

A NEW SPECIES OF *BOTHRIURUS* FROM BRAZIL (SCORPIONES, BOTHRIURIDAE)

Camilo Iván Mattoni¹ and **Luis Eduardo Acosta**: Cátedra de Diversidad Animal I, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba, Av. Vélez Sarsfield 299, X5000JJC Córdoba, Argentina. E-mail: cmattoni@com.uncor.edu

ABSTRACT. A new species of scorpion from southern Brazil, *Bothriurus pora*, is described. The hemispermatophore of this species is unique within the genus, displaying a highly developed and extremely complex capsular region. External morphology and shape of the sperm packages show a close relationship with the *Bothriurus bonariensis* species group.

RESUMEN. Se describe una nueva especie de escorpión del sur del Brazil, *Bothriurus pora*. El hemispermatóforo de esta especie presenta caracteres únicos en el género, con una región capsular muy desarrollada y extremadamente compleja. Su morfología externa y la forma general de sus paquetes espermáticos demuestran una relación cercana con el grupo de especies *Bothriurus bonariensis*.

Keywords: Scorpiones, Bothriuridae, *Bothriurus*, bonariensis group, taxonomy, Brazil, Neotropics

The genus *Bothriurus* Peters 1861 (Scorpiones, Bothriuridae) comprises small to medium-sized scorpions, distributed over a large part of South America (Argentina, Chile, Uruguay, Bolivia, Paraguay, southern Peru, and from southern to northwestern Brazil) in diverse habitats including deserts, steppes, dry forests, mountains, savannas and rainforests (Maury 1979, 1982; Lourenço & Maury 1979; Acosta & Ochoa 2002; Mattoni 2003). The genus currently contains 36 valid nominal species (Lowe & Fet 2000; Mattoni 2002a, 2002b, 2002c; Ojanguren Affilastro 2002, 2003), although the actual number should reach around 45 (Mattoni 2003), making it the most diverse genus of Bothriuridae. *Bothriurus* species are presently placed in 13 species groups, characterized by both somatic and genitalic characters (Maury 1979, 1982, 1984; Lourenço & Maury 1979; Maury & Acosta 1993; Mattoni 2002b). These “groups” show considerable internal uniformity, and some may be monophyletic (Acosta & Peretti 1998; Mattoni 2003). Although a previous analysis (Prendini 2000, 2003) questioned the mono-

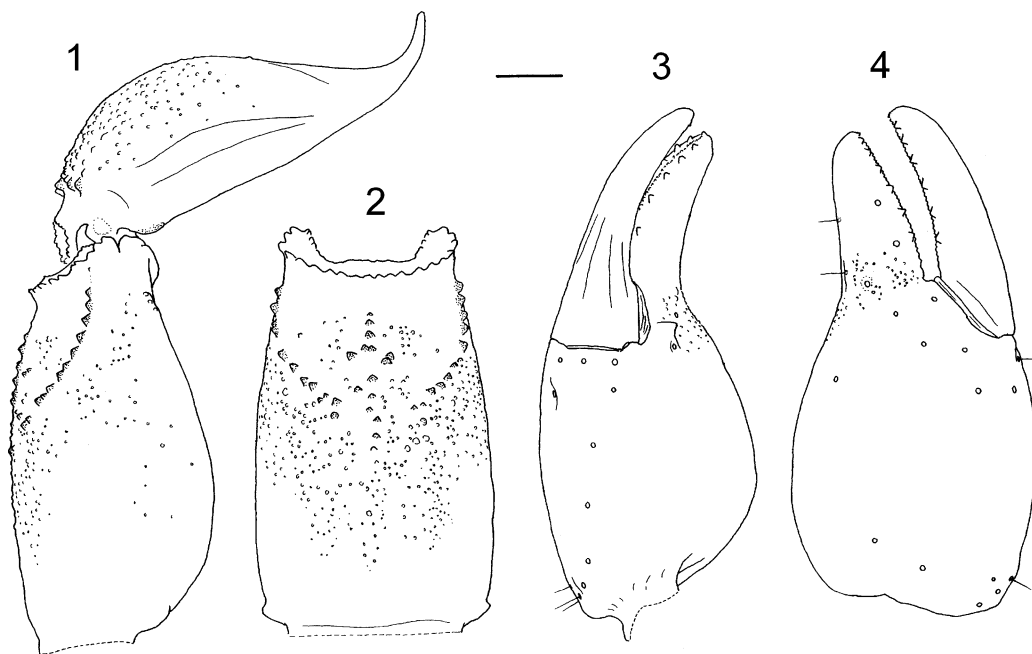
phyly of *Bothriurus*, a more recent phylogenetic analysis demonstrates, albeit with weak support, that *Bothriurus* is monophyletic (Mattoni 2003).

During the course of a larger revision of *Bothriurus*, a single *Bothriurus* male that could not be assigned to any of the known species groups, was discovered in the collection of the Instituto Butantan, São Paulo, Brazil. Its external morphology suggested a close relationship to the *bonariensis* group (Maury & Acosta 1993; Ojanguren Affilastro 2003), but the complex morphology of its hemispermatophore was unlike any other species of *Bothriurus*. The specimen is described below as *B. pora* new species.

METHODS

Terminology for general morphology follows that of Stahnke (1970), except for the pedipalp (Francke 1977) and metasomal carinae (Prendini 2000, 2003), trichobothrial nomenclature (Vachon 1974) and pedipalp segmentation (Sissom 1990). The nomenclature of the hemispermatophore is based on San Martín (1963, 1965), Peretti (1992) and Maury & Acosta (1993); we maintained the abbreviations derived from the names in Spanish, since they were widely used in the literature. Carinae of metasomal segments are

¹ Current address: Department of Invertebrate Zoology, American Museum of Natural History, 79th St. at Central Park West, New York, NY 10024 USA. E-mail: emattoni@amnh.org



Figures 1–4.—*Bothriurus pora* new species, holotype male (IBSP-SC); 1. Metasomal segment V and telson, lateral view; 2. Metasomal segment V, ventral view; 3–4. Right pedipalp chela; 3. Ventrointernal view; 4. External view. Scale bar = 1 mm.

abbreviated as follows: DSM = dorsal submedian; DL = dorsal lateral; LSM = lateral suprmedian; LM = lateral median; LI = lateral infrmedian; VL = ventral lateral; VSM = ventral submedian; VM = ventral median. Hemispermaphore structures: L = lamina; c.d. = distal crest of lamina; r.f. = frontal fold; c.f. = frontal crest; Pb. = basal portion; l.i. = internal lobe of capsule; l.b. = basal lobe of capsule; l.e. = external lobe of capsule; c.c. = capsular concavity; r.b. = basal fold. The material examined are deposited at Instituto Butantan, São Paulo, Brazil (IBSP-SC); Cátedra de Diversidad Animal I, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba, Argentina (CDA); Museu de Ciências Naturais, Fundação Zoológica do Rio Grande do Sul, Porto Alegre, Brazil (MCN); and Museu de Zoologia da Universidade de São Paulo, Brazil (MZUSP). All measurements are in mm and were taken using an ocular micrometer. Illustrations were produced using a Leica MS5 stereomicroscope and camera lucida.

***Bothriurus pora* new species**

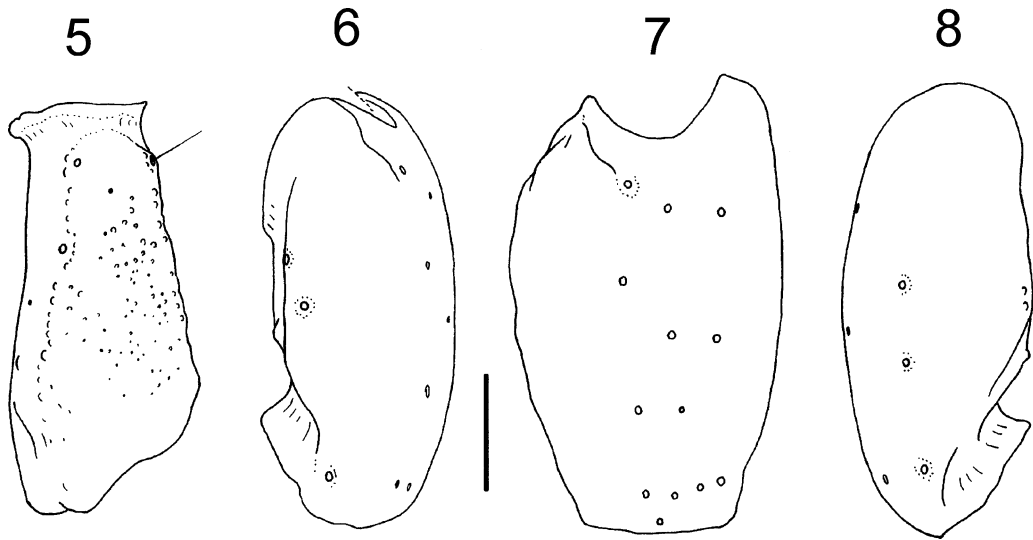
Figs. 1–16, 23

? *Bothriurus bonariensis*: Brazuna & Koller, 1998: 1 (probable misidentification).

Type.—Holotype male, BRAZIL: *Estado de Mato Grosso do Sul*: Ponta Porã (22°32'S, 55°43'W), 652 m, 13 December 1966, N.P.V. Salvaeno (IBSP-SC 937).

Etymology.—The species name is a noun in apposition taken from the type locality.

Diagnosis.—In terms of external morphology, *B. pora* appears most closely related to the bonariensis group: *B. bonariensis* (C.L. Koch 1842), *B. chacoensis* Maury & Acosta 1993, and *B. jesuita* Ojanguren Affilastro 2003. All of these species share a similar arrangement of the ventral carinae of metasomal segment V. However, subtle differences exist. In *B. bonariensis*, the VL and VSM carinae are almost connected medially (Figs. 19, 20), whereas in the other species they are not completely fused, leaving a small median gap; the most distal granules of the VM carina (slightly more developed) are placed in that space. The ventral surface of segment V is noticeably granular in *B. pora* (Fig. 2), compared with other species of the bonariensis group, in which it is smooth (Fig. 20). The DSM carinae of the metasomal segments I to IV are more weakly developed in the bonariensis group (represented only by terminal granules),



Figures 5–8.—*Bothriurus pora* new species, holotype male (IBSP–SC); 5. Right pedipalp femur, dorsal view; 6–8. Right pedipalp patella; 6. Dorsal view; 7. External view; 8. Ventral view. Scale bar = 1 mm.

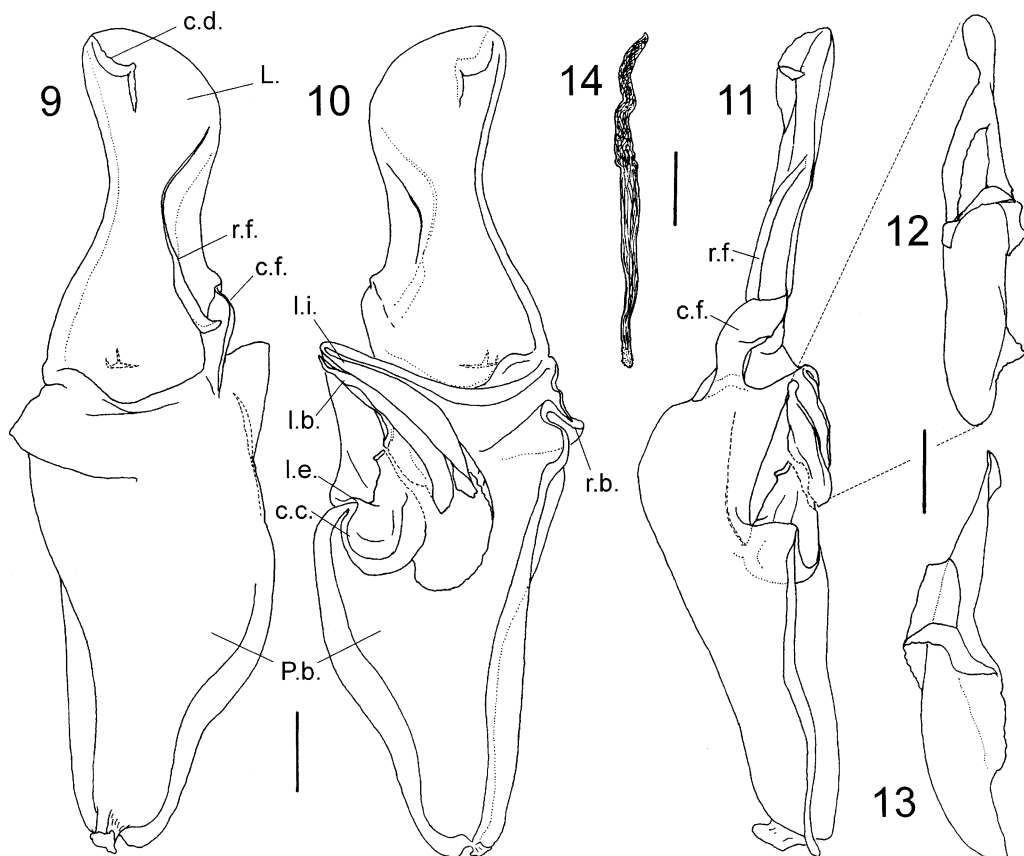
whereas in *B. pora* they are granular throughout. *Bothriurus pora* shares with the bonariensis group a robust habitus and dark coloration. Another important similarity is the pronounced dorsal gland of the male telson, which occupies the entire dorsal surface of the vesicle. However, in the bonariensis group, the gland is contained in a large depression which is absent in *B. pora*. The chaetotaxy of the metasoma is quite similar between the species of the bonariensis group and *B. pora* (Figs. 15–18), however, the latter shows a pair of ventromedian chetae on Segment III that is absent in the bonariensis group.

In spite of many external similarities, the hemispermatochore of *B. pora* is markedly different. The hemispermatochore of *B. pora* is unique in *Bothriurus*, presenting characters not previously observed in other bothriurid species (Figs. 9–13). The lamina exhibits a well developed r.f. and c.f., and a curved internal crest. The lobe region is extremely complex, with l.b. elongated and concave, bearing partitions in its dorsal surface. In the bonariensis group, the lamina is more elongated, with c.f. much more extended, and l.b. larger and triangular in shape (Figs. 21, 22). A feature shared by both *B. pora* and the *B. bonariensis* species group is the general morphology of the sperm packages (as preserved in 80% ethanol), which display a strongly gnarled, helicoidal anterior region (Peretti &

Battán-Horenstein 2003). In *B. pora*, however, the degree of torsion is less marked than in the *bonariensis* group.

Several robust synapomorphies (e.g., shape and size of spiracles, shape of sperm packages, position of *Et3* trichobothria on chela) suggest that *B. pora* is the sister taxon of the *bonariensis* species group (Mattoni 2003). Also the bonariensis species group is supported by several synapomorphies: the large depression on the dorsal surface of the telson, the hemispermatochore (similar in all the species of the group), and the pigmentation pattern of the ventral face of the metasoma (with two lateral stripes) (Mattoni 2003). However, the hemispermatochore of *B. pora* is clearly divergent, with many unique characters not previously observed in the family Bothriuridae (see, e.g., Maury 1980). The structure of the basal lobe, which bears thin dorsal walls, raises questions about its function, as this part enters the female atrium during sperm transfer (Peretti 1992).

The helicoidal end of the sperm package in *B. pora* and the three species of the bonariensis group, has not been recorded in other *Bothriurus* species, or in any other bothriurid (Peretti & Battán-Horenstein 2003; Mattoni 2003). The shape observed in *B. pora*, with a slightly helicoidal end, might represent an intermediate condition between the marked helicoid in the bonariensis group and the straight



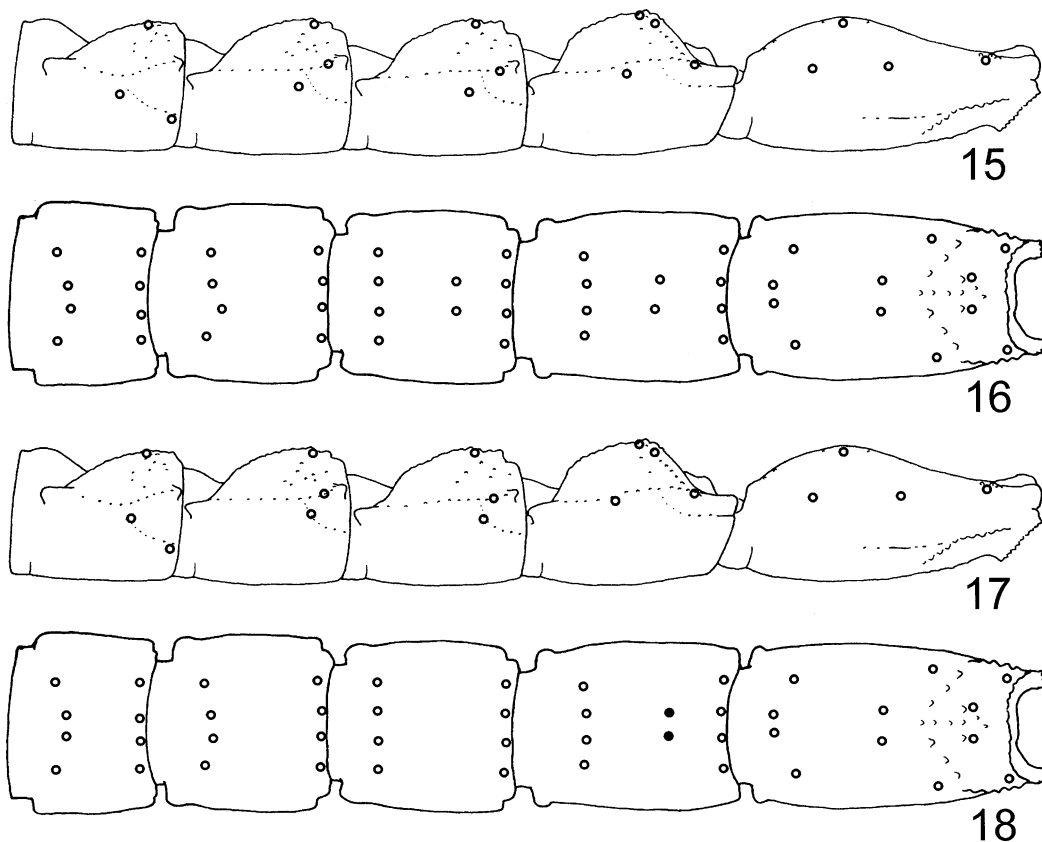
Figures 9–14.—*Bothriurus pora* new species, holotype male (IBSP-SC); 9–13. Right hemispermatophore; 9. External view; 10. Internal view; 11. Frontal view; 12–13. Detail of basal lobe; 12. Dorsal view; 13. Laterointernal view; 14. Sperm package. Scale bars = 1 mm (Figs. 9–11); 0.5 mm (Figs. 12–13); 50 μ m (Fig. 14).

condition of all remaining *Bothriurus* species (Mattoni 2003). Similarly, the morphology of the front crest (c.f.) of the hemispermatophore in *B. pora* resembles that observed in the bonariensis group, which display a plain front surface and undulated edge, though much less strongly developed.

Since the bonariensis group is longely defined through its characteristic hemispermatophore morphology, we are convinced that is not advisable to include *B. pora* as a member of this group, maintaining it just as its sister taxon.

Description.—*Coloration:* In general, brown to orange-brown, with patches of dark brown pigmentation. Carapace brown, densely pigmented near the median ocelli, and extended laterally; transverse spot on anterior margin, posterolateral margins reticulate. Tergites

almost completely and diffusely pigmented, more densely on the pretergites and the posterior edge; submedian areas with small, irregular clear dots inside the pigmented area. Legs yellowish, densely spotted prolaterally and retrolaterally; tarsi depigmented. Coxa, genital operculum and pectines faintly reticulate. Chelicerae yellowish, with very faint spots dorsally, forming longitudinal stripes that reunite transversely at the base of the fingers. Pedipalp patella and femur with numerous spots dorsally; chela with longitudinal stripes externally, joining transversely near the base of the fingers. Sternites broadly pigmented, increasing in intensity from sternite I–V. Metasoma dark orange-brown. Segments I–IV each with a wide diffuse subtriangular spot dorsally, and a transverse spot on the posterior border; segment V with a pale spot of retic-



Figures 15–18.—Distribution of macrosetae on metasoma (carinae schematic, not to scale); 15–16. *Bothriurus pora* new species, holotype male (IBSP–SC); 15. Lateral view; 16. Ventral view. 17–18. *Bothriurus bonariensis* group; 17. Lateral view; 18. Ventral view (the pair of setae in black is absent in *B. bonariensis*).

ulate, diffuse pigment, proximally. Lateral surfaces diffusely reticulate, reticulations merging ventrolaterally. Ventral surface with three longitudinal stripes (median weaker) uniting in distal half or one third of each segment. Telson reddish brown, almost depigmented, but with a narrow, longitudinal, median line ventrally; and a wide yellow area ventrally.

Morphology: Medium-sized scorpion of robust habitus. Total length: 38.11 mm (detailed measurements: Table 1). Carapace and tergites very finely and evenly granular, giving matt appearance. Carapace: three pairs of lateral ocelli; ocular tubercle prominent, median ocelli separated by one diameter; anterior margin with weak median notch, anterior median and anterior marginal furrows only weakly developed; median ocular furrow present, lateral ocular furrows weak, median and pos-

teromedian furrows strong, with a depressed area in between, posterior transverse furrows absent, posterolateral furrows well developed. Tergites I–VI acarinate, VII with four short carinae in the posterior quarter, two submedian and two lateral, with scattered granules in between. Sternites acarinate, smooth; spiracles elongated and narrow. Carinae of metasomal segments I–IV: DSM entire, formed by low granules, the distal one more strongly developed; DL present in the posterior half of segments I and IV, and the posterior fifth of segments II and III; surface between DSM and DL with scattered granules; LI vestigial in posterior third of segments I and II, absent on III and IV; VL and VSM absent. Carinae of metasomal segment V: DL only present in posterior third, very weak; LM absent; area between DL and VL with small, scattered granules, more abundant in posterior half; VL

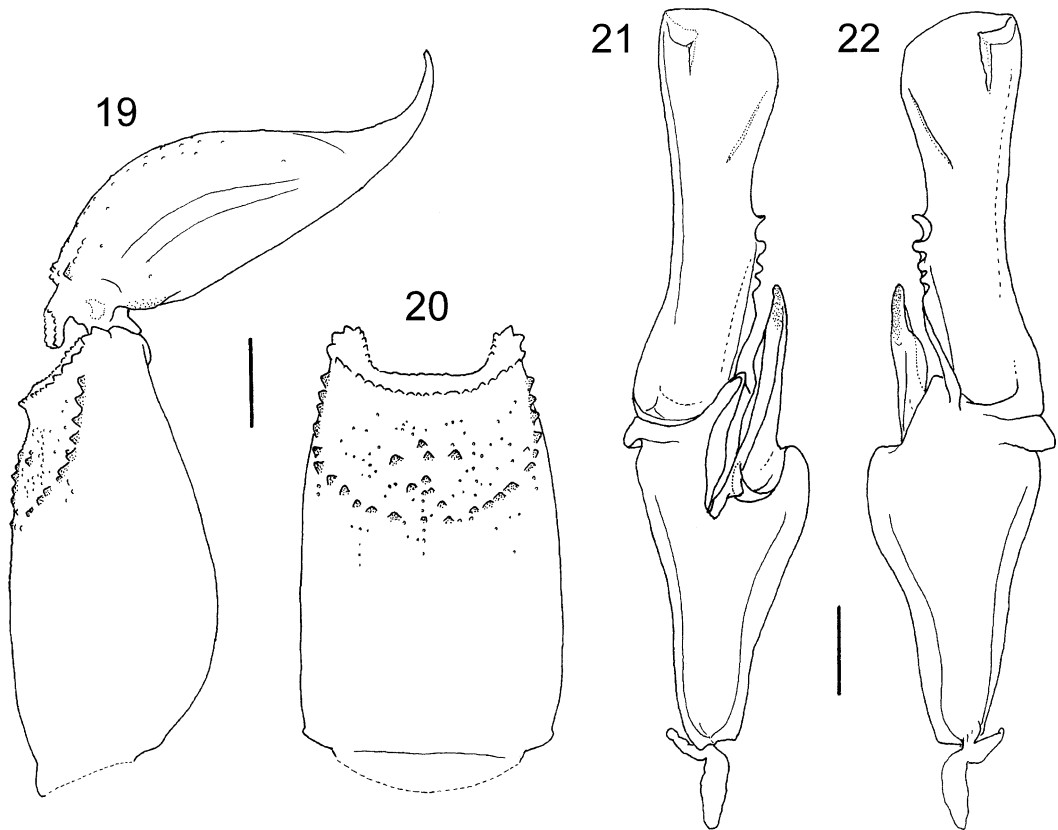
Table 1.—Measurements (mm) of the holotype male of *Bothriurus pora* new species.

Total length		38.11
Carapace	length	5.63
	anterior width	3.34
Mesosoma	length	9.37
Metasoma	length	23.21
	segment I, length	2.27
	width	3.87
	segment II, length	2.73
	width	3.67
	segment III, length	3.07
	width	3.60
	segment IV, length	3.80
	width	3.60
	segment V, length	5.00
	width	3.47
	height	2.93
	Telson	length
width		2.93
height		2.07
Pedipalp	aculeus, length	1.67
	total length	14.63
	femur, length	3.54
	width	1.60
	patella, length	3.87
	width	1.73
	chela, length	7.22
	width	2.60
height	3.74	
	movable finger, length	3.87

limited to posterior quarter, and connected with oblique VSM, together forming an open arc; VM present in posterior half, with a pair of accessory submedian granules posteriorly; area posterior to the VL+VSM arc slightly depressed, with small granules; surface anterior to the VL+VSM arc finely granular, granules more abundant posteriorly. Metasomal macrosetae as in Figs. 15 & 16. Telson: vesicle oval, ventral surface granular, with larger granules towards proximal third; dorsal surface smooth and not depressed, with a wide glandular area almost covering the dorsal surface. Chelicerae: one subdistal tooth on movable finger; ventral surface of hand and movable finger covered with abundant, fine setae. Pedipalps. Femur with three carinae comprising blunt granules; dorsointernal carina restricted to proximal half, with sparse granules distally; dorsoexternal carina well developed, becoming obsolete towards distal quarter; ventrointernal carina present in proximal half, weakening distally; dorsal and internal surface with

abundant scattered granules, ventral surface with only a few small granules, external surface smooth. Patella with two weak vestigial carinae, dorsointernal and ventrointernal, each represented by only one proximal granule. Chela robust, acarinate, surface almost smooth, with only a few small granules behind base of fixed finger; a strong conical apophysis evident near base of movable finger, internally, slightly curved dorsally, with a slight depression internally. Trichobothrial pattern type C, neobothriotaxic major, with the following segment totals: femur 3 (1 *d*; 1 *i*; 1 *e*), patella 19 (2 *d*; 1 *i*; 13 *e*; 3 *v*) and chela 27 (17 manus, with 5 *V*; 6 fixed finger); chela: *Esb* near to *Eb*₂ and *Eb*₃, *Et*₃ aligned with *Est*. Sternum slitlike, represented by a narrow transversal plate. Genital operculum loosely joined together along the anterior one-fourth of their length, isosceles triangle shaped, with the more acute angle towards posterior. Number of pectinal teeth: 19–19. Hemispermatophore: heavily sclerotized; L. large and straight, narrowing medially; c.d. strong, divided by a transverse crest (terminally curved, basally straight, parallel to the axis of L.); r.f. well developed on external surface of L., long and curved, enlarging towards base of L.; connecting to a short c.f., which extends from dorsal limit of Pb. to basal quarter of L. (c.f. straight basally and slightly sinuous on the terminal edge; front surface plain); on the interior side of L., a small curved crest is present; Pb. wide, slightly longer than L.; r.b. well developed, sinuous; lobe region large, highly complex, occupying superior half of Pb.; l.b. laminar, elongated and concave, with a spatulate end; on its anterior half, two thin dorsal trabeculae (one transverse, the other longitudinal) present; interior portion of l.i. large; l.e. with well developed c.c. Sperm packages (preserved in 80% ethanol): “head” portion visible by refringence as a darker area on the anterior third of the package, helicoidal in shape; medially corrugated; “tail” straight, becoming acute posteriorly, showing small granulations (some packages stick to each other at this point).

Distribution.—Only known from the type locality, in the southernmost part of the Cerrado Biogeographic Province (SE Brazil). A record of *B. bonariensis* from the urban area of Campo Grande, Mato Grosso do Sul (Brazuna & Koller 1998) is probably referable to



Figures 19–22.—*Bothriurus bonariensis*, male from Toledo, Córdoba (CDA); 19. Metasomal segment V and telson, lateral view; 20. Metasomal segment V, ventral view; 21–22. Left hemispermaphore; 21. Internal view; 22. External view. Scale bars = 1 mm (Figs. 19–20); 0.5 mm (Figs. 21–22).

B. pora. The single known record of *B. pora* is allopatric with respect to the known distribution of the *bonariensis* group, all component species of which are also allopatric with one another (Fig. 23). *Bothriurus bonariensis* inhabits the Pampean Biogeographic Province and a large portion of the “Espinal” Province (as defined by Cabrera & Willink 1980), whereas *B. chacoensis* is almost restricted to the western district of the Chacoan Province (Maury 1973; Maury & Acosta 1993; Acosta & Maury 1998). *Bothriurus jesuita*, the sister species of *B. chacoensis* (Ojanguren-Affilastro 2003; Mattoni 2003), has a very similar hemispermaphore morphology (a filament at the end of the basal lobe of the right hemispermaphore), and occurs in northeast Argentina and southern Brazil (Maury & Acosta 1993; Ojanguren-Affilastro 2003). The type locality of *B. pora* is in the Sierra Amambáí, almost on the southeast border of the state

Mato Grosso do Sul (close to the boundary with Paraguay). This locality lies in the Cerrado Biogeographic Province (Cabrera & Willink 1973).

We believe that the material cited by Brazuna & Koller (1998) as *B. bonariensis* from Campo Grande (Mato Grosso do Sul) should be referred to *B. pora* instead, taking into account that Campo Grande is close to Ponta Porã, on the slopes of the Sierra Maracajú (a geographical extension of the Sierra Amambáí). The fairly well known range of *B. bonariensis* is distant from both of these sites (Fig. 23), and the habitats occupied by this species are very different to the Cerrado.

The pattern of allopatric distribution among these four related species is shown by several other *Bothriurus* species groups, e.g., the conspicuus group (Mattoni & Acosta 1997; Acosta & Peretti 1998; Ojanguren Affilastro 2002; Mattoni 2003), the vittatus group (Mat-

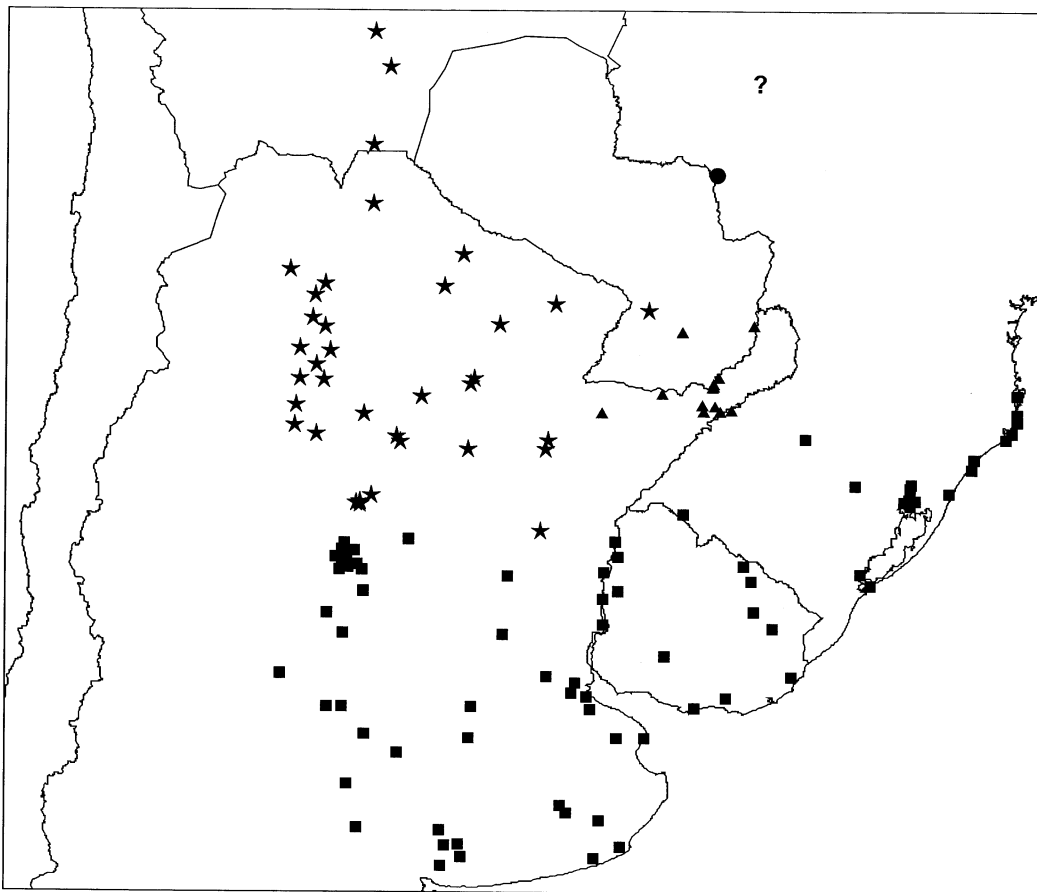


Figure 23.—Distribution map of *Bothriurus pora* new species (type locality: black dot; probable additional locality: ?) and the *Bothriurus bonariensis* group (*B. bonariensis*, squares; *B. chacoensis*, stars, and *B. jesuita*, triangles).

toni 2002a, 2002b, 2002c), and the patagonicus group (Mattoni & Acosta, unpub. data). The distribution of *B. pora* and the bonariensis group is congruent with the hypothesised relationships of the Cerrado with the Chaco, in a putative 'faunistic corridor' for scorpions ('corridor B' of Lourenço 1994). Moreover, the araguayae group, a probable sister group of the clade comprising *B. pora* and the bonariensis group (Mattoni 2003), shows a complementary pattern. The araguayae group is mainly distributed towards the center and north of the Cerrado, with one species inhabiting humid forests in the northern sector of the Argentine province of Misiones and the southwest part of Paraná State, Brazil (Lourenço & Maury 1979; Mattoni 2003).

Additional material examined (bonariensis group).—*Bothriurus bonariensis*: BRA-

ZIL: *Estado do Rio Grande do Sul*: 1 ♀, Novo Hamburgo [24°41'09"S, 51°08'03"W], 22 November 1965, C. Valle (MZUSP 8682; 22); 1 ♂, Porto Alegre [30°02'09"S, 51°12'03"W], 14 March 1957, C. Schneider (MCN 0098); 1 juvenile, same locality, 1 April 1957, E.H. Buckup (MCN 0105); 1 ♂, Pavaela 44, Viamão [30°05'09"S, 51°02'04"W], 25 November 1956, M. Palova (MCN 0061); 1 juvenile, Ipanema, Porto Alegre [30°08'10"S, 51°13'49"W], 24 September 1956, M. Palova (MCN 0043); 1 juvenile, Ponta Grossa, Porto Alegre [30°02'S, 51°12'W], 21–26 June 1945, M.P. Godoi (MZUSP 13.736); 1 juvenile, same locality and collector, 1 June 1946 (MZUSP); 4 ♀, same locality and collector, cultivated land, rocks, 23 February 1945 (MZUSP 16.115); 6 ♂, Guaíba [30°06'50"S, 51°19'04"W], 27 February 1975, H.A. Gastal (MCN 0007); 2 ♂,

same locality and collector, 5 February 1975 (MCN 0028); 1 juvenile, Belem Novo [30°12'10"S, 51°10'04"W], 4 June 1946, M.P. Godoi (MZUSP 13.733); 1 ♂, São Leopoldo [29°46'05"S, 51°09'08"W], 15 November 1965, C. Valle (MZUSP); 3 ♂, Quarai [30°23'09"S, 56°27'03"W], February 1963, J.W. Thome (MCN 0019); 1 juvenile, Barra do Quarai [30°23'S, 56°27'W], 20 February 1974 (MZUSP); 1 juvenile, km 211, Pelotas [31°46'S, 52°20'W], 28 July 1965, Exped. CDZ (MZUSP). ARGENTINA: *Provincia de Córdoba*: 5 ♂, 1 juvenile, Toledo, 1 km road to Córdoba [31°34'S, 64°01'W], 24 January 1987, L. Acosta (CDA 000.101). URUGUAY: *Departamento Tacuarembó*: 1 juvenile, Tacuarembó [31°44'S, 55°59'W], 7 March 1944, E. Mullin-Díaz (MZUSP 8710).

Bothriurus chacoensis: ARGENTINA: *Provincia de Córdoba*: 6 ♂, 2 ♀, 3 juveniles, Eufrasio Loza, 3 km to Gutenberg [29°56'S, 63°35'W], 20 February 1987, L. Acosta, A. Peretti (CDA 000.103).

Bothriurus jesuita: ARGENTINA: *Provincia de Misiones*: 1 ♂, Campo San Juan, 37 km N Posadas by route N° 12 [27°20'S, 55°38'W], 21 January 1991, G. Flores (CDA 000.102).

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