

SCORPION BIOGEOGRAPHIC PATTERNS AS EVIDENCE FOR A NEBLINA-SÃO GABRIEL ENDEMIC CENTER IN BRAZILIAN AMAZONIA

by

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Resumen

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Nuevas evidencias basadas en los modelos de la biogeografía de los escorpiones permiten ratificar como zona de endemismo la región de Imerí, y más concretamente el subcentro Neblina - San Gabriel (Venezuela-Brasil). Un 93% de las especies que habitan la región son endémicas de Imerí y el 100% lo son de la región Neblina-San Gabriel. Estos datos se comparan con los conocidos para otros centros de endemismo de escorpiones tales como Santa Marta (Colombia), Manaus (Brasil), e Imataca (Venezuela). Dos nuevas especies de Neblina-San Gabriel son descritas.

Palabras clave: Escorpiones, Endemismo, Biogeografía, Brasil, Amazonia, Pico de la Neblina.

Abstract

New evidence based on scorpion biogeographic patterns is proposed to further support an Imeri endemic center; more specifically a Neblina-São Gabriel endemic subcenter. Ninety-three percent of the species inhabiting the Imeri region are endemic; where as 100 percent are endemic in the Neblina-São Gabriel region. Comparative results are expressed for five well known scorpion endemic centers, i.e., Santa Marta (Colombia), Manaus (Brazil), Imataca (Venezuela) and Imeri/Neblina-São Gabriel (Venezuela and Brazil). Two new species from Neblina-São Gabriel are described.

Key words: Amazonia, Endemic center, Brazil, Pico de Neblina, Scorpion, Biogeography.

The Imeri refuge, a very complex area is comprised of parts of the Brazilian, Venezuelan and Colombian Amazonia (Prance, 1973, 1982; Lourenço, 1986). The extreme complexity of endemism in the upper Rio Negro area is discussed by Prance (1982), and Steyermark (1979). This paper retains the boundaries proposed and revised by Prance (1973, 1989) for the Imeri region, comprising Imeri (Prance, 1973, 1989) and Rio Negro refuges (Steyermark, 1982).

Because of their reduced vagility scorpions have frequently been used as biogeographic tools. Further studies on scorpion biogeographic patterns on the upper Rio Negro region yield new data on the Imeri region.

In addition to the definition and delimitation of a broader area as the Imeri endemic center, this paper proposes a more distinct subdivision of the Imeri region in agreement with Brown (1979, 1982). Following his studies on butterflies, Brown proposed two local endemic centers for the upper Rio Negro region: São Gabriel and Neblina. In this paper, patterns of scorpion distribution and differentiation are presented as new evidence in support of a single Neblina São Gabriel endemic center.

Description of the area

São Gabriel, pico da Neblina area is located in the upper Rio Negro region in western Brazilian Amazonia, State of Amazonas, on the border with Venezuelan Amazonia (from 0°S; 67°W to 1°N; 66°W). The pico da Neblina mountain is the highest site in Brazil (3014 m), being part of the «Sierra Imeri» which belongs to the

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Table 1
Measurements in mm of the described species

	<i>Teuthraustes lisei</i> female	<i>Vachoniochactas ashleeae</i> female
Total length	38,5	27,7
Carapace length	5,2	3,4
anterior width	3,3	2,2
Metasomal segment I		
length	2,5	1,6
width	3,5	2,2
Metasomal segment V		
length	4,8	3,6
width	3,2	1,9
depth	3,1	1,6
Vesicle		
width	2,2	1,4
depth	1,4	0,9
Chelae		
width	2,2	1,5
depth	3,3	1,3
Movable finger		
length	3,8	3,3

Table 2 Scorpion species present in the Imeri endemic center. See also figure 12

- * Species endemic to Imeri center.
** Species endemic to Neblina-São Gabriel subcenter.

BUTHIDAE

- Microtityus vanzolinii* Lourenço and Eickstedt
* *Tityus filodendron* Gonzalez-Sponga
* *Tityus urbinai* Scorza
** *Tityus* sp.

CHACTIDAE

- * *Botheas camposi* Gonzalez-Sponga
* *Botheas lichyi* Gonzalez-Sponga
* *Botheas mingueti* Gonzalez-Sponga
** *Botheas* sp.
* *Chactopsis anduzei* Gonzalez-Sponga
* *Chactopsis sujirima* Gonzalez-Sponga
** *Teuthraustes adrianae* Gonzalez-Sponga
* *Teuthraustes carmelinae* Scorza
** *Teuthraustes lisei* n.sp.
** *Vachoniochactas ashleeae* n.sp.

Roraima formation. According to Brown (1982), the Neblina-São Gabriel area is characterized by two major types of vegetation: rich, dense forests on rolling terrain, and cloud forests or montane forests. Annual rainfall in this area ranges from 3000 to 4000 mm.

Scorpions of Imeri endemic center

The scorpions of the Imeri endemic center belong to the two most common families in the Amazonia, i.e. Chactidae and Buthidae. In this specific region Chactidae scorpions are better represented than Buthidae. There are four genera and 10 species of Chactidae as compared to two genera and 4 species of Buthidae (Table 2). Within this region two new species of scorpions are described below. Two other scorpions, possibly new species, remain undescribed until more specimens can be collected.

Teuthraustes lisei n. sp. (Figs. 1-5).

Type data. Holotype female from Pico da Neblina, São Gabriel da Cachoeira, Amazonas, Brazil, 10/X/1990 (A.A.Lise). Deposited in the Museu de Ciências da PUCRS, Porto Alegre, Brazil (no paratypes).

Etymology: Patronym in honor of our colleague Dr. A.A. Lise of the Museu de Ciências da PUCRS, Porto Alegre, Brazil.

Description: Based on holotype female. Measurements as on table 1.

Coloration: Base color reddish brown. Prosoma, mesosoma, metasoma and vesicle reddish brown; eyes surrounded with black pigments. Venter yellowish brown; chelicerae yellow brown, infuscate on fingers; teeth reddish. Pedipalps: base color reddish brown; chelae and

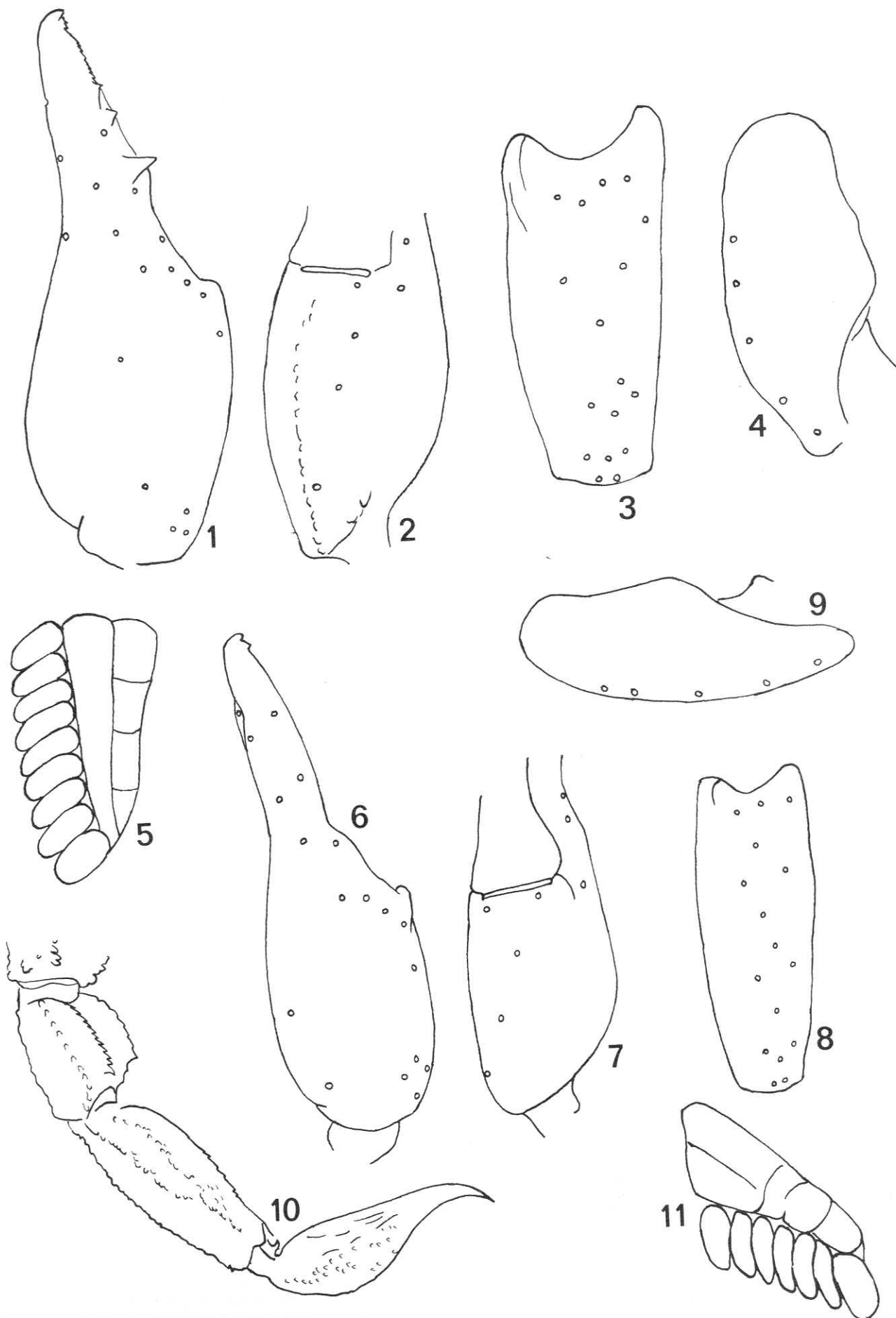
fingers reddish brown. Legs reddish with diffuse fuscous spots; tarsomeres yellowish.

Morphology: Prosoma: carapace almost smooth; anterior margin very feebly concave; median longitudinal and postero-lateral furrows distinct; median ocular tubercle distinctly anterior of middle; median eyes very small and widely separated by $1\frac{1}{2}$ diameter; two pairs of lateral eyes directed more toward the anterior margin of carapace; a third pair of vestigial eyes directly in the back of the second pair. Sternum pentagonal, wider than long. Mesosoma: tergites feebly granular, without keels; pectines: 9-9 teeth, without fulcra; distal tooth slightly wider. Genital operculum divided, with two suboval to subtriangular plates. Sternites feebly punctate, acarinate; stigmata small, oval. Metasoma: segments I-IV with strong dorsal keels; other keels vestigial; ventral keels obsolete; segment V with strong ventral keels. Vesicle, fusiform; ventral aspect feebly granular; dorsal aspect smooth. Chelicerae: movable finger with one basal and two subdistal teeth. Pedipalps: femur with four keels; all faces smooth. Tibia and Chelae with obsolete keels; intercarinal spaces feebly granular. Fingers with six rows of denticles. Trichobothrial pattern (Figs. 1-4) type C, neobothriotaxic. Legs: tarsomere II with dense setae ventrally arranged in rows.

This species is related to *Teuthraustes adrianae* Gonzalez-Sponga, but differs for most of the morphometric values.

Vachoniochactas ashleeae n. sp. (Figs. 6-11).

Type data. Holotype female from Pico da Neblina, São Gabriel da Cachoeira, Amazonas, Brazil, 8/X/1990 (A.A.Lise). Deposited in the Museu de Ciências da PUCRS, Porto Alegre, Brazil (no paratypes).



Figs. 1-5. *Teuthraustes lisei* n.sp. 1-4. Trichobothrial pattern. 1-2. Chelae, external and ventral aspects. 3-4. Tibia, external and ventral aspects. 5. Pecten. Figs. 6-11. *Vachoniochactas ashleeae* n. sp. 6-9. Trichobothrial pattern. 6-7. Chelae, external and ventral aspects. 8-9. Tibia, external and ventral aspects. 10. Metasomal segments IV, V and telson. 11. Pecten.

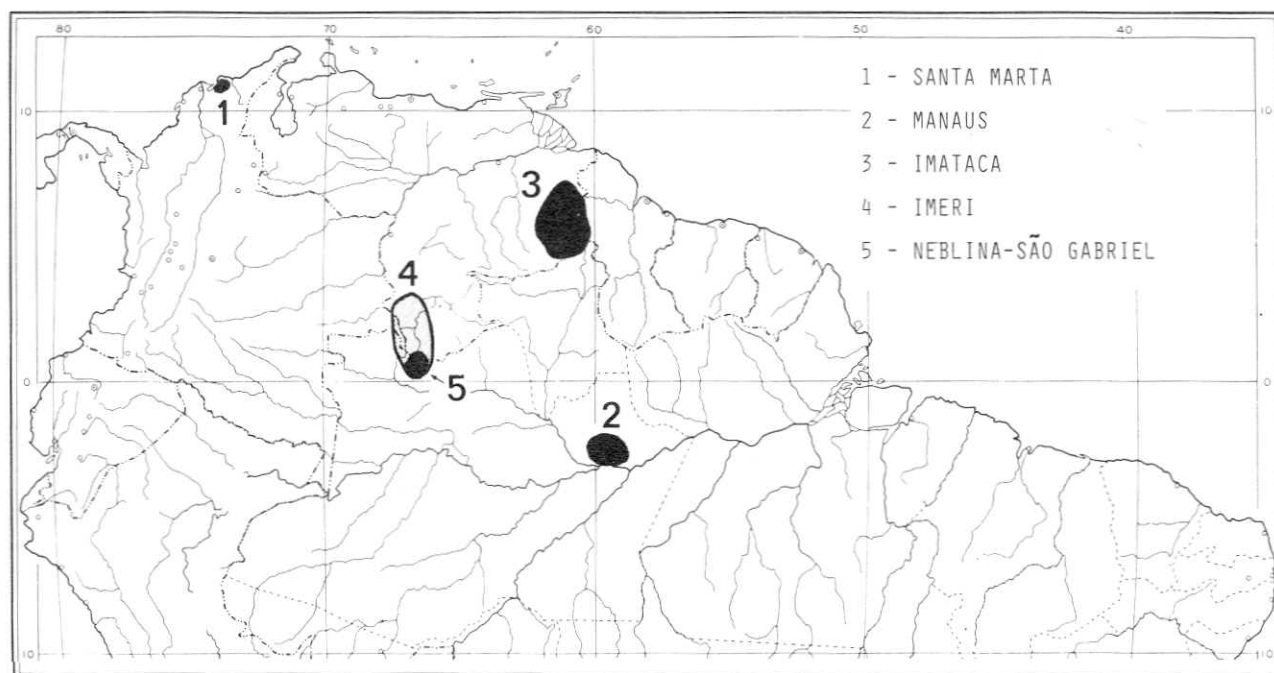


Fig. 12. Location and delimitation of the endemic centers treated in this work.

Etimology: Patronym in honor of Miss. **Ashlee Hedgecock** from Appalachian State University, Boone, N.C., USA.

Description: Based on holotype female. Measurements as on table 1.

Coloration: Base color yellow brown. Prosoma and mesosoma yellow brown; metasoma and vesicle reddish; eyes surrounded with black pigment. Venter yellowish; chelicerae yellow brown, infuscate on fingers; teeth reddish. Pedipalps: base color reddish brown; chelae yellow brown, fingers reddish brown. Legs yellowish with diffuse fuscous spots.

Morphology: Prosoma: carapace feebly granular; anterior margin feebly concave; median longitudinal and

postero-lateral furrows distinct; median ocular tubercle distinctly anterior of middle; two pairs of lateral eyes; the anterior pair larger and directed toward the anterior margin of carapace. Sternum pentagonal, wider than long. Mesosoma: tergites feebly granular, almost smooth, without keels; pectines 7-7 teeth, without fulcra; distal tooth slightly wider. Genital operculum divided, with two subolave plates. Sternites densely punctate, acarinate; stigmata small, round. Metasoma: segments I-V with strong keels, except for ventral, feebly granular; intercarinal spaces feebly granular. Vesicle, fusiform; ventral aspect granular; dorsal smooth. Chelicerae: movable finger with two basal and two subdistal teeth. Pedipalps: femur with four complete keels; all faces smooth. Tibia with five vestigial keels, intercarinal spaces feebly granular. Chelae with vestigial keels feebly granular. Fingers with seven rows of denticles. Trichobothrial pattern (Figs. 6-9) type C, neobothriotaxic. Legs: tarsomere II with dense setae ventrally, not arranged in rows.

My previous decision considering *Vachoniochactas* as a species group within *Broteochactas* (Lourenço, 1986) is herein modified; *Vachoniochactas* is reestablished as a valid genus, different from *Broteochactas* (see also Sissom, 1990). At present two species are known for this genus: *Vachoniochactas lasallei* Gonzalez-Sponga, endemic to the «Cerro Venamo» within Imataca center in Venezuela and *V. ashleeae* n.sp. endemic to Neblina-São Gabriel subcenter.

Discussion

Although several scorpion endemic centers within Amazonia are characterized at present, only a few can be considered well known. Five of the better-known centers are compared below: Santa Marta in Colombia, Manaus in Brazil, Imataca in Venezuela and Guiana, and Imeri (with the Neblina-São Gabriel subcenter in Ve-

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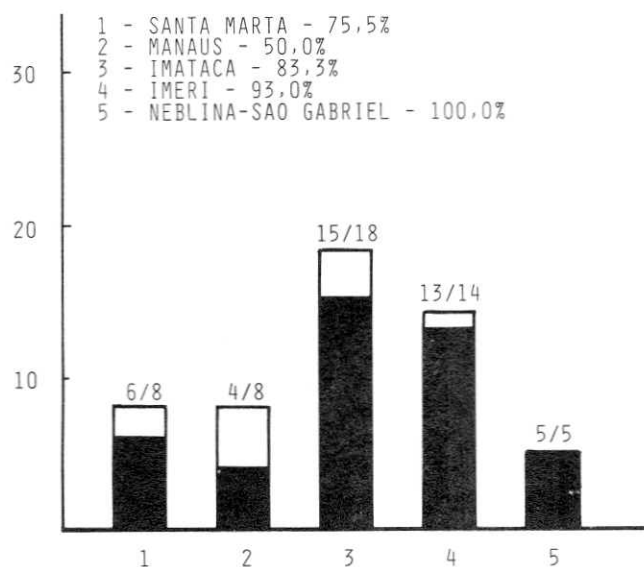


Fig. 13. Total number of species of scorpions in the five endemic centers referred in figure 12 (=total bar) and the number of endemics to each center (= black portion of bar), also expressed in percentage.

nezuela and Brazil). These centers are among the best studied sites scorpilogically in South America. The comparative results are expressed graphically in figure 13.

The new evidence discussed in this paper, based on scorpion studies supports the importance of Imeri, and especially the Neblina-São Gabriel area, as endemic centers.

The comparisons of the Imeri/Neblina-São Gabriel with the three other well studied scorpion areas (i.e., Manaus, Santa Marta and Imataca) suggests the importance of Imeri and Neblina-São Gabriel. Moreover, scorpion distribution patterns are quite well correlated with the results previously obtained for other groups of organisms; e.g. butterflies (Brown, 1979, 1982); woody plants (Prance, 1973, 1989); see also Steyermark (1979, 1986).

Having demonstrated the importance of these endemic centers, with their very high species diversity, one should ask about the present state of conservation units in these areas. According to Brown (1982), the status of the conservation units in the recovering areas of these five endemic centers can be considered as optimistic. In fact, Santa Marta already has two National Parks: Tayrona and Sierra Nevada (Lourenço, 1991a). Imataca has a forest reservation, and other southern areas have been set aside for conservation such as the Canaima National Park. Pico da Neblina area has National Parks in both Venezuelan and Brazilian sides of the border. North to the Venezuelan portion of Imeri two more units are present: Duida-Marahuaca and Orinoquia National Parks. However, because of the large size of the Imeri center more should be done. On the Brazilian side of the border, the São Gabriel area is partially protected by both Pico da Neblina National Park and the Rio Negro forest reserve. Manaus has at least one conservation unit: Reserva Ducke; however this reserve is covered mainly by Tropical rainforests on «Terra firme» latosol (Prance, 1990), and even if some small streams flood and create swamps in the rainy season, many species endemic to Manaus area, living exclusively in flooded ground areas (e.g. Tarumã-Mirim) are not present in Reserva Ducke; for this reason conservation programs concerning the «Varzea» areas should be taken more seriously in consideration locally.

Final conclusions on the actual composition of the scorpion fauna of these areas should be interpreted with caution because some of the results presented here may be biased by insufficient collecting in the field. Actually, scorpion inventory work can present some difficulties, because these organisms may be very cryptic. In some cases species can remain known from a single locality until better methods of sampling can be used. The precautions in the interpretation of results must be taken into consideration in any biogeographical work (Lourenço, 1991b; Prance, 1982).

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