

**Additions to the knowledge of the Chactidae of Brazilian
Amazonia
(Arachnida: Scorpiones)**

by

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Abstract

An account of the chactid scorpions of Brazilian Amazonia is given and a list of all recorded scorpions in the region is provided. *Broteochactas skuki* n.sp. is described. The hitherto unknown male of *Brotheas paraensis* SIMON is described, and one female of *Guyanochactas gougei* (VELLARD) new combination is described. The known distribution of *Brotheas amazonicus* LOURENÇO, 1988 is expanded to Rondonia and Roraima States.

Keywords: Scorpiones, Chactidae, taxonomy, Neotropics.

Resumo

É fornecida uma lista para os escorpiões da Amazônia brasileira. *Broteochactas skuki*, n.sp. é descrito. O macho de *Brotheas paraensis* SIMON e uma fêmea de *Guyanochactas gougei* (VELLARD), n.comb. são descritos pela primeira vez. *Brotheas amazonicus* LOURENÇO, 1988 é registrado pela primeira vez para os Estados de Rondônia e Roraima.

Introduction

Contributions to the knowledge of scorpions of the family Chactidae from Amazonia, and in particular of Eastern Amazonia (comprising eastern Brazil and parts of the Guyana region), began in the second half of the 19th century with important publications of KARSCH (1879), SIMON (1877, 1880) and POCOCK (1893, 1897, 1900).

In 1945, MELLO-LEITÃO provided a synthesis of the Chactidae of Amazonia, but did not describe any new taxa. Since the beginning of the 1970's several papers describing a large number of new taxa have been published. Of these, the most important are those by GONZALEZ-SPONGA (summarized in GONZALEZ-SPONGA, 1996) dealing almost exclusively with the fauna of Venezuela, and those of LOURENÇO (e.g. 1983, 1986, 1988a, b, 1994, 1995a, b, 1997) and LOURENÇO & FLOREZ (1990) described a large number of new taxa. The scorpion fauna of Amazonia is apparently much more complex than previously supposed, and many new taxa are yet to be found.

Study of a collection from the Museu de Zoologia da Universidade de São Paulo (MZSP), Brazil, has revealed a new species belonging to the genus *Broteochactas* POCOCK, from Central Amazonia, in the north of the State of Mato Grosso. In addition, specimens belonging to the enigmatic *Brotheas paraensis* SIMON, 1880, and *Broteochactas gougei* VELLARD, 1932 were found in the collection. The first, *B. paraensis*, was described from the State of Pará in Eastern Amazonia without a precise type locality. Only the female holotype, deposited in the Muséum d'Histoire Naturelle, Paris is known with certainty. Now the male of *B. paraensis* can be described and two precise localities for this species indicated. *Broteochactas gougei* was described by VELLARD (1932) on the basis of a single female specimen collected in the State of Pará from the forests of the "Serra dos Cayapos", 50 km west of "Conceição do Araguaia". Until now, only the type specimen of *B. gougei* has been known. This too was deposited by VELLARD in the collection of the Muséum d'Histoire Naturelle (MNHN), Paris, but the type is no longer present in the Muséum collection, and has probably been lost. Analysis of several characters of *B. gougei* has led us to transfer this species to the genus *Guyanochactas* LOURENÇO. Additional material from Instituto Butantan (IBSP) and Museu de Zoologia da Universidade de São Paulo (MZSP) was studied and provided a new species, the unknown female of *Broteochactas gougei* and more localities for the known distribution of *Brotheas amazonicus*.

***Broteochactas skuki*, n.sp. (Figs. 1-12, 35-37, 44)**

Holotype male and allotype female: Brazil, State of Mato Grosso, Aripuanã, Chapada Dardanellos (10°10'S-59°27'W), 2/13-XI-1996, G. SKUK leg. (MZSP-15,422). Paratypes: 3 males; same data as for the holotype (MZSP-15,422).

Distribution: Known only from type locality (Fig. 44).

Etymology: Named in honor of Gabriel Skuk, a biologist who has provided arachnid material from several localities in Brazil.

Diagnosis. *Broteochactas skuki* n.sp. can be included in the "Auyantepuia" species group as defined by LOURENÇO (1986). The new species can be distinguished from others and, in particular, from *Broteochactas parvulus* POCOCK, 1897 (which also belongs to the group "Auyantepuia") by the following features: (i) a smaller number of tooth in the pectines (6), and much larger teeth (Fig. 12), (ii) chelae of pedipalps much more robust (relation chela length/width = 2.89 in *B. parvulus*; 2.21 in *B. skuki*), (iii) tergites punctate, whereas in *B. parvulus* they are granulated, (iv) vesicle much longer and less robust (Fig. 11), (v) carapace flattened.

Description based on male holotype. Measurements in Table I.

Coloration. Basically reddish-yellow with some diffuse variegated brownish spots over the entire body. Prosoma: carapace reddish with brownish spots; eyes surrounded by black pigment. Tergites yellowish with distinct variegated brownish spots. Metasomal segments reddish, with brownish spots less marked; vesicle

yellowish with quite diffuse brownish spots. Chelicerae yellowish; bases with diffuse variegated brownish spots; color of fingers uniformly dense and reddish. Pedipalps reddish; fingers densely red with blackish zones over the keels of all segments; legs reddish-yellow. Venter and sternites yellowish; some darker areas over sternites and coxapophyses.

Morphology. Carapace lustrous and acarinate (Fig. 1), furrows shallow; with moderately dense, minute granulation laterally. Sternum pentagonal, wider than long (Fig. 2). Tergites acarinate, smooth and shiny without granulation. Pectinal tooth count 6-6 (Figs. 2, 12). Sternites smooth and shiny, VII acarinate; rounded spiracles present. Metasomal segments III to V longer than wide, smooth and shiny dorsally with minute granulations laterally; segment V with dense, strong granulation ventrally. Dorsal keels moderate; all other keels in segments I-IV feeble or absent. Segment V with ventral lateral and ventral median keels moderate to strong (Fig. 11). Pedipalps (Figs. 5-10): femur with dorsal internal, dorsal external and ventral internal keels strong; ventral external keels feeble; all faces feebly granular, almost smooth. Tibia smooth lustrous; dorsal internal, ventral internal, ventral external and external keels feeble. Chelae small granulate, with few reticulate areas as in figures 5-6; all keels moderate to feeble. Chelicerae with the dentition typical of the family Chactidae (Vachon, 1963); one basal and two subdistal tooth in the movable finger. Trichobothriotaxy type C; neobothiotaxic majorante (VACHON, 1973).

Hemispermatothores (Figs. 35-37): Distal lamina soft and conical; 1.8 times longer than truncus. Truncus sclerotized; flattened; rectangular; with one projection triangle-shaped in the median region of each side; external keel from the capsule to the a bifid lobe; external base with a spherical sclerotized capsule (belonging to the truncus) that communicates with the soft seminal vesicle on the internal side. Sperm duct almost twice as long as bifid lobe.

Female allotype (Figs. 3-4): Coloration similar to that of male holotype, only somewhat darker and more reddish. Morphology: Body more robust than that of male; pectines smaller with 6-6 tooth.

Pectinal tooth count in male paratypes: 6-6, 6-6, 6-3(6).

***Brotheas amazonicus* LOURENÇO, 1988 (Figs. 38-40, 44)**

Brotheas amazonicus LOURENÇO, 1988a: 330, figs. 12-15; FET et al. 2000: 297 (syn. *Broteas manauarensis*).

Broteas manauarensis MATTIESEN & GONZÁLEZ-SPONGA, 1989: 280, figs. 1-9.

Distribution (Fig. 44): *B. amazonicus* was known only from Manaus region (Amazonas State). The known distribution of this species is now extended to the Central Amazonian States of Rondonia, Amazonas and Roraima.

Hemispermatothores (Figs. 38-40): Distal lamina soft and conical; 1.5 times longer than truncus. Truncus sclerotized; flattened; sub-oval; with one projection triangle-shaped in subapical region of left side (external view); external keel from the capsule to the lobe; external base with a spherical sclerotized capsule (belonging to the truncus). Sperm duct almost three times longer than lobe of truncus.

Material examined: Brazil, Roraima, São Luís do Anauá, 6-10.VIII.1990, P.E. VANZOLINI leg., 1 female (MZSP-16168). Amazonas, Presidente Figueiredo, Usina Hidrelétrica de Balbina, 31.VII.1986 or 3.VI.1988, F. A. NÉO leg., 5 females (IBSP-2345); Rondônia, Santa Bárbara, 26.VII.1985, L.J. VITT leg., 2 juveniles (MZSP-16166); Alto Paraíso, 26.X-2.XI.1985, Museu de Zoologia/Polonoroeste leg. (MZSP-16159).

***Brotheas paraensis* SIMON (Figs. 13-24, 41-44)**

Broteas paraensis SIMON, 1880: 381; POCOCK, 1898: 99; KRAEPELIN, 1899: 170, 172; KRAEPELIN, 1912: 55; MELLO-CAMPOS, 1924: 287; MELLO-LEITÃO, 1945: 115; FET et al., 2000: 300.

Diagnosis: Until now, *Brotheas paraensis* was known only from the female holotype, deposited in the

Muséum in Paris. The type locality was vague indicating only Para state, Brazil. Two other species of *Brotheas* present in French Guyana and perhaps also in areas in the north of the Amapa state, namely *Brotheas granulatus* SIMON, 1877 (type species of the genus) and *Brotheas gervaisi* POCOCK, 1893 could not be precisely distinguished from *B. paraensis*. The study of this new material can now confirm the validity of *B. paraensis*. It can be easily distinguished from *B. granulatus* by an almost total absence of granulations over the body, whereas in *B. granulatus* the whole body is covered with very strong granulations. It can be distinguished from *B. gervaisi* by an increase in the number of tooth in the pectines. 10 to 13 in *B. paraensis*, and 6 to 10 in *B. gervaisi* (LOURENÇO, 1983).

Holotype female: Brazil, Pará, M. DE MATHAN leg., (MNHN-RS-744 - SIMON's collection-2,699).

Material studied: Brazil, Pará, Obidos, 16-XI-1965 (Exped. MZ), 1 male, 2 females, 1 juvenile (MZSP-8883). Oriximiná, Vai Quem-Quer, 27/29-I-1993 (G. SKUK leg.), 1 male, 1 female (MZSP-16565).

Distribution (Fig. 44): Known only from Pará State.

Redescription based on the male from Oriximiná. Measurements in Table 1.

Coloration. Basically dark-reddish to black. Prosoma: carapace very dark reddish; eyes surrounded by black pigment. Tergites dark reddish as for carapace. Metasomal segments reddish, with blackish zones over keels; vesicle reddish yellow. Chelicerae dark yellow; base with diffuse variegated brownish spots; base of fingers dark; fingers uniformly dense reddish in color. Pedipalps dark reddish; fingers blackish; legs dark reddish. Venter and sternites reddish with some yellowish zones.

Morphology. Carapace lustrous and acarinate (Fig. 13), furrows shallow; with dense, minute punctuation. Sternum pentagonal, wider than long (Fig. 14). Tergites acarinate, smooth and shiny with punctuations and some feeble granulations centrally. Pectinal tooth count 13-13 (Fig. 14, 24). Sternites smooth and shiny, V acarinate. Metasomal segments III to V longer than wide, moderately granular; segment V with dense, small granulation ventrally. Keels in segments I-V moderate to strong. Segments I to III with ventral lateral and ventral median keels absent. Pedipalps (Figs. 17-22): femur with dorsal internal, dorsal external and ventral internal keels strong, tuberculate; ventral external keel feeble; dorsal and ventral faces without granulation; internal face moderately granular. Tibia smooth lustrous; dorsal internal, ventral internal, ventral external and external keels moderate; other keels feeble to vestigial. Chelae lustrous; ventral median keel strong; other keels vestigial to absent; internal face moderately granular; small granules forming reticulate areas as in figures 17-18; other faces smooth. Chelicerae with the dentition typical of the family Chactidae (VACHON, 1963); one basal and two subdistal tooth in the movable finger. Trichobothriotaxy type C; neobothriotaxic "majorante" (VACHON, 1973).

Hemispermatothores (Figs. 41-43): Distal lamina soft and conical; 2.3 times longer than truncus. Truncus sclerotized; flattened; rectangular, slightly sinuous-shaped; with external keel from the base to the lobe. Sperm duct almost five times longer than lobe of truncus.

Female (Figs. 15-16): Coloration similar to that of the male, but darker reddish. Morphology: Similar to that of male. Segments less granulated. Pectines smaller with fewer tooth.

Pectinal tooth count in the specimens studied: Female holotype: 11-11. Males, 13-12. Females 11-10, 11-11, 11-12, 10-10.

Diagnosis of the genus *Guyanochactas* LOURENÇO, 1998

The genera *Brotheas* and *Broteochactas* are defined by the combination of two characters: *Brotheas* has slit-like spiracles and the tarsi armed with spines, whereas *Broteochactas* has oval or round spiracles and the tarsi armed with hairs.

The description of two species previously placed in the genus *Brotheas*, *B. gonzalespongai* LOURENÇO from French Guyana and *B. mascarenhasi* LOURENÇO from Para state, Brazil lead to some difficulties to their placement in a given genus. These two species present a mixed combination of the characters defining both *Brotheas* and *Broteochactas*. They have oval or round spiracles but the tarsi are armed with spines. This situation lead LOURENÇO (1998) to propose a new genus *Guyanochactas* to accommodate these two species. At present, the rediscovery of the species *Broteochactas gougei* shows that this species presents the same characters as defined to *Guyanochactas*, so a new combination is proposed.

Guyanochactas gougei (VELLARD, 1932), n.comb. (Figs. 25-34, 44)

Broteochactas Gougei VELLARD, 1932: 543.

Broteochactas gougei: MELLO-LEITÃO, 1945: 101; Fet et al., 2000: 291.

Diagnosis: Differs from the other species of the genus by the following characters: (i) smaller total length (35-40 mm) than the other two species of the genus (45-50 in *G. gonzalezpongai* and 58-65 in *G. mascarenhasi*); (ii) spiracles small and round, whereas in the other two species they are oval; (iii) pectines with 8 tooth; 11 in *G. gonzalezpongai* and 6-9 in *G. mascarenhasi*; (iv) femur of pedipalps with 4 keels, instead of 5 in *G. gonzalezpongai* and *G. mascarenhasi*.

Material Examined: Brazil, Pará State, Redenção, Area Indígena Cayapó, Aldeia AUKRE, 9-X-1996, R. SALM leg., female (MZSP-15,733); Itupiranga (incorrectly labeled as Otuperanga), XII.1971, A.R. HOGE & P. VILELA leg., male (badly preserved) and 2 females (IBSP-145).

Coloration. Basically reddish with some diffuse yellowish spots. Prosoma: carapace dark reddish; eyes surrounded by black pigment. Tergites reddish, with some yellowish spots laterally. Metasomal segments reddish with some blackish zones over the keels; vesicle reddish yellow. Chelicerae yellowish; base of fingers dark; fingers uniformly reddish yellow. Pedipalps dark reddish, with blackish areas over the keels; fingers densely reddish; legs dark reddish. Venter: pectines and genital operculum yellowish; coxapophyses and sternum reddish; sternites reddish yellow.

Morphology. Carapace lustrous punctuate and acarinate, furrows shallow (Fig. 25). Sternum pentagonal, slightly wider than long (Fig. 26). Tergites acarinate, smooth and shiny with very sparse small granulations centrally except on VII. Pectinal tooth count 7-7 (Figs. 26, 34). Sternites smooth and shiny, VII acarinate; spiracles oval. Metasomal segments III to V longer than wide; I to III smooth and shiny; segments IV and V with dense, strong granulation ventrally. All keels in segments III to V strong (Fig. 33). Segment I and II with ventral median keels absent. Pedipalps (Figs. 27-32): femur with all keels strong; dorsal and ventral faces without granulation, punctuate; internal face moderately granular. Tibia smooth lustrous; dorsal internal, ventral internal, ventral external and external keels feeble; other keels vestigial. Chelae lustrous, with only some sparse large granules on the internal face; small granules forming reticulated areas as in figures 27-28, all keels feeble or vestigial. Chelicerae with the dentition typical of the family Chactidae (VACHON, 1963); one basal and two subdistal tooth in the movable finger. Trichobothriotaxy type C; neobothriotaxic majorant (VACHON, 1973). Measurements in Table 1.

Male with 9-9 pectinal tooth count.

Checklist of the Brazilian Amazonian scorpions

The known scorpiofauna from the states of Acre, Amapá, Amazonas, Mato Grosso, Pará, Rondônia and Roraima is listed below. Species that occur outside the Brazilian Amazonian area are mentioned between parentheses and italicized.

BUTHIDAE

Ananteris balzani THORELL, 1891 (Brazil: Pará and Mato Grosso; *Goiás, Mato Grosso do Sul, São Paulo and Paraná; Paraguay*)

Ananteris dekeyseri LOURENÇO, 1982 (Brazil: Amazonas)

Ananteris luciae LOURENÇO, 1984 (Brazil: Pará)

Ananteris pydanieli LOURENÇO, 1982 (Brazil: Amazonas)

Isometrus maculatus (DE GEER, 1778) (pantropical species; Brazil, Amazonas and Pará; *also found in central, south and northeastern Brazil*)

Microtityus vanzolinii LOURENÇO & EICKSTEDT, 1983 (Brazil: Amazonas)

Rhopalurus amazonicus LOURENÇO, 1986 (Brazil: Pará)

Rhopalurus crassicauda DI CAPORIACCO, 1947 (Brazil: Roraima; *Guyana*)
Rhopalurus piceus LOURENÇO & PINTO-DA-ROCHA, 1997 (Brazil: Roraima)
Tityus bastosi LOURENÇO, 1984 (Brazil: Amazonas; *Peru, Ecuador and Colombia*)
Tityus cambridgei POCOCK, 1897 (Brazil: Pará and Amapá; *French Guyana*)
Tityus carvalhoi MELLO-LEITÃO, 1945 (Brazil: Mato Grosso and Pará)
Tityus clathratus C.L. KOCH, 1845 (Brazil: Roraima; *Venezuela*)
Tityus dinizi LOURENÇO, 1997 (Brazil: Amazonas)
Tityus gasci LOURENÇO, 1981 (Brazil: Amazonas and Pará; *French Guyana and Peru*)
Tityus magnimanus POCOCK, 1897 (Brazil: Amazonas; *Venezuela*)
Tityus mattogrossensis BORELLI, 1901 (Brazil: Mato Grosso; *Goiás, Bahia, Minas Gerais and Paraguay*)
Tityus metuendus POCOCK, 1897 (Brazil: Pará, Amazonas, Rondônia, Acre and Roraima; *Peru*)
Tityus raquelae LOURENÇO, 1988 (Brazil: Amazonas)
Tityus silvestris POCOCK, 1897 (Brazil: Amazonas; Pará, Amapá and Acre; *French Guyana*)
Tityus strandi WERNER, 1939 (Brazil: Amazonas and Pará)
Tityus tucurui LOURENÇO, 1988 (Brazil: Pará)

CHACTIDAE

Broteochactas delicatus (KARSCH, 1879) (Brazil: Amapá; *French Guyana*)
Broteochactas granosus POCOCK, 1900 (Brazil: Roraima; *Guyana*)
Broteochactas mapuera LOURENÇO, 1988 (Brazil: Pará)
Broteochactas parvulus POCOCK, 1897 (Brazil: Pará)
Broteochactas skuki n.sp. (Brazil: Mato Grosso)
Brotheas amazonicus LOURENÇO, 1988 (Brazil: Roraima, Rondônia and Amazonas)
Brotheas gervaisi POCOCK, 1893 (Brazil: Amapá; *French Guyana*)
Brotheas granulatus SIMON, 1877 (Brazil: Amapá; *French Guyana*)
Brotheas jordani LOURENÇO, 1997 (Brazil: Amazonas)
Brotheas overali LOURENÇO, 1988 (Brazil: Pará)
Brotheas paraensis SIMON, 1880 (Brazil: Pará)
Brotheas silvestris LOURENÇO, 1988 (Brazil: Pará)
Chactopsis amazonicus LOURENÇO & FRANCKE, 1986 (Brazil: Amazonas)
Chactopsis anduzei GONZALEZ-SPONGA, 1984 (Brazil: Amazonas; *Venezuela*)
Chactopsis insignis KRAEPELIN, 1912 (Brazil: Amazonas; *Peru*)
Guyanochactas gougei (VELLARD, 1932) (Brazil: Pará; at the border of Amazonian region)
Guyanochactas mascarenhasi (LOURENÇO, 1988) (Brazil: Pará)
Teuthraustes amazonicus (SIMON, 1880) (Brazil: Amazonas; *Peru*)
Teuthraustes lisei LOURENÇO, 1994 (Brazil: Amazonas)
Vachoniocactas ashleeae LOURENÇO, 1994 (Brazil: Amazonas)

ISCHNURIDAE

Opisthacanthus cayaporum VELLARD, 1932 (Brazil: Pará; at the border of Amazonian region)

Table 1: Morphometric measurements (in mm) of the described specimens of Brazilian Chactidae.

	<i>B. skuki</i> Holotype, male	<i>B. skuki</i> Allotype, female	<i>B. paraensis</i> MZSP-16565, male	<i>B. paraensis</i> Holotype, female	<i>G. gougei</i> MZSP-15733, female
Carapace:					
length	3.8	4.4	7.6	8.0	5.2
anterior width	2.4	3.0	4.9	5.2	3.4
posterior width	4.3	4.7	7.4	8.5	5.3
Metasomal segment I:					
length	1.4	1.4	3.6	3.1	1.9
width	1.9	2.0	4.4	4.0	2.8
length	4.1	3.6	7.4	6.8	4.8
width	1.5	1.4	3.6	3.5	2.4
depth	1.4	1.4	3.1	2.8	2.0
Vesicle:					
width	1.8	1.5	3.8	2.6	1.8
depth	1.4	1.2	3.2	2.4	1.6
Pedipalp:					
Femur length	2.9	3.2	5.3	5.6	3.6
Femur width	1.4	1.6	2.4	2.6	2.0
Tibia length	3.4	3.6	6.6	6.8	4.2
Tibia width	1.6	1.7	2.6	2.8	1.9
Chela length	5.6	6.2	12.4	13.0	8.7
Chela width	2.4	2.8	4.6	4.5	2.8
Chela depth	2.2	2.1	4.4	4.6	3.3
Movable finger:					
length	2.6	3.1	6.2	6.7	4.4
Total length:	33.0	34.0	47.0	51.0	42.0

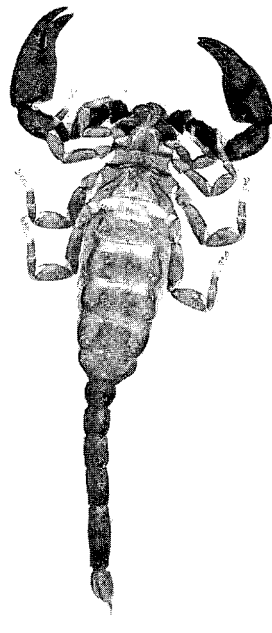
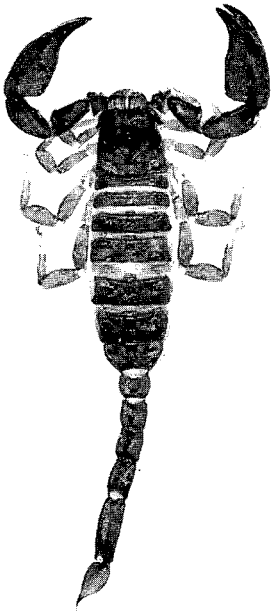
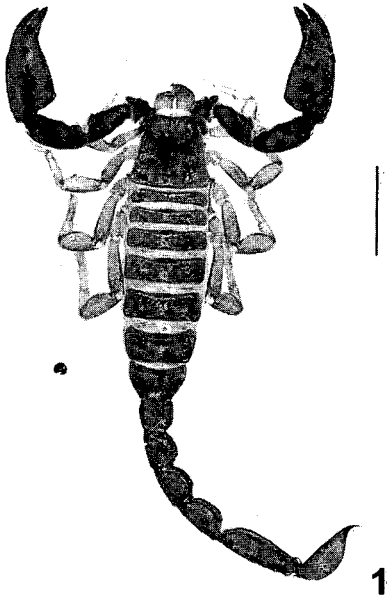
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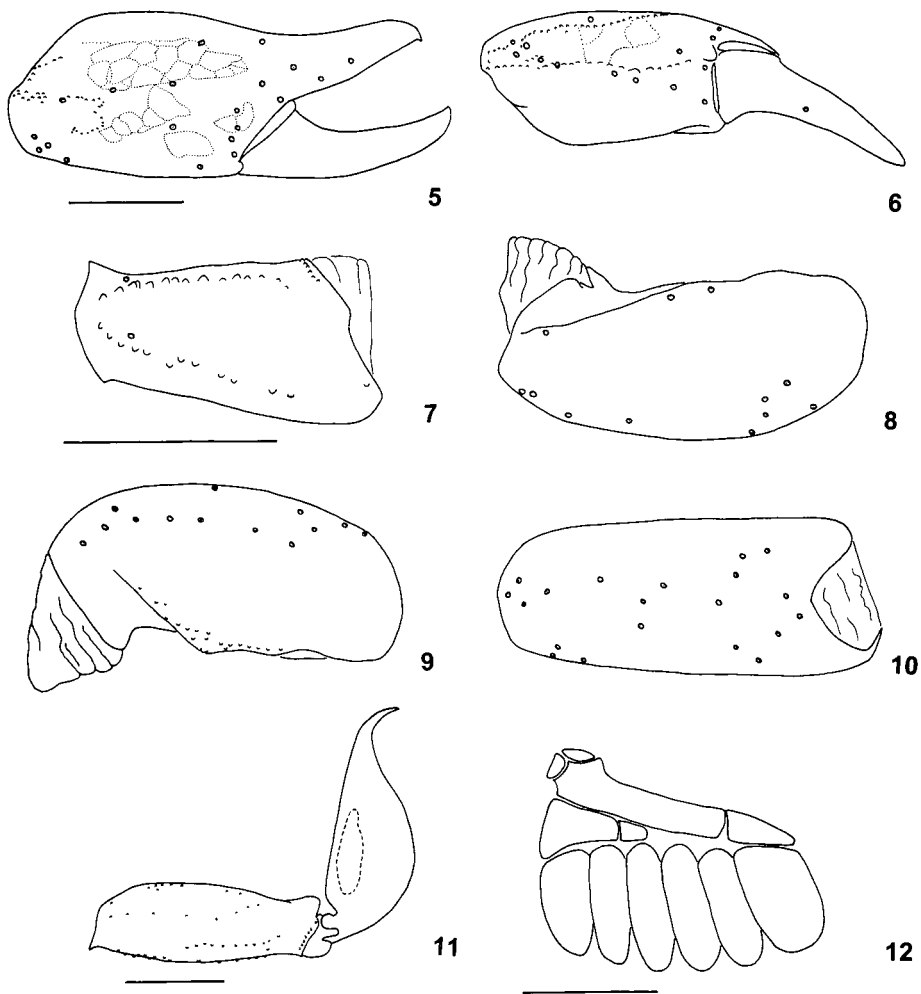
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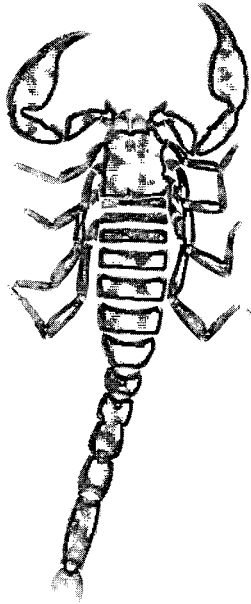
Figs. 1-4:
Broteochactas skuki, n.sp.: 1-2: male (holotype); 1: dorsal; 2: ventral. 3-4: female (allotype); 3: dorsal;
4: ventral. Scale bars: 5 mm.



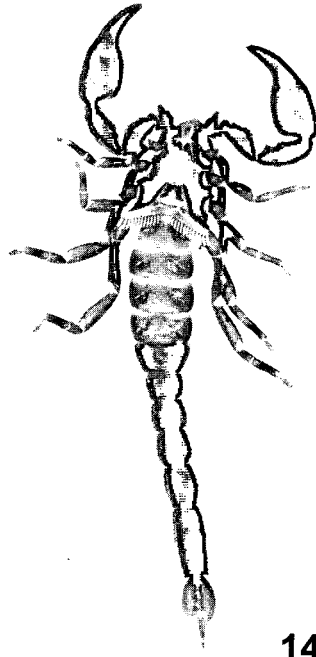
Figs. 5-12:

Broteochactas skuki, n.sp., male (holotype).

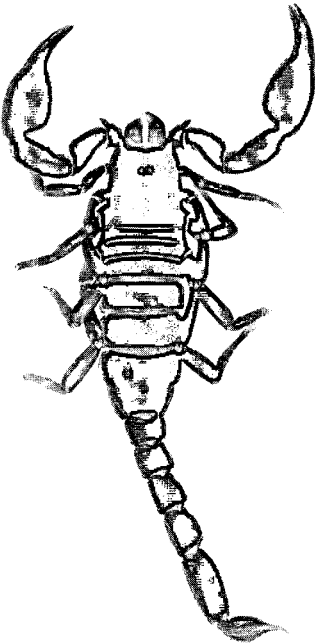
5: chelae, external; 6: ventral; 7: femur, dorsal; 8: tibia dorsal; 9: ventral; 10: external; 11: segment V and telson; 12: pectines. Scale bars: 5-11 = 2 mm; 12 = 1 mm. 5-6 and 7-10 at same scale.



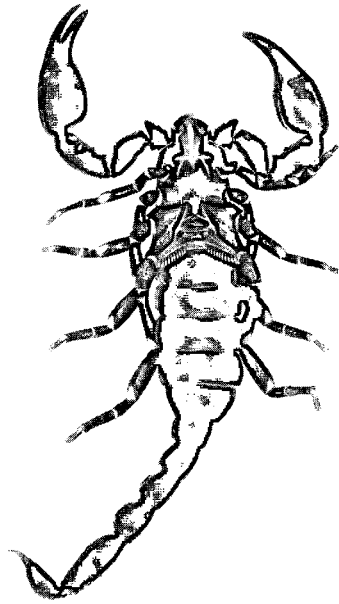
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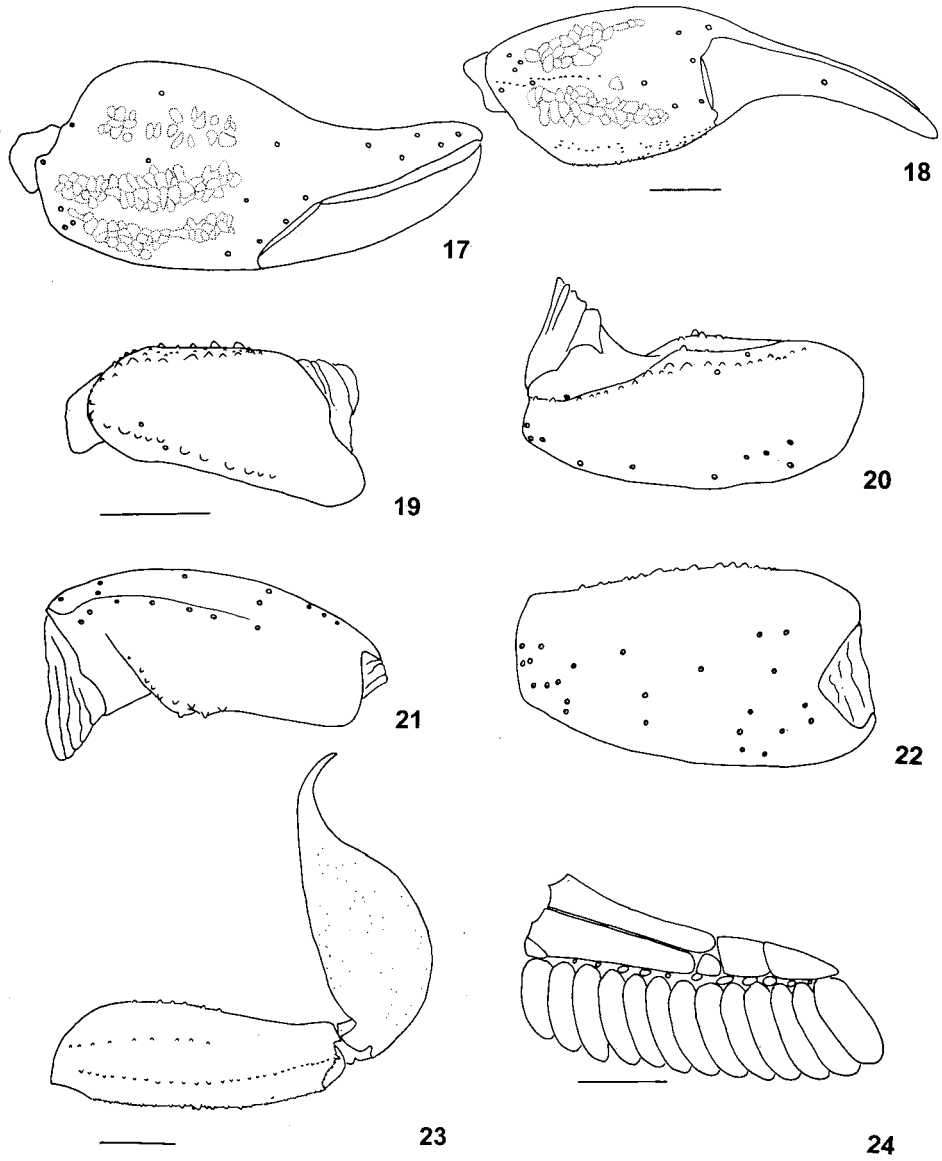


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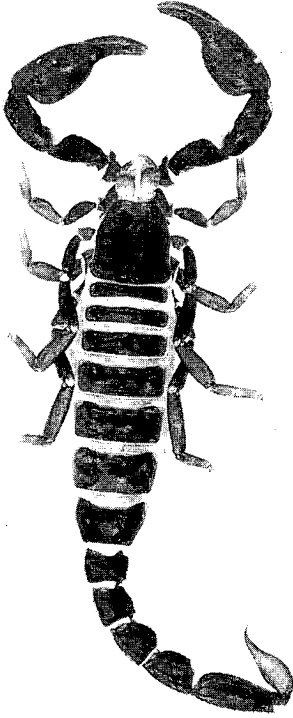
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Figs. 13-16:
Brotheas paraensis: 13-14: male; 13: dorsal; 14: ventral. 15-16: female; 15: dorsal; 16: ventral.
Scale bars: 5 mm.

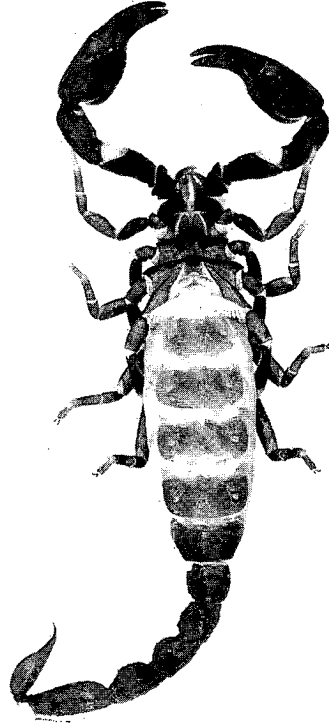


Figs. 17-24:

Brotheas paraensis, male. 17: chelae, external; 18: ventral; 19: femur, dorsal; 20: tibia dorsal; 21: ventral; 22: external; 23: segment V and telson; 24: pectines. Scale bars: figures 17-24 = 2 mm. 17-18, 19-22 at same scale.

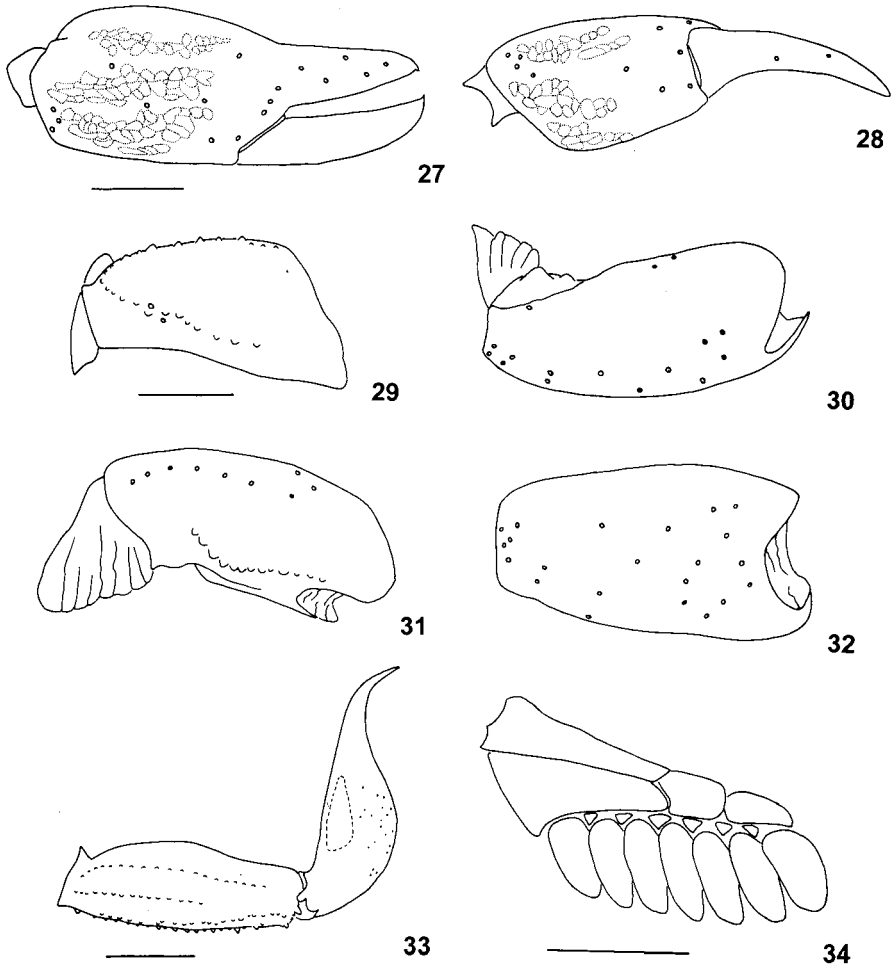


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Figs. 25-26:
Guyanochactas gougei, female: 25: dorsal; 26: ventral. Scale bar: 5 mm.

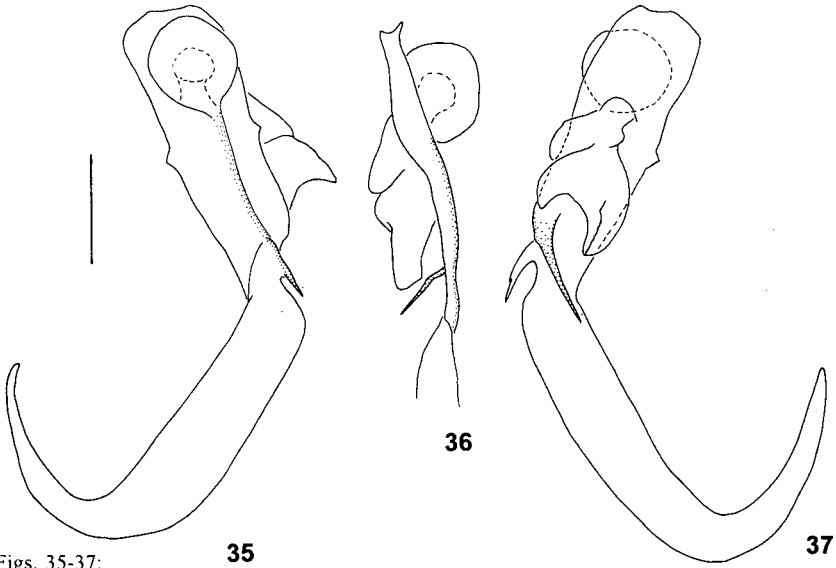


Figs. 27-34:

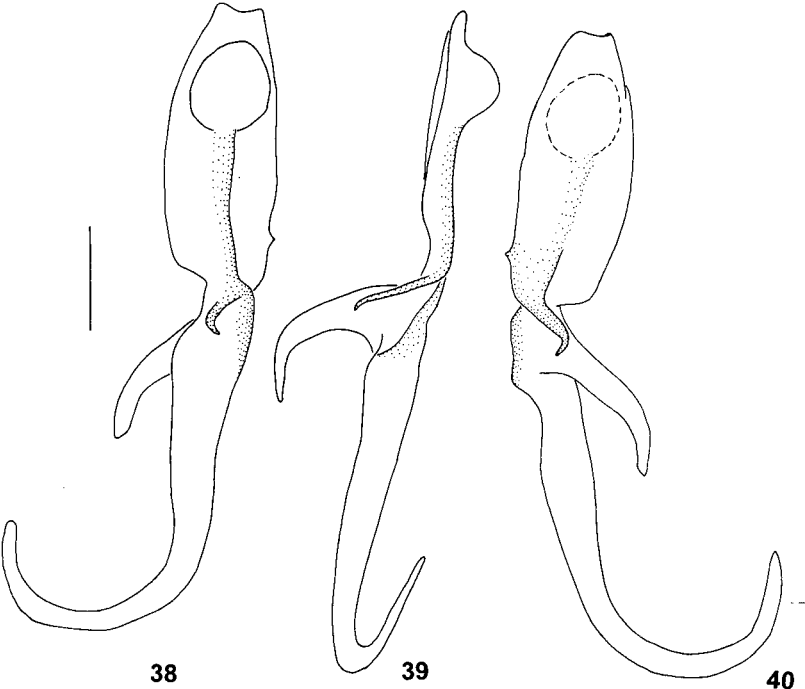
Guyanochactas gougei, female: 27: chelae, external; 28: ventral; 29: femur, dorsal; 30: tibia dorsal;

31: ventral; 32: external; 33: segment V and telson; 34: pectines. Scale bars: figures 27-33 = 2 mm; 34 =

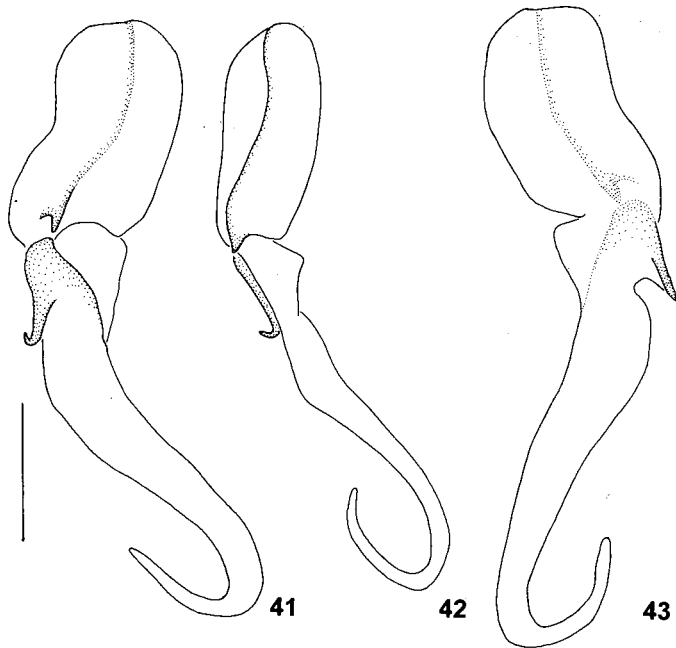
1 mm. 27-28 and 29-32 at same scale.



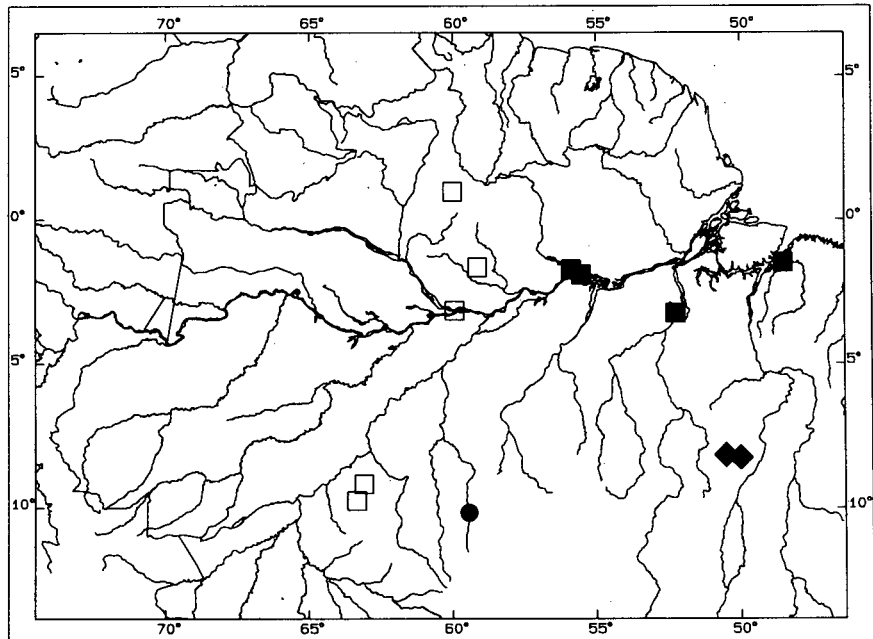
Figs. 35-37:
Broteochactas skuki n.sp., Hemispermatozoan: 35: external aspect; 36: internal; 37: lateral.
 Scale bar: 1 mm



Figs. 38-40:
Brotheas amazonicus, Hemispermatozoan: 38: external aspect; 39: internal; 40: lateral. Scale bar: 1 mm.



Figs. 41-43:
Brotheas paranesis, Hemispermatozoan: 41: external aspect; 42: internal; 43: lateral. Scale bar: 1 mm.



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Fig. 44:
 Distribution of *Brotheas paranesis* (solid square); *B. amazonicus* (open square); *Broteochactas skuki* n.sp. (solid circle) and *Guyanochactas gougei* (solid diamond).