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# Scorpions from the Mitaraka Massif in French Guiana: Description of one new genus and species (Scorpiones: Chactidae)

## *Scorpions du massif du Mitaraka en Guyane française : description d'un nouveau genre et d'une nouvelle espèce (Scorpiones : Chactidae)*

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ABSTRACT

A new genus and species, *Spinochactas mitaraka* gen. n., sp. n. (Chactidae) are described from the Mitaraka Massif in French Guiana, a site located near the borders of French Guiana, Brazil, and Suriname. The description of the new genus and species brings further evidence of the biogeographic pattern of distribution presented by some elements of the family Chactidae endemic to the Tepuys or to the Inselberg formations of South America.


*Mots clés :*
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RÉSUMÉ

Un nouveau genre et une nouvelle espèce, *Spinochactas mitaraka* gen. n., sp. n. (Chactidae) sont décrites du massif du Mitaraka, situé dans la zone frontalière entre la Guyane française, le Brésil et le Surinam. La description du nouveau genre et de la nouvelle espèce apporte un nouvel appui au modèle de distribution géographique présenté par certains éléments de la famille des Chactidae endémiques des régions des Tepuys ou des Inselbergs en Amérique du Sud.


## 1. Introduction

Until the early 1980s, the scorpion fauna of French Guiana did not particularly call the attention of experts, and the few publications devoted to this fauna were limited to isolated description [1] or to monographic compilations [2,3]. The first framework dedicated to the scorpion fauna of French Guiana was the one by Lourenço [4] in which all the species known to that date were treated. Many subsequent publications followed on the scorpion fauna of French Guiana, including some dealing with soil species [5]; however, very few studies were dedicated to the French Guiana Massifs represented by Inselbergs (Fig. 1). One exception was the description of a new species of *Ananteris* from the Haut Ouarimapan in the

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**Fig. 1.** French Guiana with several Inselberg formations and in particular the site of the Mitaraka Massif.

extreme southwest of this department [6]. Even if the studies on the French Guiana scorpion fauna are far from being complete, this region appears as one of the 'hotspots' for biodiversity in South America. The degree of endemism for the scorpion species present in the region can overpass 70% [7,8].

Previously to the scorpions recently collected by the 'French Guyana Expedition, 2015' (currently under study), two other specimens were collected in the South Mitaraka Massif (Fig. 2), located on the borders of French Guiana, Brazil and Surinam, and entrusted to me by the late J.-M. Betsch. These rather small specimens were obtained with the use of extraction methods such as Berlesi and Winkler. One proved to be *Ananteris sabineae* Lourenço, 2001, whereas the recent study of the second specimen led to the description of a new genus and species belonging to the family Chactidae Pocock, 1893. The description of this new genus and species brings further evidence about the biogeographic patterns of distribution of some chactid groups that are confirmed as endemic elements present only in Massif formations of South America such as the Tepuys and Inselberg.

## 2. Short recall about the Tepuys and Inselberg formations

The Tepuys (or Tepuis) are tabletop mountains ('mesas') found only in the Guayana highlands of South America, which are located in the Guayana Lowland Floristic Province. They consist of rather isolated entities, and present few connected ranges. This geographical particularity makes the Tepuys outstanding endemic centres for both plants and animals. From a geological point of view, the Tepuys are composed of sheer blocks of Precambrian sandstone and quartzite rocks. These mesas are the remains of a large sandstone plateau that once covered the granite basement complex between what is today the northern border of the Amazon Basin and the Orinoco, between the Atlantic coast and the Rio Negro. Throughout the course of the Earth's geological history, the plateau has been eroded and the Tepuys formed from the remaining Inselbergs (monadnocks). The plateaux of these mesas are completely isolated from the low-lying forest, making them 'ecological islands'. However, the altitude engenders a different climate from that of lowland forest.

**Fig. 2.** Aerial view of the Massif of Mitaraka in French Guiana.
Photo © Xavier Desmier.

The tops are exposed to cool temperatures with frequent rainfall, while the bases of the mountains have a warm and humid tropical climate [9–11].

As previously synthesized by Sarthou et al. [12,13], Inselbergs, from German 'Insel' = island and 'Berg' = mountain are isolated rocky outcrops consisting generally of Precambrian granite or gneiss. According to Sarthou et al. [12,13], the geomorphology and the geology of Inselbergs have been studied worldwide, and a survey was provided [14].

Contrarily to the Tepuys formations, which are exclusively of the Guiana region, shaped Inselbergs are scattered throughout Guiana and Brazilian Shields (up to East Bolivia). These outcrops rise abruptly from the surrounding plain landscape and represent singular habitats in tropical rainforests [12,13]. Consequently, these formations represent clear habitat fragmentation and constitute functional terrestrial islands [15] that contain rare endemic species, in most cases due to isolation and particular environmental conditions [12,16].

## 3. Biogeographical aspects of Tepuys and Inselbergs as possible palaeoclimate refugia and or endemic centres

As already explained in recent publications [17,18], the unique floral biota of the Guayana Highlands [19] was formerly considered to be the result either of vicariance after a long evolution in isolation, or of dispersal by successive connection and disconnection of summit floras due to Pleistocene climatic changes. Accordingly, 'dispersalists' adopted the refuge hypothesis [20–22] as a mechanism for genetic differentiation. This hypothesis invokes the alternation of dry and wet climates due to the recurrence of glacial and interglacial phases, respectively. Glacial aridity would have determined the fragmentation of forests into refugia with wet, stable climates surrounded by dry forest or savannah formations. Interglacials on the other hand, would have been characterized by forest expansion and coalescence throughout the entire Neotropical lowlands. The associated diversification model suggests allopatric speciation within forest refugia, which are still recognizable by their high biodiversity and endemism [4,7,8].

Contrarily, Rull [17] rejects, at least in part, the model of classical refugia and proposes instead one of diversification. This is based on the following observations from recent palynological data:

- vertical shifts and biotic interconnection among Tepuy and possibly Inselberg summits triggered by glacial/interglacial alternation have indeed occurred;
- about half of the summits would have remained isolated, so both vicariance and dispersal are needed to account for the long-term origin and evolution of the Pantepuy and global Inselberg biotas;
- the Guiana highlands were probably not, however, a biotic refuge during the Pleistocene glaciations [23–25].

Nevertheless, it can be assumed that these 'keystone' hypotheses should be tested by further studies yet to be carried out.

## 4. Scorpion refugia or endemic centres

The patterns of distribution and differentiation of scorpions have been used to define refugia, or at least endemic centres in the neotropics [8,26]. The refugia of scorpions correspond closely with those proposed for other groups of plants and animals in particular with those outlined by Prance [21,22] for woody plants. The patterns of distribution presented by most generic groups of the family Chactidae remain yet imprecise, but some models concerning precise cases of endemism and disruption start to be outlined. Examples are those presented by the species of the genera *Vachoniochatas* González-Sponga, 1978 and

*Hadrurochactas* Pocock, 1893 [18,27]. The first shows a clear pattern of biogeographical distribution over several Tepuy formations of the Guiana Highlands. The species of the genus *Hadrurochactas* are distributed in the Guayana and Amazon regions, but some endemic elements have been found in outlying forest islands called 'Brejos', in fact Inselbergs located within xerophytic formations, the 'Caatingas' of the northeastern Brazil. These Brejos hills are covered by forest, because their elevation causes humid air to cool so that condensation and consequent precipitation take place [28].

It is obvious that the scorpion inventory works in the Guiana Highlands, and in particular in Inselbergs is far from being complete. Consequently, one can expect the discovery of many new endemic species and even genera as well, to be found in these massif formations. The new genus and species described here represents one more element that supports Inselbergs as hotspots of plant and animal biodiversity.

## 5. Methods

Measurements and illustrations were made using a Wild M5 stereomicroscope with a drawing tube (camera lucida) and an ocular micrometer. Measurements follow those of Stahnke [29] and are given in millimetres. Trichobothrial notations are those developed by Vachon [30] and the morphological terminology mostly follows that of Hjelle [31].

## 6. Taxonomic treatment

Family Chactidae Pocock, 1893

Genus ***Spinochactas*** gen. n.

Generic name associates the name *Chactas* with the spinoid structures observed in the metasomal carinae.

Diagnose. Small scorpion, 12–13 mm in total length, including telson (the species is among the smallest ever described). Coloration yellow to reddish-yellow; only carapace and tergites are slightly marbled with brownish. Median eyes strongly anterior to the centre of the carapace; three pairs of lateral eyes; the third pair reduced and located just behind the second pair. Pectines very small with 6-6 teeth on female; fulcra absent. Spiracles strongly reduced and rounded in shape. Metasomal segments II to IV with dorsal and dorso-lateral carinae ending by a strong spinoid granule. Ventral face of segment V with a moderately marked granulation. Telson globular with a short aculeus; any subaculear tooth or spine absent; some granulations present including on the dorsal face. Pedipalps slender with fingers strongly curved; dentate margins on fixed and movable fingers with 7 almost linear rows of granules, separated only by reduced internal accessory granules. Trichobothrial pattern type C, majorante neobothriotaxy; patella with 7 ventral and 22 external trichobothria. Tarsi of legs with long thin setae.

Relationships: the presence of spinoid granules on dorsal and dorso-lateral carinae of metasomal segments II–IV associates the new genus to *Vachoniochactas* Gonzalez-Sponga, 1978, however, their trichobothrial patterns differs; the new genus has seven ventral trichobothria on patella, whereas *Vachoniochactas* has only five. In the new genus, the telson has a globular shape, as in *Auyantepuia*, but in this last genus the pedipalps are not slender, but rather short and bulky. *Broteochactas* Pocock, 1893 has also seven trichobothria on the ventral face of patella, but generally 34 on the external face, vs. 32 on the new genus. Finally, the presence of three lateral eyes, although the third pair is extremely reduced, is quite rare among chactid scorpions.

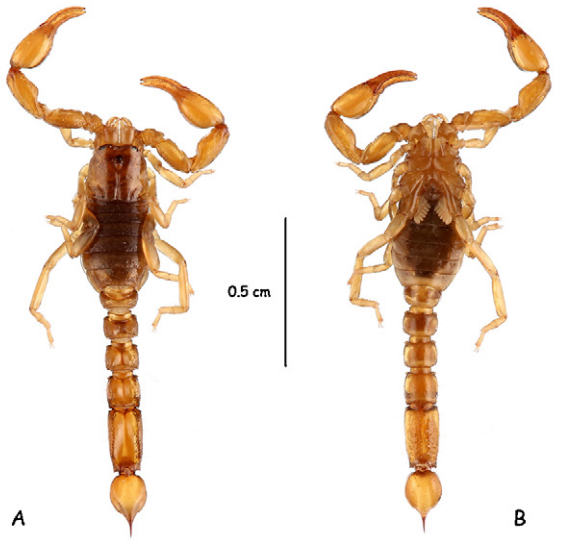


**Fig. 3.** *Spinochactas mitaraka* sp. n., female holotype. A–B. Habitus, dorsal and ventral aspects.

***Spinochactas mitaraka*** sp. n., (Figs. 3–6)

Material: female holotype. French Guiana, Mitaraka sud (640 m), 15/III/2001 (J.-M. Betsch leg.); collected by extraction together with a male specimen of *Ananteris*


**Fig. 4.** *Spinochactas mitaraka* sp. n., female holotype. A–B. Metasoma and telson, lateral aspect, showing carinae and distal spinoid granules.

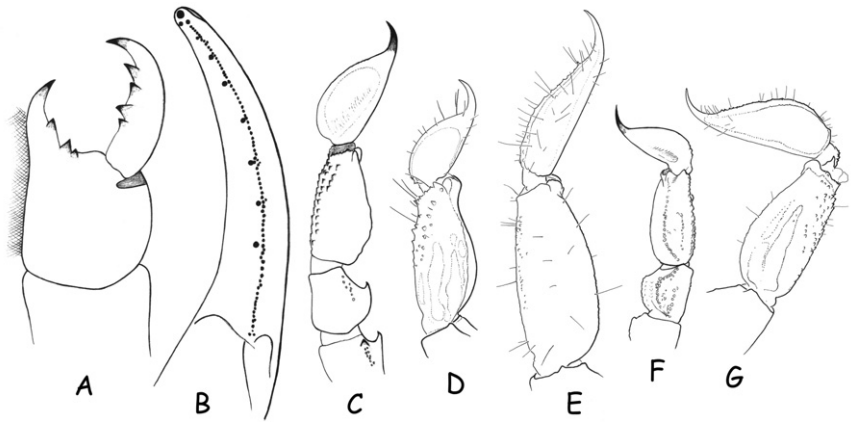


**Fig. 5.** *Spinochactas mitaraka* sp. n., female holotype. A. Chelicera, dorsal aspect. B. Cutting edge of movable finger showing rows of granulations. C. Metasomal segments III–V and telson, lateral aspect. D–G. Idem, for *Auyantepuia surinamensis*, *Hadrurochactas schaumii*, *Broteochactas delicatus* and *Vachoniochactas roraima*.

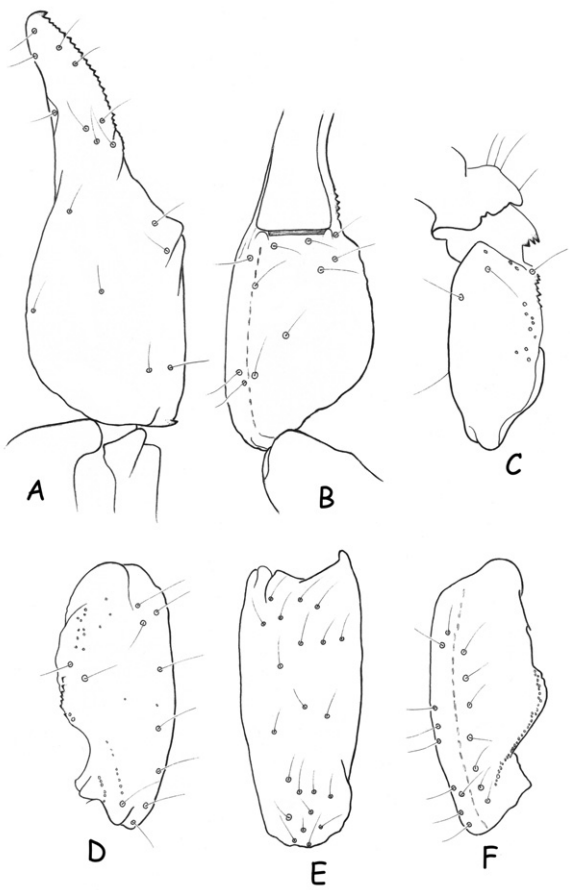


**Fig. 6.** *Spinochactas mitaraka* sp. n., female holotype. Trichobothrial pattern. A–B. Chela, dorso-external and ventral aspects. C. Femur dorsal aspect. D–F. Patella, dorsal, external and ventral aspects.

*sabineae*. Deposited in the Muséum national d'histoire naturelle, Paris.

Etymology: the specific name is placed in apposition to the generic name and refers to the Mitaraka Massif, the location in which the new species was collected.

Description based on female holotype. Measurements follow the description.

Coloration. Basically yellow to reddish-yellow; only carapace and tergites are slightly marbled with brownish. Metasomal segments yellow. Chelicerae yellow without spots; fingers yellow with reddish teeth. Pedipalps yellow to reddish-yellow. Legs pale yellow. Venter and sternites yellow; pectines pale yellow. The general pale coloration is in accordance with species dwelling in organic soils.

Morphology: carapace lustrous and slightly punctuated; carinae absent; furrows shallow; median eyes strongly anterior to the centre of the carapace; three pairs of lateral eyes; the third pair extremely reduced and located just behind the second pair. Sternum pentagonal, with length equal to width. Tergites acarinate, with only minute granulations. Pectinal tooth count 6-6 in female; fulcra absent. Sternites smooth and shiny; spiracles small and rounded. Metasomal segments I to IV wider than long; metasomal tegument punctuated except for some granulations on the ventral surface of segment V; ventral carinae absent from segments I to V. Metasomal segments II to IV with dorsal and dorso-lateral carinae ending by a strong spinoid granule. Telson globular with a short aculeus; subaculear tooth or spine absent; some granulations present including on the dorsal face. Pedipalps slender with fingers strongly curved. Femur with dorsal internal, dorsal external and ventral internal carinae moderately marked; ventral external carina vestigial; dorsal and ventral faces with minute granulations; internal face weakly granular. Patella smooth and lustrous; dorsal internal, ventral internal, ventral external and external carinae weakly marked; other carinae vestigial. Chela smooth and lustrous; carinae vestigial; internal face with granulations better marked on the base of fixed fingers. Dentate margins on fixed and movable fingers with seven almost linear rows of granules, separated only by reduced internal accessory granules; edge of movable finger with three granules. Chelicerae with the dentition typical of the family Chactidae [32]; teeth sharp. Internal and ventral setation conspicuous. Trichobothrial pattern type C, majorante neobothriotaxy; patella with 7 ventral and 22 external trichobothria [30] Tarsi of legs with long thin setae.

Morphometric values (in mm) of female holotype. Total length including telson, 12.92. Carapace: length, 2.00; anterior width, 1.34; posterior width, 2.20. Mesosoma length, 2.80. Metasomal segments. I: length, 0.80; width, 1.40; II: length, 0.87; width, 1.24; III: length, 0.94; width, 1.20; IV: length, 1.07; width, 1.20; V: length, 2.14; width, 1.20; depth, 1.07. Telson length, 2.30; width, 1.40; depth, 1.20. Pedipalp: femur length, 1.54, width, 0.74; patella length, 2.00, width, 0.94; chela length, 3.14, width, 1.10, depth, 1.14; movable finger length, 1.77.

## Disclosure of interest

The author declares that he has no competing interest.

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