Studies on Neotropical Fauna and Environment, April 2007; 42(1): 61–69

ORIGINAL ARTICLE

Systematics and distribution of *Brachistosternus (Brachistosternus) ehrenbergii* (Gervais, 1841), with the first record of stridulation in this genus *Brachistosternus* (Scorpiones: Bothriuridae)

JOSÉ A. OCHOA[1] & ANDRÉS A. OJANGUREN AFFILASTRO[2]

[1]*Urb. Kennedy ''A'', Wanchaq, Cusco, Peru, and* [2]*Museo Argentino de Ciencias Naturales ''Bernardino Rivadavia'', Buenos Aires, Argentina*

(Received 10 September 2005; accepted 12 May 2006)

Abstract
Brachistosternus (Brachistosternus) ehrenbergii (Gervais, 1841), from Peru and northern Chile at 0–2550 m, is redescribed; new data about the distribution of this species are provided, and its stridulatory organ is described.

Resumen
Se redescribe a *Brachistosternus (Brachistosternus) ehrenbergii* (Gervais, 1841), del Perú y norte de Chile (0–2550 m); se brindan además datos sobre su distribución, y se describe el órgano estridulador de la especie.

Keywords: *Brachistosternus (Brachistosternus) ehrenbergii*, Neotropics, Scorpiones, stridulatory organ, systematics

Introduction

Brachistosternus (Brachistosternus) ehrenbergii (Gervais, 1841) is the most characteristic scorpion of the Pacific desert from Peru and northern Chile. Its great size as well as its ability to inhabit outskirts of cities and towns, has favoured the early description of this species; nevertheless, and despite being the most cited species of this genus, there are several aspects about its systematic that need to be clarified. After studying a great quantity of material, as well as some notes on the type material by Dr Emilio Maury, we have been able to establish clearly the identity of this species, and to make a detailed redescription of it.

Currently, *B. ehrenbergii* is the only species included in the subgenus *Brachistosternus (Brachistosternus)*; nevertheless, we could also include *Brachistosternus pegnai* Cekalovic, 1969 in the same subgenus by the trichobothrial pattern described by Cekalovic (1969) in the original description of this species (although the identity and validity of this species should be clarified). Additionally, we detected two unnamed species with the same trichobothrial pattern from northern Peru.

Brachistosternus ehrenbergii presents a small series of granules on the median portion of the pretergites, this structure apparently corresponds to a stridulatory organ, similar to the stridulatory organ found in *Timogenes* Simon, 1880 (Acosta & Maury, 1990; Lourenço & Cloudsley-Thompson, 1995). This is the first case in *Brachistosternus*, in which a structure of these characteristics is found.

Gervais (1841) described two species in the same work: *Scorpio ehrenbergii* and *S. glaber*; the first revisor (Simon, 1880) stablished the synonymy of both names, and selected the first one as senior synonym.

Probably *B. ehrenbergii* corresponds to the forgotten ''*Buthus peruvianus*'' Guérin Méneville, 1838, described from Callao (Peru); some details—''*…thorace rubescenti, abdomine nigricanti, cauda flava … chelis flavis, apice brunneis…*'', ''*…l'avant-dernier segment présente en dessous une arete granuleuse bien marquée, les autres sont lisses en dessous…*''—besides other characters mentioned in the description, and the procedence of the specimens, let us to suppose

Correspondence: J. A. Ochoa, Urb. Kennedy ''A'', Los Brillantes A-19, Wanchaq, Cusco, Perú. Email: jaochoac2000@yahoo.com

ISSN 0165-0521 print/ISSN 1744-5140 online
DOI: 10.1080/01650520600800310

that it could be *B. ehrenbergii*. This is the only known scorpion from Callao and Lima with the characteristics mentioned by Gúerin Méneville, however, the description is not detailed, and the type specimens are unknown; for these reasons is not possible to confirm this supposition. Nevertheless, if it is true, ''*Buthus peruvianus*'' would be a *nomen oblitum* according to Art. 23.9 of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 2000); because this name has not been used by any subsequent author since the original publication, and was only listed as Incertae Sedis by Lowe & Fet (2000), in Bothriuridae.

Materials and methods

Measurements were performed with a stereomicroscope with an ocular micrometric. Drawings were made using a camera lucida mounted to a stereomicroscope. Micrographs were obtained with a scanning electron microscope from the ''Museo Argentino de Ciencias Naturales Bernardino Rivadavia''. We examined specimens from the following collections: AMNH, American Museum of Natural History, New York, USA; FMNH, Field Museum of Natural History, Chicago, USA; MACN-Ar, Museo Argentino de Ciencias Naturales ''Bernardino Rivadavia'', Buenos Aires, Argentina; MHNC, Museo de Historia Natural, Facultad de Ciencias Biológicas, Universidad Nacional de San Antonio Abad del Cusco, Peru; MUSM, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru; MUSA, Museo de Historia Natural, Universidad Nacional de San Agustín de Arequipa, Peru.

Terminology for general morphology follows that of Stahnke (1970); androvestigia or caudal glands are after Cekalovic (1973); trichobothrial nomenclature follows Vachon (1974), the terminology of cheliceral dentition follows Vachon (1963), the terminology of the hemispermatophores structures of the genus *Brachistosternus* Pocock, 1893 follows Maury (1974).

The morphological abbreviations used are : DL, dorsolateral; VM, ventral median; VL, ventrolateral; LM, lateral median; LIM, lateral inframedian; LSM, lateral supramedian; VI, ventrointernal; VE, ventroexternal; DI, dorsointernal; DE, dorsoexternal; EM, external median.

Results

Brachistosternus (Brachistosternus) ehrenbergii (Gervais, 1841) (Figures 1–19, 21–24)

Scorpio ehrenbergii Gervais, 1841, p. 282.
Scorpio glaber Gervais, 1841, p. 285 (synonymized by Simon, 1880, p. 397).
Scorpio (Telegonus) ehrenbergii: Gervais, 1843, p. 131; 1844a, p. 230; 1844b, p. 59.
Scorpio (Telegonus) glaber: Gervais, 1844b, p. 59.
Telegonus politus L. Koch, 1867, p. 234 (synonymized by Kraepelin, 1894, p. 216).
Mecocentrus ehrenbergi: Simon, 1880, p. 397.
Brachistosternus ehrenbergi: Pocock, 1893, p. 403; Kraepelin, 1899, p. 192; 1911, p. 85; Werner, 1939, p. 357; Mello-Leitão, 1945, p. 228; Aguilar, 1968, p. 167; Aguilar & Meneses, 1970, p. 2; Maury, 1973a, p. 33.
Brachistosternus ehrenbergii: Kraepelin, 1894 (part.), p. 216; Acosta & Ochoa, 2002, p. 18.
Brachistosternus (Brachistosternus) ehrenbergi: Maury, 1973b (part.), p. 249; Francke, 1977 (part.), p. 75.
Brachistosternus (Brachistosternus) ehrenbergii: Lowe & Fet, 2000, p. 48 (detailed synonymic list); Prendini, 2000, p. 41; 2003, p. 169.
Nec: Maury, 1973b, p. 250, 251 (part: references from Bolivia and Argentina).

Type material

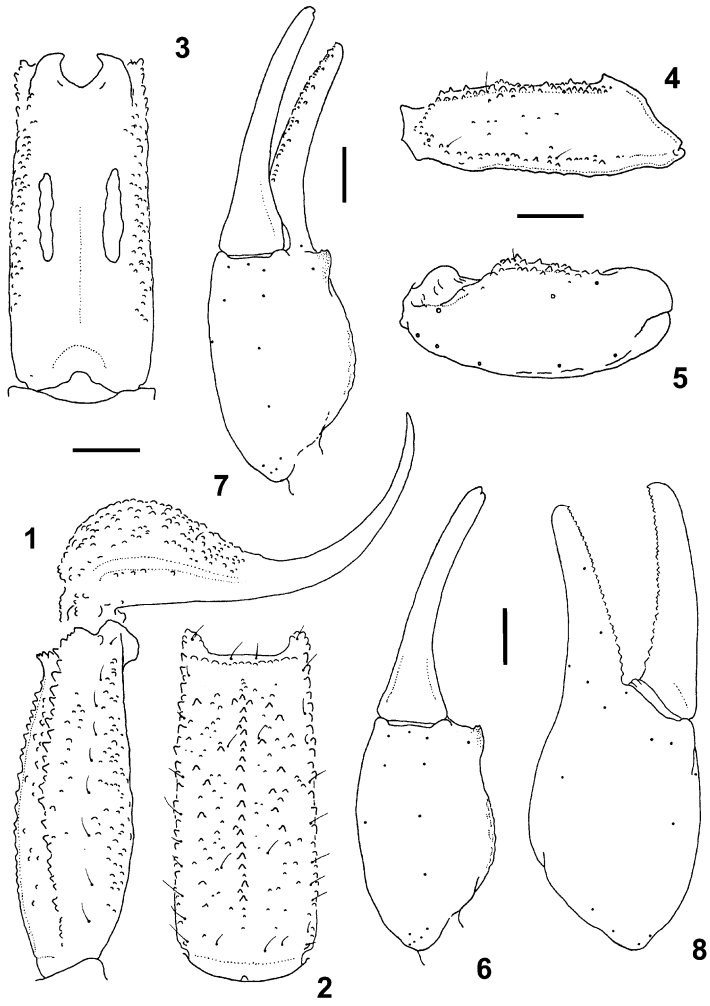
Syntypes: Peru, Callao, M. Gaudichaud coll., RS.0615, RS.O616, Muséum National d'Histoire Naturelle, Paris.

Diagnosis

Brachistosternus ehrenbergii can be distinguished from the remaining species of the genus by the shape of its hemispermatophore; in *B. ehrenbergii* the cylindrical apophysis is dorsoventrally flattened, surrounding part of the laminar apophysis, whereas in the rest of the species of the genus the cylindrical apophysis has a tubular shape, and is clearly separated from the laminar apophysis. This species can also be distinguished from the rest of the known species of the genus by having five to seven ventral trichobothria on the patella (Figure 22), whereas the remaining species have three or four; only *B. pegnai* shares the same trichobotrial pattern of *B. ehrenbergii* but its identity should be confirmed.

Description

Colour: general colour: yellowish, with a dense dusky pattern on the tergites. Chelicerae depigmented. Carapace: ocular tubercle and lateral ocelly black, the rest in most specimens has a reddish colour that is very intense in living animals, but gets opaque in ethanol-preserved specimens; in

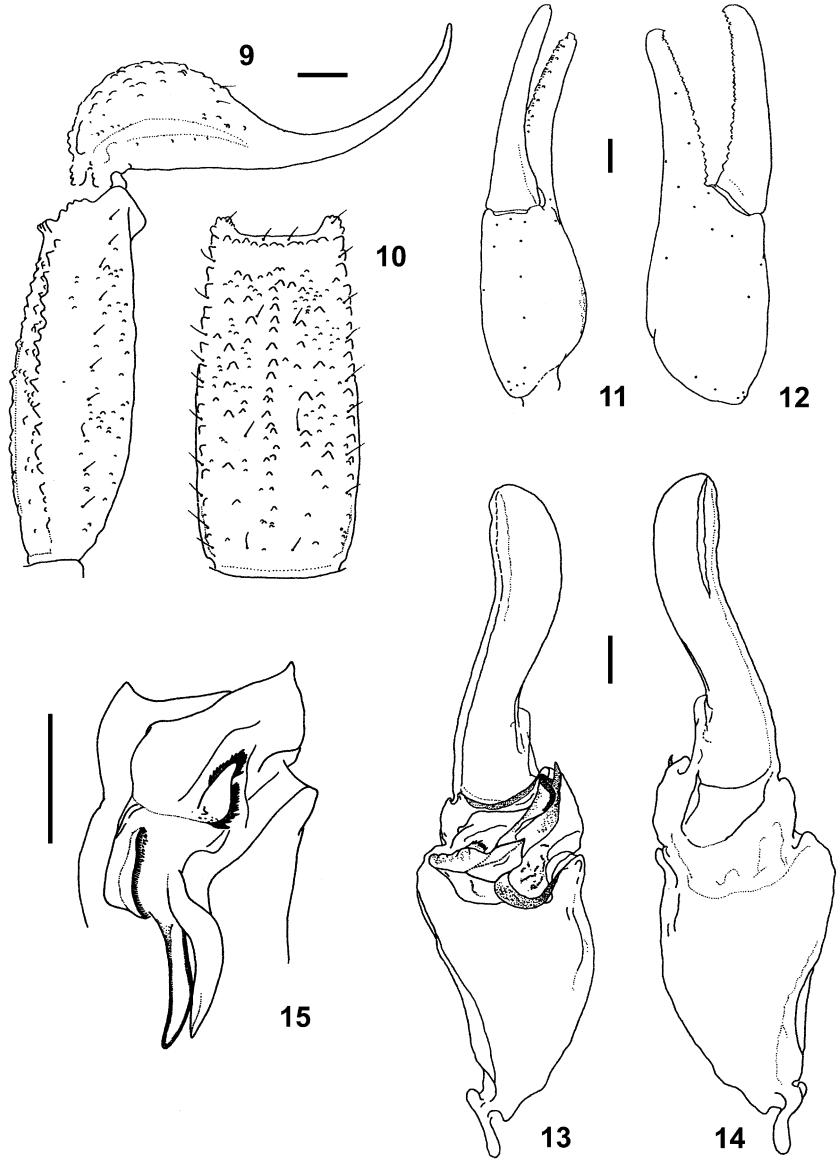


Figures 1–8. *Brachistosternus (B.) ehrenbergii* (Gervais, 1841), male (MHNC). (1) Metasomal segment V and telson, lateral view. (2, 3) Metasomal segment V: (2) ventral view; (3) dorsal view. (4) Right pedipalp femur, dorsal view. (5) Patella, dorsal view. (6–8) Chela: (6) ventral view; (7) ventromedial view; (8) lateral view. Scale bars: 2 mm.

more pigmented specimens, the area from the ocular tubercle to the front margin is densely pigmented. Legs: usually depigmented, but in more pigmented specimens femur and patella are almost completely covered by pigment. Pedipalps: depigmented in most specimens, but in more pigmented specimens femur and patella have a dense reticulated pigmentation. Tergites I–VI densely pigmented, except for a few small clear areas; in some specimens there is a median depigmented stripe; tergite VII: usually depigmented, but in some specimens there are two lateral spots near the anterior margin, in more pigmented specimens all the segment is densely pigmented. Sternites depigmented. Metasoma: usually depigmented except for some spots near the articulation of the segments, but in more pigmented specimens almost all the surface of segments IV and V is densely pigmented. Telson: vesicle depigmented, acculeus dark brown.

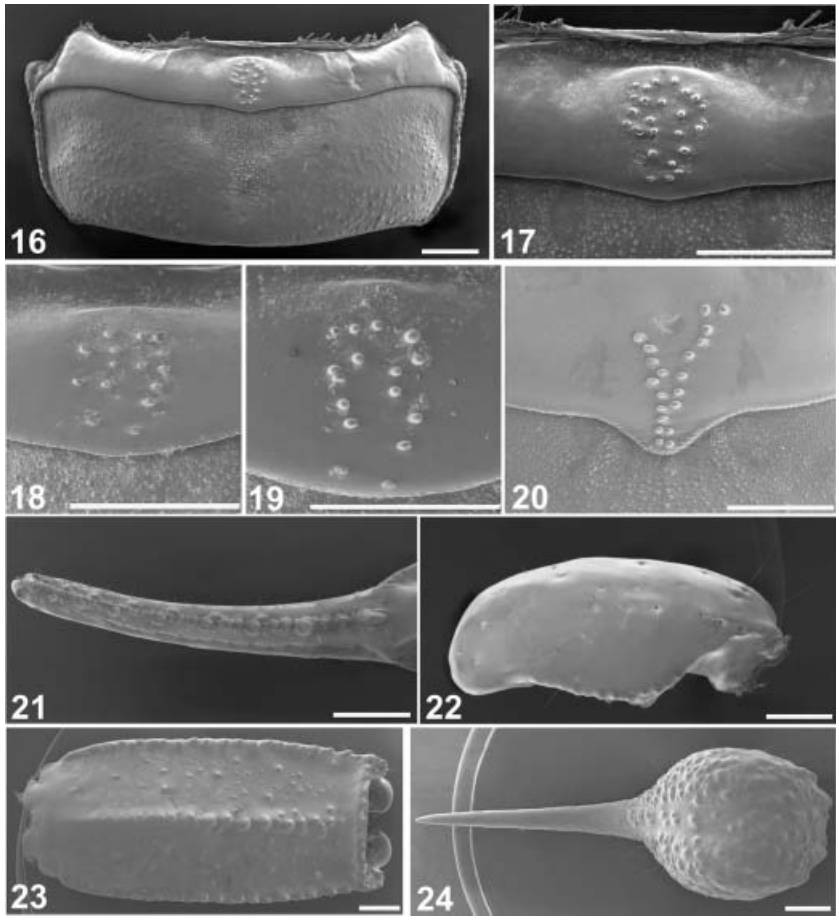
Morphology

Measurements of a male specimen and a female specimen in Table I. Chelicerae: with two subdistal teeth. Carapace: anterior edge with a slight median bulge; tegument with abundant coarse granulation, specially in males; anterior and posterior longitudinal sulcus, lateral sulcus, and postocular furrow deeply marked; ocular tubercle well developed, in the middle of the carapace, eyes two diameters apart, with a slight interocular sulcus. Tergites I–VI: tegument granular in males, smooth in females; tergite VII: granular tegument, with four longitudinal carinae; pretergites with a small group of granules in median position, these granules are poorly developed in tergite I, and well developed in the rest of the segments (Figures 16–19); these groups of granules have a stridulatory function (see ''Comments''). Sternites: finely granular in males, especially in segment V, smooth in females; spiracles narrow and well developed. Metasoma: segment I:



Figures 9–15. *Brachistosternus (B.) ehrenbergii* (Gervais, 1841). (9–12) Female (MHNC): (9) metasomal segment V and telson, lateral view; (10) metasomal segment V, ventral view; (11, 12) right pedipalp chela: (11) ventromedial view, (12) lateral view. (13–15) Left hemispermatophore: (13, 14) male (MHNC): (13) internal view, (14) external view; (15) male (MACN-Ar), detail of the lobe region of the hemispermatophore. Scale bars: 1 mm.

DL and LSM carinae well developed and extending the entire length of the segment, with the distal granules slightly more developed than the rest, LIM carinae present only in the second half of the segment, dorsal and lateral surfaces granular in males, smooth in females, ventral surface densely granular in males, smooth in females. Segments II and III: LSM carinae extend the entire length of the segment but poorly developed, LIM carinae present only in the distal third of the segment, the rest like segment I. Segment IV: DL carinae extend the entire length of the segment, bifurcating in the distal third, and with its lower branch connecting with the LSM carinae, LSM carinae complete but poorly developed, represented by a slight elevation of the tegument in the anterior two-thirds of the segment, and by some tiny granules in the distal third; LIM carinae represented only by a slight elevation of the tegument in the distal third of the segment; dorsal and lateral surfaces slightly granular; ventral surface slightly granular in males, smooth in females, with several setae comprising four or five rows. Segment V: (Figures 1–3, 9–10, 23) dorsal surface smooth; DL carinae extend the entire length of the segment; lateral surface densely granular; ventral surface sparsely granular, VL carinae well developed and extending the entire length of the segment, VM carina very well developed, extends the entire length of the segment, and placed in a conspicuous elevation of the tegument; in males the androvestigia are



Figures 16–24. (16–20) Stritulatory organ on pretergites: (16–19) *Brachistosternus (B.) ehrenbergii* (Gervais, 1841), male (MACN-Ar): (16) tergite VI, (17) detail of granules on pretergite VI, (18) pretergite IV, (19) pretergite V; (20) detail on pretergite V in *Timogenes elegans* (Mello-Leitão, 1931), male (MACN-Ar). (21–24) *B. ehrenbergii*, male (MACN-Ar): (21) detail of granules of movable finger of pedipalp chela, (22) pedipalp patella, ventral view, (23) metasomal segment V, ventral view, (24) telson, ventral view. Scale bars: 1 mm.

long and narrow, placed in the middle of the segment (Figure 3); ventral setae usually comprising three rows, each one of two setae (disposition 2-2-2), in some specimens there is an additional row of two setae. Telson: vesicle globose, its ventral surface is densely granular, except for a median smooth sulcus,

Table I. Measurements (mm) of the male and female of *Brachistosternus (B.) ehrenbergii* (Gervais).

	Male	Female
Total length	79.5	70.9
Carapace: length	10.1	9.6
Carapace: anterior/posterior width	6.4/9.5	5.5/9.7
Mesosoma, length	17.3	16.1
Metasoma, length	52.1	45.2
Metasomal segment I, length/width	6.4/5.5	5.7/5.6
Metasomal segment II, length/width	7.5/5.3	6.5/5.2
Metasomal segment III, length/width	7.5/5.1	6.7/4.9
Metasomal segment IV, length/width	8.3/4.7	7.2/4.5
Metasomal segment V, length/width/height	9.5/4.5/3.6	8.4/4.5/3.5
Telson, length	12.9	10.7
Vesicle, length/width/height	6.1/4.3/3.4	5.5/3.9/2.9
Sting, length	6.8	5.2
Pedipalp, total length	32.5	26.0
Femur, length/width	8.1/2.7	6.3/2.3
Patella, length/width	7.9/3.5	6.5/2.8
Chela, length/width/height	16.5/4.8/6.1	13.2/3.9/4.7
Movable finger, length	9.5	7.3

that divides the surface in two lobes, dorsal surface smooth, no telson gland was observed in males; acculeus longer than the vesicle, slightly curved, being longer and more curved in males (Figures 1, 9, 24). Pedipalps: trichobothrial pattern, typical of subgenus *Brachistosternus*, neobothriotaxic major type C: femur with three trichobothria: 1 *d*, 1 *i* and 1 *e*; patella with 21–23 trichobothria: five to seven ventral trichobothria (usually six, see ''Variability''), 2 *d*, 1 *i*, 3 *et*, 1 *est*, 2 *em*, 2 *esb*, y 5 *eb*; chela with 27 trichobothria: 1 *est*, 2 *et*, 5 *v*, 1 *esb*, 1 *dt*, 1 *dst*, 1 *dsb*, 1 *db*, 1 *ib*, 1 *it*, 1 *Db*, 1 *Dt*, 1 *Esb*, 3 *Eb* and 1 *eb*. Femur: DI, DE and VI carinae very well developed (Figure 4), internal surface with scattered granulation; VE carina poorly developed; EM carina slightly marked in males, absent in females. Patella: DI and VI carinae very well developed, VE carina slightly marked (Figure 5), internal surface with several coarse granules. Chela stout, with a very well developed VM carina; more robust in males, and with a very well-developed prolateral apophysis; in females, instead of the internal apophysis, there is only a small bulge (Figures 6–8); median row of denticles of chelal fingers arranged in a contiguous straight line, with seven to nine pairs of inner and outer accessory denticles, the outer accessory denticles tend to overlap with the median denticle row near the base of the finger, being the two or three more basal always included in the median row (Figure 21). Legs: trochanter and femur finely granular on the prolateral surface; telotarsi: with numerous setae (see ''Variability''). Pectines: well developed, with 30–46 pectinal teeth (see ''Variability''). Hemispermatophore (Figures 13–15): distal lamina longer than the basal portion and slightly curved; distal crest almost straight; distal lobe very well developed; laminar apophysis well developed, and longer than the cylindrical apophysis; the cylindrical apophysis is very well developed, and dorsoventrally flattened, surrounding part of the laminar apophysis; basal spines well developed; spines in a row well developed, next to the basal spines; internal spines reduced to a few granules, and placed in front of the basal triangle; basal triangle very well developed and very elongated, formed by three or four thick crests.

Variability

Total length: males 60.2–89.3 mm; females up to 93.7 mm.

Number of pectinal teeth: males (n=49 pectines): 37 teeth (3 pectines), 38 (2), 39 (6), 40 (12), 41 (10), 42 (8), 43 (6), 44 (0), 45 (1), 46 (1); females (n=55 pectines), 30 (1), 31 (3), 32 (4), 33 (9), 34 (7), 35 (14), 36 (8), 37 (7), 38 (2).

Number of ventral trichobothria on pedipalp patella (n=40 specimens): 5 (3 specimens), 6 (36), 7 (1).

Telson length/height ratio: males, 3.36–3.80 (mean=3.50; n=13); females, 3.45–3.69 (media=3,59; n=10).

Pedipalp chela length/width ratio: males, 3.23–3.86 (mean=3.39; n=14); females, 3.38–3.72 (media=3.57; n=10).

Pedipalp chela length/height ratio: males, 2.67–3.09 (mean=2.81; n=14); females, 2.79–3.03 (media=2.91; n=10).

Number of setae of metasomal segment V:

- Dorsal lateral (n=56): 0 (56 specimens).
- Lateral (n=56): 8 (15), 9 (32), 10 (8), 11 (1).
- Ventral lateral (n=56): 8 (17), 9 (33), 10 (5), 11 (1).
- Ventral (n=28): 4 (1), 5 (3), 6 (20), 7 (3), 8 (1).

Number of setae of tarsus III (n=60):

- Dorsal setae of telotarsus: 10 (2), 11 (20), 12 (26), 13 (10), 14 (2).
- Lateroventral setae of telotarsus: 8 (13), 9 (38), 10 (9).
- Dorsal setae of basitarsus: 7 (15), 8 (42), 9 (3).

Distribution and habitat

Brachistosternus ehrenbergii was recorded from Ecuador, Peru, Chile, Bolivia and Argentina, but we verified its presence only along the Pacific coast, from central Peru to northern Chile. This species has been collected from sea level up to 2550 m a.s.l., in the western slopes of West Andes (Figure 25).

Our sampling suggests that *B. ehrenbergii* is an exclusive scorpion of sandy areas, corresponding to the ''Pacific desert'' and the lowest portion of the ''Serrania Esteparia''. The change in geological conditions, climate and vegetation in the highest portion of the ''Serrania Esteparia'' marks the limit of its distribution.

This species generally builds burrows in sand (up to 25 cm), nevertheless it has been captured under stones or lumps also. *B. ehrenbergii* is a very common scorpion, it can be found around agricultural areas, farms, roads and Lomas biotope; some specimens were found around cities and other specimens were collected in urban centres (Lima, Arequipa, Ilo and Tacna). Aguilar (1968) called it as ''escorpión de los arenales'' (scorpion of the sands).

The record from Bolivia referred by Kraepelin (1911) as *B. ehrenbergi* var. *politus* (L. Koch, 1867), if it is not a mistake of the origin of the specimens, probably corresponds to the old Bolivian territories

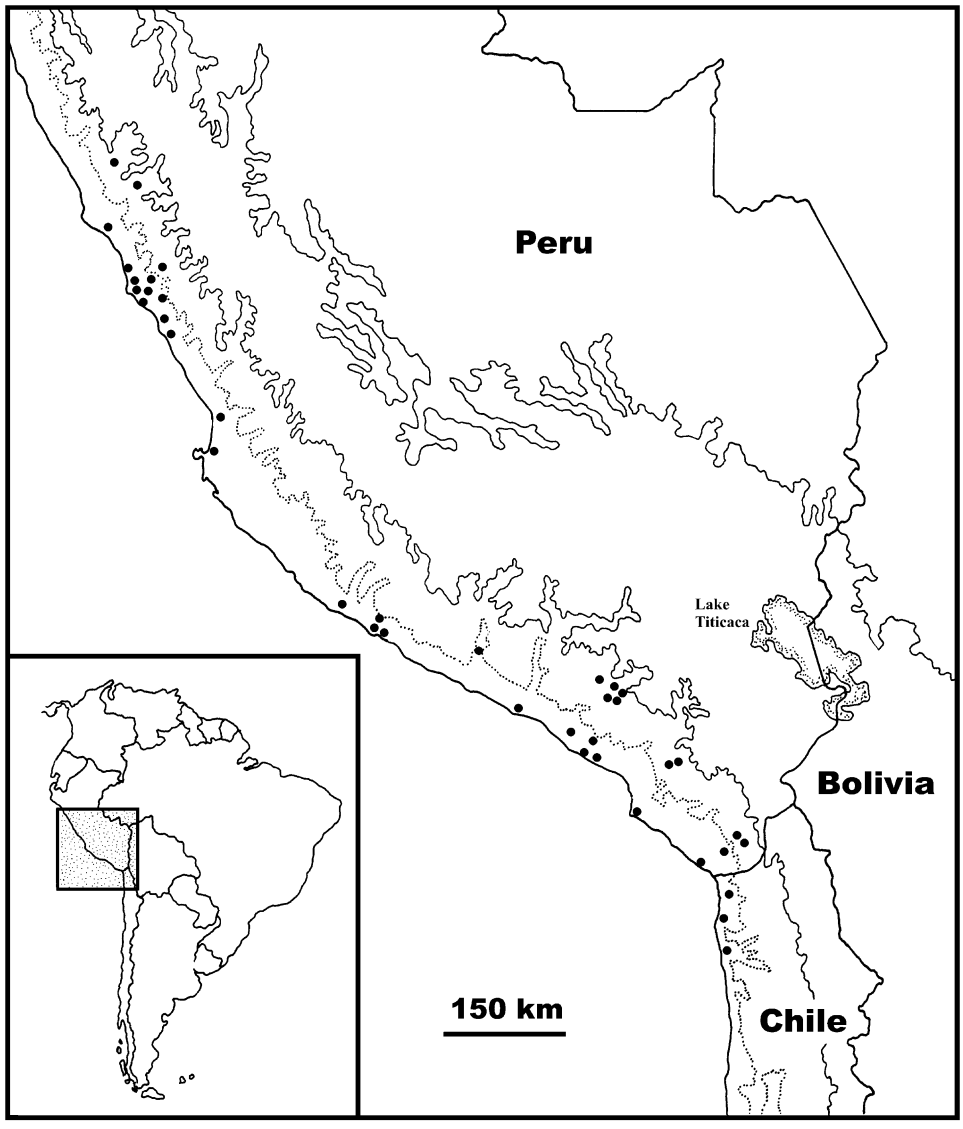


Figure 25. Distribution of *Brachistosternus (B.) ehrenbergii* (Gervais, 1841), in Peru and Chile. Dotted line=1000 m; solid lines=3800 m altitude. Inset: location of the area represented in South America.

in the Pacific coast, belonging to Bolivia until 1879; currently Region Antofagasta of Chile (Acosta & Ochoa, 2002). Maury (1973b) mentioned this species from Cochabamba (Bolivia) but its presence in this Bolivian locality is improbable; we also believe that Maury's supposition (Maury, 1973b, p. 251, 1974, p. 74) that *Brachistosternus holmbergi* Carbonell, 1923 (described from Jujuy, Argentina) could be *B. ehrenbergii* is unlikely to be true, and it probably corresponds to an error in the origin of the specimen. Records from northern Peru and Ecuador (Francke, 1977; Lourenço, 1983, 1995) also need confirmation.

Comments

B. ehrenbergii is the only species of the genus which has the small group of granules on the pretergites, mentioned previously. This group of granules has notable similarities with the stridulatory organ described in *Timogenes* by Acosta & Maury (1990). We observed in living animals that when they are disturbed they produce a noise by the friction between the pretergites and the posterior border of tergites when the mesosoma is arching; this sound is similar to the one produced by large specimens of *Timogenes elegans* (Mello-Leitão, 1931) in the same circumstances (J. A. Ochoa & A. A. Ojanguren Affilastro, personal observation). In their work Acosta & Maury (1990) called "type 5" the stridulatory organ of *Timogene*s. The type of stridulatory organ found in *B. ehrenbergii* should be assigned to the same group, because it only differs in small details with the stridulatory organ in *Timogenes*. In *B. ehrenbergii* the granules are located in a disordered group, on pretergites I–VII; while in

Timogenes the granules have an inverted ''V'' shape, and are located only on pretergites III–VI (see Figures 16–20).

Localities of B. ehrenbergii

Peru: Departamento de Lima: Molina Vieja; Santa María, Chosica; km 35 road Ancón-Balneario, Santa Rosa de Lima; Huanyani; Surco; Santa Inés, Chaclacayo; Urbanización Palao, km 5 road to Ancón; Santa María del Mar; Fundo Zapam, km 49 road to Canta; Monterrico; Negritos; Puente Piedra; Medanos de Lachay; lomas of Lachay, lomas of Atocongo, 23 km to south of Lima; lomas of Pachacamac; Playa Arica (km 40); Pamplona, Baja Ciudad de Dios; Cerro Ciudad Universitaria, Universidad Católica; Urbanización El Pacífico, km 8 road to Ancon; km 33 to south of Lima; lomas of San Bartolo; Puerto Viejo, Chillca; Cieneguilla (380 m); Churin; Huaca San Miguel; Lurin (Huamantinco). Departamento de Ica: Tambo, Chincha Alta; Paracas. Departamento Arequipa: Sacaco (near Acari); La Barrera (near Laquipi); Atiquipa; Condesuyos (700 m); Camaná; La Chira, Camaná; between Camaná and Nazca; Arequipa (2300 m); Ciudad mi Trabajo, Arequipa (2333 m); Entrada Charcani 5to (2550 m), Radio Azul (Río Chili); Yura, Arequipa; Miraflores (2327 m), Arequipa; Huayco, Arequipa (2020 m); Lara, Socabaya, Arequipa (2350 m); lomas of Mejía, Islay; playa Mejía, Islay; mountains around Mejía, Islay (300 m); Bombón, Islay (30 m); La Ensenada, Valle de Tambo (Islay); Arenales de Iberia (0–50 m), near Lagunas de Mejía; Punta de Bombón, Islay; Departamento Moquegua: Puerto Ilo (Parque Artesanal), Ilo; Cerro Baul, near Torata (2610 m); mountains around Torata (2280 m). Departamento Tacna: Pocollay (630m), Tacna; Calientes (1500 m); Miculla (1470 m); Quebrada de Burros (300 m), Sama. CHILE: Región Tarapacá: Quebrada Camarones (10–30 m); Quebrada Vitor; Arica-Azapa.

Acknowledgments

We are grateful to curators and institutions for supplying material on loan: Lorenzo Prendini (AMNH), Alfred F. Newton (FMNH), Cristina Scioscia (MACN-Ar), Olintho Aguilar (MHNC), Gerardo Lamas (MUSM), Evaristo López (MUSA) and Enrique Escobar. For help with collection of specimens we thank Camilo Mattoni, Horacio Zeballos P., Juan Carlos Chaparro, Elias Ponce, Roberto Gutiérrez, Ulrich Zanabria, Joaquín Ugarte, Henrry Alayo, Alejandro Pari, José L. Velásquez, Eduardo Berneo, Marco Arenas and Arturo Cornejo. We are indebted to Cristina Scioscia for the help with the English. J.A.O. is grateful to Percy Jiménez, Luís Villegas and Aldo Ortega for their hospitality and help in Lomas de Mejía and Atiquipa. Special thanks to Camilo Mattoni for his help during the travel to Chile. A part of this research was carried out at Universidad Nacional de Córdoba (Argentina) by J.A.O.

References

Acosta LE, Maury EA. 1990. Estridulación en *Timogenes elegans* (Mello-Leitão) (Scorpiones, Bothriuridae). Bol Soc Biol Concepción 61:29–37.

Acosta LE, Ochoa JA. 2002. Lista de los escorpiones bolivianos (Chelicerata: Scorpiones), con notas sobre su distribución. Rev Soc Entomol Argent 6:15–23.

Aguilar PG. 1968. Nota sobre los escorpiones de Lima. An Cient Univ Nac Agraria 6:165–172.

Aguilar PG, Meneses O. 1970. Escorpiones y escorpionismo en el Perú. I. Nota preliminar sobre los Scorpionida Peruanos. An Cient Univ Nac Agraria 8:1–5.

Cekalovic KT. 1969. *Brachistosternus pegnai* n. sp. de escorpión para el Ecuador (Scorpionida-Bothriuridae). Bol Soc Biol Concepción 41:163–171.

Cekalovic KT. 1973. Nuevo carácter sexual secundario en los machos de *Brachistosternus* (Scorpiones, Bothriuridae). Bol Soc Biol Concepción 46:99–102.

Francke OF. 1977. Escorpiones y escorpionismo en el Perú, VI: lista de especies y claves para identificar las familias y los géneros. Rev Per Entomol 20:73–76.

Gervais PM. 1841. Arachnides. In: F, Eydoux Souleyet LFA, editors. Voyage autour du monde exécuté pendant les années 1836 et 1837 sur la corvette La Bonite, commandée par M. Vaillant. Publié par ordre du roi sous les auspices du Département de la Marine. Zoologie. Apteres. Volume 1, Paris: Arthus Bertrand. p. 281–285.

Gervais PM. 1843. Les principaux résultats d'un travail sur la famille des Scopions. Soc Phil Paris. Extraits Procès-Verbaux Seánces 5:129–131.

Gervais PM. 1844a. Remarques sur la famille des Scorpions et déscription des plusieurs espèces nouvelles de la collection du Muséum. Arch Mus Natl Hist Nat Paris 4:201–240.

Gervais PM. 1844b. Scorpions. In: Walckenaer CA, editor. Histoire naturelle des insectes Aptères. Volume 3, Paris: Librarie Encyclopédique de Roret. p. 14–74.

Guérin Méneville FE. 1838. Arachnides. In: Lesson RP, editor. Zoologie. Voyage autour du monde, exécuté par ordre du roi, sur la corvette de sa majesté La Coquille, pendant les années 1822, 1823, 1824 et 1825. Par L. I. Duperrey. Volume 2, part 2, Paris: Bertrand. p. 47–56.

International Commission on Zoological Nomenclature. 2000. International Code of Zoological Nomenclature. 4th ed, London: International Trust of Zoological Nomenclature. p. 1–306.

Koch L. 1867. Beschreibungen neuer Arachniden und Myriapoden. Verh Kaiserlich-Königlichen Zool-Bot Ges Wien 17:173–250.

Kraepelin K. 1894. Revision der Scorpione. II. Scorpionidae und Bothriuridae. Beih Jahrb Hambg Wiss Anstalten 11:1–248.

Kraepelin K. 1899. Scorpiones und Pedipalpi. In: Dahl F, editor. Das Tierreich. Herausgegeben von der Deutschen Zoologischen Gesellschaft. Volume 8, Arachnoidea, Berlin: R. Friedländer und Sohn Verlag. p. 1–265.

Kraepelin K. 1911. Neue Beiträge zur Systematik der Gliederspinnen. Mitt Naturhist Mus 28:59–107 (2, Beih Jahrb Hambg Wiss Anstalten, 1910).

Lourenço WR. 1983. Resultados faunisticos de diversas campañas realizadas en América Latina. IV. Estudo de uma pequena coleção de escorpiões do Perú e Equador, com a redescrição de *Tityus ecuadorensis* Kraepelin, 1896. Speleon 26:11–15.

Lourenço WR. 1995. Les scorpions (Chelicerata, Scorpiones) de l'Équateur avec quelques considérations sur la biogéographie et la diversité des espèces. Rev Suisse Zool 102:61–88.

Lourenço WR, Cloudsley-Thompson JL. 1995. Stridulatory mechanisms and the evolutionary significance of sound production in *Rhopalurus* species (Scorpiones, Buthidae). J Arid Environ 31:423–429.

Lowe G, Fet V. 2000. Family Bothriuridae Simon, 1880. In: Fet V, Sissom WD, Lowe G, Braunwalder ME, editors. Catalog of the scorpions of the world (1758–1998). New York: The New York Entomological Society. p. 17–53.

Maury EA. 1973a. Essai d'une classification des sous familles de scorpions Bothriuridae. In Proceedings of the 5th International Congress of Arachnology, Brno. 1971. p. 29–36.

Maury EA. 1973b. Las tricobotrias y su importancia en la sistemática del género *Brachistosternus* Pocock, 1894 (Scorpiones, Bothriuridae). Physis (C) 32:247–254.

Maury EA. 1974. Escorpiofauna Chaqueña. 1. La verdadera identidad de *Brachistosternus (Microsternus) ferrugineus* (Thorell 1876) (Bothriuridae). Physis (C) 33:73–84.

Mello-Leitão C. 1945. Escorpiões sul-americanos. Arq Mus Nac 40:7–468.

Pocock RI. 1893. Contributions to our knowledge of the arthropod fauna of the West Indies. Part I. Scorpiones and Pedipalpi, with a supplementary note upon the freshwater Decapoda of St. Vincent. J Linn Soc 24:374–409.

Prendini L. 2000. Phylogeny and classification of the superfamily Scorpionoidea Latrielle 1802 (Chelicerata, Scorpiones): an exemplar approach. Cladistics 16:1–78.

Prendini L. 2003. A new genus and species of Bothriurid scorpion from the Brandberg Massif, Namibia, with a reanalysis of Bothriurid phylogeny and a discussion of the phylogenetic position of *Lisposoma* Lawrence. Syst Entomol 28:149–172.

Simon E. 1880. Études arachnologiques. 9e Mémoire (1). XVIII. Déscriptions de genres et espèces de l'ordre des Scorpiones. Ann Soc Entomol France 5:377–398.

Stahnke HL. 1970. Scorpion nomenclature and mensuration. Entomol News 83:121–133.

Vachon M. 1963. De l'utilité, en systématique, d'une nomenclature des dents de chelicères chez les scorpions. Bull Mus Natl Hist Nat (Ser 2) 35:161–166.

Vachon M. 1974. Étude des caractères utilisés pour classer les familles et les genres de scorpions (Arachnides). 1. La trichobothriotaxie en Arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les scorpions. Bull Mus Natl Hist Nat (Ser 3) 140:857–958.

Werner F. 1939. Neu-Eingänge von Skorpionen im Zoologischen Museum in Hamburg. II. Teil. Festschift zum 60. Geburtstage von Professor Dr. Embrik Strand 5:351–360.