



A new species of *Charinus* Simon, 1892 from northeastern Brazil with comments on the potential distribution of the genus in Central and South Americas (Arachnida: Amblypygi: Charinidae)

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Abstract

A new species of the genus *Charinus* Simon, 1892 is described from caves in the Rio Grande do Norte, Brazil. This is the first record of the genus for the state. This paper presents a map of the *Charinus* species distribution in Brazil with new records and a map of potential distribution of the genus in South and Central Americas. An updated key for *Charinus* species from Brazil is also presented.

Key words: whip spider, taxonomy, *Charinus potiguar*, Neotropics

Introduction

Amblypygi comprises one of the less diverse groups among the Arachnida. This order includes five families, 17 genera and approximately 160 species (Harvey, 2003; Rahmadi *et al.*, 2011). The genus *Charinus* is the most specious, presenting 48 described species (Jocque & Giupponi, 2012).

The Amblypygi are distributed mainly in tropical and subtropical regions of the Old and New World, *Charinus* being the only genus with an almost worldwide distribution (Weygoldt, 2000). This genus has representatives in Europe (*C. ioanniticus* (Kritscher, 1959)), Africa (*C. africanus* Hansen, 1921), Asia (*C. bengalensis* (Gravely, 1911)) and Oceania (*C. australianus* (L. Koch, 1867)), but the most of the known species are concentrated in the Neotropical region (Harvey, 2003).

The present work aims to describe a new species of *Charinus* found in caves in the state of Rio Grande do Norte, Brazil. A distribution map of the Brazilian species of *Charinus* with new records and a map of potential distribution of the genus for South and Central America are presented, as a key for the species of *Charinus* in Brazil.

Material and methods

The specimens were collected during 2007 and 2010 through visual searches throughout the floors and walls of the caves. All specimens were captured with a fine brush and placed in vials containing 70% ethanol.

The terminology of the pedipalp and legs followed Harvey and West (1998) and of the structures of male gonopods followed Giupponi and Kury (2013). For measurements and some nomenclature we followed the proposals of Quintero (1981). Measurements of the articles of the pedipalp were taken between the condyles of

each segment in order to establish fixed points and adequate length measurements. The article called tarsus by Harvey and West (1998) is divided here into tarsus and apotele, as there is no fusion of these two segments in Charinidae. The spines of the patella of the pedipalp and teeth of the chelicerae are counted from the apex to the base. The others spines of the pedipalp and leg IV segments are counted from the base. Measurements were taken of the entire type-series (quantity indicated as "n"), presenting first their mean values followed by the range of variation in parentheses.

The following abbreviations are used: BT = basitibia; DT = distitibia; Fi = fistula (gonopod tube); GO = genital operculum; LaM = lamina medialis; LoD = lobus dorsalis; LoL1 = lobus lateralis primus; LoL2 = lobus lateralis secundus.

Photographs were taken using a Leica M205A stereomicroscope with the software Leica Application Suite Automontage. Illustrations of the female genitalia and male dorsal genitalia were made using a camera lucida attached to an Olympus BX40 microscope and male ventral genitalia through a camera lucida coupled to a Leica MDLS phase contrast microscope. The other illustrations were made by means of a camera lucida attached to a Wild Heerbrugg M8 stereomicroscope.

The holotype and some paratypes are deposited in the Museu Nacional, Rio de Janeiro, Brazil (MNRJ) and the other paratypes in the Seção de Invertebrados Subterrâneos, Coleção de Zoologia of the Universidade Federal de Lavras, Minas Gerais, Brasil (ISLA).

Distribution analysis. The map of potential distribution of *Charinus* species was prepared using the Maximum Entropy method by means of the software MAXENT version 3.3.3k. This software considers 14 environmental variables including altitude, temperature, precipitation, seasonality, among other climatic data for ecological modeling and GIS-Worldclim. A file was made (Csv) in Microsoft Excel as input samples in MAXENT from the geographical coordinates of 55 previous records of the occurrence of species of the genus. Adopting the standard configuration of the software, a map of potential occurrence in *.asc format was generated, which was converted to a layer matrix through ArcMap. After this first step, the final map was generated containing a scheme of different colors, the red indicative of high potential habitat for the occurrence of *Charinus* and blue areas of unlikely occurrence.

Systematic accounts

Charinidae Quintero, 1986

Charinus Simon, 1892

Type species: *Phrynus australianus* L. Koch, 1867, by original designation.

Included Neotropical species: *C. caribensis* (Quintero, 1986) (Jamaica); *C. muchmorei* Armas & Teruel, 1997 (Virgin Islands); *C. perezassoi* Armas, 2010 and *C. victori* Armas, 2010 (Puerto Rico); *C. bruneti* Teruel & Questel, 2011 (Lesser Antilles); *C. dominicanus* Armas & Pérez González, 2001 (Dominican Republic), *C. acosta* (Quintero, 1983), *C. cubensis* (Quintero, 1983), *C. decu* (Quintero, 1983), *C. wanlessi* (Quintero, 1983), *C. centralis* Armas & Ávila Calvo, 2001 and *C. toasmicheli* Armas, 2007 (Cuba); *C. koepcke* Weygoldt, 1972 (Peru); *C. insularis* Banks, 1902 (Ecuador – Galapagos Islands); *C. tronchonii* (Ravelo, 1975), *C. bordoni* (Ravelo, 1977), *C. pardillalensis* (González-Sponga, 1998) and *C. camachoi* (González-Sponga, 1998) (Venezuela); *C. guianensis* (Caporiacco, 1947) (Guyana); *C. quinteroi* Weygoldt, 2002 and *C. gertschi* Goodnight & Goodnight, 1964 (Guyana and Suriname); *C. platnicki* (Quintero, 1986) (Suriname); *C. bromeliaea* Jocque & Giupponi, 2012 (French Guiana); and *C. schirchii* (Mello-Leitão, 1931), *C. brasilianus* Weygoldt, 1972, *C. montanus* Weygoldt, 1972, *C. acaraje* Pinto-da-Rocha, Machado & Weygoldt, 2002, *C. asturius* Pinto-da-Rocha, Machado & Weygoldt, 2002, *C. mysticus* Giupponi & Kury, 2002, *C. troglobius* Baptista & Giupponi, 2002, *C. eleonorae* Baptista & Giupponi, 2003 and *C. vulgaris* Miranda & Giupponi, 2011 (Brazil). *Charinus guianensis* is considered *nomen dubium*, seeing that it is perhaps a protonymph of *C. gertschi* (Weygoldt, 2002; Weygoldt, 1998). *C. schirchii* is also considered *nomen dubium*, since its type specimen was lost and further records of the species have not been obtained (Pinto-da-Rocha *et al.*, 2002).

***Charinus potiguar* sp. nov.**

(Figs. 1–13)

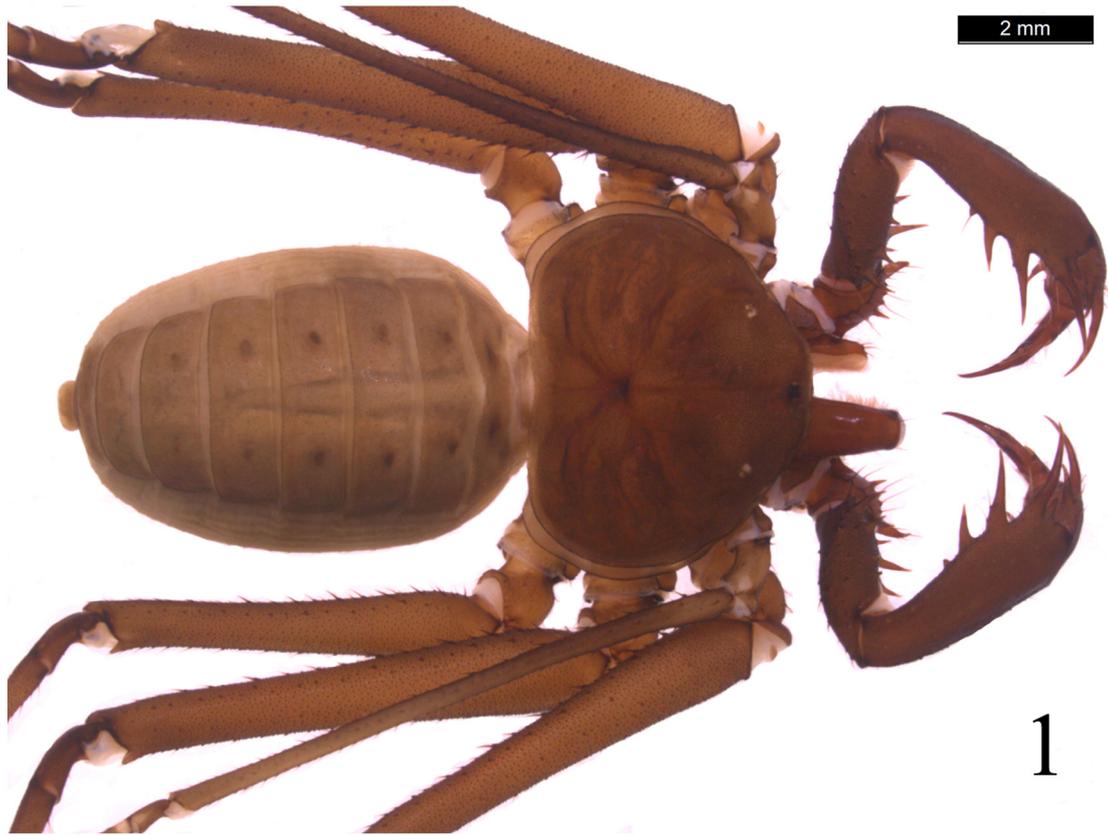
Type material. BRAZIL: *Rio Grande do Norte*: Felipe Guerra: **Male holotype:** Caverna do Buraco Redondo (05°34'42.98"S 37°39'04.99"W), 22.VII.2010, *leg.* D. M. Bento (MNRJ 09216). **Male paratype:** Caverna da Rumana (05°33'54.25"S 37°39'07.13"W), 10.I.2010, *leg.* D. M. Bento (ISLA 1890). **Male paratype:** Gruta da Carrapateira (05°33'38.22"S 37°39'50.32"W), 24.IV.2007, *leg.* R. L. Ferreira (MNRJ 09214). **Male paratype:** Caverna do Pau (5°35'34.19"S 37°41'14.64"W), 08.I.2007, *leg.* R. L. Ferreira (MNRJ 09212). **Female paratype:** Caverna do Pau (5°35'34.19"S 37°41'14.64"W), 08.I.2007, *leg.* R. L. Ferreira (ISLA 3924). **Female paratype:** Caverna do Pau (5°35'34.19"S 37°41'14.64"W), 08.I.2007, *leg.* R. L. Ferreira (MNRJ 09212). **Female paratype:** Caverna Buraco da Nega (05°31'57.16"S 37°50'40.73"W), 21.I.2010, *leg.* D. M. Bento (ISLA 1875). **Female paratype:** Caverna do Geilson (05°35'53.23"S 37°41'17.56"W), 23.IV.2007, *leg.* D. M. Bento (MNRJ 09213). BRAZIL: *Rio Grande do Norte*: Governador Dix-Sept Rosado: **Female paratype:** Gruta Boca de Peixe (05°29'04.45"S 37°33'29.62"W), 07.I.2010, *leg.* D. M. Bento (ISLA 1888). **Female paratype:** Gruta Boca de Peixe (05°29'04.45"S 37°33'29.62"W), 03.VI.2010, *leg.* D. M. Bento (MNRJ 09215). BRAZIL: *Rio Grande do Norte*: Baraúna: **Male paratype:** Gruta da Escada (05°10'07.83"S 37°43'40.98"W), 29.VII.2010, *leg.* D. M. Bento (ISLA 1894).

Diagnosis. *Charinus potiguar* differs from others species of the genus by having the following combination of characters: body size of adults ranging from 6.72 to 13.73 mm; frontal process with length slightly longer than the width; eyes and ocular tubercle not very developed with 1 setae posterior to every triad of lateral eyes; claw of the chelicerae with 9–13 denticles; male gonopod with a very unusual pattern in the lobus lateralis primus and secundus, subdivided into several filamentous structures; female gonopod with a "bottleneck" just before the entrances and with the edge with a small fold and "V-neck"; patella of pedipalp with 5 dorsal spines; basitibia of leg IV with 4 pseudo-articles, distitibia with 3 basal and 15 distal trichobothria, basitibia-distitibia with lengths: DT>BT1>BT4>BT3>BT2, and metatarsus of this same leg slightly larger than the tarsus; tibia of leg I with 23 articles and tarsus with 41 articles.

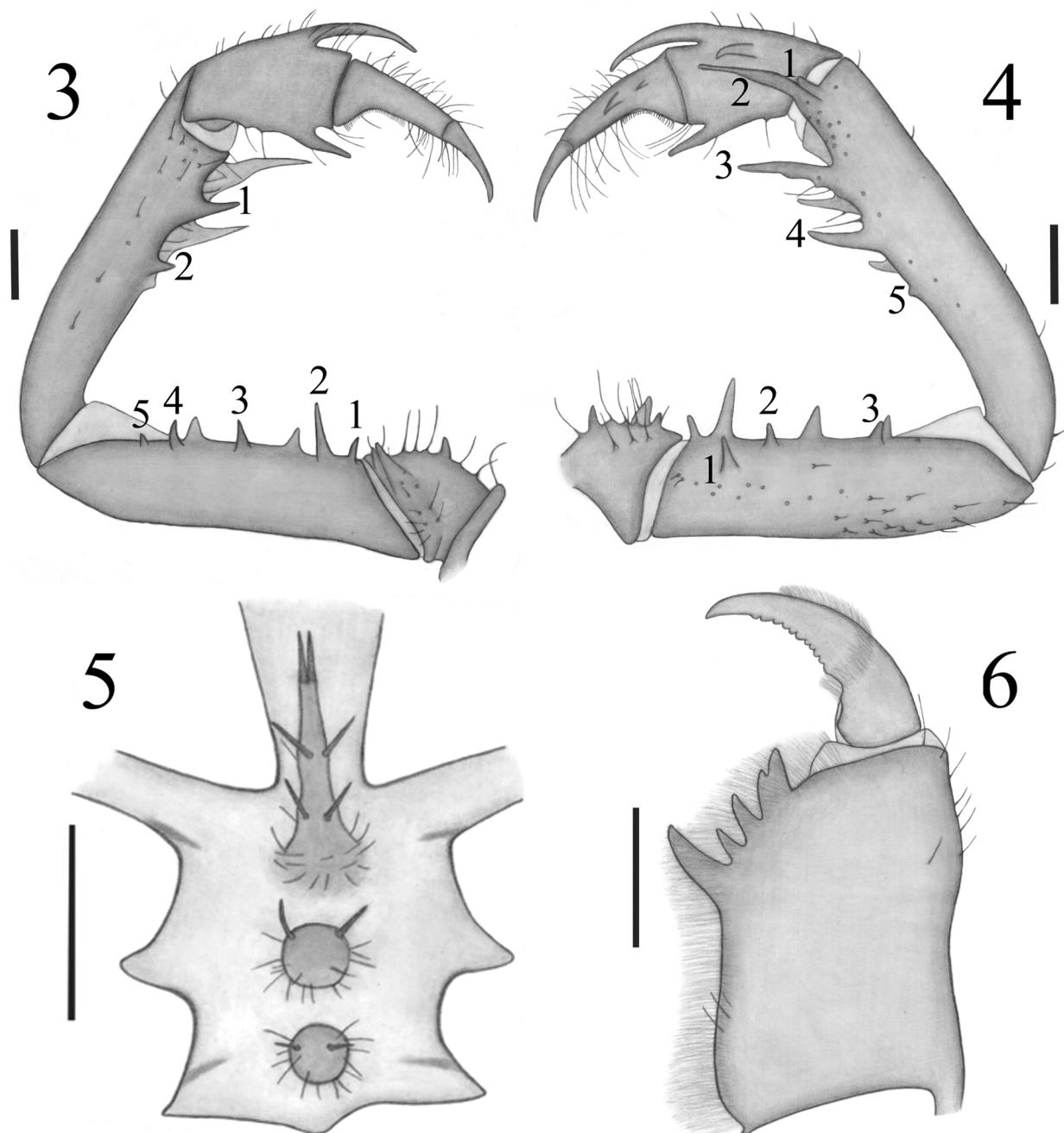
Description. Carapace (Figs. 1–2): Approximately 1.25 times wider than long. Slightly convex in the anterior region, but with a general flattened aspect. Portions above the coxae of legs I slightly curved upwards. Anterior margin rounded with corners flattened down. 6 strong setae (7 can be found) on the anterior margin projected upwards, the central two usually located directly in front of the tubercle of the median eyes. Several fine setae along the lateral margin. Frontal process triangular with length slightly greater than the width and may be seen dorsally by its small curvature facing forward. Carena begins at the corners of the anterior margin and extends from the coxa of leg II until the corners of the posterior margin. Median eyes not very developed with flattened tubercle. Lateral eyes with lenses flattened, without pigmentation and with 1 seta posterior to every triad. A thin furrow follows from the tubercle of the median eyes and reaches medially in the posterior margin of the carapace. This furrow crosses the fovea (a deep depression located behind the center) from which follow two pairs of furrows. The first pair follows anteriorly, being that each furrow arrives below the pair of lateral humps situated behind the lateral eyes. Each of the furrows of the second pair follows more posteriorly and reaches the medial posterior portion of the sides of the carapace. Small transverse depression located on each side of the carapace between the radiations of these two pairs of furrows. Punctuations follow radiating out in lines and spots, more densely arranged in the anterior portion than the posterior median portion.

Sternum (Fig. 5): Tri-segmented with all segments sclerotized and convex. Tritosternum projected anteriorly, elongated and cone-shaped, with 1 apical pair, 1 medial (only one seta can be found) and 1 basal of strong setae and with various small setae round the base. Second segment (mesosternum) rounded with 1 strong seta at each upper corner (in some specimens 1 or 2 more setae subequal in size to this pair can be found) and several setulae encircling the base. Third segment (metasternum) rounded and slightly smaller compared to medial, with 1 strong seta at each upper corner and several setulae encircling the base (in some specimens the upper pair of setae is not distinguishable in size compared to basal setulae). The segments are separated from each other approximately by the diameter of the metasternum.

Abdomen (Fig. 1): Oblong, thinner than the carapace, with punctuations distinguishable in larger specimens and barely distinguishable in smaller specimens.



FIGURES 1–2. *Charinus potiguar* sp. n. Male paratype: 1. Dorsal view of the pedipalps, carapace and abdomen. 2. Front view of the frontal process.



FIGURES 3–6. *Charinus potiguar* sp. n. Male holotype: 3. Ventral view of right pedipalp. 4. Dorsal view of right pedipalp. 5. Sternum. 6. Internal view of right chelicera. Scale bar= 1.0mm.

Chelicera (Fig. 6): Cheliceral furrow with 4 inner teeth. The distal tooth is bifid, the distal cusp being larger than the proximal. Teeth length: $IV > Ia > Ib = II > III$. Claw with 11 denticles (9–13 can be found), the basal being the widest. Dorsal setae located distally and sometimes in the inner proximal portion of the body of the chelicera.

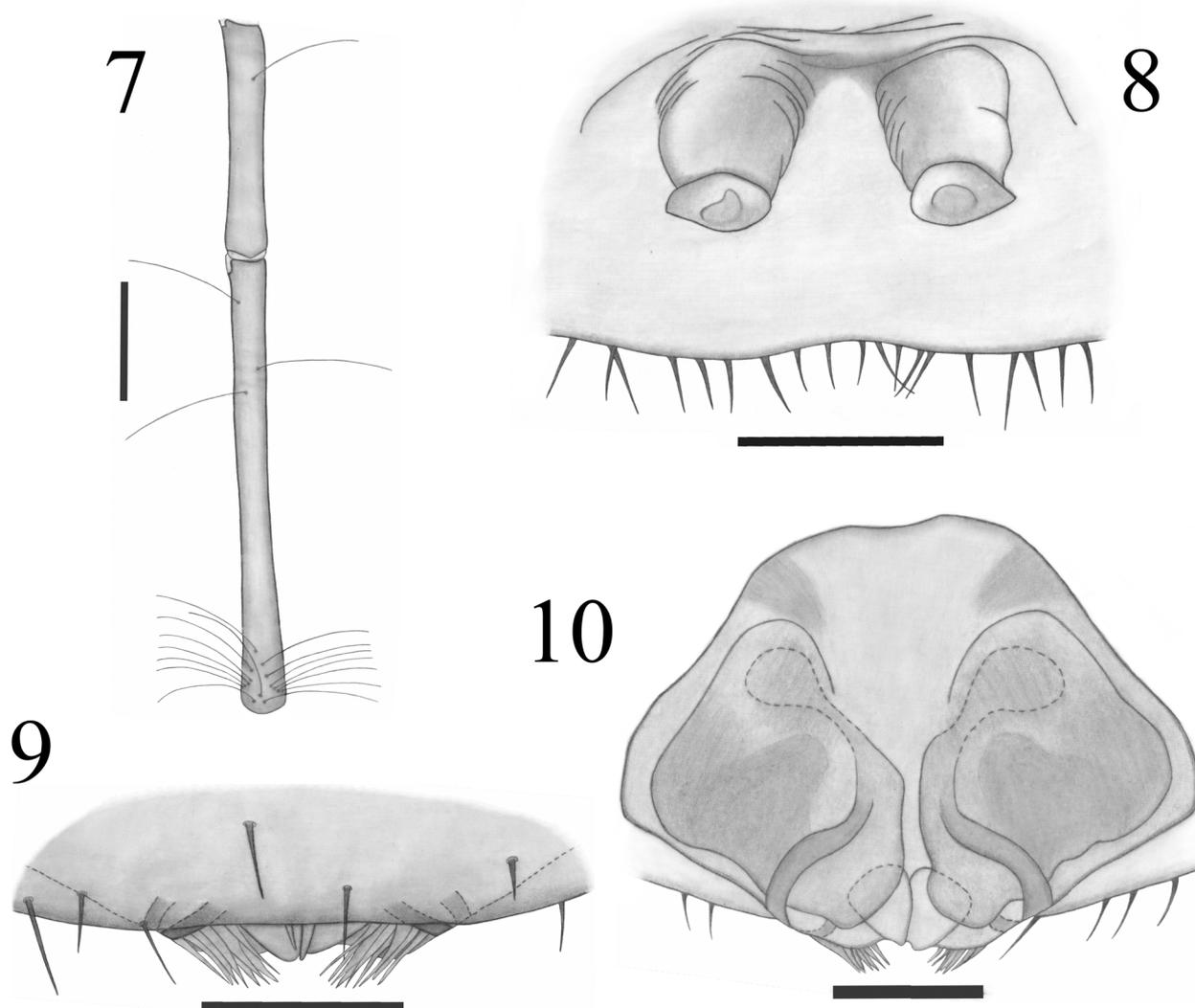
Pedipalp (Figs. 3–4): **Trochanter:** Ventral spiniform apophysis pointed forwards with a series of subequal setiferous tubercles. 2 spines of subequal length located aligned on prolateral face, the first being near the medial region and second above the projection of the apophysis. 3 setae aligned between the spines and 1 of a basal location to the first spine. Dorsal oblique series of strong setae. **Femur:** Dorsal portion with several strong setae and 2 basal setae tubercles. 3 medial dorsal spines (4 can be found in larger specimens) decreasing in size. 5 ventral spines (4 can be found in specimens of smaller size) of sizes: $II > III > IV > I > V$. The firsts 2 spines are close to each other and the trochanter. Spine I can be greatly reduced in smaller specimens. **Patella:** 5 dorsal spines (4 can be found in smaller specimens) of sizes: $II > III > IV > I > V$. The spines are located in the distal half and present several

strong setae. Strong ventral setae. Two spines located in the ventral distal half, I being approximately 2 times larger than the II. **Tibia:** 2 dorsal spines with several strong setae on their bases, the second being approximately 2 to 3 times larger than the first. 1 ventral spine located in the distal half having approximately half of the size of the second dorsal spine. **Tarsus:** Strong dorsal setae and long ventral setae. 2 spines dorsal on the cleaning organ, the second spine being approximately 2 to 3 times larger than the first. Cleaning organ occupies about half the length of article. **Apotele (claw):** Long with sharp curved tip.

Legs (Fig. 7): All densely setose, the femurs being denser dorsally and tibiae (basitibia + distitibia) denser ventrally. Femur lengths: I>III>II>IV. **Leg I:** Tibia with 23 articles and tarsus with 41 articles. **Leg IV:** Basitibia with 4 pseudo-articles and 1 basal trichobothrium on the last article. Distitibia with 3 basal and 15 distal trichobothria; frontal and caudal series with 6 trichobothria each. Basitibia-distitibia length: DT>BT1>BT4>BT3>BT2. Metatarsus slightly larger than the tarsus. Tarsus tetramerous.

Measurements (n=11): Total length: 10.18 mm (6.27–13.73). Cephalothorax: Length: 3.75 mm (2.20–5.14); Width: 5.05 mm (3.00–6.97). Pedipalp: Femur: 2.67 mm (1.15–5.06); Patella: 2.92 mm (1.18–5.31); Tibia: 1.35 mm (0.70–2.28); Tarsus: 1.07 mm (0.58–1.60); Apotele: 0.77 mm (0.38–1.30).

Color: Live specimens (Figs. 11.E–11.F) show a pattern of grayish coloration. In alcohol (Figs. 1–2): Carapace, chelicerae and pedipalps reddish brown. Sternum and legs yellowish brown. Abdomen varying from grayish brown to light brown. Smaller specimens exhibit a lighter color pattern.



FIGURES 7–10. *Charinus potiguar* sp. n. Male holotype: 7. Arrangement of trichobothria on the last pseudo-article of the basitibia and on the distitibia of left leg IV. Scale bar = 1.0 mm. Female paratype: 8. Dorsal view of gonopods. Male holotype: 9. Ventral view of genitalia. 10. Dorsal view of genitalia. Scale bar = 250 μ m.

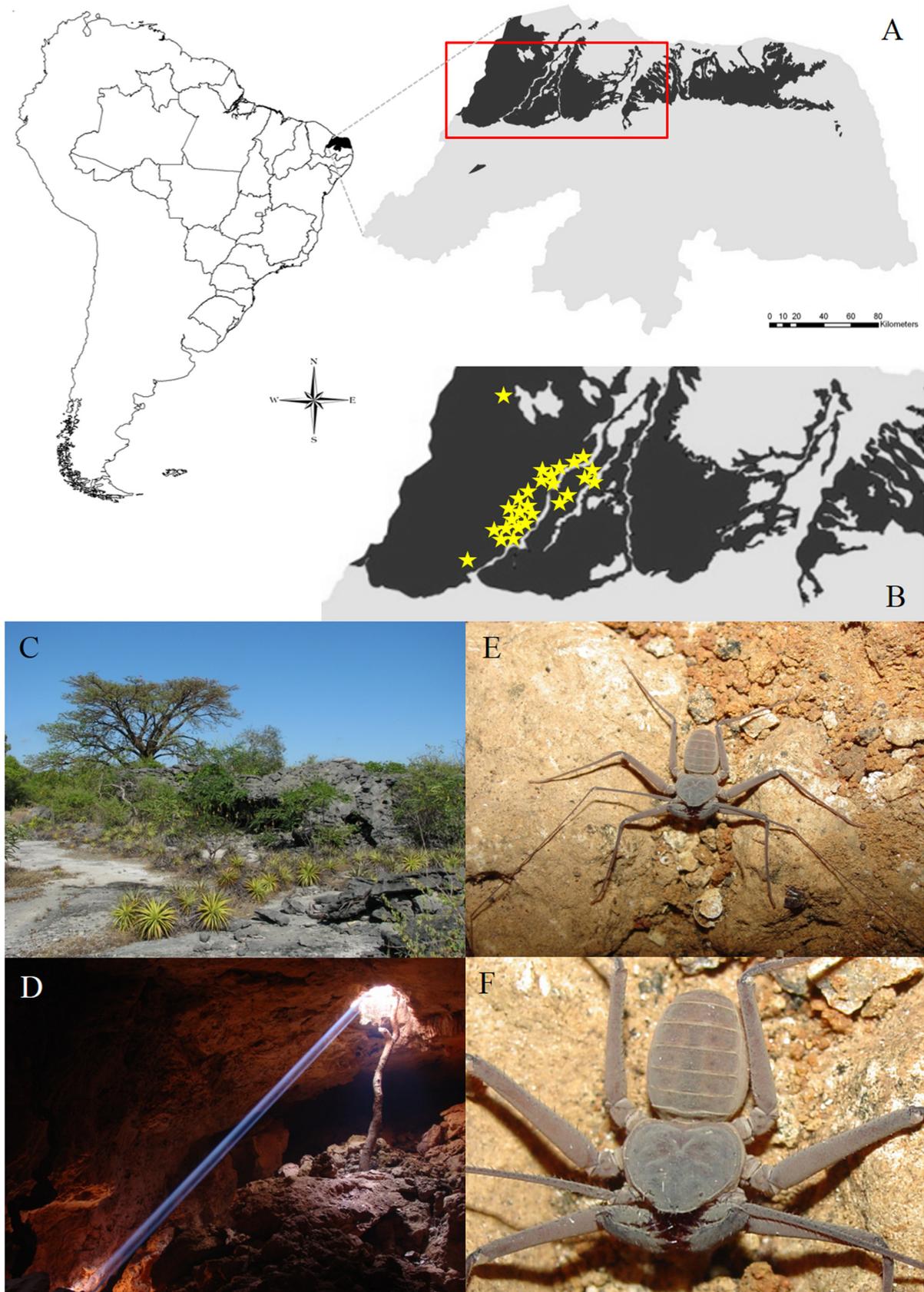


FIGURE 11. A. Location of the Chapada do Apodi in Rio Grande do Norte. B. Location of the Apodi caves where the *Charinus potiguar* sp. n. was collected. C. Caatinga Biome. D. Inner portion of the “Pau” Cave, where *Charinus potiguar* sp. n. was collected. E. Individual of *Charinus potiguar* sp. n. inside the cave. F. Individual in detail.

Genitalia: Male genitalia (Figs. 9–10): Margin of GO rounded with a few scattered setae. Genitalia a little wider than long. Fi exceeds a bit from the genital operculum margin. Sclerotized band surrounds each terminal portion of Fi, where several long and digitiform lamellae (LoL1 and LoL2) protrude ventrally. LoD smaller, saclike and slightly converged with each other to follow from the interior of the upper portion of Fi until reaching an area above the edge of GO. A pair of LaM project ventrally to these two lobes, with a claw shape and size corresponding to LoD. **Female genitalia** (Fig. 8): Rounded genital operculum margin and several strong setae. Gonopods sucker-like, barrel shaped and longer than wide. Gonopods opening rounded, edges with a small fold and a "V neck" directed towards opposite sides and a bottleneck below these. Gonopods separated from one another by a distance less than the diameter of each one and away from the margin of the operculum by a distance a little greater than its length. Sclerotization present between the base and the central side of each gonopod and slightly on the collar opening.

Etymology. The specific epithet is an adjective used in Brazil to designate the natives from the state of Rio Grande do Norte.

Natural history. The specimens examined came from collections conducted in karst areas (only in caves – Fig. 11) located in Rio Grande do Norte state (Fig. 11.A). All collection localities are from a limestone formation called the Apodi group, dated from the late Cretaceous. Most of the area is covered by limestone outcrops locally called "lajedos". Such formations embrace several caves, with an extraordinary subterranean biodiversity (Ferreira *et al.*, 2010).

This region is under the domain of an exclusively Brazilian biome, called Caatinga (Fig. 11.C). It is a warm area, characterized by a semi-arid climate, where rainfall is concentrated in a few months of the year, resulting in long drought periods (Rizzini, 1997). Its average annual precipitation is around 800 mm, concentrated mainly between the months of October and May, and the average annual temperature is 28°C.

Although the *Charinus potiguar* can be considered widespread within the Apodi limestone formation, the abundances in each cave were usually low (3.9 ± 3.4 individuals). This fact can indicate that *i*) the population densities are very low in each cave or, conversely, *ii*) the caves are not the main habitat of the species and only part of the population is sheltered within caves. Corroborating the latter hypothesis is the fact that specimens were more abundant in the caves in the dry season. In 16 caves in which the inventories occurred in both seasons, the abundance in the dry period was significantly higher than in the rainy season (t-value: -2.91, $p=0.007$). This can eventually indicate that specimens can migrate to caves especially in dry seasons, when the external environment becomes extremely dry (the Caatinga formation is the only semi-arid biome in Brazil). A total of 175 individuals were observed in 32 caves in the municipalities of Felipe Guerra, Baraúna and Governador Dix-Sept Rosado, Rio Grande do Norte State, Brazil (Figs. 11.B–11.D).

Specimens were usually found on the cave walls, although immatures were frequently found on the floor, sheltering themselves under rocks. This behavior is quite common in other arachnids and may be a result of protection against predation. Potential prey includes young crickets (*Endecous* sp.) and roaches, that were frequently seen in the caves where *C. potiguar* specimens were observed.

Distribution patterns of the genus. The MAXENT program generated a map of potential distribution with a modeling confidence level of AUC=0.916. The map of potential distribution (Fig. 13) included localities of occurrence of the species of the genus already described for South and Central Americas. Furthermore, it have also considered occurrences of new species for Panama (Viquez *et al.*, 2012) and Colombia (Armas *et al.*, 2012), records in Brazil for the states of Tocantins (Luzimangue municipality) registered by Kury *et al.* (2010) and Ceará (Ubajara municipality) registered by Miranda and Giupponi (2011), besides other new records of new species of Brazil (Fig. 12). The troglobitic species *C. troglobius* and *C. eleonorae* were not considered in this analysis, since the external environment of the cave has no influence on their current distributions.

New records of Brazilian Charinidae (*Charinus* sp.): State of Pará: Serra Leste and Morro II (first record for the state); Bahia: Ourlândia, Lençóis and Campo Formoso (first record for the municipalities); Minas Gerais: Arcos/Pains and Sete Lagoas (first record for the municipalities); and Rio de Janeiro: Cambuci and Cantagalo (first record for the municipalities).

Observations on the type locality of *Charinus brasiliensis* and *Charinus montanus* Weygoldt, 1972. The identification keys of Giupponi and Kury (2002), Baptista and Giupponi (2003) and Miranda and Giupponi (2011) report the type localities of *C. brasiliensis* and *C. montanus* as respectively São Domingos and Serra, Espírito Santo, Brazil. However, according Weygoldt, 1972, the type locality of *C. brasiliensis* is Serra, and *C. montanus* is Domingos Martins, Espírito Santo, Brazil.

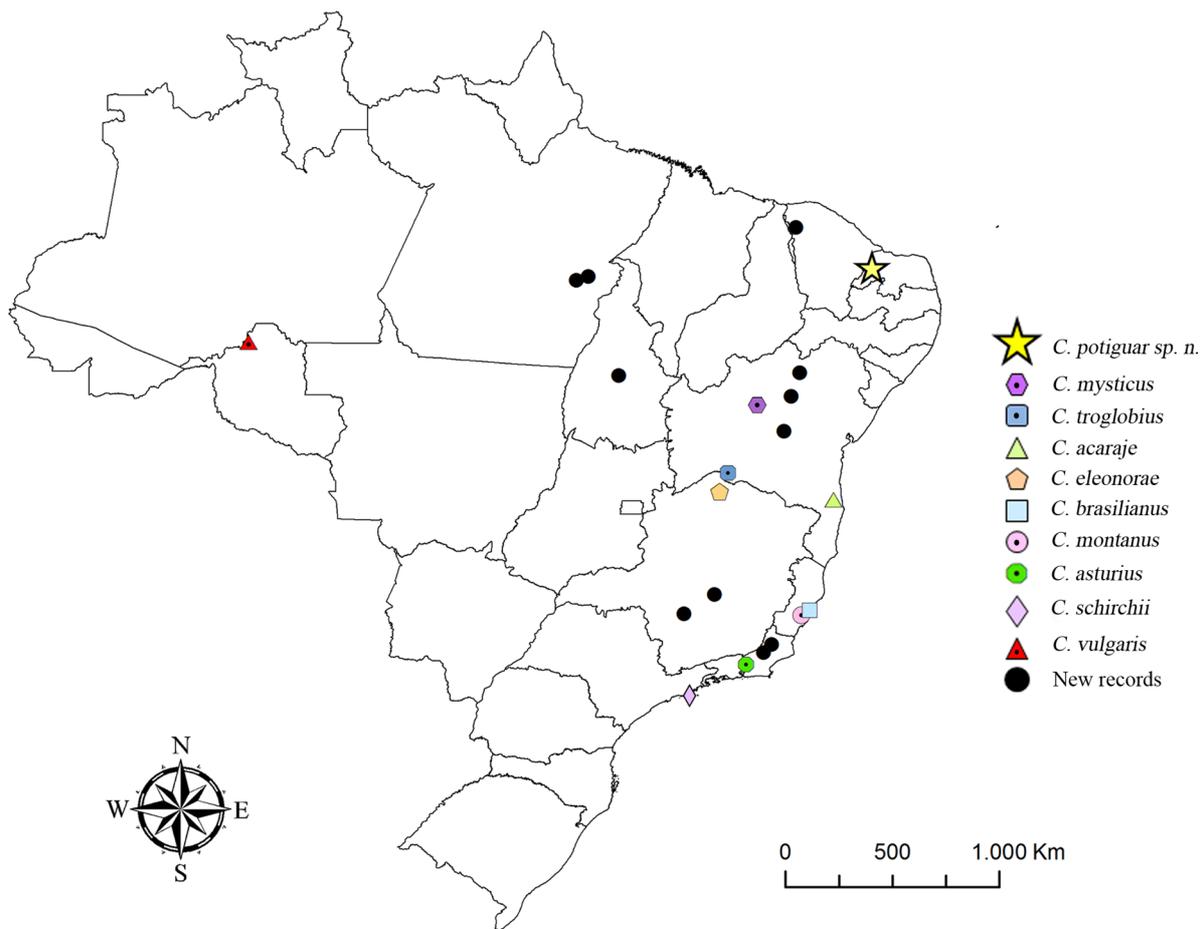


FIGURE 12. Distribution map of *Charinus* in Brazil with records of new species of the genus.

Key to the Brazilian species of *Charinus*

The key proposed here was based on Miranda and Giupponi (2011) with some modifications and addition of characters (the caves indicated represent only the type-locality).

- | | | |
|---|--|---------------------------|
| 1 | Median eyes absent | 2 |
| - | Median eyes present | 3 |
| 2 | Conical gonopods with an apical sucker-like prehensile structure; basitibia IV with four pseudoarticles (Bahia: Carinhanha, Serra do Ramalho, Zé do Bastos cave) | <i>C. troglobius</i> |
| - | Rounded, cushion-like gonopods with an apical sharp edge partially covering the atrium of the seminal receptacle; basitibia IV with three pseudoarticles (Rondônia: Porto Velho) | <i>C. vulgaris</i> |
| 3 | Second and third sternal sclerites flattened and twice as wide as long (Espírito Santo: Domingos Martins) | <i>C. montanus</i> |
| - | Second and third sternal sclerites convex and more or less rounded | 4 |
| 4 | Median eyes tubercle indistinct (Minas Gerais: Itacarambi, Olhos d'Água Cave). | <i>C. eleonora</i> |
| - | Median eyes tubercle distinct | 5 |
| 5 | Distitibia of leg IV with 16 trichobothria (Espírito Santo: Serra). | <i>C. brasilianus</i> |
| - | Distitibia of leg IV with 18 trichobothria | 6 |
| 6 | Femur of pedipalp with 6 ventral spines and tarsus with 3 dorsal spines (Bahia: Gentio do Ouro, Caverna Encantados) | <i>C. mysticus</i> |
| - | Femur of pedipalp with 5 ventral spines and tarsus with 2 dorsal spines | 7 |
| 7 | Patella of pedipalp with 6 (or 7 in large males) dorsal spines and 4 (or 5 in large males) ventral spines (São Paulo: Ilha Bela) | <i>C. asturius</i> |
| - | Patella of pedipalp with 4 or 5 dorsal spines and 2 ventral spines. | 8 |
| 8 | Lateral eyes triads with pigmentation (Bahia: Santa Luzia, Gruta Pedra do Sino). | <i>C. acaraje</i> |
| - | Lateral eyes triads without pigmentation (Rio Grande do Norte: Felipe Guerra, Caverna do Buraco Redondo) | <i>C. potiguar sp. n.</i> |

Discussion

Charinus potiguar has close similarities with other species of the genus in Brazil, like the carapace furrow pattern similar to *C. eleonora* and *C. brasilianus*. Furthermore, *C. potiguar* has six setae on the anterior margin of the carapace, like most Brazilian *Charinus* species. This pattern of setae differs markedly only from *C. eleonora*, which has 10 setae. *Charinus potiguar* has the median eye tubercle low like *C. mysticus*. The pattern of the sternum setae on *C. potiguar* resembles that found on *C. vulgaris*. The number of claw denticles of the chelicera on *C. potiguar* is the highest among the Brazilian species, but approaches that found in *C. troglobius*, which has nine, and in *C. eleonora*, which has 10–11. *Charinus vulgaris* has the most divergent number of denticles, with only four.

The pattern and number of spines of the femur and patella of the pedipalps of *C. potiguar* are similar to those found in *C. acaraje*. Both species have the dorsal femur with three or four spines, the ventral portion with five, the patella with five dorsal and two ventral spines. The spines of the femur differ considerably in quantity among the Brazilian species of *Charinus*. *Charinus troglobius* presents only two ventral and two dorsal spines, while *C. mysticus* presents six in each portion. On the patella, the variation of the amount of spines is somewhat lower. The lowest value reported is four spines on the dorsal patella of *C. troglobius* and *C. vulgaris*, and the highest is seven in *C. mysticus*. On the ventral patella the lowest reported value is two spines present in *C. potiguar*, *C. acaraje*, *C. troglobius* and *C. vulgaris*. *Charinus eleonora* has three spines, whereas the other four remaining species present four.

The leg I of *C. potiguar* presents a tibia with 23 articles and tarsus with 41, as in the average for the genus (Weygoldt, 2000). *Charinus potiguar* presents the frontal and caudal series of the leg IV with six trichobothria, similar to that observed in *C. asturius* and *C. acaraje*. The number of pseudoarticles of the basitibia of the leg IV of *C. potiguar* corresponds to four segments, and the female gonopod is the sucker type. These are characteristics which among the Brazilian species are not only present in *C. vulgaris*.

Charinus potiguar belongs to the *C. brasilianus* species group, defined by Weygoldt, 2005, which have sucker-like gonopods as a characteristic. *C. potiguar* has the gonopod opening with a "V" collar and below this a bottleneck as in *C. mysticus*. The difference between them is that the basal portion is thinner in the *C. potiguar* gonopod and the "V" collar of the opening is directed to opposite sides. The gonopod of male *C. potiguar* is easily distinguishable when compared to the other Brazilian species. This has the lobus lateralis (LoL1 and LoL2) subdivided into several long finger-like blades that project ventrally, similar to what occurs in *C. eleonora*. The difference between these gonopods is that in *C. potiguar* the lobus dorsalis (LoD) and medial laminae (LaM) are more visible and have no longitudinal genital split. The format of the genital organ is similar to that observed in *C. asturius*, however this does not have the lobus lateralis forming long lamellae as in *C. potiguar*. *C. brasilianus* presents an aspect of the lobus dorsalis similar to that of *C. potiguar*, but also lacks lamellae.

Charinus potiguar is easily distinguished from other species of South America by having four pseudo-articles in basitibia of leg IV, while *C. quinteroi*, *C. platnicki* and *C. bromeliaea* have just two, and *C. tronchonii*, *C. bordoni*, *C. pardillalensis* and *C. camachoi* have three pseudo-articles. *C. potiguar* separates from *C. gertschi*, among other characteristics, by the number of spines in dorsal and ventral patella of the pedipalp. The first species has five dorsal and two ventral spines, whereas *C. gertschi* has six dorsal and four ventral spines. *C. potiguar* is distinguishable from *C. koepcke* due to the latter having small claws on the female gonopods. *C. insularis* is endemic to the Galapagos Island (Ecuador) and has three spines on the ventral femur of the pedipalp, while *C. potiguar* presents five.

The Amblypygi continue to reproduce and grow throughout life even after reaching sexual maturity (Weygoldt, 1999). This fact explains the wide difference between the sizes observed in adult body length (ranging from 6.27 to 13.73mm). Some adults observed were twice as large in relation to others.

Charinus potiguar is the northernmost record of the genus in Brazil and the first for the state of Rio Grande do Norte. On the other hand *C. asturius*, of Ilha Bela on the coast of the state of São Paulo, comprises the southernmost registration of Brazil and South America. The Brazilian species of *Charinus* are more distributed in the eastern portion of Brazil, where there are regions of different climatic conditions. These conditions range from subtropical climate, such as the Atlantic Forest, where *C. asturius*, *C. montanus*, *C. brasilianus*, *C. schirchii* and *C. acaraje* are inserted, to the semi-arid climate, as in the Brazilian northeast, where *C. potiguar* inhabits. According to the map of *Charinus* potential distribution (Fig. 13), there is still a potential possibility of other species of the genus to be found in the southeast (states of Espírito Santo and Rio de Janeiro) and northeastern Brazil (states of Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe and Bahia).

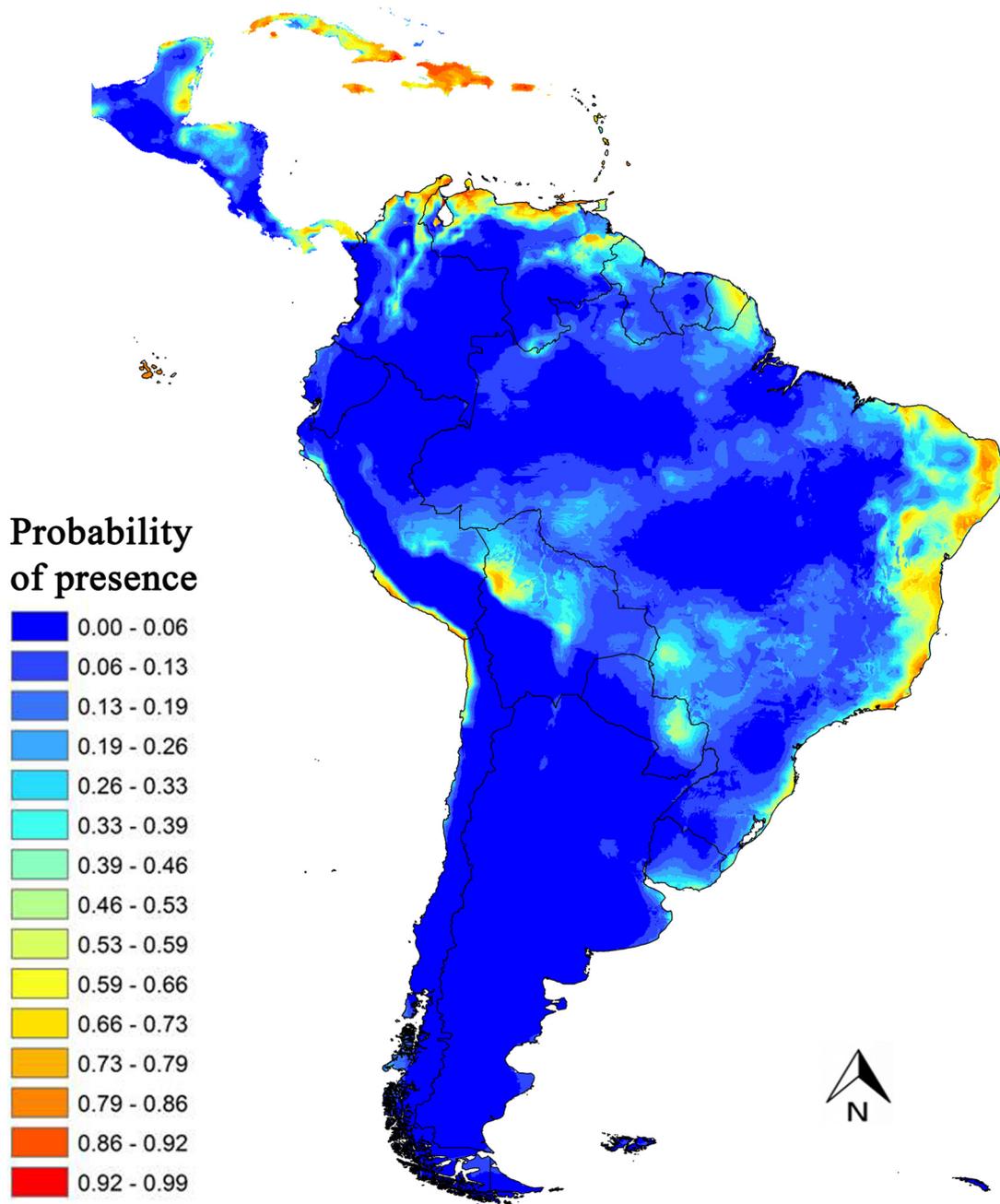


FIGURE 13. Map of potential distribution of Neotropical species of *Charinus*.

Charinus has most of its species represented on islands such as the Antilles, Solomon Islands in the Southwest Pacific, Ilha Bela in Brazil, Saint Thomas and Prince and Seychelles in Africa, or in portions near the continental coastlines, as in Venezuela, Peru, Panama, on the eastern borders of the Mediterranean, and India (Harvey, 2003; Viquez *et al.*, 2012). This predisposition to occupy coastline portions and islands is also revealed in the *Charinus* potential distribution (Fig. 13), which shows a high possibility of occurrence of species on the coast of northeastern and southeastern Brazil, in portions of coastal Peru, Chile, north and northwest of South America, in Panama, eastern portions of Honduras, Guatemala and Belize, and in the Caribbean (Cuba, Haiti, Dominican Republic, Puerto Rico and Jamaica). The only exception found was an area in Bolivia near the Andes, which comprises part of the Madidi National Park, which borders the Beni River, a major tributary of the Rio Madeira. This last river bathes Porto Velho, where *C. vulgaris*, species of the interior of South America, was collected. The two main environmental variables that were identified by the Maxent program to explain the potential distribution of *Charinus* (Fig. 13) were diurnal temperature range and annual cloud cover, which corroborates the fact of the genus has preferred to inhabit shadowed environments and shelter during the day (Weygoldt, 2000).

The Brazilian legislation that currently protects the cave environments (decree-law no. 6640) categorizes the caves according to their geological and biological importance. Subterranean environments that are type locality of a species are considered most relevant. Thus, the description of new species for caves can help increase the biological importance of these environments, increasing the chances that they are preserved, as well as their adjacent external environments.

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