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Scorpions from Brazilian Amazonia, with a description of two new species from 'Serra da Mocidade' National Park in the State of Roraima (Scorpiones: Buthidae, Chactidae)

Scorpioni dall'Amazzonia brasiliana, con la descrizione di due nuove specie dal parco nazionale 'Serra da Mocidade' nello stato di Roraima (Scorpiones: Buthidae, Chactidae)

Wilson R. Lourenço

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Abstract

Scorpions belonging to the genera *Tityus* C. L. Koch, 1836 (subgenus *Atreus* Gervais, 1843) and *Broteochactas* Pocock, 1893 (subgenus *Taurepania* González-Sponga, 1978) are studied and two new species are described: *Tityus (Atreus) generaltheophilo* sp. n. and *Broteochactas (Taurepania) mauriciodiasi* sp. n., based on specimens collected in the mountain range of Serra da Mocidade National Park in the State of Roraima, Brazil. Both new species are most certainly endemic elements of these mountain ranges. Moreover, the discovery of these new elements confirms the poor knowledge available for most of the summits in the Amazon region.

Key-Words: Scorpiones, Buthidae, Chactidae, *Broteochactas*, *Taurepania*, new species, Serra da Mocidade National Park, mountain range, State of Roraima, Brazil.

Riassunto

Vengono studiati scorpioni appartenenti ai generi *Tityus* C. L. Koch, 1836 (sottogenere *Atreus* Gervais, 1843) e *Broteochactas* Pocock, 1893 (sottogenere *Taurepania* González-Sponga, 1978) e due nuove specie vengono descritte: *Tityus (Atreus) generaltheophilo* sp. n. e *Broteochactas (Taurepania) mauriciodiasi* sp. n., basate su esemplari raccolti nell'area montuosa del parco nazionale della Serra da Mocidade nello stato di Roraima, Brasile.

Entrambe le nuove specie sono molto probabilmente elementi endemici di queste aree montuose. Inoltre, la scoperta di questi nuovi elementi conferma la scarsa conoscenza disponibile per molte delle vette della regione amazzonica.

Parole-chiave: Scorpiones, Buthidae, Chactidae, *Broteochactas*, *Taurepania*, nuova specie, parco nazionale Serra da Mocidade, area montuosa, stato di Roraima, Brasile.

Introduction

As outlined in several previous papers (Lourenço, 2002a, b, 2012, 2014; Lourenço *et al.*, 2010, 2011), contributions to the knowledge of the Amazonian scorpion fauna and in particular of the elements belonging to the families Buthidae C. L. Koch, 1837 and Chactidae Pocock, 1893 have been the subject of several previous studies (e. g. Lourenço, 2011, 2012, 2014; Lourenço & Duhem, 2010; Lourenço *et al.*, 2011). However, the Amazon region remains one of the world's most diverse areas for its scorpion fauna. Inventory on the Amazonian scorpion fauna began in the second half of the 19th century, and was for the first time synthesized in a monograph by Mello-Leitão (1945). Since then, other contributions have been published, e. g. González-Sponga (1978, 1996) and Lourenço, (2002a, b). On account of the diversity and richness of the Amazonian scorpion fauna, the discovery and description of new species is by no means unusual (e. g. Lourenço, 2002a, b, 2012, 2014; Lourenço & Duhem, 2010; Lourenço *et al.*, 2010, 2011).

Since Mello-Leitão (1945) published his monograph on South American scorpions, the number of known Amazonian species, in particular from Brazil, was much less significant than it is today. In fact, most species known in Amazonia have been described only in recent years (e. g. González-Sponga, 1978, 1996; Lourenço, 2002a, b, 2014; Lourenço *et al.*, 2010, 2011).

In fact, many different regions within the Amazon basin, including those nearby the Rio Negro, and in particular the various summits of the northern range of Amazonia were among the last to attract the attention of investigators because most of the pioneer work in Amazonia was carried out along the Solimões and Amazon rivers, in some cases up to Peru (Papavero, 1971, 1973). In so far as scorpions are concerned, only in recent decades more intensive collecting was possible in most of these summits composed by the Tepuys or Inselbergs (e. g. González-Sponga, 1978; Lourenço, 1994, 2008; Lourenço *et al.*, 2011). This has resulted in several new discoveries and descriptions. One exception among the elder expeditions is the one performed by an English Team composed of Messrs F. V. McConnell and J. J. Quelch in Mount Roraima (British Guiana), in the period from August to October 1898, which resulted in the description of two scorpion species (Pocock, 1900), most certainly endemic to this summit. See also Lourenço and Duhem (2009).



Fig. 1. General view of the 'Serra da Mocidade' National Park, showing the typical vegetation (photo by T. Laranjeiras).

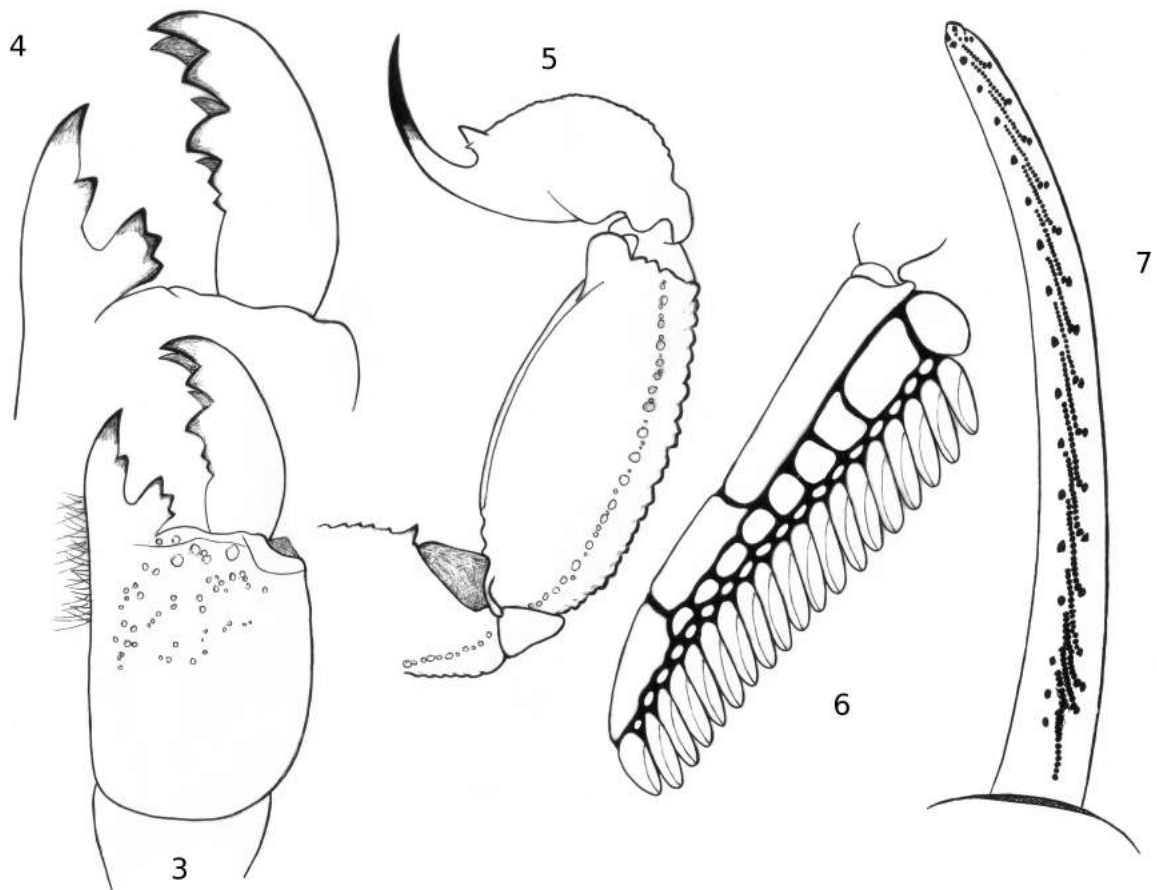


Fig. 2. A typical Inselberg formation in the 'Serra da Mocidade' National Park (photo by T. Laranjeiras).

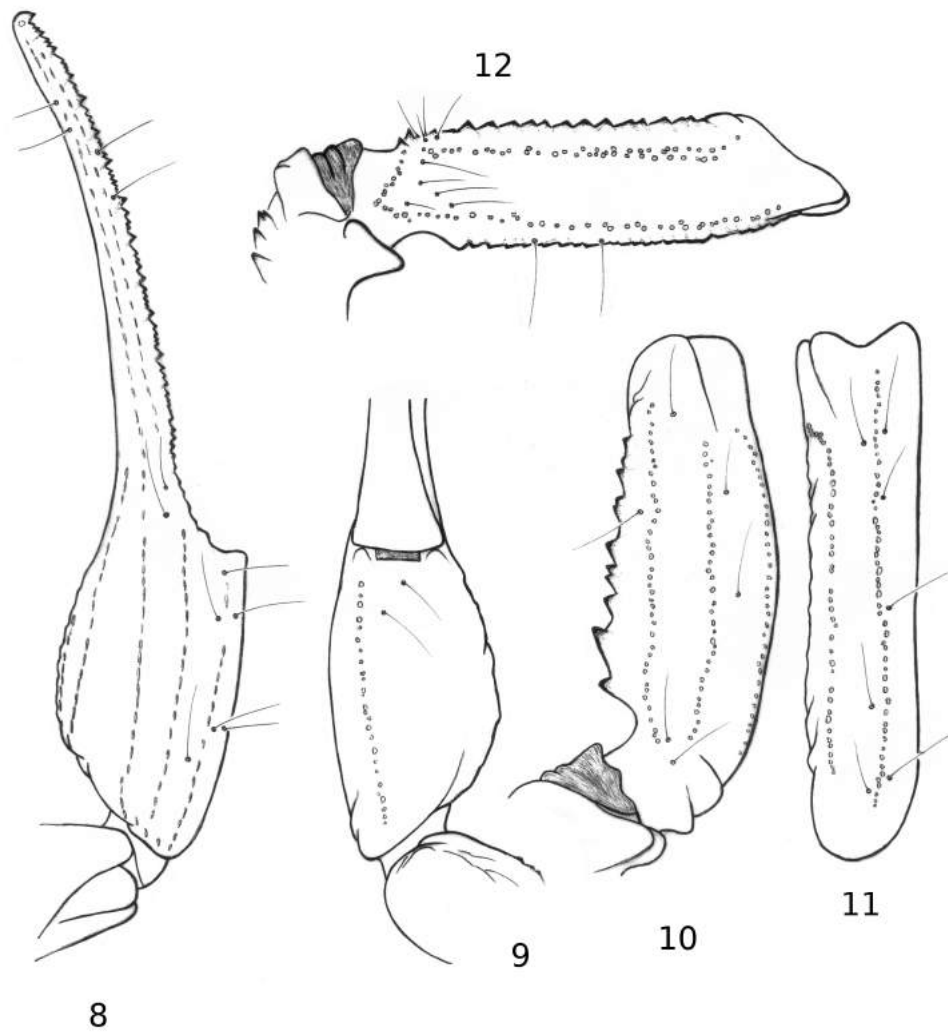
In this contribution, two new species are described from the Mountain range of 'Serra da Mocidade' National Park (Figs. 1-2) in the state of Roraima, Brazil. These belong to the genera *Tityus* C. L. Koch, 1836 (subgenus *Atreus* Gervais, 1843) and *Broteochactas* Pocock, 1893 (subgenus *Taurepania* González-Sponga, 1978). Both new species are most certainly endemic elements of these summits which have been explored for the first time during the INPA's Team expedition of 2016.

Methods

Illustrations and measurements were made using a Wild M5 stereo-microscope with a drawing tube and an ocular micrometer. Measurements follow those of Stahnke (1970) and are given in mm. Trichobothrial notations are those developed by Vachon (1974) and the morphological terminology mostly follows Hjelle (1990).



Figs. 3-7. *Tityus (Atreus) generaltheophiloï* sp. n. Female holotype. 3. Chelicera, dorsal aspect. 4. Idem, fingers and teeth in detail. 5. Metasomal segment V and telson, lateral aspect. 6. Pecten. 7. Cutting edge of movable finger showing series of granules.



Figs. 8-12. *Tityus (Atreus) generaltheophiloii* sp. n. Female holotype. Trichobothrial pattern. **8-9.** Chela, dorso-external and ventral aspects. **10-11.** Patella, dorsal and external aspects. **12.** Femur, dorsal aspect.

Taxonomic treatment

Family **Buthidae** C. L. Koch, 1837

Genus *Tityus* C. L. Koch, 1836

Subgenus *Atreus* Gervais, 1843

Tityus (Atreus) generaltheophiloii sp. n. (Figs. 3-12)

Type material: Brazil, Roraima State, Serra da Mocidade National Park, 'Terra-Firme', 600 m alt. (Fig. 13), 1° 36' N, 61° 54' W, 15-26/I/2016 (leg. F. F. Xavier, R. Boldrini, P. Barroso). One female holotype. Holotype deposited in the National Institute for Amazon Research (INPA), Manaus, Brazil.

Patronym: name honors the Brazilian Army General Guilherme Cals Theophilo Gaspar de Oliveira, based in Brasilia, Brazil, who strongly supported the field expedition to the Serra da Mocidade National Park.

Diagnosis: a moderate species when compared with the average size of the other species in the subgenus *Atreus*: female up to 70.5 mm in total length. General pattern of pigmentation blackish-brown to dark blackish overall (a type of velvet blackish). Basal middle lamella of female pectines moderately to strongly dilated. Subaculear tooth moderately long and strongly spinoid. Pectinal tooth count 19/20 in female. Fixed and movable fingers of the pedipalp with 16/16 oblique rows of granules. Ventral carinae of metasomal segments II to IV parallel in configuration. Basal tooth of chelicera fixed finger with a trifold (trifidus) morphology. This new species is a possibly endemic element to the mountains of Serra da Mocidade National Park.

Description: based on female holotype. Measurements after the description.

Coloration. Basically blackish-brown to dark blackish overall (velvet blackish). Prosoma: carapace blackish-brown; eyes surrounded by dark blackish pigment. Mesosoma: tergites blackish-brown with reddish-brown confluent stripes on the posterior edges of tergites I-VI. Metasomal segments blackish-brown; V very dark, almost blackish. Vesicle dark, almost blackish; aculeus reddish at the base and blackish at the tip. Ventral aspect blackish-brown with diffused reddish spots; sternite V with a white triangle; pectines pale yellow. Chelicerae dark yellow with a dark thread; fingers blackish with dark reddish teeth. Pedipalps globally blackish with the extremities of fingers reddish. Legs globally blackish.

Morphology. Carapace strongly granular; anterior margin with a moderate concavity. Anterior median superciliary and posterior median carinae moderate. Furrows moderately to strongly deep. Median ocular tubercle distinctly anterior to the centre of carapace. Eyes separated by a little more than one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular. Mesosoma: tergites strongly granular. Median carina moderate in all tergites. Tergite VII pentacarinata. Venter: genital operculum divided longitudinally; each half with a semi-triangular shape. Pectines: pectinal tooth count 19/20 in female holotype; basal middle lamellae of the pectines moderately to strongly dilated in the female. Sternites weakly granular with elongate spiracles; VII with four carinae. Metasomal segment I with 10 carinae, crenulate; segment II with 8 carinae, crenulate; segment III with 8 carinae, crenulate; segment IV with 8 carinae, crenulate; segment V with 5 carinae, crenulate. Dorsal carinae on segments II to IV with 2-3 strong spinoid granules. Lateral inframedian carinae on segment I complete, strongly crenulate; on II represented by only 3 distal granules; absent from III and IV. Ventrolateral carinae strong, crenulate. Ventral submedian carinae strongly crenulate. Intercarinal spaces weakly to moderately

granular. Segment V with dorsolateral, ventrolateral and ventromedian carinae strongly crenulated. Lateral intercarinal spaces moderately granular. Telson, moderately to weakly granular, with a long and strongly curved aculeus. Dorsal surface smooth; ventral surface moderately granular in female; subaculear tooth moderately long and strongly spinoid. Cheliceral dentition characteristic of the family Buthidae (Vachon, 1963); movable finger with two well-formed basal teeth; fixed finger with a trifid (trifidus) basal tooth; ventral aspect of both fingers and manus with long dense setae. Pedipalps: femur pentacarinat; patella with 7 carinae; chela with 9 carinae; all faces moderately granular. Fixed and movable fingers with 16/16 oblique rows of granules. Trichobothriotaxy; orthobothriotaxy A- α (Vachon, 1974, 1975). Legs: tarsus with numerous short fine setae ventrally.



Fig. 13. Habitat of *Tityus (Atreus) generaltheophiloi* sp. n., showing typical vegetation (photo F. F. Xavier Filho).

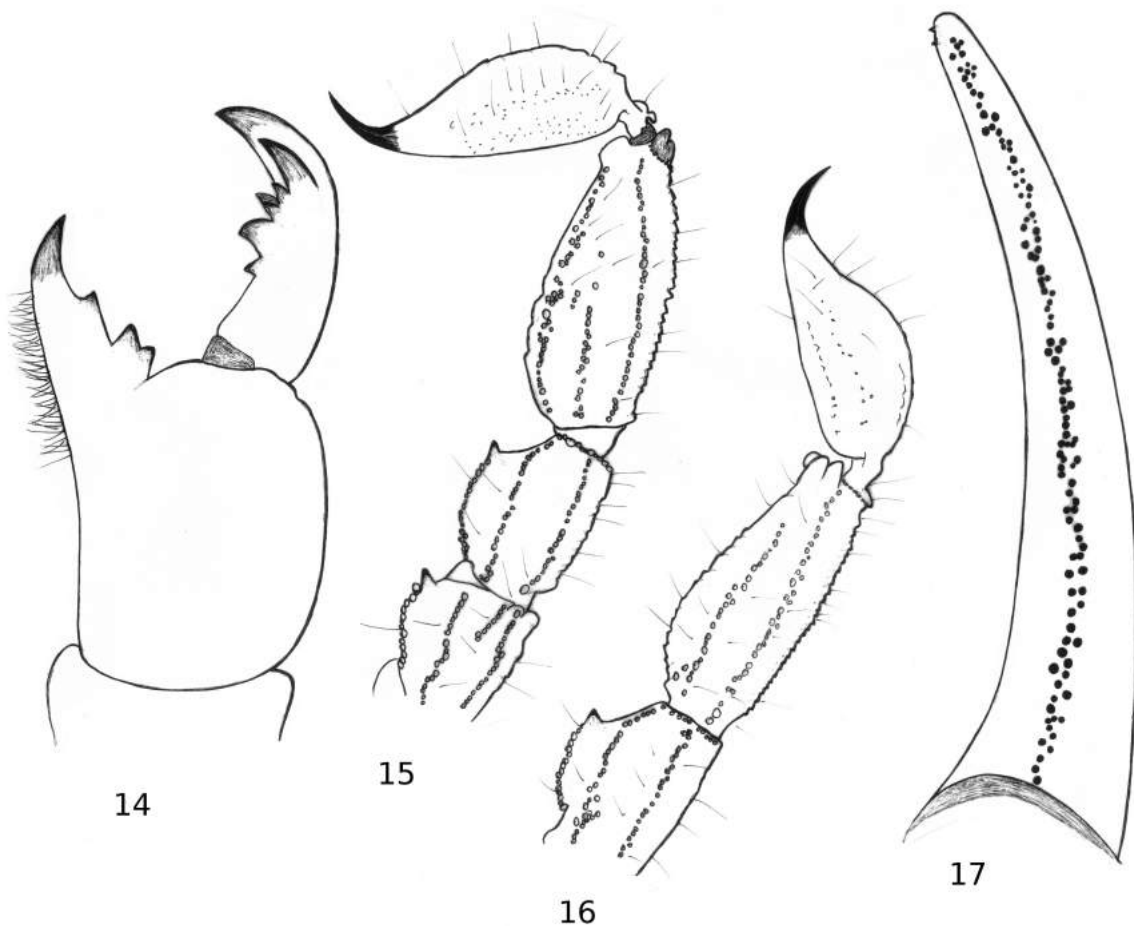
Relationships: from its general morphology, the new species belongs to the subgenus *Atreus*. Because of its morphological features and also because of the closest area of distribution, it can be associated with *Tityus dinizi* Lourenço 1997, described from the Rio Negro area. The two species can, however, be distinguished from each other by a number of features: I) the new species has a darker blackish coloration overall, particularly on the legs and pedipalps; II) the basal middle lamella of the pectines is less dilated in the new species than it is in *T. dinizi*; III) body and appendages are less elongated in the new

species; IV) basal tooth on fixed finger of chelicera has a particular trifid morphology in the new species.

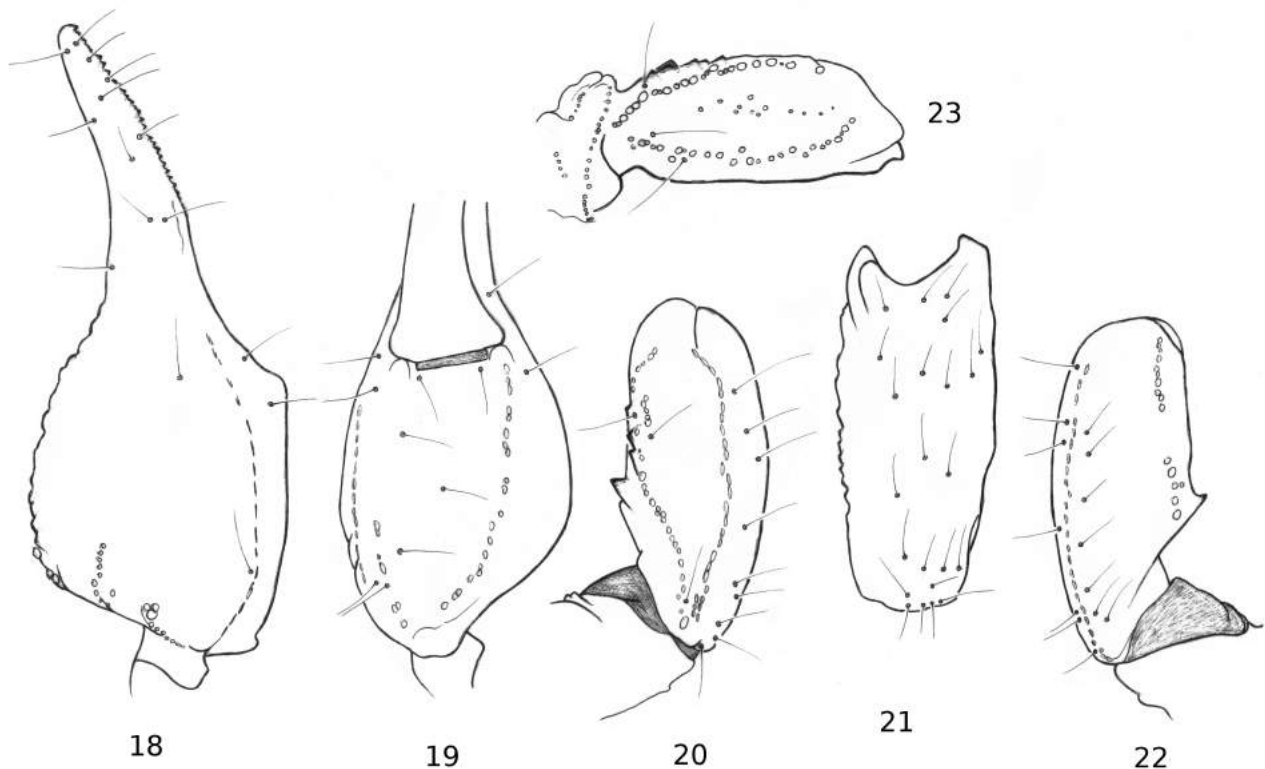
Moreover, the habitat of both species is quite distinct. *Tityus dinizi* is found in flooding areas (Igapos) in the region nearby the Rio Negro margins whereas the new species was collected in the mountain range of 'Serra da Mocidade' National Park, at altitudes of 600-700 m.

Morphometric values of the female holotype of *Tityus (Atreus) generaltheophilo* sp. n.

Total length (including the telson), 70.5. Carapace: length, 8.0; anterior width, 5.9; posterior width, 9.1. Mesosoma length, 19.6. Metasomal segments. I: length, 5.2; width, 4.3; II: length, 6.2; width, 4.3; III: length, 7.1; width, 4.2; IV: length, 8.1; width, 4.1; V: length, 8.9; width, 3.9; depth, 3.7. Telson length, 7.4. Vesicle: width, 2.9; depth, 3.0. Pedipalp: femur length, 8.5, width, 2.2; patella length, 8.8, width, 3.1; chela length, 15.8, width, 2.8, depth, 2.7; movable finger length, 10.7



Figs. 14-17. *Broteochactas (Taurepania) mauriciodiasi* sp. n. Female holotype (14, 16) and male paratype (15, 17). 14. Chelicera, dorsal aspect. 15-16. Metasomal segments III-V and telson, lateral aspect. 17. Cutting edge of movable finger, showing granulations.



Figs. 18-23. *Broteochactas (Taurepania) mauriciodiasi* sp. n. Female holotype. Trichobothrial pattern. **18-19.** Chela, dorso-external and ventral aspects. **20-22.** Patella, dorsal, external and ventral aspects. **23.** Femur, dorsal aspect.

Family **Chactidae** Pocock, 1893

Genus *Broteochactas* Pocock, 1893

Subgenus *Taurepania* Gonzalez-Sponga, 1978 stat. n.

Broteochactas (Taurepania) mauriciodiasi sp. n. (Figs. 14-23)

Type material: Brazil, Roraima State, Serra da Mocidade National Park, 'Terra-Firme', 1050 m alt. (Fig. 24), 1° 42' N, 61° 47' W, 25/I-6/II/2016 (leg. M. Oliveira, F. F. Xavier, T. Mahlmann). One female holotype, 2 females and 4 males paratypes. Holotype and 4 paratypes deposited in the National Institute for Amazon Research (INPA), Manaus, Brazil; two paratypes (one male and one female) deposited in the Muséum national d'Histoire naturelle, Paris, France.

Patronym: name honors Mr Mauricio Dias, Director of GRIFA, São Paulo, Brazil, who strongly supported the field expedition to the Serra da Mocidade National Park.

Diagnosis. Small to moderate sized scorpions with respectively 34.7 and 32.9 mm in total length for the biggest female and male examined. Coloration reddish-yellow to reddish-

brown. Body and appendages moderately to strongly granulated with some smooth and lustrous zones. Metasomal carinae moderately to strongly marked; segment V with several spinoid granules on ventral aspect; segments I to IV with strong posterior spinoid granules on dorsal carinae. Pectines with 8-9 teeth (mode 8/9). Dentate margins on fixed and movable fingers of pedipalps with 6/7 more or less delimited rows of granules. Rows not separated by clearly larger accessory granules, but rather by a conglomeration of small granules. Trichobothrial pattern of type C, majorante neobothriotaxy.

Description: (based on female holotype and paratypes). Coloration. Basically reddish-yellow to reddish-brown. Prosoma: carapace reddish-brown. Tergites reddish-brown, as the carapace. Metasomal segments reddish-yellow, paler than tergites; vesicle reddish-yellow; aculeus dark red. Chelicerae yellowish marked with diffused variegated spots; fingers yellow with diffused variegated spots; teeth reddish. Pedipalps reddish-brown; femur and patella with blackish zones over the carinae; chelae reddish-brown; granulations over the dentate margins of fingers blackish. Legs yellow without spots. Venter yellow to reddish-yellow; sternite V with a pale, almost white triangle; coxapophysis brownish; pectines and genital operculum pale yellow in female to pale brown in male.

Morphology. Carapace moderately granular; furrows shallow. Sternum pentagonal, wider than long. Tergites almost acarinate, moderately granular, with granulations better marked on male. Pectinal tooth count 9/8 for female holotype (see diagnose for variation), fulcra absent. Sternites weakly granulated, better marked on male, VII acarinate; spiracles with an oval-shape. Only metasomal segment V longer than wide; metasomal tegument lustrous with some minute granulations; segment V with conspicuous spinoid granulations ventrally. Dorsal and latero-dorsal carinae strongly marked on segments I-IV; other carinae equally strong; ventral carina present on all segments; vestigial on segment I of female. Pedipalps: femur with dorsal internal, dorsal external and ventral internal carinae moderately to strongly marked; ventral external carina weak; tegument with very few granulations, almost smooth; internal aspect very weakly granular. Patella almost smooth; all carinae moderate to strong. Chela with minute granulations; all carina weakly to moderately develop; internal aspect with a few granules. Dentate margins on fixed and movable fingers of pedipalps with 6/7 more or less delimited rows of granules. Rows not separated by clearly larger accessory granules, but rather by a conglomeration of small granules. Chelicerae with a dentition typical of Chactidae (Vachon, 1963), and with dense setation ventrally and internally. Trichobothrial pattern of type C, majorante neobothriotaxy. (Vachon, 1974).

Relationships: *Broteochactas (Taurepania) mauriciodiasi* sp. n. can be distinguished from other species in the subgenus *Taurepania* and in particular from *Broteochactas (Taurepania) porosa* (Pocock, 1900) which occurs in the nearby region of the Monte Roraima, by the

following features: I) some distinct morphometric values; II) carapace and tergites more intensely granulated; III) a slightly inferior number of teeth on pectines; IV) a particular granulation on chela fingers, randomly arranged and without the presence of conspicuous accessory granules.

Moreover, the two cited species are most certainly endemic elements to their respectively summits.

Morphometric values of the female holotype and male paratype of *Broteochactas (Taurepania) mauriciodiasi* sp. n.

Total length (including the telson), 34.7/32.9. Carapace: length, 4.8/4.4; anterior width, 3.2/2.8; posterior width, 5.0/4.5. Mesosoma length, 9.8/8.3. Metasomal segments. I: length, 2.0/1.8; width, 3.0/3.1; II: length, 2.2/2.0; width, 2.8/2.9; III: length, 2.3/2.2; width, 2.7/2.9; IV: length, 2.5/3.1; width, 2.6/2.8; V: length, 5.5/5.6; width, 2.5/2.6; depth, 2.2/2.2. Telson length, 5.6/5.5. Vesicle: width, 2.4/2.4; depth, 1.8/1.8. Pedipalp: femur length, 4.0/3.5, width, 1.7/1.5; patella length, 4.6/4.1, width, 1.9/1.7; chela length, 8.6/7.7, width, 2.7/2.8, depth, 3.2/3.2; movable finger length, 5.2/4.4.



Fig. 24. Habitat of *Broteochactas (Taurepania) mauriciodiasi* sp. n., showing typical vegetation (photo F. F. Xavier Filho).

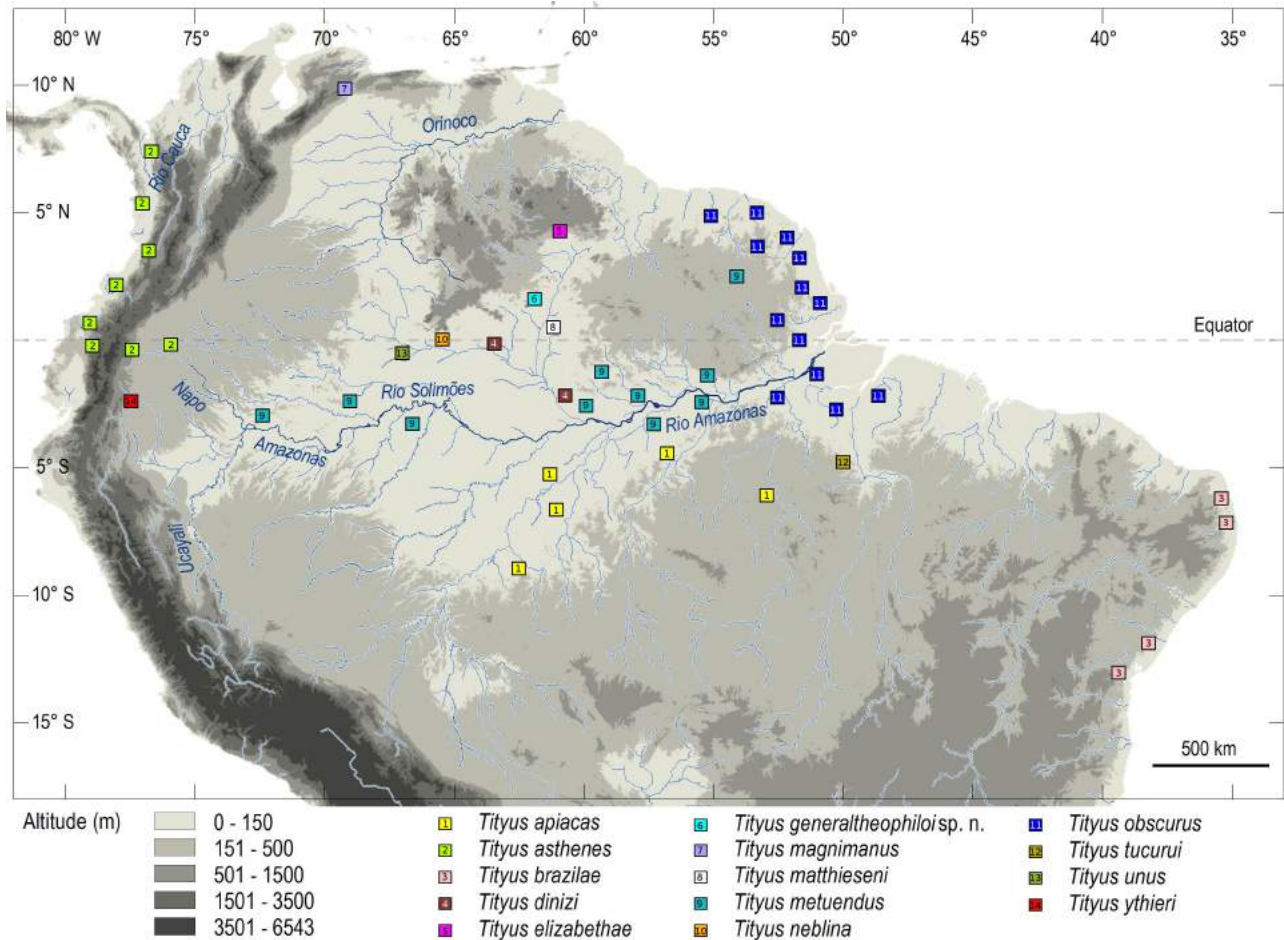


Fig. 25. Map of Northern South America - Amazonian and Guayana regions - showing the known distribution of the most important *Tityus* (*Atreus*) species, including the type locality of *Tityus* (*Atreus*) *generaltheophilo* sp. n.

Taxonomic comments on the subgenus *Taurepania* stat. n.

The genus *Taurepania* was created by González-Sponga (1978) based on the species *Broteochactas porosus* Pocock, 1900, one of the two species described by this author from Mt. Roraima. González-Sponga (1978), erroneously attributed the type locality of this species to Estado Bolivar in Venezuela. Sissom (2000) in the 'Catalog of the scorpions of the world', confirmed the type locality to Venezuela, but stated that Pocock (1900) cited Guyana instead. In fact the field expedition performed by Messrs F. V. McConnell and J. J. Quelch in Mount Roraima, was a British expedition and *a priori* took place in British Guiana. The matter may be problematic since Mt. Roraima is located in a tri-frontier location, between Brazil, Guyana and Venezuela.

Since the genus *Taurepania* and several other genera of Chactidae are very closely related to the genus *Broteochactas*, their status changed during the last decades. Lourenço (1986) considered *Taurepania* and several other genera as only group-of-species within

Broteochactas. In subsequent years some of these genera were rehabilitated as valid genera (Lourenço, 1994). *Taurepania* was maintained as a valid genus by Sissom (2000), but again invalidated by Soleglad and Fet (2003). In reality, the species associated to *Taurepania* remain extremely poorly studied. All these species apparently are associated to several summits of Northern Amazonia. For this reason and until better studies may be possible on these summit populations, *Taurepania* is considered here as a subgenus of *Broteochactas*.

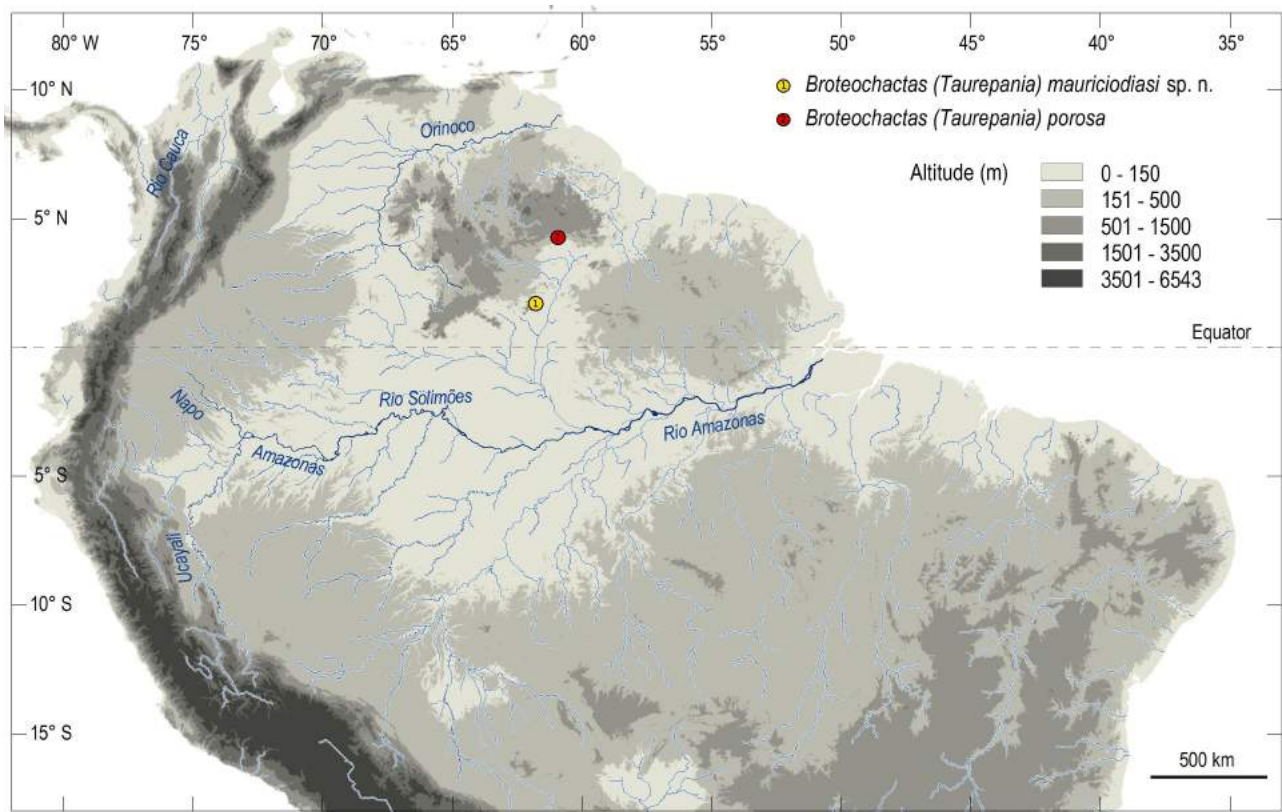


Fig. 26. Map of Northern South America - Amazonian and Guayana regions - showing the type localities of *Broteochactas (Taurepania) mauriciodiasi* sp. n. and *Broteochactas (Taurepania) porosa* (Mount Roraima).

Biogeographic considerations

Because of their low vagility, scorpions have frequently been used as biogeographic tools (Lourenço, 1996). The two new species described here were collected in the summits of Serra da Mocidade National Park, an area located E to the Imeri Endemic Centre (Figs. 25-26) as defined by Lourenço (1986, 1994). These new descriptions provide further evidence of the very high biodiversity and the important levels of endemism around the Rio Negro region (Lourenço, 2005; Lourenço & Molteni-Machado, 2004). The Serra da Mocidade National Park may be considered as a sub-centre of endemism related both to Imeri and Imataca centres.

Although several endemic centres of scorpions have been established within Amazonia, only a few can be considered to be well known. The best known centre is unquestionably

Manaus in Brazil, but even in this area new species are continuously being discovered and described (e. g. Lourenço & Pézier, 2002; Lourenço & Araujo, 2004; Lourenço *et al.*, 2005; Monod & Lourenço, 2001; Pinto da Rocha *et al.*, 2002).

Since the region around the Rio Negro is much more vast than that of Manaus, many new taxonomic elements, mainly at the level of species, but also even of genera, may be expected to be discovered and described in coming years. Any final conclusions regarding the actual composition of the scorpion faunas of both Manaus and specifically of the Rio Negro region should be interpreted with caution because the results obtained may well be biased in consequence of insufficient collecting and field work. The inventory of scorpions may present difficulties because these animals are often extremely cryptic and some species remain known only from a single locality. Until better methods of sampling are used, precautions must be taken into consideration in the interpretation of all biogeographical results (Prance, 1982; Lourenço, 1986, 1996).

The new evidence presented in this paper, based on scorpion studies, supports the conclusion that the upper Rio Negro and surrounded areas such as the 'Serra da Mocidade' National Park may represent important endemic centres.

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