

**A REAPPRAISAL OF THE GEOGRAPHIC DISTRIBUTION OF THE GENUS
RHOPALURUS THORELL (SCORPIONES, BUTHIDAE) AND DESCRIPTION
OF TWO NEW SPECIES**

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ABSTRACT.— A review of the geographical distribution of the genus *Rhopalurus* Thorell (Scorpiones, Buthidae) is proposed. Two new species are described from Brazil : *Rhopalurus lacrau* n. sp. from a cave in the State of Bahia and *Rhopalurus piceus* n. sp., from the State of Roraima. Both new species came from localities having open vegetation formations, thus confirming the supposition that the species of *Rhopalurus* occur exclusively in open vegetation formations such as Savannas, Cerrados, Caatingas and Llanos.

KEY-WORDS.— Scorpion, Geographical distribution, New *Rhopalurus* species, Buthidae, Brazil

RESUME.— Une synthèse sur la distribution géographique du genre *Rhopalurus* Thorell (Scorpiones, Buthidae) est proposée. Deux nouvelles espèces sont décrites pour le Brésil : *Rhopalurus lacrau* n. sp., collectée dans une grotte dans l'Etat de Bahia et *Rhopalurus piceus* n. sp., collectée dans l'Etat de Roraima. Les deux nouvelles espèces ont été collectées dans des localités constituées par des formations végétales ouvertes, confortant ainsi l'hypothèse selon laquelle les espèces du genre *Rhopalurus* se distribuent exclusivement sur des formations végétales ouvertes telles les Savanes, les Cerrados, les Caatingas et les Llanos.

MOTS-CLES.— Scorpion, Distribution géographique, Nouvelles espèces de *Rhopalurus*, Buthidae, Brésil

INTRODUCTION

During almost half of a century, the validity of the characters used to separate the genera *Rhopalurus* Thorell, 1876 and *Centruroides* Marx, 1889 have been questioned (MEISE, 1934; MELLO-LEITÃO, 1945; VACHON, 1977). The matter was finally settled by LOURENÇO (1979; 1982) who revised the genus *Rhopalurus*, reducing the total number of known species to nine: five in Brazil, one in the Llanos of Venezuela and Colombia and three in the Caribbean area, Cuba and Hispaniola. Subsequently, LOURENÇO (1986) in a more detailed biogeographical and phylogenetic study added a new species from the Brazilian Amazon. This work confirmed the presence of a stridulatory apparatus in all the species of *Rhopalurus*, and suggested that it corresponded to an apomorphic or derived character (LOURENÇO & CLOUDSLEY-THOMPSON 1995), which clearly differentiates this genus from *Centruroides*. More recently another species, *Rhopalurus abudi* was described by ARMAS & MARCANO FONDEUR (1987), from the Dominican Republic. However, this new species requires confirmation since it might merely represent a variety of *Rhopalurus princeps* (Karsch, 1879) known from Haiti.

A recent study of collections deposited in the «Museu de Zoologia» of the University of São Paulo, revealed two new species of *Rhopalurus* from quite different localities. One was in the State of Bahia, in the «core» distributional area of this genus, and the second from the north of the State of Roraima, next to the border with Guyana. In both cases the specimens had been collected from areas with open vegetation formations, confirming that the genus *Rhopalurus* lives exclusively in open vegetation formations as Savannas, Cerrados, Caatingas and Llanos (LOURENÇO, 1982, 1986).

In addition to describing the two new species, the aim of this paper is to provide an up to date view of the geographical distribution of the genus *Rhopalurus* in both South America and Caribbean area, thereby confirming that it presents a typical distribution over open vegetation formations.

Rhopalurus lacrau new species (Figs. 1, 2, 3, 5, 7, 9, 11, 14)

Type.— Holotype female: Brazil, State of Bahia, Itaeté, Lapa do Bode (inside cave, 12°56'S - 41°04'W), 7/IX/1993 (E. Trajano leg.). Deposited in the «Museu de Zoologia, Universidade de São Paulo», MZSP-15.175.

Etymology.— The specific name is a Portuguese word that makes reference to an ancient name of scorpions, commonly used in the past in Brazil.

Description (based on female holotype).— Measurements in Table I.

Coloration. Basically yellowish. Prosoma: carapace yellowish; eyes surrounded with black pigment. Mesosoma: yellowish. Metasoma: segments I to IV yellowish, V yellowish-red. Vesicle of same colour as segment V. Venter yellow. Chelicerae yellow; fingers yellowish-red. Pedipalps: yellowish; fingers reddish. Legs yellowish without diffuse fuscous spots.

Morphology. Carapace moderately granular; anterior margin with a median concavity. Anterior median superciliary and posterior median keels moderate. All furrows moderate to deep. Median ocular tubercle distinctly anterior of the center. Eyes separated by more than one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular. Mesosoma: tergites moderately to strongly granular. Median keel strong in all tergites. Tergite VII pentacarinat. Venter: genital operculum divided longitudinally. Pectines: pectinal tooth count 17-16; basal middle lamellae of the pectines not dilated. Sternites smooth with moderately elongate stigmata; sternite VII with four keels. Metasoma: segments I to IV with dorsolateral and lateral supramedian keels crenulate. Lateral inframedian keels on segment I complete, strongly crenulate; absent from II to IV. Ventrolateral keels strong, crenulate. Ventral submedian keels strongly crenulate. Intercarinal spaces feebly granular. Segment V with dorsolateral keels moderate; lateromedian, ventrolateral and ventromedian keels vestigial. Lateral intercarinal spaces feebly granular, almost smooth. Telson, smooth with a short and curved aculeus. Subaculear tooth strong and very stocky, not spinoid. Cheliceral dentition characteristic of the family Buthidae; ventral aspect of both fingers and manus with dense, long setae. Pedipalps: femur pentacarinat; tibia with 7 keels; chelae with 9 keels, moderate or vestigial; all faces feebly granular. Movable fingers with 7 oblique rows of granules. Internal and external accessory granules present. Trichobothriotaxy : orthobothriotaxy A- α . Legs: tarsus ventrally with numerous short fine setae.

Taxonomical position.— Among the known species of *Rhopalurus*, *Rhopalurus lacrau* new species is most similar to *Rhopalurus debilis* (Koch, 1841), originally known from the State of Ceará in Brazil, mainly because of its small size. Both species can be identified by their patterns of coloration: *R. debilis* is darker with a conspicuous trapezoidal black spot on the anterior part of the carapace which is absent from the new species. Moreover, the subaculear tooth is absent in *R. debilis*.

Note.— Although this species was found inside a cave, it cannot be classified as a cavernicolous species because only one specimen (without troglomorphisms) was found. A biospeleologist visited the Lapa do Bode cave for 13 months, and she did not find any scorpions (L. F. Mendes personal

communication). Most of the scorpions of the family Buthidae found in caves are considered to be troglonexes (see LOURENÇO & FRANCKE 1985; PINTO-DA-ROCHA 1995).

Rhopalurus piceus new species (Figs. 4, 6, 8, 10, 12, 13, 15 to 20)

Types.— Holotype male: Brazil, State of Roraima, Tepequén, 15–22/VI/1993 (P.E. Vanzolini *leg.*). Deposited in the «Muscu de Zoologia, Universidade de São Paulo», MZSP–15173. Female allotype, same data as holotype. Male and female paratypes: Brazil, State of Roraima, Surumu (4°12'N – 60°47'W), 10/VII/1986 (C.M. Carvalho *leg.*), MZSP–10565; Rio Surumu, Rio Branco, X/1966 (M. Alvarenga *leg.*), Muséum National d'Histoire Naturelle, Paris (RS–8497).

Etymology.— The specific name makes reference to the blackish coloration of the new species.

Description (based on male holotype).— Measurements in Table I.

Coloration. Basically blackish. Prosoma: carapace blackish. Mesosoma: blackish with two longitudinal yellowish lines. Metasoma: segments I to V blackish with some reddish–yellow lateral spots. Vesicle: reddish–black. Venter yellow. Chelicerae reddish–yellow with a very dark thread; fingers dark. Pedipalps: blackish; fingers reddish–yellow. Legs yellowish with diffuse fuscous spots.

Morphology. Carapace strongly granular; anterior margin with a median concavity. Anterior median superciliary and posterior median keels strong. All furrows moderate to very deep. Median ocular tubercle distinctly anterior of middle. Eyes separated by more than one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular. Mesosoma: tergites strongly granular. Median keel strong in all tergites. Tergite VII pentacarinat. Venter: genital operculum divided longitudinally. Pectines: pectinal tooth count 23–24; basal middle lamellae of the pectines not dilated. Sternites smooth with elongate stigmata; VII with four keels. Metasoma: segments I to IV with dorsolateral and lateral supramedian keels crenulate. Lateral inframedian keels on segment I and II complete, strongly crenulate; on III represented by only two to three distal granules; absent from IV. Ventrolateral keels strong, crenulate. Ventral submedian keels strongly crenulate. Intercarinal spaces strongly granular. Segment V with dorsolateral and lateromedian keels vestigial; ventrolateral and ventromedian keels strong, crenulate. Lateral intercarinal spaces strongly granular. Telson, moderately granular with a long and strongly curved aculeus. Dorsal surface smooth; ventral surface granular; subaculear tooth very feeble, not spinoid. Cheliceral dentition characteristic of the family Buthidae; ventral aspect of both fingers and manus with dense, long setae. Pedipalps: femur pentacarinat; tibia with 7 keels; chelae with 9 keels; all faces moderate granular. A strong chetotaxy can be observed in all segments. Movable fingers with 10 oblique rows of granules. Internal and external accessory granules present. Trichobothriotaxy: orthobothriotaxy A– α . Legs: tarsus ventrally with numerous short fine setae.

Allotype and paratypes with same coloration and same general morphology as for the holotype. Female metasomal segments IV–V slightly slender than male. Female pectines smaller with 23–22 and 22–22 teeth. Male with 22–22.

Taxonomical position.— *Rhopalurus piceus*, new species, can readily be distinguished from all the other known species of the genus by its dark blackish coloration. The new species is the only one known with such dark pigmentation, although it lives also in an open vegetation formation, being an exception to the general coloration patterns observed in scorpions of the genus *Rhopalurus* (see LOURENÇO & CLOUDSLEY–THOMPSON 1996).

Table I.— Measurements (in mm) of the new species of *Rhopalurus*.

	<i>Rhopalurus lacrau</i>	<i>Rhopalurus piceus</i>	
	female	male (holotype)	female (allotype)
Carapace:			
length	4.6	7.9	8.2
anterior width	3.2	5.3	5.8
posterior width	5.0	8.6	9.2
Metasoma, segment I.			
length	2.8	5.4	5.6
width	2.7	4.6	4.9
Metasoma, segment V.			
length	5.2	6.8	7.5
width	3.6	5.5	5.6
depth	2.2	3.6	4.4
Vesicle:			
width	1.8	3.0	3.3
depth	1.8	2.7	2.9
Femur:			
length	4.7	7.7	8.1
width	1.4	2.2	2.4
Tibia:			
length	5.4	8.4	9.3
width	1.9	2.8	2.9
Chelae:			
length	8.7	13.9	15.7
width	2.2	2.4	2.6
depth	2.1	2.5	2.6
Movable finger:			
length	5.2	9.9	11.1

THE GEOGRAPHICAL DISTRIBUTION OF THE GENUS *RHOPALURUS*. AN EXAMPLE OF DISJUNCT DISTRIBUTION OF SCORPION TAXA IN SAVANNA FORMATIONS

Among the scorpion patterns of distribution observed at the millennial scale or Pleistocene biogeography there are examples of genera presenting a discontinuous distribution which are exclusively adapted to savannas such as *Rhopalurus* spp. or to rainforests such as some *Broteochactas* spp. (LOURENÇO, 1996).

These examples have an important relationship with species endemic to present habitat islands of savanna in Amazonian enclaves (*Rhopalurus amazonicus* Lourenço is endemic to an enclave of savanna inside the Amazonian rainforest; see Fig. 21), and with forest islands inside xerophytic formations as the Brazilian Caatingas. These isolated endemic populations provide good evidence in form of the hypothesis of past connections between the savannas of central Brazil and savanna enclaves in Amazonia and Gran-Sabana (Guayana region). When forest cover was reduced, open vegetation formations probably coalesced during past dry periods (AB'SABER, 1977). Moreover, the presence of « Brejos » inside the xeric Caatingas with typical rainforest elements, suggests past connections between the Amazon region and the Atlantic forest (ANDRADE-LIMA, 1982; BIGARELLA & ANDRADE-LIMA, 1982).

Scorpion provide good examples to support this suggestion. The genus *Rhopalurus*, which is specifically adapted to open vegetation formations (savannas and

caatingas) is widely distributed from north-eastern and central Brazil to the Guiana, Venezuela and Colombia, with some species present in the Greater-Antilles (LOURENÇO, 1982). This genus 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 region. Good evidence for this hypothetical paleodistribution is provided by the species *R. amazonicus* (LOURENÇO, 1986), endemic to savanna enclaves in Alter do Chão (State of Pará, Brazil). A cladistic analysis of the species of *Rhopalurus* demonstrated that *R. amazonicus* is phylogenetically closely related to *R. ucromelus* Lutz & Mello from central Brazil, which presents a range of distribution close to the area of transition between Cerrados and Amazonia.

The description of the two new species from Brazil (*Rhopalurus lacrau* from the State of Bahia and *Rhopalurus piceus* from the State of Roraima), brings further support to confirm the supposition that the species of the genus *Rhopalurus* can exclusively be found in open vegetation formations such as Savannas, Cerrados, Caatingas and Llanos.

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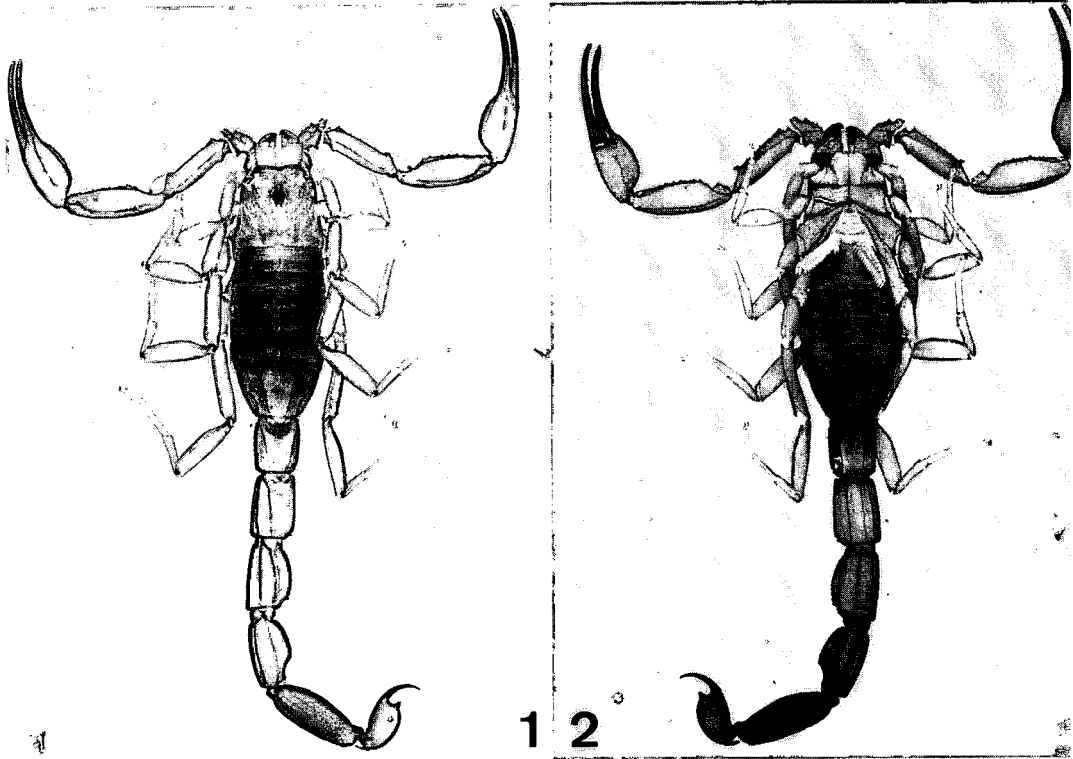
We are very grateful to Prof. John L. Cloudsley-Thompson of University College London, for reviewing the manuscript and to three anonymous referees for many useful suggestions.

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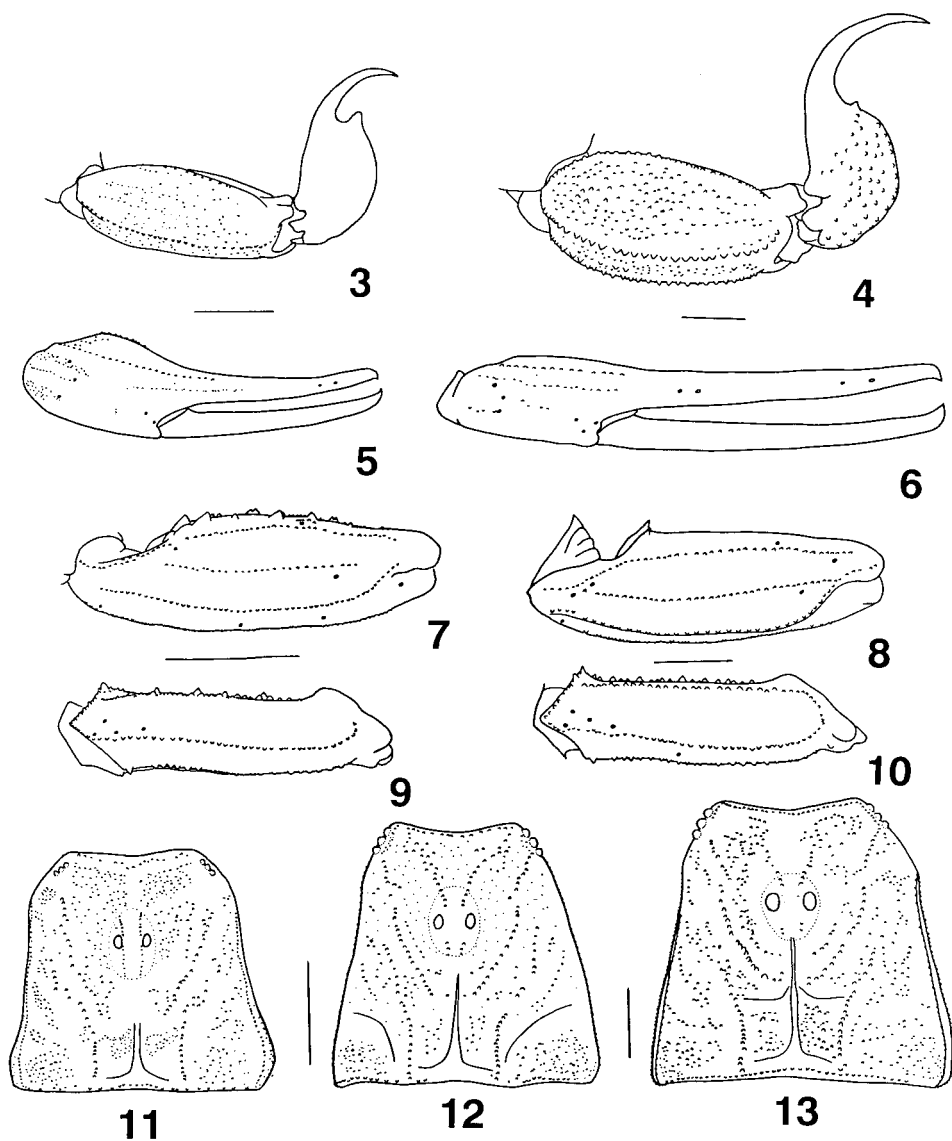
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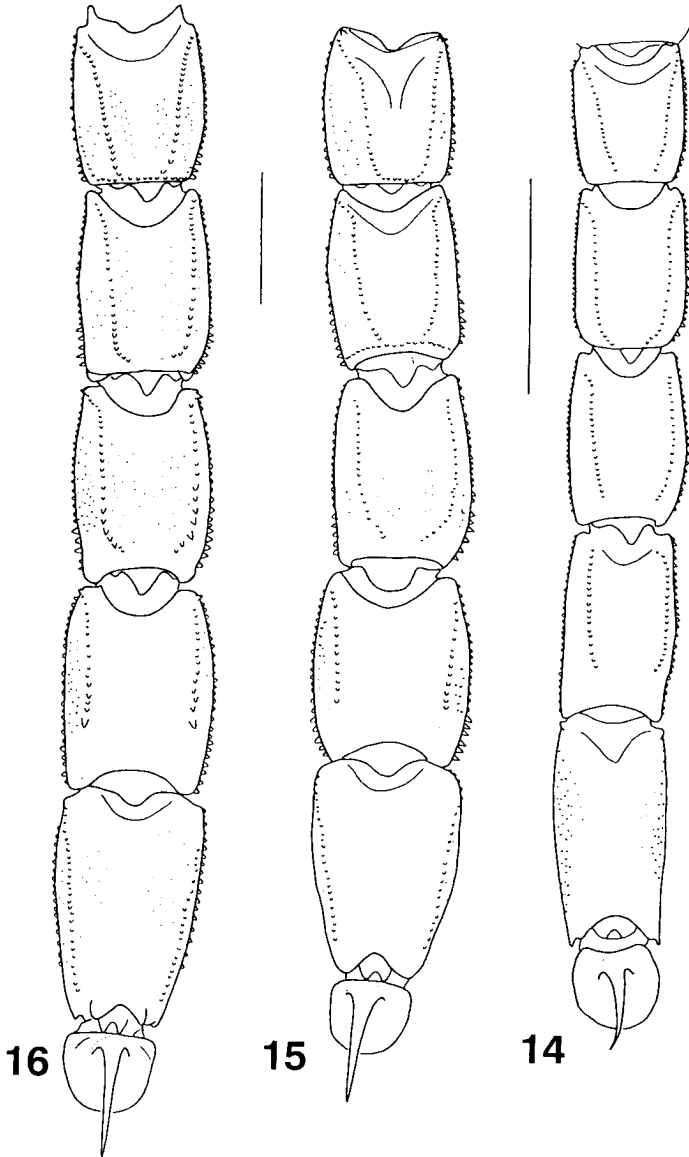
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Figs. 1 and 2. Female holotype of *Rhopalurus lacrau*. 1. dorsal view. 2. ventral view.



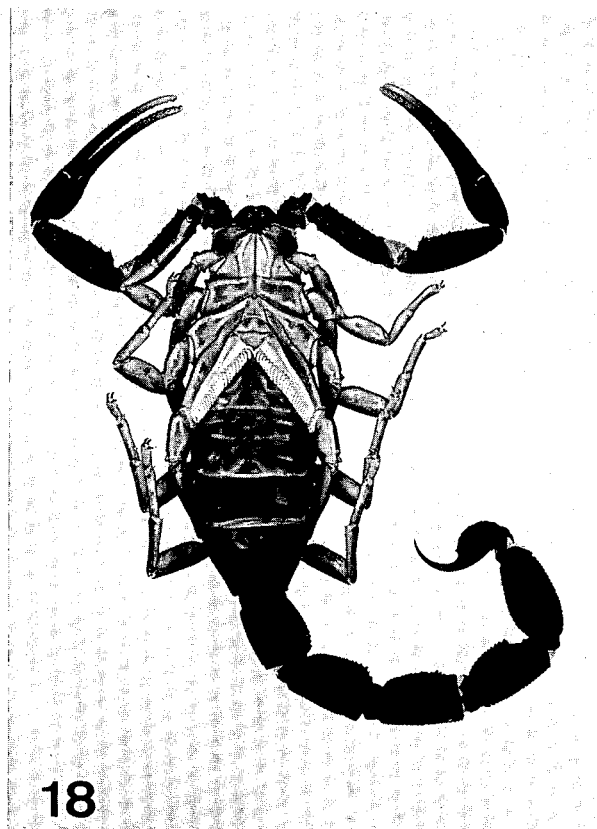
Figs. 3 to 13. Fifth metasomal segment and telson, lateral aspect. 3. *Rhopalurus lacrau* (holotype). 4. *Rhopalurus piceus* (holotype). Chelae, external aspect. 5. *R. lacrau* (holotype). 6. *R. piceus* (holotype). Tibia, dorsal aspect. 7. *R. lacrau* (holotype). 8. *R. piceus* (holotype). Femur, dorsal aspect. 9. *R. lacrau* (holotype). 10. *R. piceus* (holotype). Carapace. 11. *R. lacrau*. 12 and 13. *R. piceus*. 12. Male holotype. 13. Female allotype. Scale bars 2 mm.



Figs. 14 to 16. Metasoma, dorsal aspect. 14. *R. lacrau*, holotype. 15 and 16. *R. piceus*. 15. Male holotype. 16. Female allotype. Scale bars 5 mm.

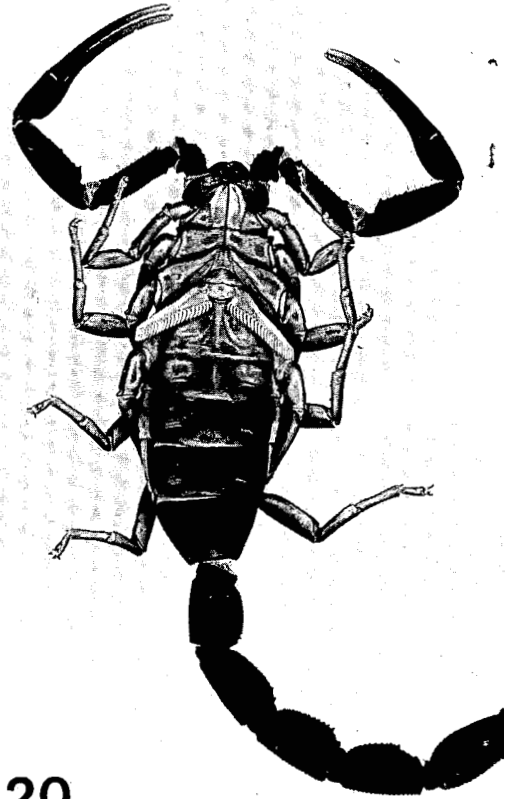


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Figs. 17 and 18. *Rhopalurus picèus*. Male holotype, dorsal and ventral views.



Figs. 19 and 20. *Rhopalurus piceus* Female allotype dorsal and ventral views.

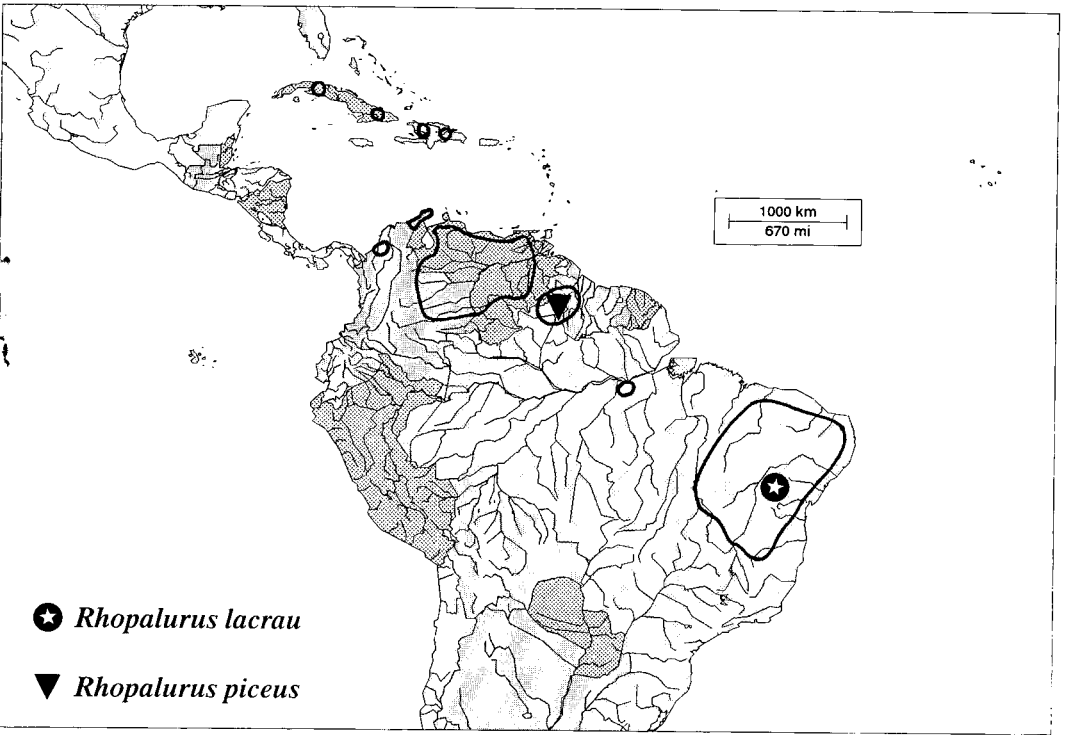


Fig. 21. Map showing the global distribution of the genus *Rhopalurus*, with the type-localities of the two new species.

NOUS AVONS REÇU

« *Les palmiers de l'Eldorado* »: Francis KAHN

Juin 1997, 252p., ORSTOM Editions. Diffusion : 32, avenue Henri-Varagnat, 93143 Bondy Cedex. Prix 160 FF t.t.c.

« L'Amazonie, cet océan de forêts qui semble infini, recèle de nombreux palmiers, fort diversifiés. Ces princes du monde végétal restent bien petits auprès des arbres géants, mais il n'est pas un Amazonien qui les ignore. Ce livre est une invite à la découverte des palmiers. Quelles sont leurs différentes formes et les grandes lignes de leur biologie ? Quels rôles jouent-ils au sein des forêts amazoniennes ? Quelle est leur place dans la vie quotidienne et dans l'imaginaire de l'homme ? Quel potentiel économique représentent-ils pour la mise en valeur des forêts ? Enfin, comment les reconnaître ? L'auteur passe en revue les différents genres de palmiers d'Amazonie et leurs principales espèces, et donne une clé d'identification des caractères les plus faciles à observer. Mais comment parler des palmiers sans aborder les menaces qui pèsent sur l'Amazonie, cet enfer vert au goût de paradis où la vie a tout osé, ce temple du vivant sans cesse profané pour son or jaune ou noir, pour son fer, sa bauxite, pour la force de ses eaux, pour ses terres gratuites ? Les palmiers nous entraînent vers une terre mythique, l'Eldorado, porteuse des rêves et des désirs de l'homme. Là, s'ouvrent les portes d'un monde fascinant où la nature, rayonnante de diversité, nous rappelle qu'il est peut-être encore temps d'éviter des désastres irréparables. Car l'Amazonie, c'est la mémoire de la vie...la nôtre aussi ».

« *L'homme et la forêt méditerranéenne de la Préhistoire à nos jours* »: Jean-Louis VERNET
Avril 1997, 248p., Editions Errance, 7, rue Jean-du-Bellay 75004, Paris. Prix 240 FF.

« La forêt méditerranéenne a connu, depuis un lointain passé, de nombreux changements dus aux variations climatique et, plus récemment, à l'action de l'homme. Dès le Néolithique, l'empreinte des paysans va organiser le paysage. La végétation actuelle est, en effet, le résultat des différentes interventions dans l'exploitation des terres qui, à certaines époques, purent provoquer de véritables crises dans l'agriculture. Travaillant avec les archéologues sur de nombreux sites, l'auteur a étudié des milliers d'échantillons de charbons de bois, créant une école d'anthracologie qui a permis une avancée unique en préhistoire sur la dynamique des écosystèmes. La connaissance de l'histoire de l'écologie de la forêt méditerranéenne est indispensable pour la nécessaire gestion de ces espaces, aujourd'hui si fragiles et menacés ».

« *Atlas de distribution des Orthoptères de Suisse* »: Philippe THORENS & Adolf NADIG
1997, 236p., Documenta Faunistica Helvetiae, Terreaux 14, CH-2000 Neuchâtel. 30 FS.

Cet ouvrage, très pratique, traite les espèces d'une manière individuelle. Elle est très bien illustrée, et particulièrement riche en cartes de répartition, constituant ainsi un outil très utile pour les amateurs des Orthoptères travaillant en Europe.