Description of a new species of *Opisthacanthus* Peters (Scorpiones: Hormuridae) from Suriname/Brazil border with some biogeographic considerations

Descrição de uma nova espécie de *Opisthacanthus* Peters (Scorpiones: Hormuridae) da fronteira Suriname/ Brasil com considerações biogeográficas

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Scorpions of the genus *Opisthacanthus* Peters, 1861, family Hormuridae (formerly Ischnuridae and Liochelidae) have been the subject of several studies and revisions during the 1980s (*e.g.* Lourenço, 1983, 1985, 1987). In more recent years, only episodically, new discoveries were possible within this genus (*e. g.* Lourenço & Fé, 2003; González-Sponga, 2006; Rojas-Runjaic *et al.*, 2008). The only exceptions took place within the Malagasy scorpion fauna to which several new species have been described in the last ten years (*e. g.* Lourenço & Goodman, 2006, 2008; Lourenço, 2014 a, b; Lourenço *et al.,* 2016). For a synopsis of the patterns of distribution of the Malagasy species refer to Lourenço *et al.* (2016).

The study of two specimens belonging to the genus *Opisthacanthus*, from 'Campos' formations in northern Amazonia (Sipaliwini Savannah in Suriname) in the border between Suriname and Brazil leads to the description of a new species. This new species is related to *Opisthacanthus cayaporum* Vellard, 1932, originally described from 'Campos' formations in the south of the state of Pará, Brazil and, to a less extent to *Opisthacanthus heurtaultae* Lourenço, 1980 described from the Coastal savannas of French Guiana. Some comments on the

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known geographic distribution of the Neotropical species of *Opisthacanthus* are included in the paper.

The composition of the genus *Opisthacanthus* Peters, 1861

The classification given below takes into account the most recent taxonomic modifications proposed for the genus: (a) revalidation of *O. heurtaultae* Lourenço as an endemic element of the fauna of French Guiana, (b) description of the subgenus *Monodopisthacanthus* Lourenço to accommodate the Malagasy species (LOURENÇO, 2001), (c) description of two new species fromVenezuela.

Subgenus *Opisthacanthus* Peters, 1861

I. *cayaporum* group
Opisthacanthus cayaporum Vellard, 1932
Opisthacanthus heurtaultae Lourenço, 1980
Opisthacanthus weyrauchi Mello-Leitão, 1948
Opisthacanthus surinamensis sp. n.

II. *lepturus* group
Opisthacanthus lepturus (Beauvois, 1805)
Opisthacanthus elatus (Gervais, 1844)
Opisthacanthus valerioi Lourenço, 1980
Opisthacanthus borboremai Lourenço & Fé, 2003
Opisthacanthus autanensis González-Sponga, 2006
Opisthacanthus brevicauda Rojas-Runjaic, Borges & Armas, 2008

III. *lecomtei* group
Opisthacanthus lecomtei (Lucas, 1858)

Subgenus *Nepabellus* Francke, 1974

I. *africanus* group
Opisthacanthus africanus africanus Simon, 1876
Opisthacanthus africanus pallidus Lourenço, 2003
Opisthacanthus capensis Thorell, 1876
Opisthacanthus diremptus (Karsch, 1879)

II. *asper* group
Opisthacanthus asper (Peters, 1861)

Opisthacanthus basutus Lawrence, 1955
Opisthacanthus rugiceps Pocock, 1897

III. *laevipes* group
Opisthacanthus laevipes (Pocock, 1893)

IV. *rugulosus* group
Opisthacanthus lamorali Lourenço, 1981
Opisthacanthus rugulosus Pocock, 1896

V. *validus* group
Opisthacanthus piscatorius Lawrence, 1955
Opisthacanthus validus Thorell, 1876

Subgenus *Monodopisthacanthus* Lourenço, 2001

I. *madagascariensis* group

Opisthacanthus madagascariensis Kraepelin, 1894
Opisthacanthus lucienneae Lourenço & Goodman, 2006
Opisthacanthus maculatus Lourenço & Goodman, 2006
Opisthacanthus darainensis Lourenço & Goodman, 2006
Opisthacanthus piceus Lourenço & Goodman, 2006
Opisthacanthus milloti Lourenço & Goodman, 2008
Opisthacanthus pauliani Lourenço & Goodman, 2008
Opisthacanthus andohahela Lourenço, 2014
Opisthacanthus antsiranana Lourenço, 2014
Opisthacanthus ambanja Lourenço, 2014
Opisthacanthus lavasoa Lourenço, Wilmé & Waeber, 2016

Some comments on the geographical distribution of the Neotropical species of *Opisthacanthus*

The taxonomy of *Opisthacanthus lepturus*, remained unclear for a long time and, until the 1990s, this species was considered to be the same as *O. elatus*. The status of *O. lepturus* was finally clarified by Lourenço (1995), who confirmed that it represents an element endemic to the island of Hispaniola in the Caribbean area. It lives in tropical forests, but the population has apparently regressed with the destruction of its natural habitat.

Opisthacanthus elatus is found in the tropical forests of Panama, Colombia and parts of Venezuela. In Panama, where the species seems to be abundant, it is found in the palm '*Scheelea zonensis*' (Lourenço, 1988).

Opisthacanthus brevicauda was recently described from Venezuela from a region close to the Colombian border and not too far from The Maracaibo Lake. This population was previously considered as part of the distribution of *O. elatus*. The morphologic differences between the two species are weak, however, molecular evidence based on DNA studies seem to confirm the validity of the species (Rojas-Runjaic *et al.*, 2008).

Opisthacanthus valerioi is an endemic species to 'Cocos Island' on the Pacific coast of South and Central Americas. It also inhabits tropical forests.

Opisthacanthus cayaporum lives exclusively in a transition area between the central savannas of Brazil, and the Amazon forest. This region, called 'Campos dos Cayapos' can be considered already as part of the Amazon region, but is a savannah type formation. Due to intense human activity in the area, mainly cattle rising, the habitat of *O. cayaporum* is severely threatened and the scorpion population has experienced an important regression in the last 30 years.

Opisthacanthus weyrauchi is only known by a few specimens collected exclusively from the North of Peru. Its habitat is altitudinal savannah between 700-1000 m called the 'Punas' domaine.

Opisthacanthus heurtaultae has been found exclusively in coastal savannas of French Guiana, in the area of Kourou. The habitat of this species has also been considerably modified by human activity. Its population has severely regressed and will probably vanish.

Opisthacanthus borboremai was the first species of this genus to be described from the Amazon tropical rain forest in Brazil. It lives in the forests of the middle Rio Negro bordering the Riparian zones. It was found under death log in aggregated groups. New studies will be necessary to obtain further ecological information regarding *O. borboremai*.

Opisthacanthus autanensis is the second species described from Amazon region, but in this case from Venezuela. Lourenço & Fé (2003) already suggested that this population (not yet described to that date) could be the same as *O. borboremai*. Rojas-Runjaic *et al.* (2008) rejected this possibly synonymy but provide no justification. In account of the very poor description supplied by González-Sponga (2006) to this species, further studies will be necessary to define its status.

METHODS

Illustrations and measurements were produced using a Wild M5 stereomicroscope with a drawing tube and an ocular micrometer. Measure-

ments follow STAHNKE (1970) and are given in mm. Trichobothrial notations follow VACHON (1974) and morphological terminology is after HJELLE (1990).

TAXONOMIC TREATMENT

Family Hormuridae, Laurie, 1896
Genus *Opisthacanthus* Peters, 1861
Opisthacanthus surinamensis sp. n. (Figs. 1-4, 7-15)

MATERIAL — One female holotype, 1 male (pre-adult) paratype. Suriname/Brazil border, Serra do Tumucumaque region, SE Apikalo, X/1966 (F. Petter). Holotype and paratype deposited in the Muséum national d'Histoire naturelle, Paris.

ETYMOLOGY — The specific name refers to Suriname the country where the new species was found.

DIAGNOSIS — Medium to large size scorpions: adult female 71.3 mm in total length. Coloration reddish brown to dark brown, with some blackish zones. Pectines with 8-7 teeth in female and 10-10 teeth in male. Hemispermatophore unknown. Female genital operculum strongly heart-shaped and elongated at the base. Metasomal segments and telson, pedipalps and legs with a very strong chetotaxy Trichobothrial pattern of type C, majorante neobothriotaxy. Presence of three trichobothria on territory esb in the external face of patella.

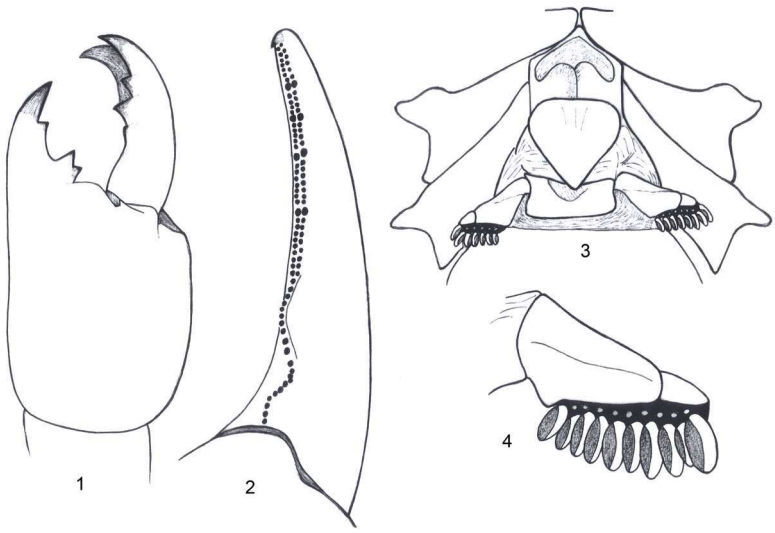
RELATIONSHIPS — Among the neotropical species of the genus *Opisthacanthus*, subgenus *Opisthacanthus*, the new species is allied to *Opisthacanthus cayaporum* Vellard and to *Opisthacanthus heurtaultae* Lourenço. It can, however, be distinguished from these two species by the following characters:

(i) bigger overal size, (ii) the morphology of female genital operculum plate, strongly heart-shaped and elongated at the base, more like that of *O. elatus*, (iii) a very strong chetotaxy on metasomal segments and telson, pedipalps and chela, (iv) metasomal segment I larger than long.

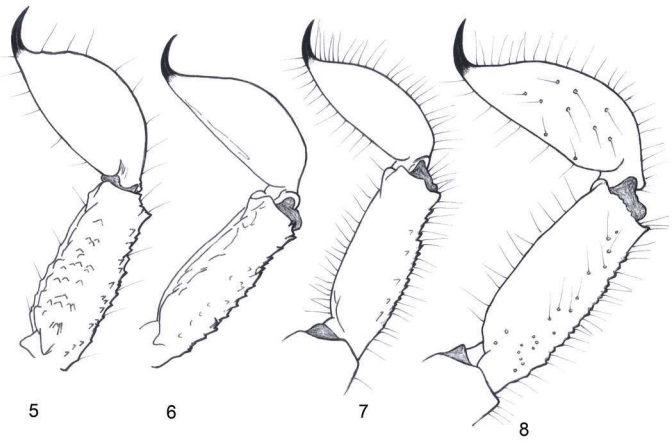
Moreover, the geographical distribution of the new species is markedly different from those of the other Neotropical species of the genus. Undoubtedly, the new species is a vicariant species to both *O. cayaporum* and *O. heurtaultae*, with a distribution located at a half distance of those of these two species

DESCRIPTION BASED ON FEMALE HOLOTYPE AND MALE PARATYPE.

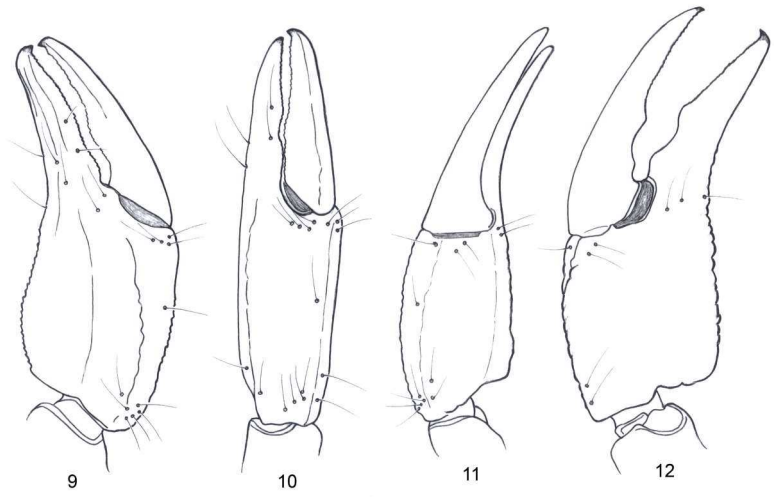
COLORATION — Basically reddish brown to dark brown with some blackish zones on the pedipalp carinae. Carapace reddish brown with a paler zone on the posterior edge; median and lateral eyes surrounded



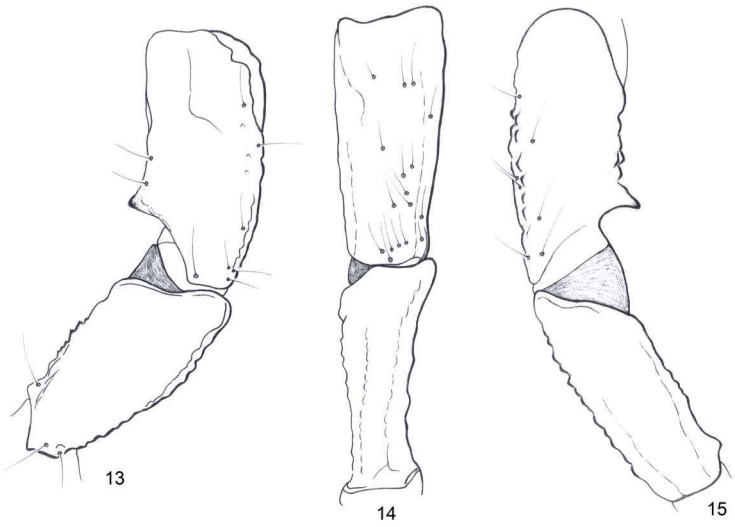
Figs. 1-4. *Opisthacanthus surinamensis* sp. n. 1-3, female holotype; 2-4, male paratype; 1, chelicera, dorsal aspect; 2, disposition of the granulation over the dentate margins of the movable finger of the pedipalp-chela; 3, ventral aspect, showing sternum, the shape of the genital operculum plate and pectines; 4, pecten.



Figs. 5-8. Metasomal segment V and telson, lateral aspect. 5, *O. cayaporum*, male holotype. 6, *O. heurtaultae*, male holotype. 7-8, *O. surinamensis* sp. n.: 7, male paratype; 8, female holotype.



Figs. 9-12. *Opisthacanthus surinamensis* sp. n. Male paratype. Trichobothrial pattern. Chela, dorso-external, external, ventral and internal aspects.



Figs. 13-15. *Opisthacanthus surinamensis* sp. n. Male paratype. Trichobothrial pattern. Femur and patella, dorsal, external and ventral aspects.

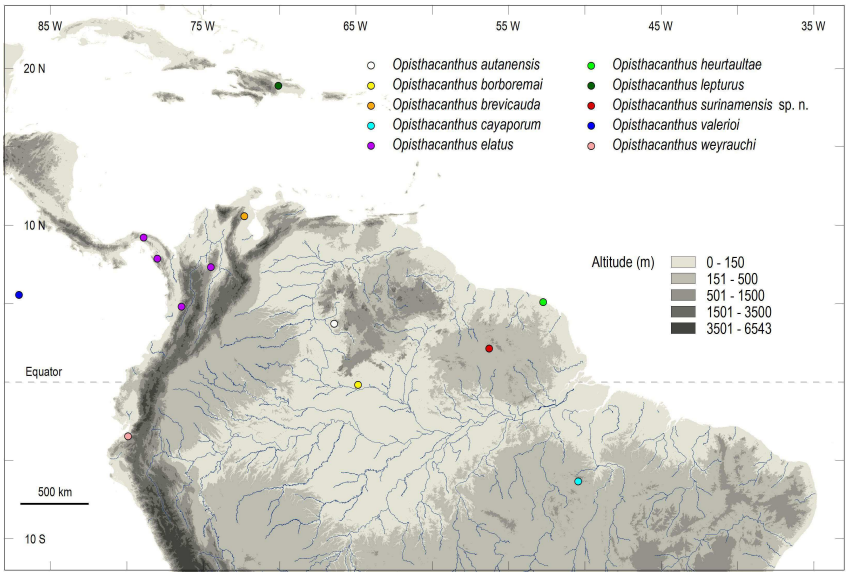


Fig. 16. Map of Tropical America showing the distribution of the Neotropical species of *Opisthacanthus* (subgenus *Opisthacanthus*).

with black pigment. Tergites dark brown with two longitudinal series of yellowish spots. Metasomal segments reddish brown, darker in female; vesicle dark yellow in both sexes; aculeus dark reddish. Chelicerae brownish-yellow; base of fingers darker; the whole surface with a diffuse variegated fuscous colour; fingers and teeth dark red. Pedipalps dark reddish-brown; chela darker than femur and patella; carinae and granulations almost blackish. Venter and sternites reddish yellow; pectines and genital operculum pale-yellow; legs brownish-yellow.

Morphology — Carapace with a thin and moderate granulation and no punctuation; furrows shallow. Anterior margin with a strong concavity reaching as far as the level of the 3rd lateral eye. Median ocular tubercle flattened and almost in the centre of the carapace; median eyes moderate, separated by a little more than one ocular diameter; three pairs of large lateral eyes. Sternum pentagonal and wider than long. Genital operculum formed by two semi-triangular plates in male, and one single heart-like shaped plate in female, very elongated on its base. Tergites with one vestigial median carina, and with thin and very weak granulation. Pectinal tooth count 8-7 in female holotype and 10-10 in male paratype. Sternites smooth and shiny; VII acarinate without punctuations. Metasomal segments II to V longer than wide; only segment I larger than long

Table 1. Measurements (in mm) of the female holotype of *Opisthacanthus surinamensis* sp. n. and of the female paratype of *Opisthacanthus cayaporum*.

	Opisthacanthus surinamensis sp. n. Female	*Opisthacanthus cayaporum* Female
Total length	71.3	63.7
Carapace:		
Length	10.9	11.0
Anterior width	7.3	8.2
Posterior width	12.8	12.4
Mesosoma length	29.6	20.9
Metasoma, segment I:		
Length	3.5	3.7
Width	3.7	3.4
Metasomal segment II:		
Length	3.8	4.2
Width	3.2	3.1
Metasomal segment III:		
Length	4.2	4.5
Width	2.8	2.9
Metasomal segment IV:		
Length	5.0	5.0
Width	2.7	2.5
Metasoma, segment V:		
Length	6.8	6.7
Width	2.3	2.4
Depth	2.6	2.7
Telson length	7.5	7.7
Vesicle:		
- width	2.4	2.6
- depth	2.7	3.0
Femur:		
- length	10.2	10.0
- width	4.3	4.2
Patella:		
- length	10.1	10.0
- width	5.8	5.9
Chela:		
- length	21.5	22.0
- width	6.2	4.9
- depth	8.5	8.2
Movable finger:		
- length	11.1	11.9

(diagnostic); all segments almost smooth and shiny, with a few punctuations, except for some sparse granulations ventrally on segment V. All carinae vestigial in segments I-IV; segment V rounded. All segments with a very marked chetotaxy, strongly marked on V. Telson with a pear-like shape; smooth and covered with strongly marked chetotaxy. Pedipalps: femur with dorsal internal, dorsal external, ventral internal and ventral external carinae strong, tuberculate; dorsal face with very thin granulation; ventral face smooth; internal face weakly granulose. Patella with external face strongly granulated; other faces smooth and lustrous; dorsal internal, ventral internal, ventral external and external carinae strong; other carinae less well marked. Chela strongly granular excepted on internal and ventral faces; dorsal marginal, external secondary, ventrointernal and ventral median carina strong; other carinae less well marked. Chelicerae typical of Scorpionoidea (Vachon, 1963). Trichobothriotaxy type C; Trichobothrial pattern of type C, majorante neobothriotaxy (Vachon, 1974). Presence of three trichobothria on territory esb in the external face of patella. Legs: tarsi with two lateral rows of spines, globally 4 internal and 3 external; all surrounded by several long setae. Spurs moderate. Hemispermatophore unknown

Biogeographic comments

As already outlined in previous publications (Lourenço, 2008), in South America some genera, as *Rhopalurus* are typical of open vegetation formations. This is also the case of some species of the genus *Opisthacanthus*, in occurrence these of the '*cayaporum* group of species'. The core area of distribution of this group of species is composed by the Amazonian and Guayanian savannas which extent from Eastern Amazonia to the Guayana floristic region (sensu Mori, 1991). One exception within this group is *Opisthacanthus weyrauchi* which is only known from the Punas, altitudinal savannah between 700-1000 m in the north of Peru.

The biogeographic pattern presented by the species of the '*cayaporum* group' is a good example of a discontinuous distribution. This kind of pattern can be both observed among scorpions exclusively adapted to savannas or rainforest formations. These endemic populations isolated inside savannah islands provide good evidence in support to the hypothesis of past connections between the savannas of central Amazonia and the savannah enclaves in the Guayana region. When forest cover was reduced, these open vegetation formations probably coalesced during past dry periods (Ab'Saber, 1977; Van der Hammen, 1983).

Some *Opisthacanthus* populations most probably exhibited a continuous distribution during Pleistocene dry periods and the present disrupted distribution is a possible consequence of the reestablishment of rainforest over the regions which previously served as corridors (Ab'Saber, 1977; Van der Hammen, 1983). The most recent of these events can be dated of only 18.000 to 13.000 years BP (Ab'Saber, 1977). This rather recent process of isolation led only to a minor process of speciation and differentiation, and as consequence the populations now found in several isolate fragments of savannas show very little morphological differences.

In face of the observed patterns of distribution and differentiation it becomes difficult to be sure about the true taxonomic status of these isolate populations. Consequently, the definition of these populations as true species, subspecies or only local morphs belonging to large to polymorphic populations is largely problematic.

SUMMARY

A re-analysis of the geographical distribution of neotropical species of the genus *Opisthacanthus* Peters (Scorpiones: Hormuridae) is proposed. A new species, *Opisthacanthus surinamensis* sp. n., is described from the Region of the Serra do Tumucumaque in the border between Suriname and Brazil (Sipaliwini Savannah in Suriname). This is the first record of a species of the genus *Opisthacanthus* from Suriname and the third one from Brazil. The total number of species in the Neotropical region is now raised to 10, although some of the Venezuelan species may yet require confirmation. The known geographical distribution of the genus is also enlarged with a new location in the Guayana region (sensu Mori, 1991).

Keywords: scorpion; distribution; *Opisthacanthus*; Amazonia: Suriname/Brazil

SUMÁRIO

Uma re-análise da distribuição geográfica das espécies do gênero *Opisthacanthus* Peters (Scorpiones: Hormuridae) é proposta. Uma nova espécie, *Opisthacantus surinamensis* sp. n., é descrita da região da Serra de Tumucumaque na fronteira entre a Suriname e Brasil (campos do Sipaliwini em Suriname). Este é o primeiro registro de uma espécie do gênero *Opisthacanthus* de Suriname e a terceira do Brasil. O número total de espécie na região Neotropical agora subiu para 10, embora algumas das espécies venezuelanas ainda requeiram confirmação. A distribuição conhecida do gênero é também ampliada com uma nova localidade na região da Guayana (*sensu* Mori, 1991).

Palavras chave: distribução; *Opisthacanthus*, Amazonia: Suriname/Brasil

RÉSUMÉ

Une ré-analyse de la distribution géographique des espèces néo-tropicales du genre *Opisthacanthus* Peters (Scorpiones : Hormuridae) est proposée. Une nouvelle espèce, *Opisthacanthus surinamensis* sp. n. est décrite de la région de la Serra do Tumucumaque à la frontière entre le Surinam et le Brésil (Savanne du Sipaliwini au Surinam). Ceci est le premier registre du genre *Opisthacanthus* au Surinam et le troisième pour le Brésil. Le nombre total d'espèces d'*Opisthacanthus* s'élève désormais à 10 pour la région néo-tropicale, cependant certaines espèces décrites du Venezuela requièrent encore une confirmation de leurs validités. La répartition du genre est également élargie avec une nouvelle station dans la région Guayana (sensu Mori, 1991).

Mots-Clés: distribution; *Opisthacanthus*; Amazonie; Surinam/Brésil

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