



ARTÍCULO:

**Broteochoactas fei, a new scorpion species (Scorpiones, Chactidae) from Brazilian Amazonia, with notes on its abundance and association with termites**

Ricardo Pinto-da-Rocha

Depto. de Biología, Instituto de  
Biotecnología, Universidade de São  
Paulo, Rua do Matão, Travessa  
14, No. 321, 05508-900 São  
Paulo/SP, Brazil  
ricrocha@usp.br

Thierry R. Gasnier

Depto. de Biología, Instituto de  
Ciências Biológicas, Universidade  
do Amazonas, Av. Gal. R.O.J.  
Ramos 3000, CEP 69067-000,  
Manaus, AM, Brazil  
tgasnier@fua.br

Antonio D. Brescovit

Laboratório de Artrópodos  
Peçonhentos, Instituto Butantan,  
Av. Vital Brazil 1500,  
São Paulo, Brazil, 05503-900  
adbresc@terra.com.br

Fabiano B. Apolinário

Instituto Nacional de Pesquisas  
da Amazônia, Depto de  
Entomologia, C. Postal 478,  
69011-970 Manaus AM, Brasil

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Grupo de trabajo en Aracnología  
de la Sociedad Entomológica  
Aragonesa (SEA)  
Avda. Radio Juventud, 37  
50012 Zaragoza (ESPAÑA)  
Tef. 976 324415  
Fax. 976 535697  
C-elect.: amelic@telefonica.net  
Director: A. Melic

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**BROTEOCHACTAS FEI, A NEW SCORPION SPECIES  
(SCORPIONES, CHACTIDAE) FROM BRAZILIAN  
AMAZONIA, WITH NOTES ON ITS ABUNDANCE  
AND ASSOCIATION WITH TERMITES**

Ricardo Pinto-da-Rocha, Thierry R. Gasnier,  
Antonio D. Brescovit & Fabiano B. Apolinário

**Abstract**

*Broteochoactas fei* sp. n. from Manaus, State of Amazonas, Brazil, is newly described. *B. fei* belongs to the *Broteochoactas* species-group, and differs from the remaining species by having two lateral eyes, a reddish carapace, finely granulate tergites and a nearly smooth telson. Based on two sampling methods, different estimates of abundance were obtained: 0.0027 and 0.022 ind/m<sup>2</sup>. These values are low when compared to the abundance of other sympatric scorpion species. The species is apparently termitophile (27 out of 30 specimens were collected in termite mounds). They were found associated with 13 species of termites from 3 subfamilies. However, females with young were more frequent in the mounds of apicotermite termites.

**Key words:** Scorpion, termitophily, abundance, Reserva Ducke.**Taxonomy:** *Broteochoactas fei* sp. n.

***Broteochoactas fei*, una nueva especie de escorpión (Scorpiones, Chactidae) de la Amazonia brasileña, con notas sobre su abundancia y asociación con termitas**

**Resumen**

*Broteochoactas fei* n.sp. es descrito de Manaus, Estado de Amazonas, Brasil. Perteneció al grupo de especies *Broteochoactas*, donde difiere del resto de las especies por presentar dos ojos laterales, carapacho rojizo, terguitos finamente granulados y telson casi liso. A partir de dos métodos de muestreo se estimaron abundancias diferentes de 0,0027 y 0,022 ind/m<sup>2</sup>. Estos valores pueden considerarse bajos cuando son comparados con la abundancia de otras especies simpátricas de escorpiones. La nueva especie es aparentemente termitófila (27 de los 30 especímenes fueron colectados en termiteros), encontrándose asociada a 13 especies de termitas pertenecientes a tres subfamilias. Sin embargo, hembras con juveniles fueron colectadas, con mayor frecuencia, en termiteros pertenecientes a especies de Apicotermiteinae.

**Palabras clave:** Escorpiones, termitofilia, abundancia, Reserva Ducke.**Taxonomía:** *Broteochoactas fei* sp. n.**Introduction**

According to Lourenço (2002), over 90 species of scorpions are known from Brazil, belonging to the families Bothriuridae, Buthidae, Chactidae and, Ischnuridae (the later with only one species recorded). The Amazonian region contains the poorest sampled fauna. Nevertheless, 43 species are known from the area (Lourenço & Pinto-da-Rocha, 2000), almost half the number of the hitherto recorded Brazilian scorpions.

The Amazon forest will probably provide more new species than any other biogeographical region in Brazil. Most of the sampled areas are close to the main rivers (mainly Amazonas, Solimões) and the interior regions are virtually unknown. Scorpions are a group with numerous endemic species in neotropics. The type locality for the new species here described is located inside the “Manaus endemic center”) that contains ten known species, six of which are endemic for this area (Lourenço, 2001). Recently, Monod & Lourenço (2001) described *Broteochoactas polisi* from an area of white sand forest close to Manaus.

*Broteochoactas* Pocock, 1893 includes 40 species: 37 species According Sissom (2000), plus three described recently: *B. skuki* Lourenço & Pinto-da-Rocha, 2000, *B. polisi* Monod & Lourenço, 2001 and *B. fei*, sp. n. Two other species, can be added to *Broteochoactas* if *Hadrurochoactas* Pocock 1893 is accepted as its junior synonym as stated by several authors (e.g. Monod & Lourenço, 2001) that consider it as a species-group within *Broteochoactas*. However, Sissom (2000) following González-Sponga (1978, 1996) stated *Hadrurochoactas* as a valid genus.

***Broteochactas fei* Pinto-da-Rocha & Brescovit, sp.n.**

(Figs. 1-15)

*Broteas* sp.; Höfer, Wollscheid & Gasnier, 1996:34.

**DIAGNOSIS:** *B. fei* sp. n. is included in the *Broteochactas* species-group based on median size and shape of pedipalpal chela (see Lourenço, 1986). It differs from the other Brazilian species of its species-group, *B. delicatus* (Karsch, 1879), and *B. granosus* Pocock, 1900, by have the smooth carapace on anterior half and on the region around postero-median furrow, by the tergites equall finelly granulate, telson almost smooth (except basal portion) and smaller total length. Particularly, *B. fei* differs from *B. delicatus* possessing tubercles on ventral base of telson and absence of spinoid tubercle on movable finger and from *B. granosus* by the reddish carapace.

**TYPE MATERIAL:** **Holotype** male (INPA, Instituto Nacional de Pesquisas da Amazônia), Reserva Florestal Adolpho Ducke, Manaus, State of Amazonas, Brazil, 1.III.1994, M. Christoffer leg. **Paratypes** (all from same locality): 7.VIII.1990, F. Apolinário leg., female (INPA); 21.XII.1990, F. Apolinário leg., female (INPA); 20.II.1990, F. Apolinário leg., one female and seven juveniles (INPA); 10.XII.1990, F. Apolinário leg., female (INPA); 13.I.1991, H. Höfer & T. Gasnier, female (INPA); 4.XII.1990, F. Apolinário leg., female and four juveniles (IBSP 3068, Instituto Butantan, São Paulo); 6.XI.1990, F. Apolinário leg., female (IBSP 3069); 4.XII.1990, F. Apolinário leg., female and five juveniles (MZSP 20955, Museu de Zoologia, Universidade de São Paulo); 12.XII.1990, F. Apolinário leg., female (MZSP 20956).

**DISTRIBUTION:** Know only from the type locality.

**ETYMOLOGY:** The specific name honors Nelson Fé, technician of the Instituto de Medicina Tropical de Manaus who devoted his work to scorpions and spiders. He identified scorpion species collected by Gasnier & Höfer (2001), and detected that *Broteochactas fei* could be a new species (Fé, pers. comm.).

**DESCRIPTION BASED ON MALE HOLOTYPE:****Measurements** in Table I.

**Coloration** (in 70% ethanol). Basically reddish-brown; pedipalps chelae darker with lighter reticulate, mesosomal tergites lighter; aculeus black. Femur and patella of legs yellowish with distal half with a darker area with lighter circles of different sizes.

**Morphology** (Figs.2-3, 6-13). Carapace lustrous, acarinate, anterior margin with a weak notch, postero-median furrow well pronounced, minutely granulated laterally and around eye mound. Two small lateral eyes on each side. Sternum subpentagonal, wider than long, posterior margin V-shaped. Tergites acarinate, uniformly covered with delicate granulation, except for the posterior margin with larger granules. Mesosomal tergites I-VII with 1 pair of setae on the posterior margin. Genital operculum divided longitudinally, each

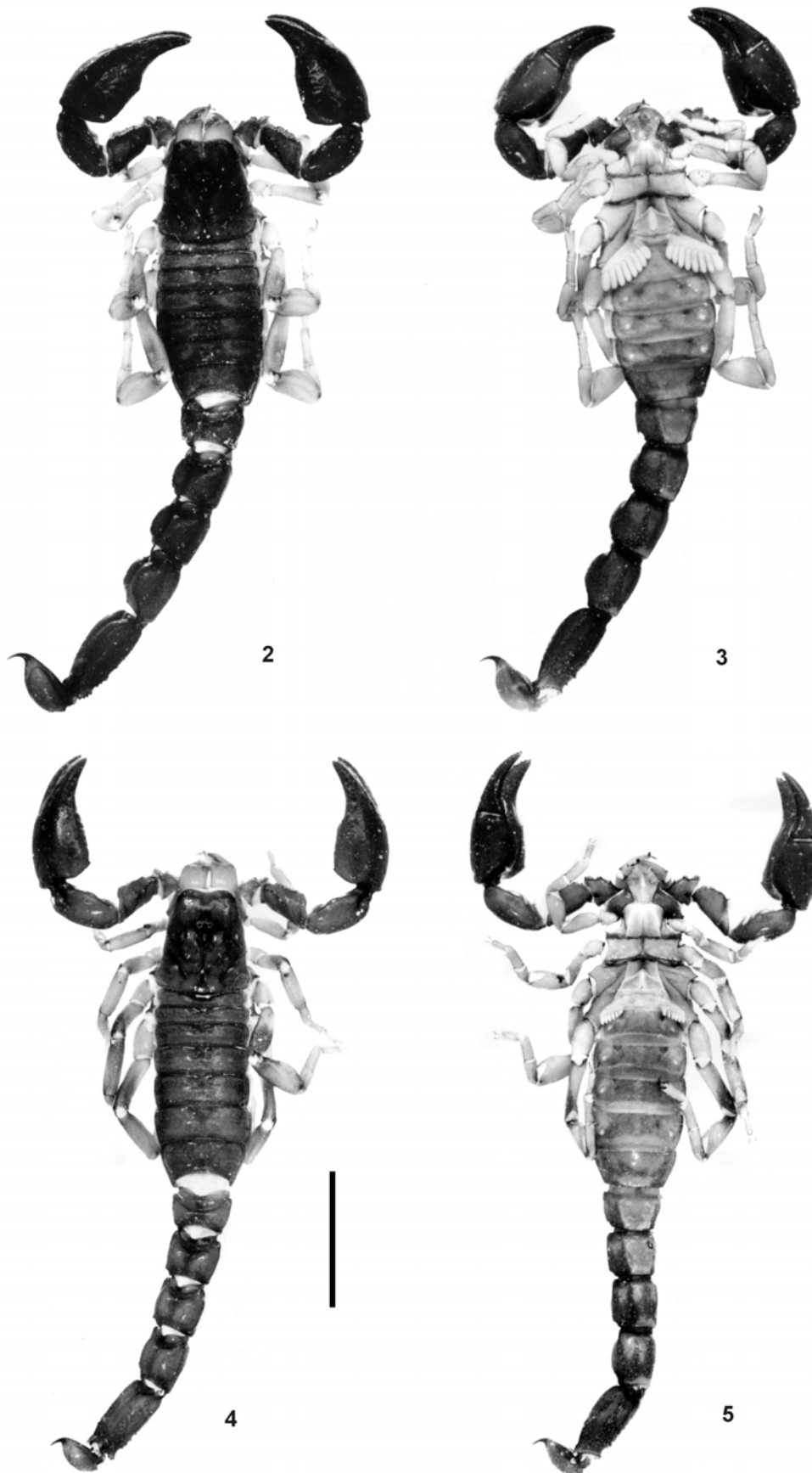
**Table I**  
**Measurements (in mm) of male holotype and female paratype (INPA, 6 Jan..1990) *Broteochactas fei* sp.n.**

	Male	Female
Total length	30.5	28.4
Carapace:		
Length	4.1	4.4
Anterior width	2.8	2.6
Posterior width	4.8	4.3
Metasomal segment I:		
Length	2.3	2.0
Width	3.1	2.6
Metasomal segment V:		
Length	4.8	4.4
Width	2.2	1.8
Height	1.9	1.6
Telson	3.8	2.3
Vesicle:		
Width	2.1	1.4
Height	1.6	1.1
Pedipalp:		
Femur length	2.6	2.5
Femur width	1.5	1.3
Patella length	3.2	3.0
Patella width	1.7	1.6
Chela length	6.1	6.6
Chela width	2.5	2.1
Chela depth	3.2	2.7
Movable finger:		
Length	3.7	3.4

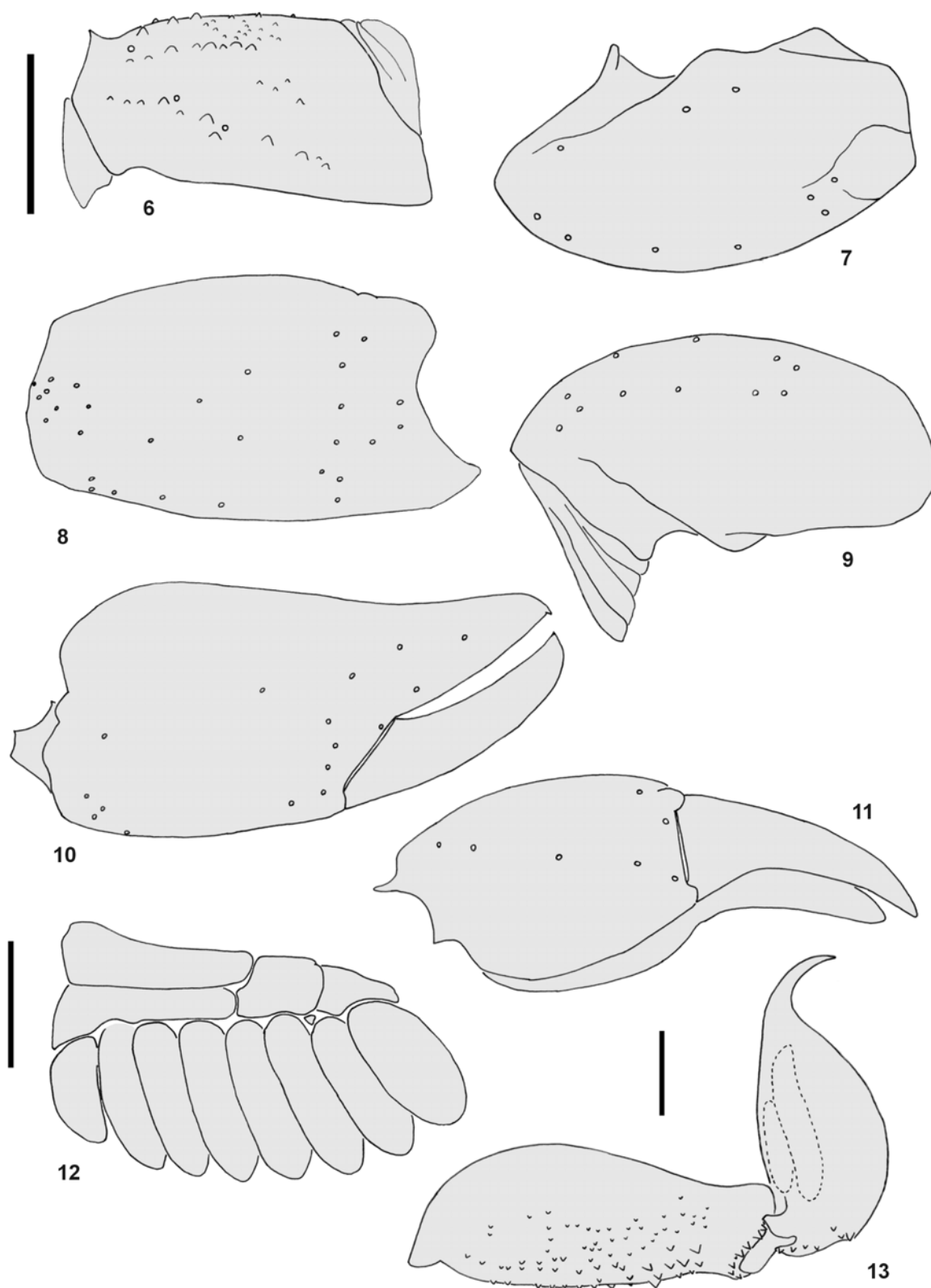
half roughly triangular. Sternites acarinate, III-VII smooth and shiny; V minutely granulated laterally. Metasomal segments I-IV smooth ventrally; IV-V longer than wide; I-III dorso-medially with dense minute granules; IV only with larger granules medially; V (Fig. 13) with larger granules laterally on distal third, ventrally with medially spinoid acute granules followed by subapical U-shaped row and a row on posterior margin. Carinae on metasomal segments I-IV moderate; absent on V. Telson globular, approximately same width as metasomal segment V, with some spinoid granules close to base, aculeus short with small scattered setae, two pairs longer and thicker close to ventral base of aculeus. Chelicerae: fixed finger with three teeth, medial and basal forming a bicuspid; movable finger with four teeth, basal small followed by one large, one small and, one subdistal larger than others. Trichobothriotaxy type C; neobotriotaxic majorante; pedipalpal femur with 3 trichobothria; patella with 34, chela with 21. Pedipalps (Figs. 6-9): femur (Fig. 6) with dorso-medial, dorso-lateral and ventro-medial carinae strong and with large granules; patella (Fig. 7-9) with dorso-internal carina moderate, with 2 granules; chela (Figs. 10, 11) without carinae, with basal prolateral pointed teeth. Leg tarsi with two ventral rows of irregularly disposed setae. Pectinal teeth (Fig. 12) count 8-8. Fulcra vestigial.



**Fig. 1.** *Broteochactas fei*, sp. n., female paratype.



**Figs. 2-5.** *Broteochactas fei*, sp. n.: 2-3: male holotype; 4-5: female (INPA, 20.Feb..1990). Scale bar = 5 mm.



**Figs. 6-13.** *Broteochactas fei*, sp. n. (male holotype): **6:** pedipalp femur, dorsal view, **7-9:** pedipalpal patella; **7,** dorsal view; **8,** lateral view; **9,** ventral view; **10,** pedipalpal chela, lateral view; **11,** ventral view; **12,** left pecten; **13,** metasomal segment V and lateral view of telson. Figures at same scale = 6-9; 10, 11 and 13. Scale bars = 1 mm.

**Hemispermatothore** (Figs. 14-15). Distal lamina soft and flattened, with two darker carinae, one small subdistal and another larger distal oblique; 1.2 times longer than trunkus. Trunkus sclerotized; flattened, rectangular, with one distal apophysis long, dark and hook-shaped.

**FEMALE** (INPA, 6.I.1990): (Fig. 1, 4, 5). Colour (in ethanol) basically brownish, pedipalpal chelae reddish-brown. Carapace longer than male, without granules around the eye mound. Tergites smooth, except granules on the posterior margin. Mesosomal tergites I-VII with one row of small setae and one pair of larger setae on the posterior margin. Metasomal tergites I-IV poorly minute granulate. Telson width slightly less wider than the metasomal segment V width. Pedipalpal patella with 32 trichobothria and chela with 24. Pectinal teeth smaller than male, count: 6-6 (n=6), 5-6 (n=2), 6-7 (n=1), 7-7 (n=1).

**NATURAL HISTORY:** *Broteochoactas fei*, sp.n. was rarely found outside termite mounds. None were found in the collections studied by Lourenço (1988) in his synopsis of the scorpion fauna of Manaus region, although many scorpions had been collected in the area. During two intensive studies with traps, only two individuals of the species were collected. In the first study (Gasnier *et al.*, 1995; Höfer & Beck, 1995) arthropods were collected during 18 months, with three large tree photoelectors (or funnel trap) and five ground photoelectors (or emergence traps) moved monthly. Each ground photoelector covered an area of 1 m<sup>2</sup>, totaling 90 m<sup>2</sup>. In that study, 71 scorpions were collected, belonging to 6 species, including one female and one juvenile of *B. fei* in two ground photoelectors. They were not collected inside a termite mound, but it does not mean that they were wandering around; small termite mounds are abundant in the area, and there is the possibility that the photoelectors were positioned over termite mounds. The second study (Höfer *et al.*, 1996) was carried out to compare the activity-density of scorpions among habitats in Reserva Ducke (Manaus), using pitfall traps. In this study, 1200 traps were installed during 8.5 weeks. A total of 211 scorpions, belonging to five species were captured, namely: *Brotheas amazonicus* Lourenço, 1988, *Chactopsis amazonica* Lourenço & Francke, 1986, *Tityus metuendus* Pocock, 1897, *Tityus silvestris* Pocock, 1897 and *Ananteris* sp. However, no *B. fei*, sp.n. was found.

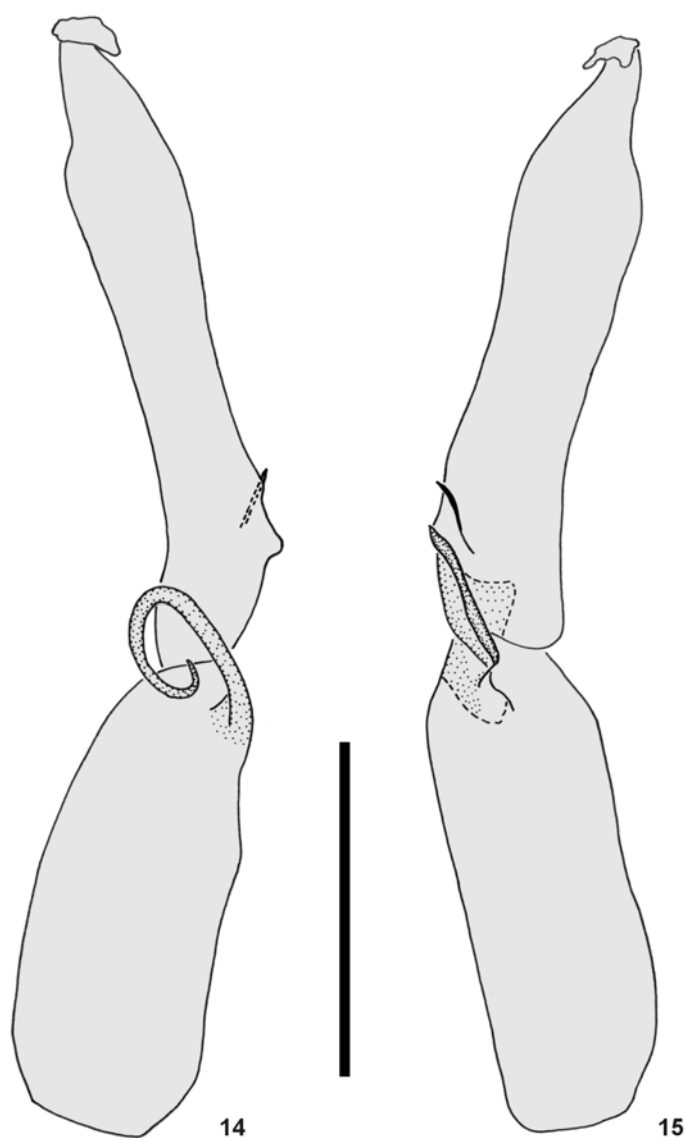
On the other hand, Apolinário (1993) collected 27 individuals of *B. fei* in 8 termite mounds in an area of 10,000 m<sup>2</sup> during a study of the termite fauna of Reserva Ducke. He found 6 adult females and 21 juveniles, 7 of which were recently born (table II). Two adult females were never found together, but juveniles were frequently found with an adult female. This suggests that juveniles might be developing inside the termite mound under the protection of the mother, or at least they are tolerated. The only adult male was pro-

bably also collected in a termite mound. This information was not noted on the label, but the collector was Christopher Martius, a specialist in termites. Based on these results, we believe that this is a real termitophile species, i. e., a species with an obligatory relationship with termites, and that they are found in the termite mound at least during one part of their life cycle (Kistner, 1969).

*Brotheochoactas fei* was found only in epigeic termite mounds, cohabiting with 13 termites species belonging to 12 genera and 3 subfamilies (table II). Females with juveniles were found only with termites of the subfamily Apicotermatinae, which suggests that there may be a specificity in the mounds chosen as shelter by females about to reproduce. Although the diversity of cohabiting termite species is high, there is some specificity in the kind of mound used. Apolinário (1993) found 90 species and 43 genera of termites in his study area. Most of the termite species cohabiting with the scorpions either use mounds constructed by other termite species, or construct a mound using small natural mounds, such as, for example, those elevations created by the roots of fallen trees. This is the reason why many scorpions were found together with more than one termite species in a mound. There were no scorpions in the termite mounds located at tree tops, nor in large epigeic mounds. The sample did not include subterranean colonies.

Apolinário (1993) found 27 individuals of *B. fei*, sp.n. in a 10.000 m<sup>2</sup> area (0.0027 ind./m<sup>2</sup>), and Höfer & Gasnier (unpublished data) found 2 in a 90 m<sup>2</sup> area (0.022 ind./m<sup>2</sup>). Both calculations might underestimate, because *B. fei* may also occur in subterranean termite colonies, they may not be restricted to termite colonies, and the ground photoelectors used by Höfer and Gasnier were only placed in more or less open and plane ground areas. In the same ground photoelector, Höfer and Gasnier (unpublished data) found nine *Brotheas amazonicus*, eight *Chactopsis amazonica* and one *Ananteris* sp. In the tree photoelector, they found 26 *Tityus metuendus*, nine *T. silvestris*, two *T. raquelae*, 13 *Brotheas amazonicus* and one *Ananteris* sp. Apparently, *Chactopsis amazonica* and *B. fei* are unable to climb trees, and termite mounds might be an important shelter in forests where army ants are frequent and effective predators of scorpions (Gasnier & Höfer, 2001; Vieira & Höfer, 1994). The absolute abundance of *B. fei* may be low, but they are not rare in termite mounds; they were present in 6.5 % of the total number of mounds sampled, and in 20% of the mounds with at least one species of non termite inquiline (ou inhabitant??).

The scorpions were not included among the animals known as termitophiles by Kistner (1969, 1982) or Grassé (1986). The termitophiles belong to the insect orders Collembola, Ensifera, Heteroptera, Psocoptera, Coleoptera, Hymenoptera, Lepidoptera and Diptera. Among the arachnids, they include some Acari, Araneae, Pseudoscorpiones and Solifugae. However,



**Figs. 14-15.** *Broteochactas fei*, n.sp. (male holotype). Right hemispermaphore: **14**, external view; **15**, internal. Scale bars = 5 mm.

**Table II**  
**Specimens of *Broteochactas fei* collected in Reserva Ducke and the termite species associated.**  
 % = male; &= female; j= juvenile

Sex	Date	Termite species in the mound
1 %	1 Mar. 1994	? no data on termite associated
1 j	13 Apr. 1992	? no data on termite mound
1 &	13 Jan. 1991	? no data on termite associated
1 j	7 Aug. 1990	<i>Syntermes</i> sp. (Nasutitermitinae)
2 jj	12 Dec. 1990	<i>Cavitermes</i> sp. (Termitinae); <i>Anoplotermes</i> sp. (Apicotermitinae); <i>Neocapritermes brasiliensis</i> (Snyder, 1926) (Termitinae); <i>Creptitermes verruculosus</i> (Emerson, 1925) (Termitinae)
1 &	6 Nov. 1990	<i>Atlantitermes</i> sp. (Nasutitermitinae); <i>Spinitermes trispinosus</i> (Hagen & Bates, 1858) (Termitinae)
1 &	12 Dec. 1990	<i>Neocapritermes brasiliensis</i> (Snyder, 1926) (Termitinae); <i>Orthognathotermes</i> sp. (Termitinae); <i>Coatitermes</i> sp. (Nasutitermitinae)
1 &	4 Dec. 1990	<i>Spinitermes trispinosus</i> (Hagen & Bates, 1858) (Termitinae)
1 &, 4 jj	4 Dec. 1990	<i>Dihoplotermes</i> sp. (Termitinae); <i>Cylindrotermes parvignathus</i> (Termitinae); <i>Anoplotermes</i> sp. (Apicotermitinae)
1 &, 7 jj (with two sizes)	20 Feb. 1990	<i>Ruptitermes arboreus</i> (Apicotermitinae)
1 &, 7 recently born individuals	19 Nov. 1990	<i>Grigiotermes</i> sp. (Apicotermitinae)

Lourenço (1981) considered *Opisthacanthus cayaporum* a termitophile, restricted to mounds of the genus *Armitermes*. An additional information on this scorpion species, mentioned as personal communication by Lourenço, was presented by Polis (1990: 263) "the mother and the young cooperate to build communal chambers in the center of termite mounds". Lourenço (1995) also considered *Tityus fasciculatus* a termitophile. Immatures of this species are errant, often hiding under bark. However adults of this species take shelter exclusively in mounds of *Armitermes euamignathus* Silvestri, 1901.

Apolinário (1993) found many arachnids (Araneae, Opiliones, Pseudoscorpiones, Uropygi, Amblypygi and Solifugae) in 26% of the sampled mounds; they were present in 70% of the nests with inquilins. The four Solifugae individuals found by him, together with two individuals collected by Höfer and Gasnier at about the same period in the tree photoelectors in Reserva Ducke (Höfer & Beck, 1995), were the first individuals of the order found in Amazônia (Savory, 1977: 242). Arachnids considered rare, or even unknown species, may be common in termite mounds in forests. Two of the scorpion species found by Apolinário (*B. amazonicus* and one female of *Chactopsis amazonica*) are probably better to be considered eventual host because they are more frequent outside termite mounds. *Brotheochactas fei* apparently is a termitophile scorpion species, but future studies would be necessary to establish if it is really restricted to termite mounds and if it uses the mounds only as shelters or if they also prey on termites.

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