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THE GENUS *TEUTHRAUSTES* SIMON, 1878 (SCORPIONES: CHACTIDAE) IN BRAZIL WITH DESCRIPTION OF A NEW SPECIES

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Abstract: A new species of scorpion, *Teuthraustes japura* **sp. n.** (Scorpiones: Chactidae), is described from the State of Amazonas, Brazil. This is the fourth species of the genus to be collected in the lowlands of South America, and the third record of a species of *Teuthraustes* from the Brazilian Amazonia. The total number of species of *Teuthraustes* is now raised to 28. The distribution patterns of the genus are commented upon, and its known geographical distribution is also extended.
Key words: Scorpiones, Chactidae, *Teuthraustes*, new species, geographical distribution, Amazon, Brazil.

El género *Teuthraustes* Simon, 1878 (Scorpiones: Chactidae) en Brasil y descripción de una especie nueva
Resumen: Se describe una nueva especie de escorpión, *Teuthraustes japura* **sp. n.** (Scorpiones: Chactidae), del estado de Amazonas, Brasil. Es la cuarta especie del género que se recoge en las zonas bajas de Sudamérica, y la tercera vez que se cita el género *Teuthraustes* de la Amazonia brasileña. El número total de especies de *Teuthraustes* se ve elevado así a 28. Se comentan los patrones de distribución del género y se extiende su distribución conocida.
Palabras clave: Scorpiones, Chactidae, *Teuthraustes*, especie nueva, distribución geográfica, Amazonia, Brasil.

Taxonomy / Taxonomía: *Teuthraustes japura* **sp. n.**

Introduction

As already synthesized in previous papers (Lourenço & Duhem, 2010), the genus *Teuthraustes* was originally erected by Simon (1878), having as type species by monotypy *Teuthraustes atramentarius* Simon, 1878, collected in Ecuador by M. Deville of the Brussels Museum. The descriptions of both the genus and species are extremely synthetic and poorly diagnostic. After the creation of *Teuthraustes* by Simon (1878) and the first revision proposed for the genus by Kraepelin (1912), thirteen additional species have been described or transferred to *Teuthraustes*. Remarkably, eleven of these species have been described from Ecuador and only two exceptions, *Teuthraustes amazonicus* (Simon, 1880) and *Teuthraustes glaber* Kraepelin, 1912, were described from Peru. The taxonomic status of most Ecuadorian species has been confirmed as valid (Lourenço, 1995a; Ythier & Lourenço, 2017) and this remarkable concentration of species in Ecuador is realistic and can be explained by biogeographic models (Lourenço, 1995a and see also biogeographic section). After the revision by Kraepelin (1912) and until the publication of the monography on South American scorpions by Mello-Leitão (1945), no new species belonging to the genus *Teuthraustes* have been described.

Several years after the publication of the monograph by Mello-Leitão (1945), several new species were described from Venezuela, Brazil, Colombia and Ecuador (González-Sponga, 1996; Lourenço, 1994a, 1995b; Lourenço & Duhem, 2010; Lourenço et al., 2011; Ythier & Lourenço, 2017). Most of the species of *Teuthraustes* described, including those in recent years, have been collected in the Andean mountains in Ecuador, Peru and Colombia, and in the Amazonian highlands of Venezuela and Brazil; these highlands corresponding to formations named 'Tepuys'. Exceptions are known however, such as that of *T. amazonicus*, species described from Pebas, a small town located on the banks of the Solimões River in Peruvian Amazonia, followed by other descriptions such as those of *T. braziliensis* Lourenço & Duhem, 2010 from Brazilian Amazonia and *T. castiglii* Rossi, 2015, equally described from Peruvian Amazonia (Rossi, 2015).

In the present paper, one more new species of *Teuthraustes* is described from Brazilian Amazonia. This represents the fourth element of the genus to be found in the Amazonian lowlands. The pattern of distribution presented by the species of the genus *Teuthraustes* remains, however, a typical model of species living in highland formations of South America.

Material and Methods

Measurements and illustrations were made using a Wild M5 stereo-microscope with a drawing tube (camera lucida) and an ocular micrometer. Photographs were made with a Canon EOS 7D and Adobe Photoshop software. Map was made using maps-for-free.com and Adobe Photoshop software. 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). The type specimen will be deposited in the 'Museu Nacional', Rio de Janeiro, Brazil.

Results

Composition of the genus *Teuthraustes* (in order of description)

Teuthraustes atramentarius Simon, 1878 – Ecuador (Chimborazo, Cotopaxi, Imbabura, Pichincha, Tungurahua).

Teuthraustes amazonicus (Simon, 1880) – Peru (Loreto), Brazil (Amazonas), Colombia (Amazonas).
Teuthraustes gervaisii (Pocock, 1893) – Ecuador (Azuay).
Teuthraustes whymperi (Pocock, 1893) – Ecuador (Cotopaxi, Pichincha, Tungurahua).
Teuthraustes wittii (Kraepelin, 1896) – Ecuador (Loja).
Teuthraustes rosenbergi (Pocock, 1898) – Ecuador (Guayas).
Teuthraustes dubius (Borelli, 1899) – Ecuador (Morona-Santiago).
Teuthraustes festae (Borelli, 1899) – Ecuador (Morona-Santiago).
Teuthraustes lojanus (Pocock, 1900) – Ecuador (Loja).
Teuthraustes oculatus Pocock, 1900 – Ecuador (Chimborazo, Cotopaxi, Tungurahua).
Teuthraustes simonsi (Pocock, 1900) – Ecuador (Carchi).
Teuthraustes glaber Kraepelin, 1912 – Peru (San Martin).
Teuthraustes ohausi Kraepelin, 1912 – Ecuador (Loja).
Teuthraustes camposi (Mello-Leitão, 1939) – Ecuador (Cañar).
Teuthraustes carmelinae Scorza, 1954 – Venezuela (Amazonas).
Teuthraustes adrianae González-Sponga, 1975 – Venezuela (Amazonas).
Teuthraustes akananensis González-Sponga, 1984 – Venezuela (Amazonas).
Teuthraustes maturaca González-Sponga, 1991 – Venezuela (Amazonas).
Teuthraustes reticulatus González-Sponga, 1991 – Venezuela (Amazonas).
Teuthraustes lisei Lourenço, 1994 – Brazil (Amazonas).
Teuthraustes guerdouxi Lourenço, 1995 – Colombia (Boyaca).
Teuthraustes braziliensis Lourenço & Duhem, 2010 – Brazil (Amazonas).
Teuthraustes newaribe Lourenço, Giupponi & Pedroso, 2011 – Brazil (Amazonas).
Teuthraustes castiglii (Rossi, 2015) – Peru (Loreto).
Teuthraustes giupponii Ythier & Lourenço, 2017 – Ecuador (Sucumbíos).
Teuthraustes khodayarii Ythier & Lourenço, 2017 – Ecuador (Orellana).
Teuthraustes kuryi Ythier & Lourenço, 2017 – Ecuador (Esmeraldas).
Teuthraustes japura sp. n. – Brazil (Amazonas).

Taxonomic treatment

Family **Chactidae** Pocock, 1893

Genus ***Teuthraustes*** Simon, 1878

***Teuthraustes japura* sp. n.**
Figs. 3-13.

MATERIAL: Brazil, state of Amazonas, Rio Japurá, in the region of Manguari, (1° 36' 20" S – 69° 16' 8" W), X/1982 (collected by local Indian population – leg J.-B. Lacroix). Holotype, 1 juvenile, supposedly a female.

COMPARATIVE TYPE MATERIAL EXAMINED: *Teuthraustes amazonicus* Simon, originally three male syntypes. One male was designated lectotype (Lourenço & Duhem, 2010, see Figs. 1-2) and the other two males were designated paralectotypes. The lectotype and one paralectotype are deposited in Muséum national d'Histoire naturelle, Paris (MNHN), RS-0767 (ES-3637). One paralectotype is deposited in Zoologischen Museum Hamburg (ZMH).

OTHER TYPE MATERIAL EXAMINED: *T. atramentarius* Simon, 1878, *T. braziliensis* Lourenço & Duhem, 2010, *T. dubius* (Borelli, 1899), *T. festae* (Borelli, 1899), *T. giupponii* Ythier & Lourenço, 2017, *T. khodayarii* Ythier & Lourenço, 2017, *T. kuryi* Ythier & Lourenço, 2017, *T. lisei* Lourenço, 1994, *T. newaribe* Lourenço, Ponce de Leao Giupponi & Pedroso, 2011.

ETYMOLOGY: The specific name is placed in apposition to the generic name and refers to the Rio Japurá, location where the new species was collected.

DIAGNOSIS: Probably moderate sized scorpions; the juvenile, supposedly a female, most certainly corresponds to a third instar juvenile, and has a total length of 19.9 mm. The age of the juvenile is based on previous developmental studies done for elements of the family Chactidae (Lourenço et al., 2003). Coloration reddish-brown to dark brown. The carapace is straight anteriorly. Body and appendages weakly granulated to smooth, with minute punctation. Pectines with 8-7 teeth in female. Fixed and movable fingers of chela with 5-6 rows of granules. Ventral carinae absent on metasomal segments I to IV. Trichobothrial pattern of type C neobothriotaxic 'majorante'.

RELATIONSHIPS: The new species shows some morphological convergences with *Teuthaustes dubius* Borelli, described from Ecuador, but both species are different in the number of external trichobothria of patella: 17 in *T. dubius* and only 14 for the new species (Lourenço, 1981). The new species can also be distinguished from other species inhabiting the Amazonian lowlands such as *Teuthraustes amazonicus* Simon (Figs. 1-2), *Teuthraustes braziliensis* Lourenço & Duhem and *Teuthraustes castiglii* Rossi, by a number of features: (i) carapace perfectly straight anteriorly, a character totally absent in the other species which show concavities, (ii) body almost totally smooth; even if in juveniles the presence of granulations may be attenuated, the other species show intense granulations, (iii) a higher number of teeth on pectines.

DESCRIPTION (based on female holotype). Measurements after the description.

Coloration: Basically reddish-brown to dark brown. Prosoma: carapace dark brown; eyes blackish. Tergites reddish-brown to dark brown slightly paler than carapace, with one incomplete yellowish longitudinal strip. Metasomal segments reddish-brown to dark brown; telson yellowish with vesicle slightly infuscate; the tip of the aculeus darker than vesicle. Chelicerae yellow to reddish-yellow with intense variegated reddish-brown spots; fingers reddish-yellow. Pedipalps dark reddish; carinae almost blackish. Legs yellowish with intense brownish spots. Venter and sternites yellow to slightly reddish-yellow; VII dark brown; pectines and genital operculum pale yellow.

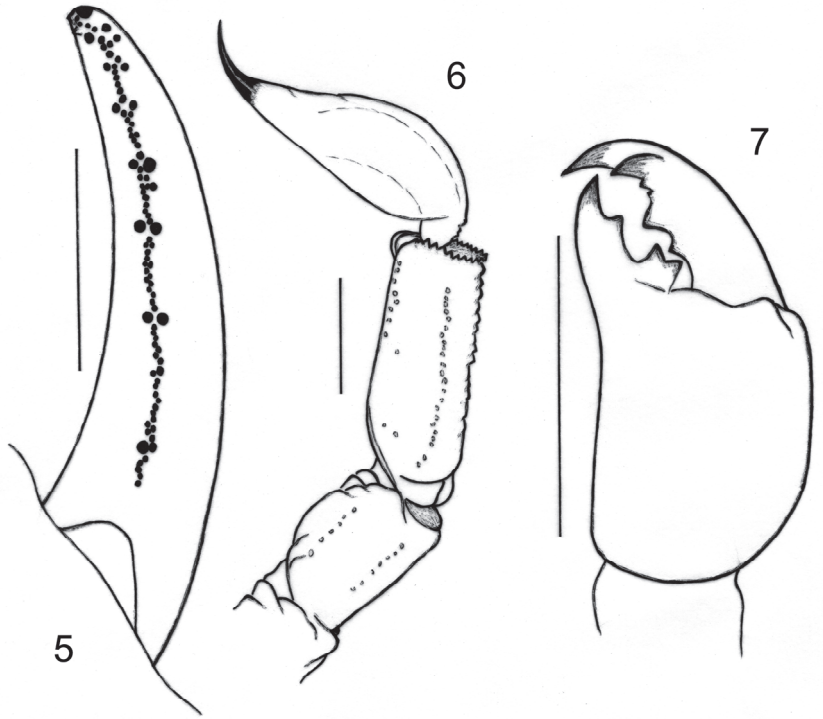
Morphology: Carapace straight anteriorly, lustrous and acarinate, with minute punctuation; furrows moderately to weakly shallow. Sternum pentagonal, as long as wide. Tergites acarinate, with punctations (the specimen has been broken between tergite I and II). Pectinal tooth count 8-7, fulcra absent. Sternites smooth and shiny; spiracles oval-shaped but inconspicuous; VII acarinate. Metasomal segments I and II wider than long; metasomal tegument on segments I to IV lustrous without granulations; segment V with some minor spinoid granulations ventrally. Carinae on segments I-V weakly developed; ventral absent; only dorsal and latero-dorsal are vestigial. Telson without granulations, smooth; aculeus shorter than vesicle. Pedipalps: femur with dorsal internal, dorsal external and ventral internal carinae strongly marked; ventral external carina absent; dorsal, ventral and internal aspects smooth. Patella smooth with vestigial carinae; presence of a minor apophysis on the internal aspect. Chela with ventro-external and a dorso-internal carinae; internal aspect with

Figs. 1-2. *Teuthraustes amazonicus* (Simon, 1880), male lectotype, habitus. **1**, dorsal aspect; **2**, ventral aspect. Scale bar = 1 cm.

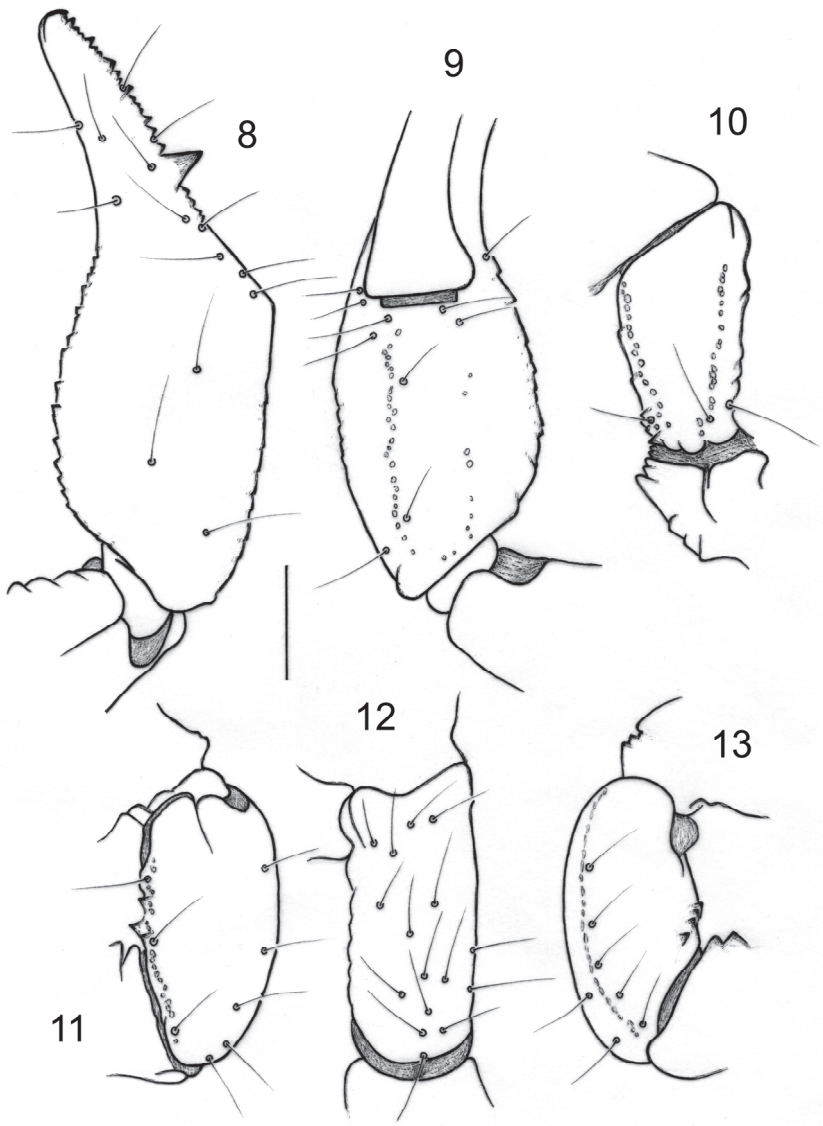


Figs. 3-4. *Teuthraustes japura* sp. n., female holotype, habitus. **3**, dorsal aspect; **4**, ventral aspect. Scale bar = 0.5 cm.





Figs. 5-7. *Teuthraustes japura* sp. n., female holotype. **5**. Cutting edge of movable finger with rows of granules (the most basal series is isolated from distal ones by a depressed zone in which the strong tooth of the fixed finger gets inserted). **6**. Metasomal segments IV-V and telson, lateral aspect. **7**. Chelicera, dorsal aspect. Scale bars = 1 mm.



Figs. 8-13. *Teuthraustes japura* sp. n., female holotype. Trichobothrial pattern. **8-9**. Chela, dorso-external (**8**) and ventral (**9**) aspects. **10**. Femur, dorsal aspect. **11-13**. Patella, dorsal (**11**), external (**12**) and ventral (**13**) aspects. Scale bar = 1 mm.

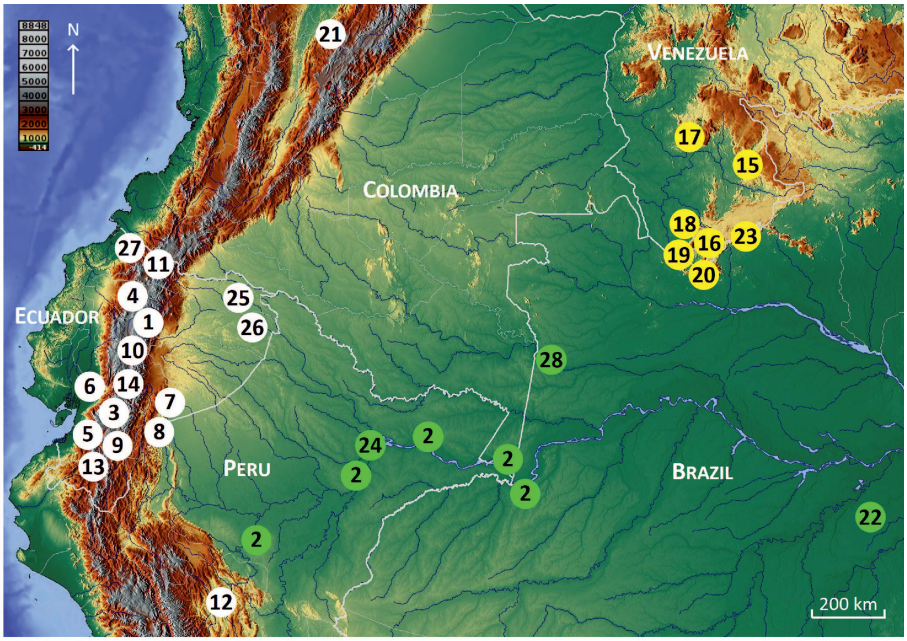


Fig. 14. Map of northern South America showing the known distribution of *Teuthraustes* species in the Andean highlands (white dots, 200-3600 m alt.), Guayana highlands (yellow dots, 200-1800 m alt.) and Amazonian lowlands (green dots, < 200 m alt.): 1. *T. atramentarius*, 2. *T. amazonicus*, 3. *T. gervaisii*, 4. *T. whymperi*, 5. *T. wittii*, 6. *T. rosenbergi*, 7. *T. dubius*, 8. *T. festae*, 9. *T. lojanus*, 10. *T. oculatus*, 11. *T. simonsi*, 12. *T. glaber*, 13. *T. ohausi*, 14. *T. camposi*, 15. *T. carmelinae*, 16. *T. adrianae*, 17. *T. akananensis*, 18. *T. maturaca*, 19. *T. reticulatus*, 20. *T. lisei*, 21. *T. guerdouxi*, 22. *T. braziliensis*, 23. *T. newaribe*, 24. *T. castiglii*, 25. *T. giupponii*, 26. *T. khodayarii*, 27. *T. kuryi* and 28. *T. japura* sp. n. (only type localities are indicated for species occurring in Ecuador; for more detailed information see Ythier & Lourenço, 2017).



Fig. 15. Lowland tropical rainforest in the Brazilian Amazonia, natural habitat of *Teuthraustes japura* sp. n.

some marked granules. Dentate margins on movable and fixed fingers with 5-6 rows of granules. Chelicerae with dentition typical of the family Chactidae (Vachon, 1963) and with dense setation ventrally and internally. Trichobothriotaxy of type C, neobothriotaxic 'majorante' (Vachon, 1974); only 14 trichobothria are present on the external aspect of patella. Legs tarsi with short setae disposed in a single line.

Morphometric values (in mm) of the female holotype of *Teuthraustes japura* sp. n. Total length, including telson, 19.9. Carapace: length, 3.1; anterior width, 2.2; posterior width, 2.8. Mesosoma length, 6.8. Metasomal segments. I: length, 1.0; width, 1.4; II: length, 1.1; width, 1.2; III: length, 1.2; width, 1.1; IV: length, 1.4; width, 1.0; V: length, 2.4; width, 1.0; depth, 0.8. Telson length, 2.9; vesicle: width, 1.1; depth, 0.8. Pedipalp: femur length, 2.3, width, 1.2; patella length, 2.7, width, 1.3; chela length, 5.6, width, 1.7, depth, 1.6; movable finger length, 3.0.

Biogeographic considerations in relation to the species of *Teuthraustes*

The geographical distribution presented by most species of the genus *Teuthraustes* clearly suggests a global pattern marked by cases of endemism but also of disruption. Of the 28 species known at present, a majority is distributed in the Andean highlands of Ecuador, Peru and Colombia. Another group of several species has been described from different highland sites located between Brazil and Venezuela (see Figs. 14-15). This last area corresponds to what was named as the Imeri endemic centre and defined based on the patterns of distribution of both plants and for animals (Prance 1982a,b; Lourenço, 2001). The Imeri endemic centre, largely matches with the region dominated by the 'Tepuys', distributed mainly in the Guayana floristic province largely distinct from the core Amazonian forest (Mori, 1991). Three others species have been reported from the lowlands of the Peruvian and Brazilian Amazonia. The new species represents a fourth element of these Amazonian lowlands.

This outstanding concentration of *Teuthraustes* species in the Andean highlands and in the Imeri endemic centre, may be comparable to the 'explosive' pattern of speciation proposed by Gentry (1992) for plants of the genus *Gasteranthus*. In fact, about 25% of the species of this genus, which is distributed worldwide, are distributed in the Andean region. Gentry (1992) also suggests that an entirely distinct evolutionary model is possibly operating in the Andean region. The exceedingly dynamic speciation is perhaps mediated more by genetic transilience associated with genetic drift in small founder populations in a kaleidoscopically changing

environment, than by fine-tuned selection of the type generally suggested to be typical of lowland rain forest.

Several botanists (Gentry, 1988, 1992) and entomologists (Erwin, 1982; Wilson, 1988) globally accept that tropical rainforests are the most species-rich ecosystems on earth. They also agree, on the basis of solid evidence, that the 'epicentre' of global biodiversity occurs in the tropical Andes, a region of the upper Amazonia which includes the North of Peru, Ecuador and the southern half of Colombia. This suggestion seems to be valid for plants, vertebrates and butterflies (Prance, 1982b; Gentry, 1988, 1992). The Andean and Cisandean regions appear also as one of the world's greatest sites of alpha-diversity for scorpions (Lourenço, 1994b). Therefore, the very high number of *Teuthraustes* species in the Andean and Cisandean regions is probably a consequence of the marked ecological diversity observed for these regions.

Naturally, scorpion speciation and differentiation is absolutely not recent. Haffer (1982) suggests that the isolation of large populations during the Cenozoic palaeogeographic vicissitudes certainly played a major role in the establishment of the present patterns of distribution and differentiation. This isolation concerned most tropical floras and faunas. However, at the same time, members of less 'plastic' groups with low evolutionary rates, today present among the flora and fauna probably survived with only minor changes since the Cenozoic. Since the rise of the Andes in the form of strings of growing islands from a marine geosynclinals basin, no pre-Andean continuous and widespread lowland fauna had occupied what later become the Andes. Consequently, Andean elements must have come from abroad. The 'Tepuys' region which includes the Imeri endemic centre, is located in the Precambrian Guiana Craton (or shield). 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 huge 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 (Lourenço & Duhem, 2009). Ecological, paleoclimatic and palynologic data (Prance, 1982b) suggests that the apparent 'stability' of present day rainforests was interrupted by periods of climatic change through several dry/wet/dry episodes during the late Cenozoic period and especially during more recent Pleistocene and Holocene epochs. During the earlier Quaternary period, temperate regions were glaciated. Cooler and drier conditions prevailed in the present tropical zones and reduced the rainforest to savannas or dry forests except in localized regions where conditions of temperature and humidity allowed them to persist. During these glacial phases, more mesic species of scorpions, such as those of the genus *Teuthraustes*, and also of other mesic genera such as *Chactas* Gervais, 1844 and *Vachoniochactas* González-Sponga, 1978 probably experienced a more enlarged range of distribution than that observed today. With the return of the present interglacial phase these genera are again restricted to the highlands where mesic conditions prevail. Some species of the genera *Teuthraustes* and *Chactas*, however, probably evolved in and became adapted to the tropical forest when this one expanded throughout the entire Neotropical lowlands (Lourenço & Duhem; 2010; Lourenço et al., 2005). Consequently, one can expect new species of both genera still to be found in the lowlands of Amazonia.

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