and very densely granulose. Patella slightly curved inwards distally and very sparsely setose, all carinae moderately granulose to subgranulose, intercarinal tegument very finely and densely granulose, internal surface with abundant sharp, conical tubercles of various sizes. Chela robust and sparsely setose; manus oval (1.67 times longer than wide), much wider than patella (ratio 1.26), and with the basal half widest, with all carinae weakly costate to subcostate, intercarinal tegument glossy to coriaceous, with minute granules scattered on all surfaces and abundant sharp, conical granules on internal surface; fingers long and thick (movable finger 1.31 times longer than underhand), evenly curved, moderately setose, and with 8/8 principal rows of denticles flanked by 2–4 supernumerary denticles on each side (usually two, but increasing in number basally and vice versa), movable finger with apical subrow of four denticles plus a large internal accessory denticle (large terminal denticle not included), basal lobe/notch combination moderate.

Carapace (fig. 7 depicts male paratype). Trapezoidal and longer than wide; anterior margin very widely V-shaped, with two pairs of medium-sized macrosetae and some inconspicuous microsetae. Carination essentially absent: the only definable carinae are the superciliary (strong, costate to subcostate, glossy) and the posterior medians (weak, formed by distinctly isolated, medium-sized, glossy granules). Furrows: anterior median, median ocular, central median, posterior median and posterior marginal fused, narrow and deep, posterior laterals long, narrow and deep, other furrows indistinct. Tegument very finely and densely granulose, with many

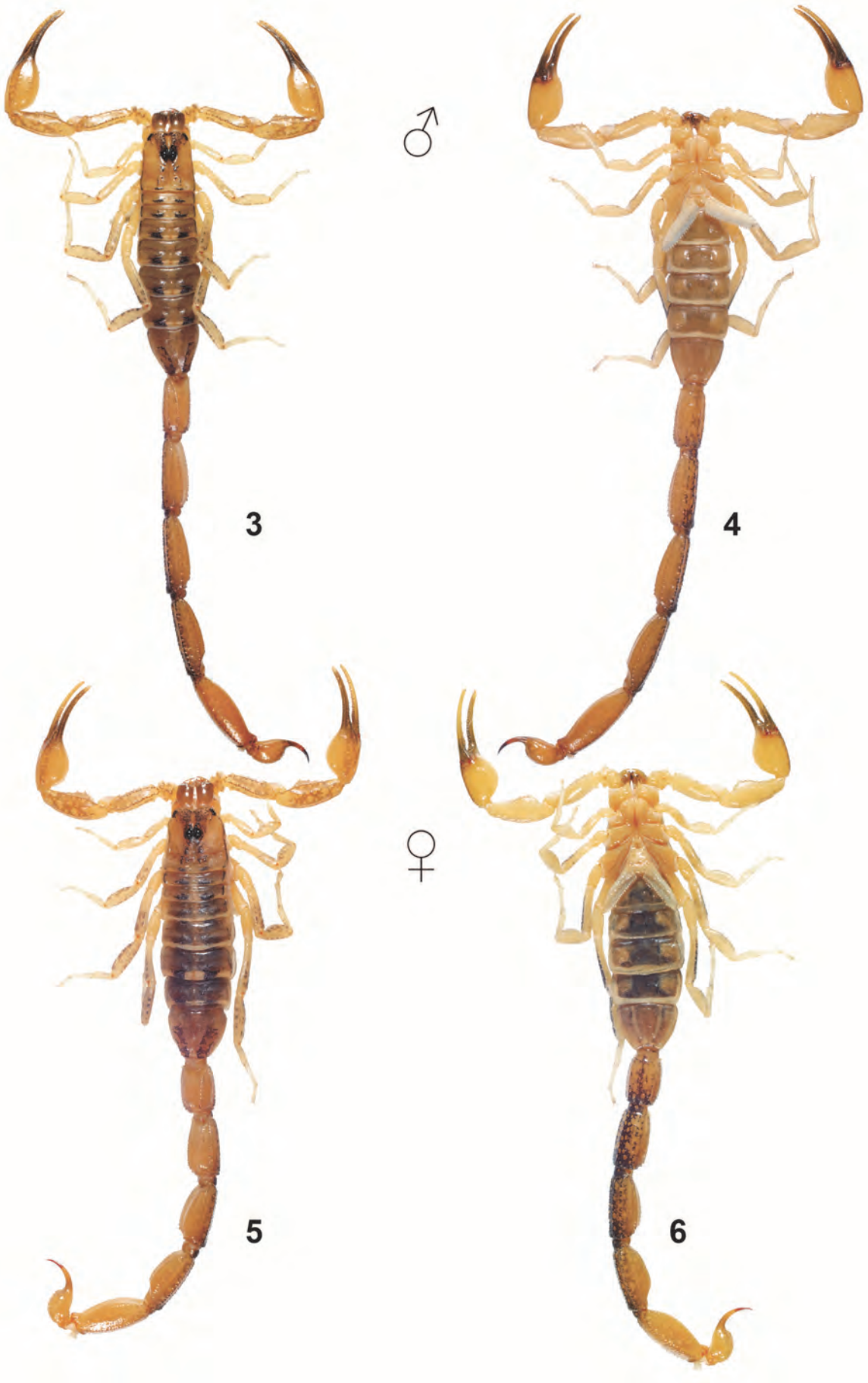

Fig. 3–6. Male (3–4) and female (5–6) paratypes of *Centruroides altagraciae* **n.sp.**: entire dorsal (3, 5) and ventral (4, 6) views.

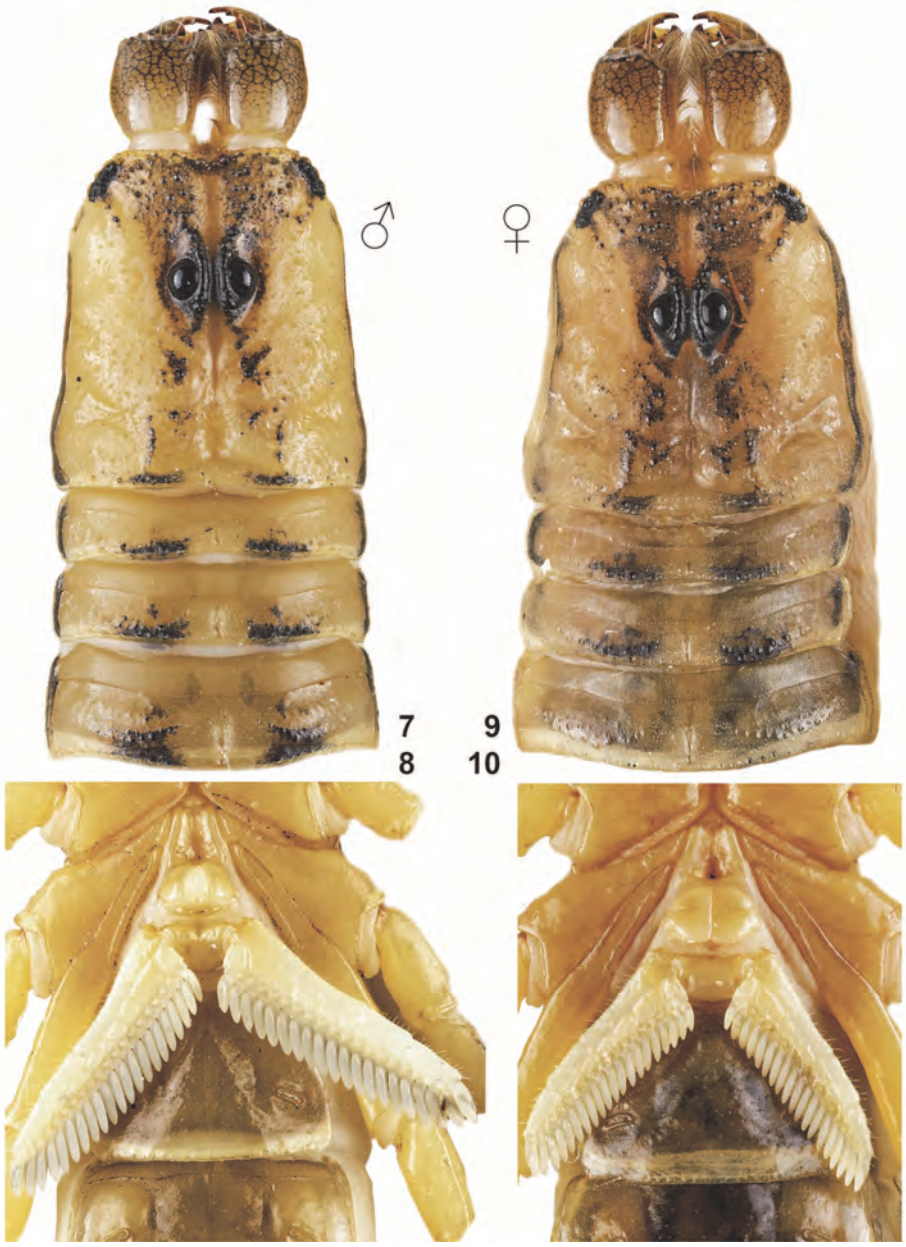

Fig. 7–10. Male (7–8) and female (9–10) paratypes of *Centruroides altagraciae* **n.sp.**: carapace and tergites I–III (7, 9), coxosternal region, pectines and sternite III (8, 10).

Table II. Pectinal tooth count variation in *Centruroides altagraciae* sp.n. Abbreviations: number of pectines (N), average (Ave.), standard deviation (SD).

Sex	N	Pectinal tooth count				Ave.	SD
		18	19	20	21		
♂♂	14	–	4	6	4	20.00	± 0.76
♀♀	15	5	6	4	–	18.93	± 0.77

slightly coarser, glossy granules scattered all over. Median eyes very large, separated by about one ocular diameter; lateral eyes much smaller, all same-sized.

Sternum (fig. 8 depicts male paratype). Standard for the genus: type 1, medium-sized, longer than wide, and subtriangular in shape, with two pairs of long macrosetae. Tegument minutely, densely granulose.

Genital operculum (fig. 8 depicts male paratype). Medium-sized, halves narrowly separated and subtriangular in shape, with three pairs of medium-sized macrosetae and several microsetae. Genital papillae medium-sized, not protruding, with tips narrowly conical. Pre-pectinal plate heavily sclerotized and widely crescent-shaped.

Pectines (fig. 8 depicts male paratype). Size and shape standard for the genus: extending beyond leg IV trochanter, subrectangular and moderately setose. Tooth count 21/21, teeth slightly swollen and basally slightly separated. Basal plate moderately sclerotized, wider than long, anterior margin with a deep, V-shaped anteromedian notch, posterior margin essentially straight.

Legs (fig. 28 depicts female paratype). Slender, with all carinae finely serrate to crenulate, intercarinal tegument coriaceous to glossy, with minute granules scattered on external surface of trochanter and femur only. Prolateral and retrolateral pedal spurs strong. Ventral surface of all telotarsi round and very densely covered by long, dark setae irregularly arranged into two longitudinal, broad, dense rows converging basally. Claws short and strongly curved.

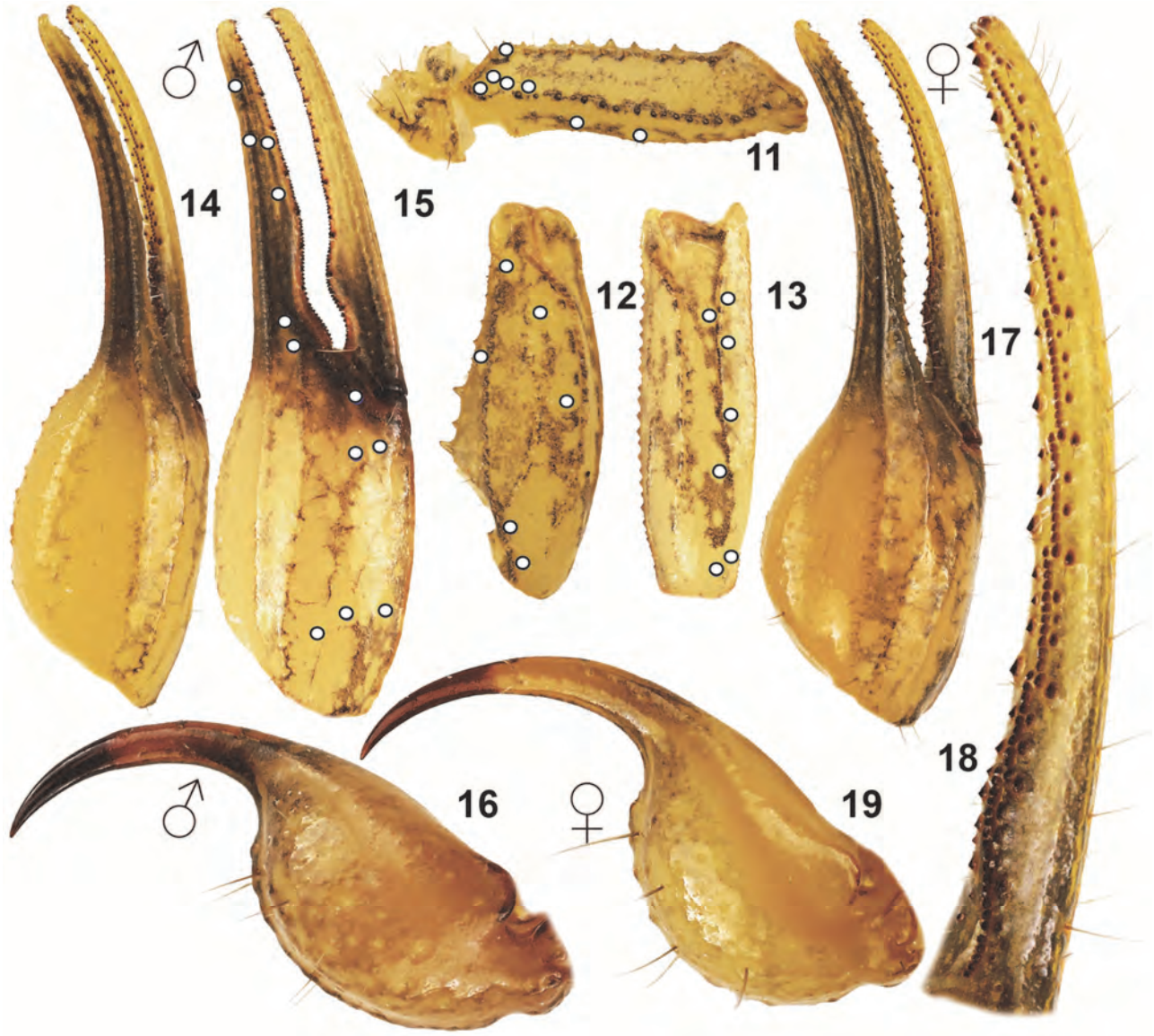

Fig. 11–19. Male (11–16) and female (17–19) paratypes of *Centruroides altagraciae* **n.sp.**: pedipalp femur in dorsal view (11), pedipalp patella in dorsal (12) and external (13) views, pedipalp chela in dorsal (14) external (15) and dorsoexternal (17) views, pedipalp movable finger in dorsoexternal view (18), telson in lateral view (16, 19).

Mesosoma (fig. 7–8 depict male paratype). Tergites sculptured similar to carapace, but with scattered, remarkably less coarser granulation; I–VI with only one well-defined median longitudinal carina (long, moderately strong, formed by partially anastomosed, medium-sized, glossy granules that do not project beyond posterior margin), with very subtle traces of accessory dorsosubmedian carinae on IV–VI; VII with five carinae (median, submedians and laterals), those paired are very long, strong and denticulate. Sternites essentially glabrous, with spiracles oblique, long and slit-like, posterior margin of III–IV and VI very widely concave, V widely convex to weakly lobed, VII narrowly concave; III–V acarinate, VI with smooth vestiges of one pair of lateral carinae, VII with two pairs of long, weak to moderate, coarsely granulose carinae (submedians and laterals); intercarinal tegument glossy but with abundant minute granules scattered all over, denser on lateral areas and on VII; V with smooth patch indistinct, translucent, and densely setose, the base of each seta is invaginated into a coarse puncture.

Metasoma (fig. 20–22 depict male paratype). Moderately long and slender, progressively wider and higher distally; I with ten complete, coarse carinae, II–IV with eight, and V with three: dorsal laterals moderately serrate to denticulate on I–II, weakly serrate to denticulate on III, vestigially serrato-crenulate to crenulate on IV, absent on V; lateral supramedians strongly serrato-crenulate to denticulate on I–II, moderately serrato-crenulate to denticulate on III, weakly to vestigially serrato-crenulate on IV, absent on V (mostly indistinguishable from intercarinal granulation); lateral inframedians strongly serrato-crenulate on I, absent on II–V; ventral laterals moderately to weakly serrate on I–IV, vestigially subcrenulate to subgranulose on V; ventral submedians moderately serrate on I–IV, absent on V; ventral median absent on I–IV, vestigially subserrate on V. Intercarinal tegument glossy, densely punctate, and with scattered, variously-sized glossy granules (especially laterally and on V). Dorsal furrow narrow and shallow on all segments. Two pairs of dark ventrolateral macrosetae on I–V, plus inconspicuous microsetae scattered over all carinae.

Fig. 20–25. Male (20–22) and female (23–25) paratypes of *Centruroides altagraciae* **n.sp.**: metasoma in dorsal (20, 23), ventral (21, 24) and lateral (22, 25) views.

Telson (fig. 16 depicts male paratype). Essentially bare, with several pairs of dark macrosetae scattered on ventral and lateral surfaces (each macroseta with base invaginate as a coarse puncture). Vesicle very short oval, globose and slightly depressed (1.34 times longer than wide, 1.11 times wider than high), with vestigial laterodistal swellings, tegument glossy, densely punctate and with many scattered, vestigial but coarse, glossy granules; ventral median carina coarsely subgranulose, progressively elevated into a broad, crest-like subaculear tubercle which is very small, blunt, and not too close to the base of aculeus. Aculeus long, thick, sharp, longer than vesicle and evenly curved.

Female (paratype: fig. 5–6, 9–10, 17–19, 23–31, 30–32; tabs. I–II). Similar to male in coloration, but with well-marked sexual dimorphism: **(1)** size conspicuously smaller; **(2)** pedipalp manus shorter and rounder, with granulation of internal surface less developed; **(3)** genital papillae and pre-pectinal plate absent; **(4)** pectines slightly shorter, almost reaching coxa-trochanter joint of leg IV; **(5)** basal pectinal plate larger, with anterior margin less notched, with posterior margin widely convex, and with a large and moderately deep, transverse central depression; **(6)** mesosoma wider, with sides more convex; **(7)** metasomal segments conspicuously shorter, wider and higher; **(8)** telson with vesicle slightly smaller and less globose, but with aculeus conspicuously longer.

Variation. Adult size varied from 45.9–54.6 mm in males and 37.3–47.2 mm in females (tab. I); the examined sample contains two adult size-classes in each sex. Inside the same

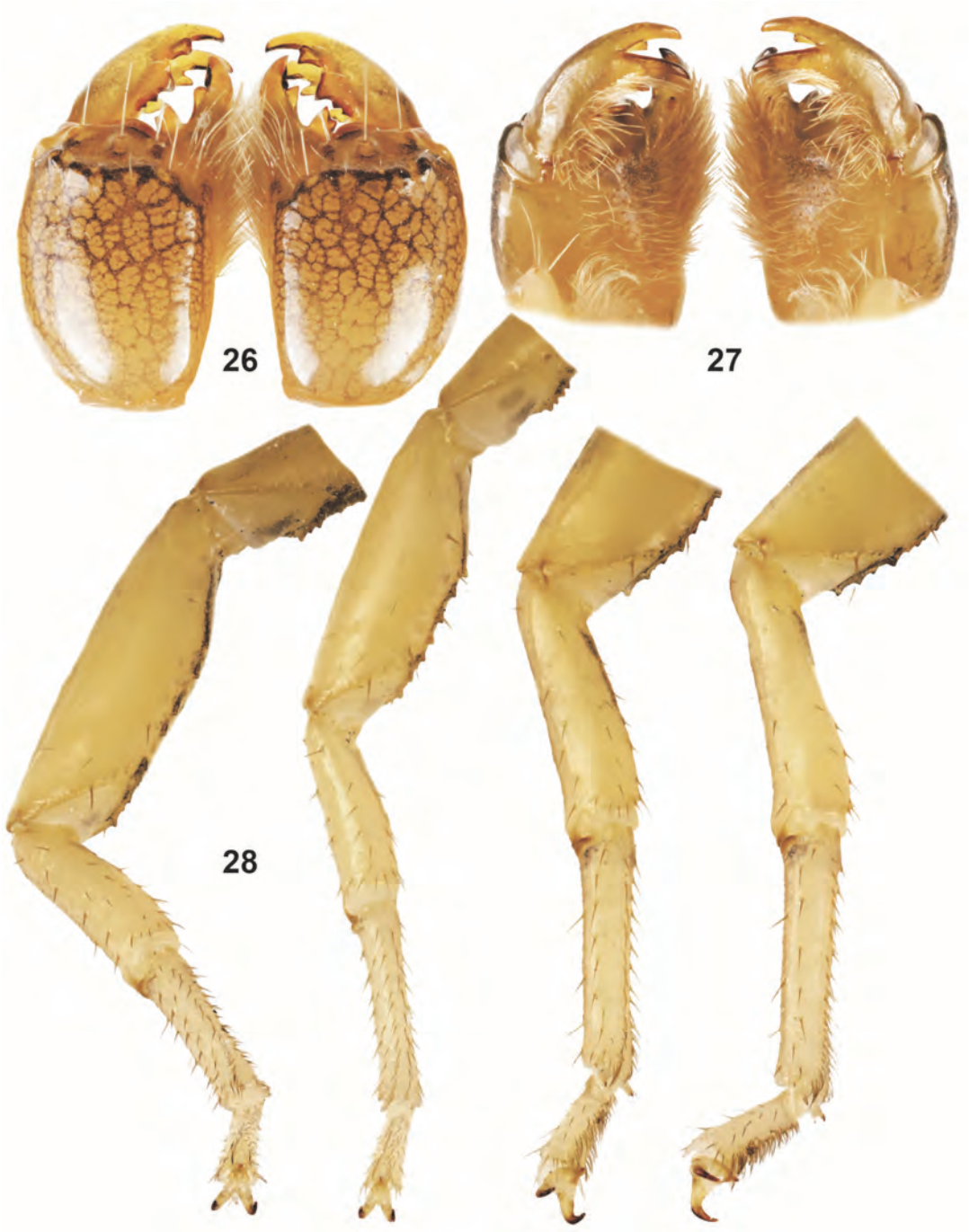

Fig. 26–28. Female paratype of *Centruroides altagraciae* **n.sp.**: chelicerae in dorsal (26) and ventral (27) views, legs in ventrointernal view (28, I–IV ordered from left to right).

class, males are conspicuously larger than females, matching the standard for the genus. As usually observed amongst scorpions, smaller adults invariably exhibit the weaker expression of secondary sexual dimorphic characters such as the elongation of pedipalps and metasoma, i.e., smaller males are always proportionally less slender. Nevertheless, the dimorphism is always well-evident and adults of any size-class can be easily sexed even with unaided eye.

The coloration presented only minor variations among different individuals, with some being paler and less densely spotted (fig. 29–32).

The number of principal rows of denticles in pedipalp fingers and the composition of apical subrow of movable finger were both invariable in all examined specimens.

Pectinal tooth counts were fairly constant in the whole sample and varied from 19–21 in males and 18–20 in females, with poorly defined modes of 20 and 19 in each sex, respectively (tab. II). There are no detectable variations between different subpopulations; the degree of variation observed is larger inside than between populations compared.

Comparison. By the characteristic combination of size, color pattern, and relative size, carination and sculpture of pedipalps and metasoma, *C. altagraciae* **n.sp.** is most closely-related to three other Hispaniolan congeners: *Centruroides bani* Armas & Marcano Fondeur, 1989, *Centruroides lucidus* Teruel, Armas & Kovařík, 2015 (its sibling species), and *Centruroides nitidus* (Thorell, 1876).

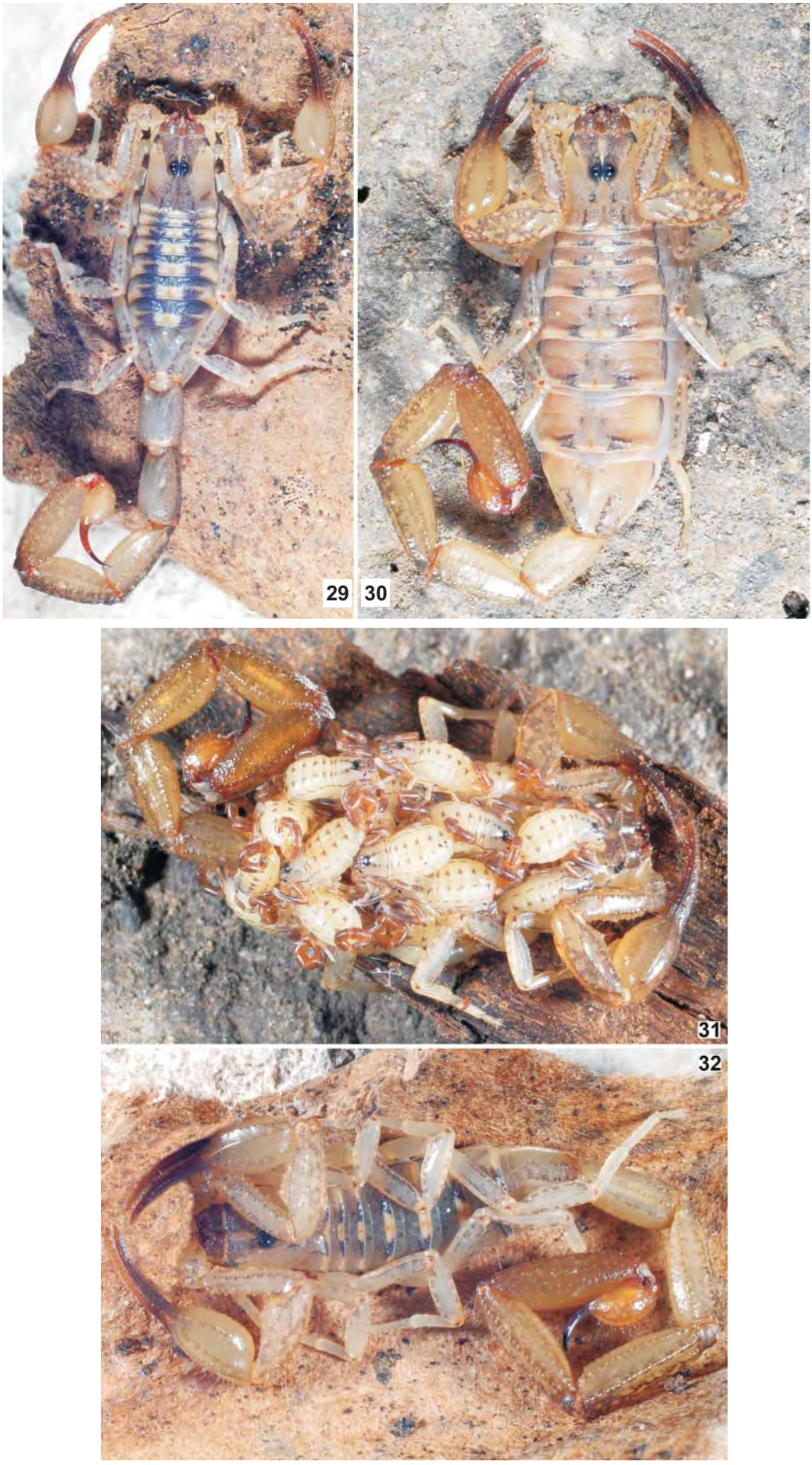

Fig. 29-32. Female (29-31) and male (32) paratypes of *Centruroides altagraciae* **n. sp.**, photographed when still alive: shortly after last ecdysis (29), pregnant (30), with first-instar litter (31).

Fig. 33–34. Two views of the habitat of *Centruroides altagraciae* **n.sp.**, at the type-locality. **Fig. 35.** Geographical distribution of *Centruroides altagraciae* **n.sp.** (black squares, white cross indicates type-locality) and its closest relative *C. lucidus* (white squares).

In general, *C. altagraciae* **n.sp.** can be easily distinguished even with unaided eye from those three species by its smaller size, densely punctate metasoma and especially for the unique shape of the telson: with a small vesicle and very long aculeus, especially in females. Moreover, herein we tabulated a detailed diagnostic comparison amongst these three taxa (tab. III).

DISTRIBUTION (fig. 35). This species is known only from the southeastern tip of Hispaniola, in the limestone-terrace coastal plain.

Table III. Diagnostic comparison among four closely-related Hispaniolan species of *Centruroides*. The species have been arranged by overall similarity to facilitate comparisons.

	Characters	*C. altagraciae* sp.n.	*C. lucidus*	*C. nitidus*	*C. bani*
1.	Base color	Light to pale yellow	Light yellow to pale yellowish brown	Yellowish brown	Yellowish brown
2.	Metasoma, ventral color pattern	With an irregular, narrow ventromedian dark band	With an irregular, narrow ventromedian dark band	Densely but irregularly spotted with blackish brown	With a compact, broad ventromedian blackish band
3.	Pedipalp fingers, color	Much darker than manus, blackish	Slightly to conspicuously darker than manus, variably infuscate	Much darker than manus, blackish	Much darker than manus, blackish
4.	Pedipalp manus, shape	♂: robust, oval ♀: robust, oval	♂: robust, stout ♀: robust, round	♂: very robust, stout ♀: very robust, globular	♂: robust, stout ♀: very robust, globular
5.	Pedipalp manus, carinae	Weak	Obsolete to vestigial	Obsolete to vestigial	Weak to moderate
6.	Pedipalp manus, setation	♂: very scarce ♀: very scarce	♂: very scarce ♀: very scarce	♂: dense ♀: very dense	♂: dense ♀: very dense
7.	Pedipalp manus, dorsal and external intercarinal sculpture	Glossy, with minute granules	Glossy, with minute granules	Glossy, smooth	Coriaceous, with irregular granules scattered
8.	Pedipalp fingers, shape	Long, thick. Basal lobe/notch combination moderate	Long, thick. Basal lobe/notch combination moderately strong	Short, thick. Basal lobe/notch combination very strong	Long, thick. Basal lobe/notch combination moderately strong
9.	Metasoma, shape	♂: slender ♀: slender	♂: slender ♀: slender	♂: robust ♀: robust	♂: slender ♀: robust
10.	Metasoma, ventrolateral macrosetae (II–IV)	2 pairs	3-4 pairs	3-5 pairs	2 pairs
11.	Metasoma, dorsolateral and lateral supramedian carinae	♂: weak to moderate, serrato-crenulate to subdenticulate	♂: obsolete to weak, subcrenulate to subdenticulate	♂: absent to very weak, smooth to subcrenulate	♂: weak to moderate, crenulate to serrate
12.	Metasoma, intercarinal sculpture	Smooth, glossy, with irregular granules and punctures scattered	Smooth, glossy, with minute granules and punctures scattered	Smooth, glossy, with irregular granules scattered	Coriaceous, with irregular granules scattered
13.	Pectines, basal plate depression	♀: large, transverse, deep	♀: large, transverse, deep	♀: absent to vestigial	♀: large, transverse, shallow
14.	Sternite V, posterior margin	♂: widely convex to shallowly lobed	♂: widely convex to shallowly lobed	♂: weakly to moderately lobed	♂: widely convex to shallowly lobed

ECOLOGICAL DATA. This is a thermophile species that inhabits hot lowland areas, with vegetation ranging from secondary to semicaducifolious forest (fig. 33–34). Moreover, it is exclusively arboreal, as all specimens either personally collected by us or with complete label data have been found under barks of trees, bushes, and wooden fence posts.

At night, individuals of *C. altagraciae* **n.sp.** are found also exclusively over the vegetation, either walking slowly or sit-and-wait hunting on logs and branches of trees and bushes, as well as on columnar cacti and hanging on lianas. During this nocturnal activity, as soon as the scorpions are touched they display a rush escape behavior that consists in either a fast run along the log (usually upwards) to enter the first crevice available, or to roll-up tightly the body and appendages and drop to the ground to immediately hide under leaf litter.

Along its entire known distributional range, *C. altagraciae* **n.sp.** is the most commonly found scorpion species, even though it is not as abundant as other Hispaniolan members of the genus. It lives syntopically with *C. bani* in the vegetation, and sympatrically with the diplocentrine *Cazierius cicero* Armas & Marcano Fondeur, 1987, the hormurid *Opisthacanthus lepturus* (Beauvois, 1805) and the buthids *Microtityus* (*Parvabsonus*) *lourencoi* Armas & Teruel, 2012 and *Rhopalurus abudi* Armas & Marcano Fondeur, 1987, all of which occur in the ground under rocks, fallen logs and inside rock crevices, rotten logs and leaf litter.

Two females from Guaraguao and Boca de Yuma were found with, or gave birth in captivity to litters of 16 and 20 newborn, respectively; first instar lasted for 4–6 days.

REMARKS. Our examination of the specimens from Botijuela and Guaraguao recorded by Armas (2002) as *C. nitidus*, demonstrated that all are conspecific with *C. altagraciae* **n.sp.** and therefore have been designated as paratypes (see above). We could not study those from Higüey (also in La Altagracia province) recorded by Armas & Marcano Fondeur (1987) as *C. nitidus nitidus*, but we have tentatively treated them as potential misidentification of *C. altagraciae* **n.sp.** too, because this site is located less than 30 km northwest of its nearest record (Boca de Yuma) and inside the same continuous of coastal landscape and vegetation.

On morphological grounds, the closest relative of *C. altagraciae* **n.sp.** is *C. lucidus*, which occurs only in the meridional slopes and adjacent coastal plain of the Sierra de Bahoruco mountain range (= Bahoruco Range), in the opposite extreme of southern Dominican Republic. Such allopatric distribution of a pair of sister taxa mirrors that of *Rhopalurus abudi* and *Rhopalurus bonettii* Armas, 1999 in the same southeastern and southwestern areas of the country, respectively (Armas & Marcano Fondeur, 1987; Armas *et al.*, 1999; Teruel, 2005; Prendini *et al.*, 2008). Such coincidence suggests the existence of a biogeographical track between both areas of Hispaniola.

Family Scorpionidae Latreille, 1802

Subfamily Diplocentrinae Karsch, 1880

Heteronebo barahonae, **new species**

Figures 36–76. Table IV.

"Una especie de Diplocentridae": Armas & Marcano Fondeur, 1992: 34 [record from road up to Polo].

HOLOTYPE. ♂ (RTO). **Barahona Province**: Cabral Municipality: Sierra de Bahoruco: km 7–9 of road from Cabral to Polo; 18°10'55"N - 71°15'10"W; 221 m a.s.l.; March 7–8, 2014; under rock in leaf litter, semicaducifolious forest on karstic terrain; R. Teruel, F. Kovařík, P. Kindl.

PARATYPES (25 specimens: 1♂, 9♀♀, 15 juveniles). Same locality as holotype; August 23, 1987; under rocks; L. F. de Armas, E. J. Marcano, A. Abud, D. Lantigua; 1♀, 1 juvenile (IES). Same data as holotype; 5♀♀, 3 juveniles (RTO), 1♂, 3♀♀, 11 juveniles (FKCP, the male born and raised to adulthood in captivity).

ETYMOLOGY. The selected name is a Latinized noun in genitive case, taken from the name of the province where this species occur.

DIAGNOSIS. Adult size small for the genus (male 21 mm, females 21–25 mm). Coloration dark olivaceous brown with a reddish tint, densely spotted with blackish brown all over the body and appendages except ventrally on prosoma and mesosoma. Punctate tegument present on pedipalps (sparse on femur, denser on patella and much denser on chela), legs (sparse on coxa) and telson (sparse). Carapace very finely and densely granulose, with coarser granules scattered on anteromedian and lateromedian areas (much denser and matt in male, with a glossy appearance in females and juveniles). Tergites very finely and densely granulose (males) or glossy (females and juveniles), with many scattered, coarser granules. Metasoma robust (first segment that is longer than wide is III in male, IV in female) and sparsely hirsute, with 10/10/10/10/7 complete to essentially complete carinae composed by fine, regular granulation (coarser in female); intercarinal tegument very finely and densely granulose (male) or glossy (female), with abundant scattered coarser granules; segment V with ventral transverse carina straight. Pedipalp chela short, robust and sparsely hirsute, intercarinal tegument moderately (male) to vestigially (female) reticulate dorsoexternally, with only a few coarse granules internally, fingers shorter and moderately hirsute (male) or longer and sparsely hirsute (females). Pectinal tooth count 6–7 (mode 6) in males, 5–6 (mode 5) in females. Legs smooth and glossy; modal formula of telotarsal spiniform setae 4/4 : 5/5 : 6/6 : 6/6.

DESCRIPTION (adult male holotype). **Coloration** (fig. 36–37, see also paratypes in fig. 38–41) base dark olivaceous brown, with a slight reddish tint on distal segments of pedipalps and metasoma; entire body and appendages densely spotted with blackish brown throughout, except essentially immaculate on the ventral region of prosoma and mesosoma. Chelicera manus sparsely reticulate with blackish brown all over, much denser distally; fingers moderately infuscate, especially the movable. Pedipalps with all carinae deeply infuscate to blackish, interconnected by blackish reticulations on all surfaces except ventral; chela fingers blackish with slightly paler tips. Carapace symmetrically and very densely spotted and reticulated with blackish brown (most spots are interconnected), with anterior and posterior margins very deeply infuscate; tergites with the same pattern as on carapace, but remarkably denser; venter essentially immaculate. Legs only slightly paler than body (except on specimens recently molted and sacrificed), densely infuscate on all surfaces except internally; coxa and trochanter essentially immaculate. Metasoma with all carinae deeply infuscate to blackish, interconnected by blackish reticulations on all surfaces; lateral and ventral surfaces of all segments with dark pattern confluent in an entirely blackish patch that covers the distal half of all segments;

Fig. 36–37. Male holotype of *Heteronebo barahonae* **n.sp.**: entire dorsal (36) and ventral (37) views.

Table IV. **Measurements (mm) of three adult types of *Heteronebo barahonae* sp. n., from RTO collection**. Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), heigth (H).

Dimensions		Cabral-Polo road, km 7–9		
		♂ Holotype	♀ Paratype	♀ Paratype
Carapace	L / W	2.80 / 2.60	3.03 / 2.92	3.48 / 3.30
Mesosoma	L	6.00	7.30	8.30
Tergite VII	L / W	1.30 / 2.38	1.40 / 2.71	1.80 / 3.30
Metasoma + Telson	L	11.96	10.90	12.86
Segment I	L / W / H	1.40 / 1.73 / 1.32	1.22 / 1.80 / 1.40	1.50 / 2.10 / 1.50
Segment II	L / W / H	1.55 / 1.63 / 1.33	1.38 / 1.70 / 1.40	1.60 / 1.95 / 1.50
Segment III	L / W / H	1.70 / 1.60 / 1.35	1.49 / 1.61 / 1.32	1.75 / 1.90 / 1.48
Segment IV	L / W / H	2.06 / 1.52 / 1.43	1.83 / 1.58 / 1.35	2.15 / 1.78 / 1.58
Segment V	L / W / H	2.65 / 1.43 / 1.12	2.43 / 1.42 / 1.21	2.80 / 1.66 / 1.55
Telson	L	2.60	2.55	3.06
Vesicle	L / W / H	1.80/ 1.29 / 0.88	1.75 / 1.42 / 1.05	2.10/ 1.65 / 1.20
Aculeus	L	0.80	0.80	0.96
Pedipalp	L	8.60	8.65	9.90
Femur	L / W	2.00 / 0.90	2.00 / 0.85	2.25 / 1.05
Patela	L / W	2.20 / 1.00	2.05 / 1.00	2.40 / 1.20
Chela	L	4.40	4.60	5.25
Manus	L / W / H	1.80 / 1.70 / 2.10	1.80/ 1.70 / 1.80	2.10 / 2.08 / 2.20
Movable finger	L	2.60	2.80	3.15
Total	**L**	**20.76**	**21.23**	**24.64**

dorsal surface with a large, irregular blackish spot on I–IV. Telson vesicle deeply infuscate to spotted with blackish brown, with four pale stripes corresponding to longitudinal furrows.

Chelicerae (fig. 46–47 depict female paratype). Dentition typical for the genus, all teeth very sharp and slender. Tegument smooth and shiny. Fingers very long, slender, evenly curved, and conspicuously unequal (movable much longer). Setation essentially absent dorsally, but dense ventrally.

Pedipalps (fig. 48–49 depict male paratype). Orthobothriotaxic C. Femur higher than wide, and almost flat dorsally; all carinae indistinct or absent except irregularly granulose dorsoexternal; tegument finely and densely granulose, with coarse granules scattered dorsally. Patella higher than wide, and with all surfaces convex; all carinae moderate and irregularly subcostate; tegument coriaceous to glossy and irregularly, weakly reticulate on all surfaces except internal, which is very finely and densely granulose. Chela short and robust (2.59 times longer than wide), higher than wide and sparsely hirsute; hand distally narrower in dorsal view and prismatic in cross-section, with all carinae moderate to strong (especially the digital and ventroexternal), tegument glossy but moderately reticulate dorsoexternally, densely punctate on all surfaces and moderately granulose distally; fingers short and thick (movable 1.44 times longer than underhand), moderately curved and hirsute, with basal lobe/notch combination extremely vestigial and with a single principal row of denticles flanked by abundant external and internal accessory denticles partially merged with the principal row, apical third of both fingers internally with 4–5 coarse, sharp granules aligned longitudinally, well removed from dentate margin.

Carapace (fig. 42 depicts male paratype). Slightly longer than wide, paraboloid in dorsal view. Anterior margin bilobed, with two long macrosetae plus several small microsetae on each frontal lobe; median notch widely U-shaped,

Fig. 38–41. Male (38–39) and female (40–41) paratypes of *Heteronebo barahonae* **n.sp.**: entire dorsal (38, 40) and ventral (39, 41) views.

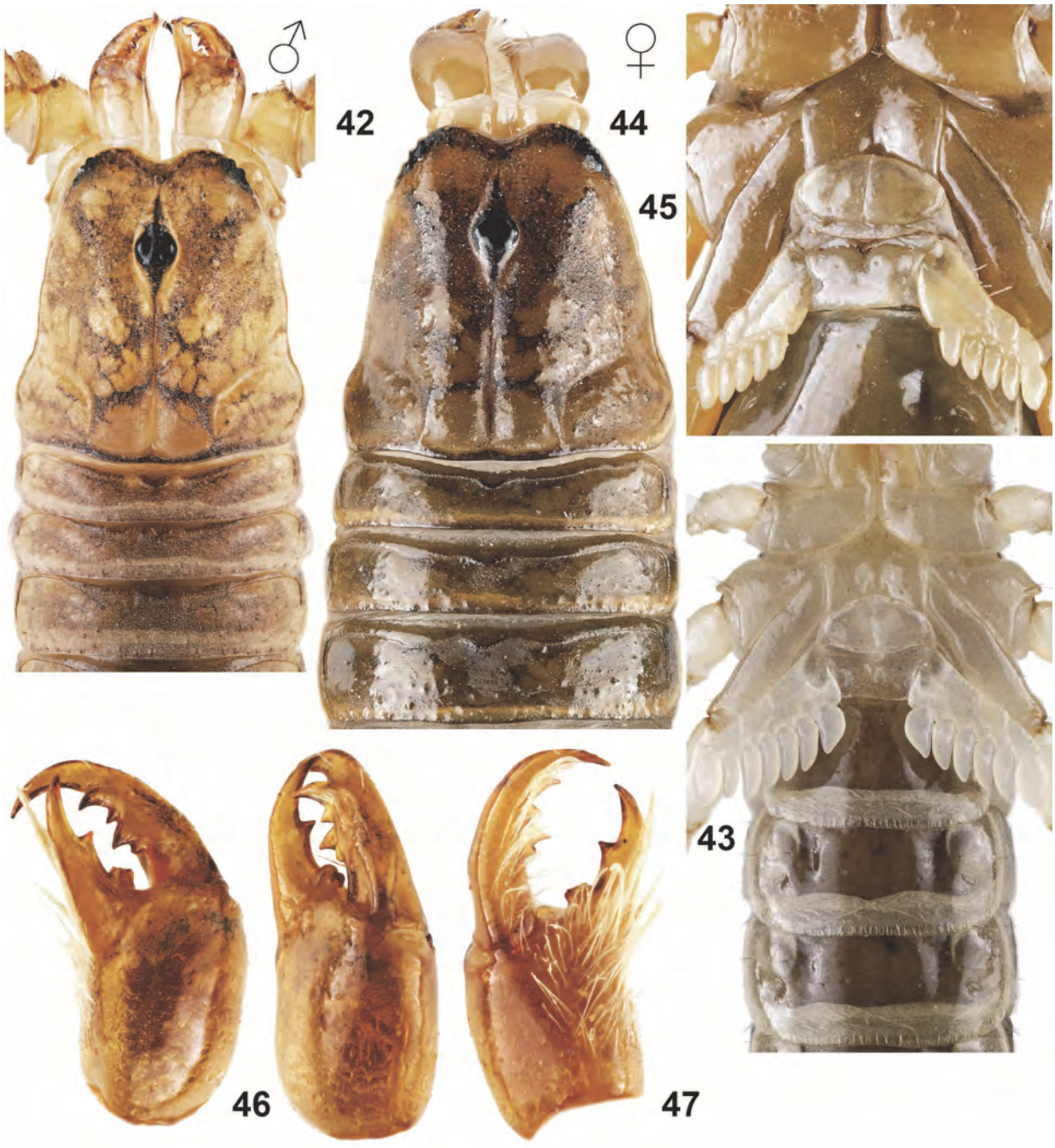

Fig. 42–47. Male (42–43) and female (44–47) paratypes of *Heteronebo barahonae* **n.sp.**: carapace and tergites I–III (42, 44), coxosternal region, pectines and first sternites (43, 45), chelicerae in dorsal and dorsoexternal (46) plus ventral (47) views.

moderately deep. Tegument very finely and densely granulose, with coarser granules scattered on anteromedian and lateromedian areas. Carinae indistinct or absent. Furrows: lateral oculars, central median, posterior median and posterior marginal very narrow and moderately deep, fused; posterior laterals narrow and deep; other furrows indistinct or absent. Median eyes separated by less than one ocular diameter, ocular tubercle raised and elongate; three pairs of lateral eyes, less than half the size of the median eyes.

Sternum (fig. 43 depicts male paratype). Standard for the genus: type 2, large, wider than long, pentagonal in shape but with lateral sides slightly divergent anteriorly, with two pairs of dark macrosetae. Tegument smooth and glossy.

Genital operculum (fig. 43 depicts male paratype). Medium-sized, halves not separated nor fused and roundly subtriangular in shape, with single pair of dark macrosetae. Genital papillae medium-sized, only slightly protruding, with tips rounded.

Pectines (fig. 43 depicts male paratype). Relatively small and simple-structured for the genus: not reaching apex of leg IV trochanter, subtriangular and sparsely setose, anterior area with three lamellae, median area with only one. Tooth count 6/6, teeth conspicuously swollen, not conspicuously angled and basally only slightly separated; fulcra reduced, essentially flat and very weakly sclerotized. Basal plate very weakly sclerotized, wider than long, anterior margin with a deep, V-shaped anteromedian notch, posterior margin essentially straight.

Legs (fig. 59 depict female paratype). Somewhat slender, with all carinae absent or indistinct, intercarinal tegument

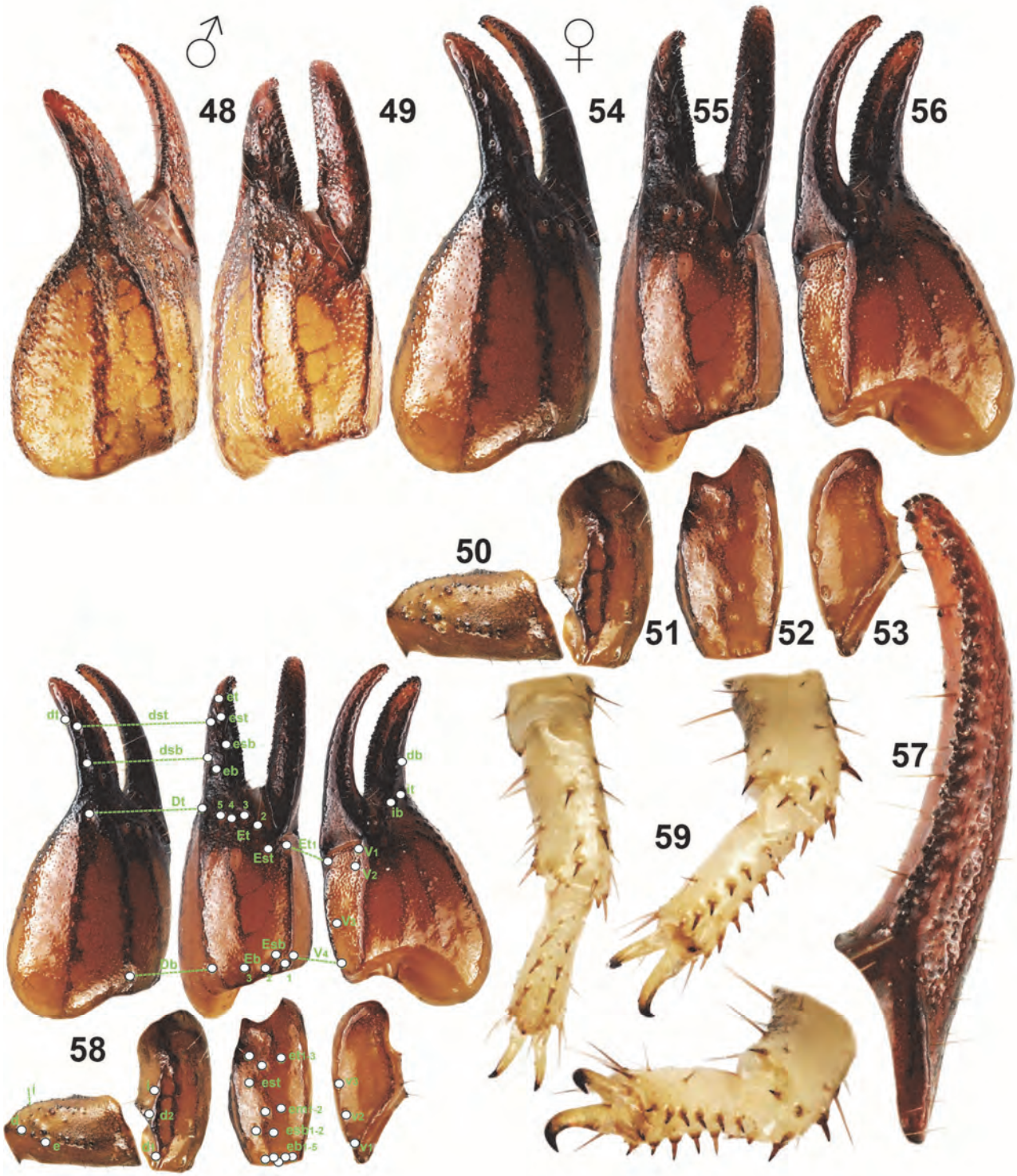

Fig. 48–59. Male (48–49) and female (50–59) paratypes of *Heteronebo barahonae* **n.sp.**: pedipalp femur in dorsal view (50), pedipalp patella in dorsal (51), external (52) and ventral (53) views, pedipalp chela in dorsoexternal (48, 54), external (49, 55) and ventrointernal (56) views, pedipalp finger in dorsal view (57), trichobothrial pattern (58), legs II–IV in ventrointernal view (59).

coriaceous to glossy except for sparsely punctate coxa and minutely granulose femur. Prolateral pedal spurs somewhat reduced on all legs. Telotarsi with spiniform setal formula 4/4 : 5/5 : 6/6 : 6/6. Claws relatively long (more than one-third the length of its respective telotarsus) and strongly curved.

Mesosoma (fig. 42–43 depict male paratype). Tergites without distinct carinae; tegument very finely and densely granulose, with some coarser granules scattered all over; VII moderately bilobed by a depressed, triangular area mediposteriorly. Sternites III–VI acarinate, with posterior margin vestigially bilobed and tegument smooth and glossy, spiracles small, elongate oval; VII with two pairs of long, fine, moderately crenulate, parallel carinae (submedians and laterals), tegument coriaceous to minutely granulose.

Metasoma (fig. 60–62 depict male paratype). Short, robust, sparsely hirsute, and narrower distally; segments I–II wider than long, III–V longer than wide; all segments wider than high. Segments I–IV with ten complete carinae, V with

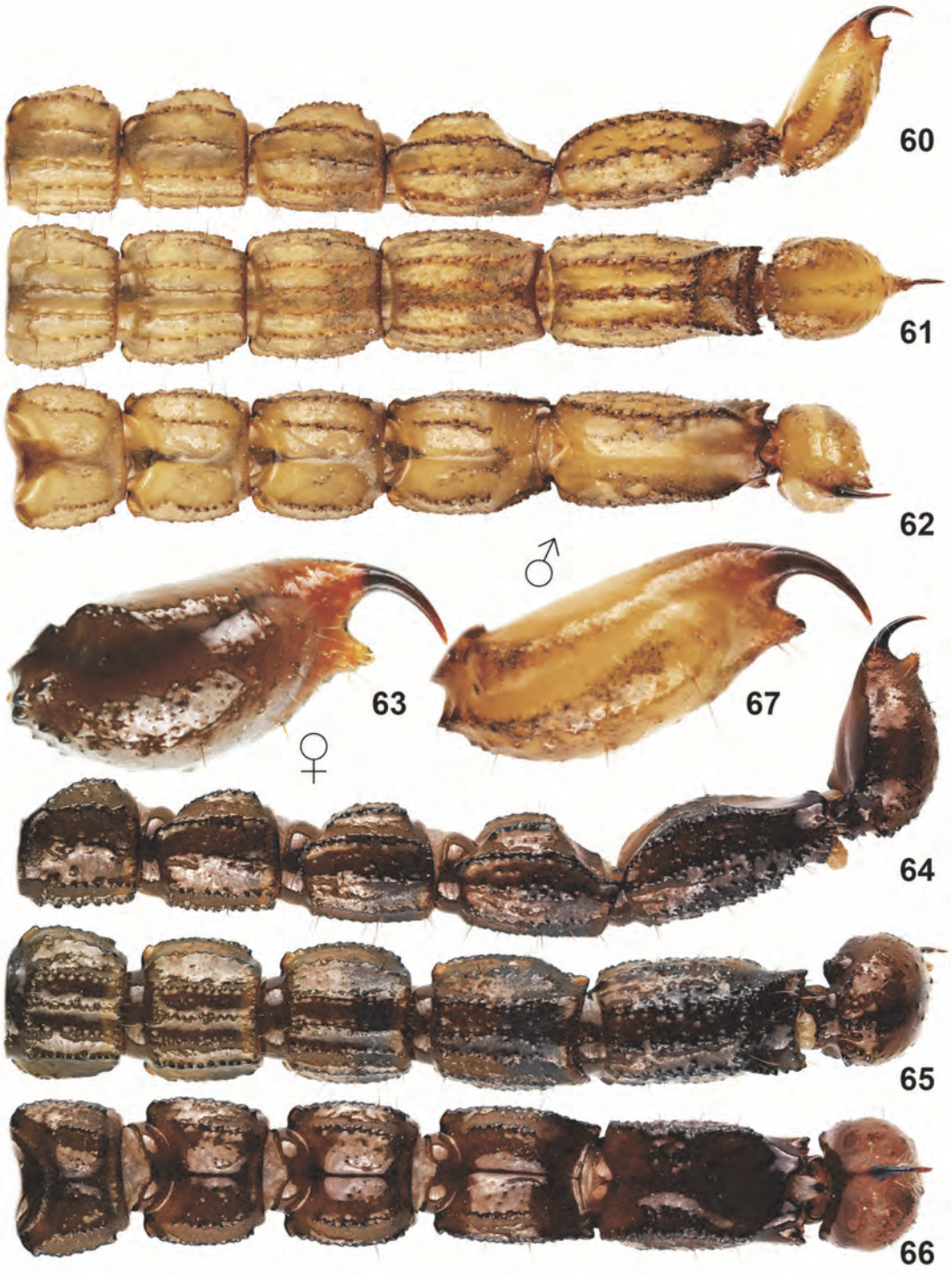

Fig. 60–67. Male (60–63) and female (64–67) paratypes of *Heteronebo barahonae* **n.sp.**: metasoma in lateral (60, 64), ventral (61, 65) and dorsal (62, 66) views, telson in lateral view (63, 67).

seven: dorsal laterals finely, moderately serrate to subdentate on I–IV, absent from V; lateral supramedians finely, moderately serrate to subdentate on I–V; lateral inframedians irregular but complete, finely, moderately serrate to subdentate on I–V; ventral laterals finely, moderately serrate to subdentate on I–V (much stronger and distally divergent on the latter); ventral submedians finely, moderately serrate to subdentate on I–III, irregularly granulose on IV, absent from V; ventral median carina absent on I–IV, strong, irregular and composed of a double row of closely alternate conical granules that end in the ventral transverse carina, which is composed of an irregular, straight, transverse row of closely-set coarse granules. Segment V with anal arc strongly denticulate; laterodistal lobes straight and sharply triangular. Intercarinal tegument very finely and densely granulose, with some larger, sharp granules scattered on all segments. Dorsal furrow complete, narrow and moderately deep on all segments. Three pairs of dark macrosetae on every carina of I–V (sometimes two, mostly on ventral submedian carinae).

Telson (fig. 63 depicts male paratype). Essentially bare, with several pairs of dark macrosetae scattered on ventral and lateral surfaces. Vesicle oval slender and depressed (1.40 times longer than wide, 1.47 times wider than high), tegument glossy to coriaceous, sparsely punctate, with a few scattered,

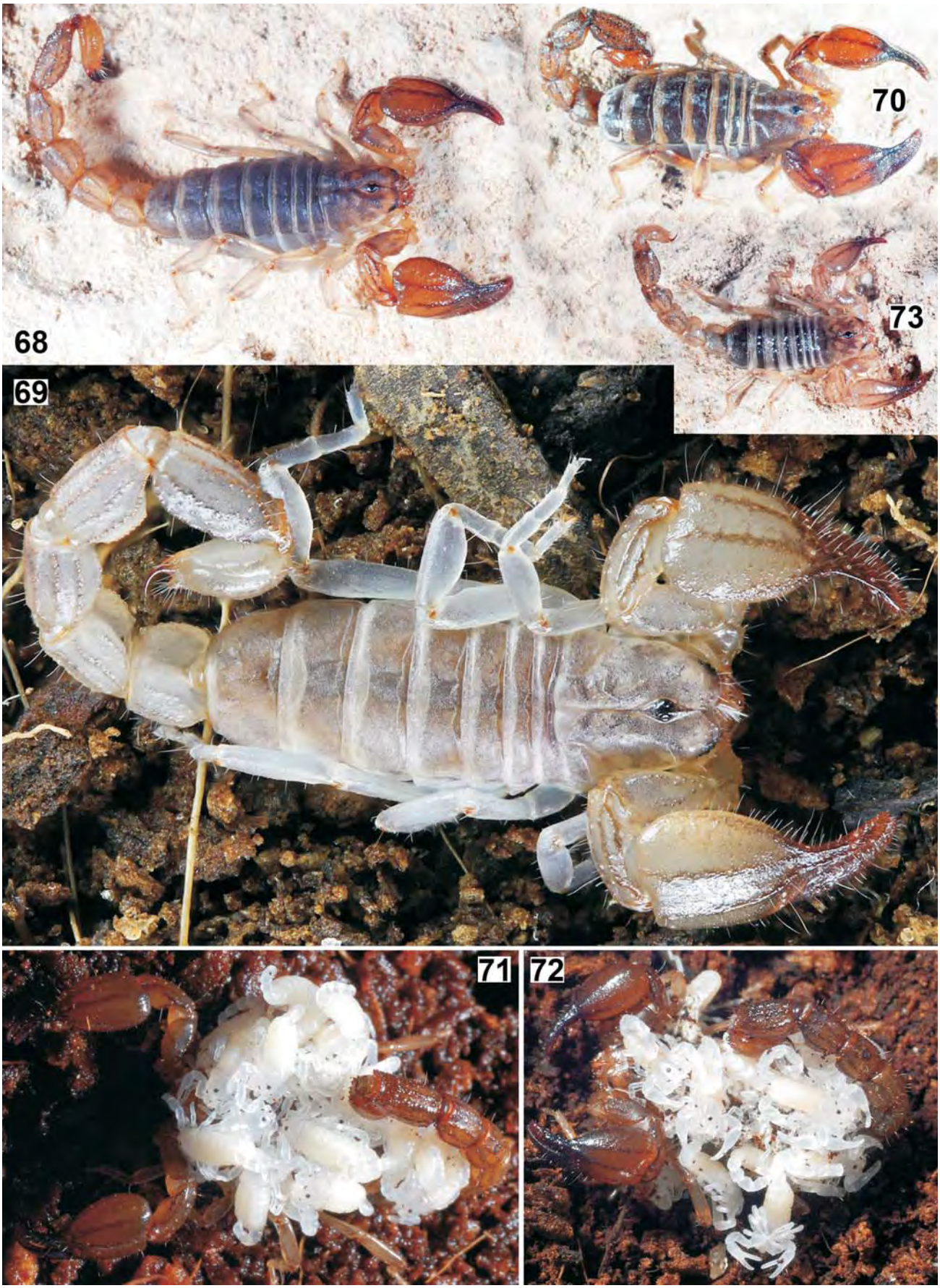

Fig. 68-73. Male holotype (68), male paratype (69), females (70-72) and juvenile (73) paratypes of *Heteronebo barahonae* **n. sp.**, photographed when still alive: shortly after last ecdysis (69), with forst-instar litter (71), wirh second-instar litter (72).

Fig. 74–75. Two views of the habitat of *Heteronebo barahonae* **n.sp.**, at the type-locality. **Fig. 76.** Geographical distribution of *Heteronebo barahonae* **n.sp.** (black square) and its closest relatives *H. monticola* (white squares) and *H. pumilus* (grey square).

weak to moderate granules ventrally (denser on basal portion) and with four smooth, shallow, longitudinal furrows, subacular tubercle large, conical, weakly granulose and covered by translucent macrosetae and white microsetae. Aculeus very short, sharp and shallowly curved.

FEMALE (paratype: fig. 40–41, 44–47, 50–59, 64–67, 70–72; tab. IV). Similar to the male, but sexual dimorphism is evident by: **1)** size slightly larger; **2)** genital operculum with valves completely fused by a medial membrane, without genital papillae; **3)** carapace, tergites and metasoma with intercarinal tegument glossy, with scattered granulation much sparser; **4)** pectines smaller and narrower, with slightly lower tooth counts; **5)** pedipalps with femur and patella slightly broader, but with hand narrower and oval in shape, and fingers longer; **6)** pedipalp manus larger and more slender, with keels noticeably weaker and with reticulate and punctate sculpture much weaker and sparser; **7)** metasoma more robust and with all carinae coarser.

VARIATION. Both adult males from the type locality belong to the same size-class, but two classes are represented among females: all of them correspond to the same class as males except one, which is a large adult (tab. IV). As usual for a typical member of the genus *Heteronebo* Pocock, 1898, males are slightly smaller than same size-class females.

Pectinal tooth counts are essentially invariable in *H. barahonae* **n.sp.**: four out of five males have 6/6 (one has 6/7) and nine out of ten females have 5/5 (one has 5/6). This character stasis seems to be size-correlated, because it is shared by the remaining two smallest species of the genus: *Heteronebo vachoni* Francke, 1978 and *Heteronebo yntemai* Francke & Sissom, 1980 (see Francke, 1978, 1986; Francke & Sissom, 1980).

The formula of telotarsal spiniform setae is remarkably constant in the type-series. Variations are exceptional, restricted to one-seta asymmetry between both rows, and on legs I or IV only (e.g., counts of 3–4/4 or 5/5–6).

The juvenile specimens (fig. 73) differ from the adult in the characters standard for all diplocentrines: base color much lighter (pale to medium gray), with the dark pattern more contrasting, as well as pedipalps and metasoma more slender and with noticeably weaker carinae.

COMPARISON. After the generic reassignment made by Teruel (2005), four other southern Hispaniolan species remained allocated in this genus: *Heteronebo dominicus* Armas, 1981, *Heteronebo monticola* (Armas, 1999), *Heteronebo oviedo* (Armas, 1999), and *Heteronebo pumilus* Armas, 1981; the latter remains known from a single locality in extreme southwestern Haiti (Tiburon Peninsula), whereas the remaining taxa are parapatrically widespread along the southern watershed of the Bahoruco Range in Dominican Republic.

By the combination of very dark overall coloration, densely granulose body and metasoma, and especially by having the ventral transverse carina on metasomal segment V irregularly straight and not crossing beyond the ventral lateral carinae, *H. barahonae* **n.sp.** is most closely related to both *H. monticola* and *H. pumilus*. These two taxa can be safely distinguished from it as follows:

• ***H. monticola***: **1)** adult size larger: 22–30 mm in males, 24–34 mm in females; **2)** pedipalp patella in females with all carinae stronger, especially the dorso-exterior and exterior-median; **3)** pedipalp manus in both sexes conspicuously shorter, wider and higher, rounder in dorsal view; **4)** pectines with slightly but consistently higher tooth counts: 6–7 in both sexes, with mode 7 and 6 in males and females, respectively; **5)** metasoma somewhat longer and more slender in both sexes.

• ***H. pumilus*** (**note:** our examination of both type-specimens revealed that the juvenile paratype is a male, not a female as declared in the original description of Armas, 1981): **1)** pectines with slightly but consistently higher tooth counts: 7/7 in both sexes; **2)** punctate tegument in adult female much denser and more extended, entirely covering carapace, sternites, pedipalp, legs, and telson; **3)** metasoma somewhat shorter and less slender in adult female, e.g., segment III as long as wide; **4)** metasomal segments with intercarinal tegument very finely and densely granulose; **5)** telson in adult female with vesicle comparatively smaller, more slender and flatter.

On the other hand, both *H. dominicus* and *H. oviedo* can be very easily separated from *H. barahonae* **n.sp.** by their pale to light yellowish brown coloration, mostly smooth body and metasoma, and metasomal segment V with ventral transverse carina fully developed and semicircular, replacing the distal part of the ventral lateral carinae.

Apart from the diagnostic characters discussed above, *H. barahonae* **n.sp.** is the only member of *Heteronebo* so far known to occur on both the northern watershed and the eastern section of the Bahoruco Range (fig. 76).

DISTRIBUTION (fig. 76). This scorpion is known only from the type locality, in the northern foothills of the Bahoruco Range, southwestern Dominican Republic. Despite intensive searches all along the paved road that comes up the mountains and connects the villages of Cabral and Polo, specimens have been found only between mileposts marking kilometers 7 and 9 of this route. Additional intensive and repeated searches in other localities of the northern watershed of the Bahoruco Range and around Barahona city, have been unsuccessful.

ECOLOGICAL DATA. This species lives under limestone rocks semi-buried in the dry leaf litter on karstic terrain. The vegetation is semicaducifolious forest, still well preserved, at an elevation of 200–300 m above sea level (fig. 74–75).

Other four scorpion species were found at the same locality, all of them buthids: the syntopic *Centruroides marcanoi* Armas, 1981 and *Microtityus* (*Parvabsonus*) *iviei* Armas, 1999 (both sometimes found even under the same rocks as *H. barahonae* **n.sp.**), plus the sympatric *Centruroides lucidus* and *Tityus crassimanus* (Thorell, 1876), which inhabit under barks of trees, shrubs and fence posts, as well as inside epiphytic bromeliads.

A captive paratype female gave birth to a litter of 12; the first instar lasted for five days.

REMARKS. With the present addition, the known diversity of *Heteronebo* in Hispaniola reaches five species. This firmly places this island as the most speciose Antillean territory for the genus: Cuba and the Virgin Islands have two species each, whereas Puerto Rico, Jamaica, Cayman Islands and Navassa are represented by a single described member of the genus, according to the most recent contributions (Armas, 2001, 2005; Teruel, 2005, 2009).

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