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ARTICLE

Presence and distribution of *Leptodactylus guianensis* Heyer and de Sá, 2011 in Colombia: comparisons with other species in the *L. latrans* group

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ABSTRACT

Leptodactylus guianensis is reported for the first time for Colombia along with a distributional map of the species. The species is the fifth species of the *L. latrans* species group documented in the country. Males possess a single, conical and slightly chisel-shaped thumb spine; only three species in the group have a single thumb spine. In collections, specimens of *L. guianensis* are misidentified as *L. macrosternum*, *L. latrans or L. bolivianus*. We provide morphological, colouration and habitat descriptions for where the species occurs in Colombia.

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Introduction

The Neotropical genus *Leptodactylus* Fitzinger, 1826 currently consists of 75 species that are clustered into four species groups (Heyer 1969; Larson and de Sá 1998; de Sá et al. 2014). The *L. latrans* species group contains eight recognised taxa: *L. bolivianus* Boulenger, 1898, *L. chaquensis* Cei, 1950, *L. guianensis* Heyer and de Sá, 2011, *L. insularum* Barbour, 1906, *L. latrans* (Steffen 1815), *L. macrosternum* Miranda-Ribeiro, 1926, *L. silvanimbus* McCranie et al., 1980 and *L. viridis* Jim and Spirandeli-Cruz, 1973. One species, *L. silvanimbus*, is endemic to Honduras, and the remaining species are widely distributed in South America with *L. insularum* entering Mesoamerica and reaching Costa Rica. The *latrans* species group is recognised by five osteological cranial synapomorphies (de Sá et al. 2014). Four species of the *latrans* species group have been reported to occur in Colombia: *L. bolivianus*, *L. insularum*, *L. latrans* and *L. macrosternum*. The description of *Leptodactylus guianensis* suggested the species is most closely related to *L. bolivianus* based on the presence of a single keratinised thumb spine in both species (Heyer and de Sá 2011). In addition, it reported the species inhabits lowland environments of the Guiana Shield, occurring in Guyana, Suriname, Venezuela and Brazil. A more extensive distribution was suggested with question marks, pending confirmation, since those specimens did not include males with sexual secondary characters (i.e. only juveniles and females; Heyer and de Sá 2011). Although the species has been reported to occur in Colombia (e.g. Frost 2011; Cole et al. 2013), this has not

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Figure 1. Adult female (SINCHI-A 3318) of *Leptodactylus guianensis*.

been verified from specimens collected in Colombia. We report the presence of *Leptodactylus guianensis* in Colombia and discuss the characteristics that differentiate it from breeding adult males of *L. bolivianus*. We also provide information on the habitat occupied by *L. guianensis* in Colombia.

Material and methods

Specimens herein identified as *L. guianensis* are deposited in the amphibian collections of the Instituto Amazónico de Investigaciones Científicas (SINCHI; Bogotá, Colombia) under the numbers SINCHI-A 3318–23, 5200, 5225 and 2453; and the Instituto de Ciencias Naturales, Universidad Nacional de Colombia, with number ICN 46855; specimens SINCHI-A 3320–21 and 2453, and ICN 46855, are adult males with distinct secondary sexual breeding traits. Measurements were taken with digital Mitutoyo callipers to the nearest 0.1 mm; morphological terminology follows Heyer and de Sá (2011) and de Sá et al. (2014).

Results

Description of specimens

Adult specimens of *Leptodactylus guianensis* from Colombia (Figure 1) have a snout-vent length (SVL) in females of 73.25–90.70 mm, $\bar{x}$ = 82.97 mm, n = 5, and in males of 78.70–104 mm, $\bar{x}$ = 90.36 mm, n = 4; and the SVL of the one juvenile was 69.65 mm. Two of the specimens examined correspond to adult males, one with hypertrophied arms

Figure 2. Adult males of (a,b) *Leptodactylus bolivianus* SINCHI-A 2335: (a) non-conical, square, and chisel-shaped thumb spine; (b) tympanum without tubercles; and (c,d) *Leptodactylus guianensis* SINCHI-A 2453: (c) conical, slightly chisel-shaped thumb spine, (d) tympanum and tympanic region with tubercles.

and distinct (fully developed) thumb spines (SINCHI-A 3320) and the second one (SINCHI-A 3321) with non-hypertrophied arms and thumb spines that are not fully keratinised. Vomerine teeth are arranged in two arches found posteriorly and slightly medially to the choanae. Tympana are distinct; in adult males, the rim of the tympanum (edge of underlying tympanic ring) bears small tubercles (during the breeding season they may be keratinised); small tubercles are also found on the area between the tympanum and the eye and may be present on the supratympanic fold (Figure 2(d)). Finger lengths in increasing order are V < III < II < IV; all fingers have lateral fleshy ridges which are less defined on finger V; ridges of fingers III and IV have abundant and keratinised spines (the spines are less abundant and not keratinised in females); small keratinised spines are also found on the laterodorsal surfaces of fingers II, III, and IV, but are scarce on finger II; no spines were found on the laterodorsal surface of fingers on females. Subarticular tubercles large, rounded and distinct; thenar tubercle large, slightly

triangular with apex towards the wrist and narrowly separated from the palmar tubercle; palmar tubercle large and rounded with outer margin slightly bifid.

Breeding males with keratinised thumb spines that are overall conical and slightly chisel shaped distally (Figure 2(c)), usually ending in two or three very small cusps. One male (SINCHI-A 3320) shows a central patch of keratinised spines on chest. Toe lengths in increasing order are I < II < V < III < IV; toes with distinct lateral fleshy ridges that basally form the interdigital membrane; ulnar ridge distinct, extending almost the entire length of the tarsus and reaching the base of an elongated inner metatarsal tubercle, outer metatarsal tubercle smaller (about 50–55% the length of inner tubercle), rounded to slightly triangular (wider distally), tarsal ridge and tarsus scattered with small tubercles, of variable size, with keratinised tips and extending over the ventral surface of metatarsal element; these small tubercles are more abundant in males. Texture of the anterior 2/3 of the body is smooth; from the anterior tip of the ilium and over the dorsal surfaces of thigh and shank, the skin is scattered with tubercles (larger on the legs than on the posterior dorsal body). Dorsal folds absent; dorsolateral folds complete, extending from posterior eye to groin; lateral fold present continuous or interrupted. An elongated gland is found above the insertion of the arm; it is continuous with the commissural gland, but it differs from the latter by its brownish, darker colouration. The colouration of the throat ranges from almost homogeneously grey to a mottled pattern (with mottling of varying sizes); the mottled pattern on the chest and ventral surface of the arms is continuous on the belly (mottling becomes scarce on mid- and posterior belly), ventral surface of thighs varies from entirely mottled to mottled only close to the edges, or non-mottled; posterior surface of thighs mottled. Colouration of dorsum (i.e. between dorsolateral folds) lighter than lateral body colouration; a large, triangular interorbital marking extends from the eyes posteriorly on the dorsum, gradually narrowing and usually ending in a truncated apex (posterior width about 1/3 of the anterior margin), immediately behind a light coloured spot that is rounded to oval; dorsal surfaces of thighs and shanks with distinct dark brown bars; a dark band extends over the posterior surface of the arm from the insertion of the arm-body to the elbow; snout is rounded in dorsal and lateral views; light stripe on upper lip, extending from below the eye and continuous over the elongated commissural gland, which is always light coloured; dark band from anterior edge of eye, reaching the tip of the snout; *canthus rostralis* indistinct, tympanum distinct. A distinct, dark-coloured supratympanic fold extending from the posterior corner of the eye, running above the tympanum, and curving ventrally to reach the posterior end of the commissural gland.

Discussion

Among species in the *L. latrans* group, breeding males of only *L. bolivianus*, *L. guianensis*, and *L. viridis* have a single keratinised thumb spine (two thumb spines in all other species). Consequently, *L. guianensis* can be differentiated from all species in the *L. latrans* species group possessing two thumb spines in breeding males. The thumb spine of only one species in the *L. latrans* group has not been reported, *L. macrosternum*. However, previous work suggested that the taxonomic status of *L. macrosternum* is not clear and the distribution was restricted to the type locality (de Sá et al. 2014), which makes *L. guianensis* allopatric with *L. macrosternum* [*Leptodactylus macrosternum*

Miranda-Ribeiro, 1926, type locality: Bahia, Brazil (subsequently restricted to Salvador, Bahia, Brazil, by Bokermann 1966)]. A wide allopatric distribution is also observed between *L. guianensis* and *L. viridis* Jim and Spirandeli-Cruz, 1973 (1979), another species with a single thumb spine (type locality: Fazenda Pedra Branca, Município de Itajibá, Bahia State, Brazil). Consequently, our comparison suggests that adult specimens of *L. guianensis* with fully developed secondary sexual traits collected from Colombia can only be confused with *L. bolivianus*.

Leptodactylus guianensis is a medium- to large-sized species within the *L. latrans* species group. Although specimens from Colombia fit within the size range reported for *L. guianensis*, morphometric data are not useful to differentiate the species from *L. bolivianus* (females: SVL 61.2–107.7 mm, $\bar{x}$ = 85.3 mm; males: SVL 79.0–121.5 mm, $\bar{x}$ = 104.6 mm; *L. guianensis*: females: SVL 66.0–109.2 mm, $\bar{x}$ = 88.2 mm; males: SVL 79.5–109.5 mm, $\bar{x}$ = 94.8 mm) (Heyer and de Sá 2011). Adult breeding males of *L. guianensis* and *L. bolivianus* can be unequivocally distinguished by the presence of a single and slightly chisel-shaped thumb spine in *L. guianensis* (Heyer and de Sá 2011). Furthermore, the single spine in *L. guianensis* is overall conical in shape, whereas that of *L. bolivianus* is square (Figure 2(a,c), also see Heyer and de Sá 2011). The presence of tubercles on the rim of the tympanum and surrounding area in in males *L. guianensis*, absent in *L. bolivianus*, also helps to differentiate the two species (Figure 2(b,d)). Other characters are less reliable due to variation in populations (Heyer and de Sá 2011). *Leptodactylus bolivianus* was reported to have a white stripe on the upper lips extending from the snout to the commissural gland, whereas in *L. guianensis* it extends from below the eye to the commissural gland. The appearance of the posterior thigh of *L. bolivianus* ranges from mostly uniform to a moderately mottled pattern, whereas in *L. guianensis* the posterior thighs show a boldly mottled pattern with larger irregular spots on a dark background. Although the latter two characters show some variation within each of the species, they are useful in combination with the thumb spine and characteristics of the tympanum's rim. One trait that needs additional observations, on adult males during the breeding season, is the presence of patches of chest spines. *Leptodactylus guianensis* and *L. bolivianus* were reported to possess a central patch of keratinised spines and two lateral tubercles on the chest (Heyer and de Sá 2011). We found only a central patch of keratinised chest spines on one individual of *L. guianensis* (SINCHI-A 3320) which exhibits all other traits expected of an adult male during a breeding period; the second male we examined (SINCHI-A 3321) is an adult male that had not yet fully reached the breeding stage (e.g. conical, thumb spine is not fully keratinised and chest spines not visible). The largest male examined (SINCHI-A 2453) has a central and a smaller lateral patch of chest spines on either side. We also observed a central patch of chest spines in the large breeding male of *L. bolivianus* we examined (SINCHI-A 2335). The development of secondary characters (e.g. chest spines) may be variable with the age, size, and endocrine stage of the individual; consequently, they need to be assessed carefully when being used to identify species.

Larval stages and the advertisement call of *Leptodactylus guianensis* have not been reported. In Colombia, *Leptodactylus guianensis* is reported from the geological formation of the Guiana Shield (Gibbs and Barron 1993; Hollowell and Reynolds 2005). The species occurs in the Departments of Guainía and Vichada (Figure 3; Appendix).

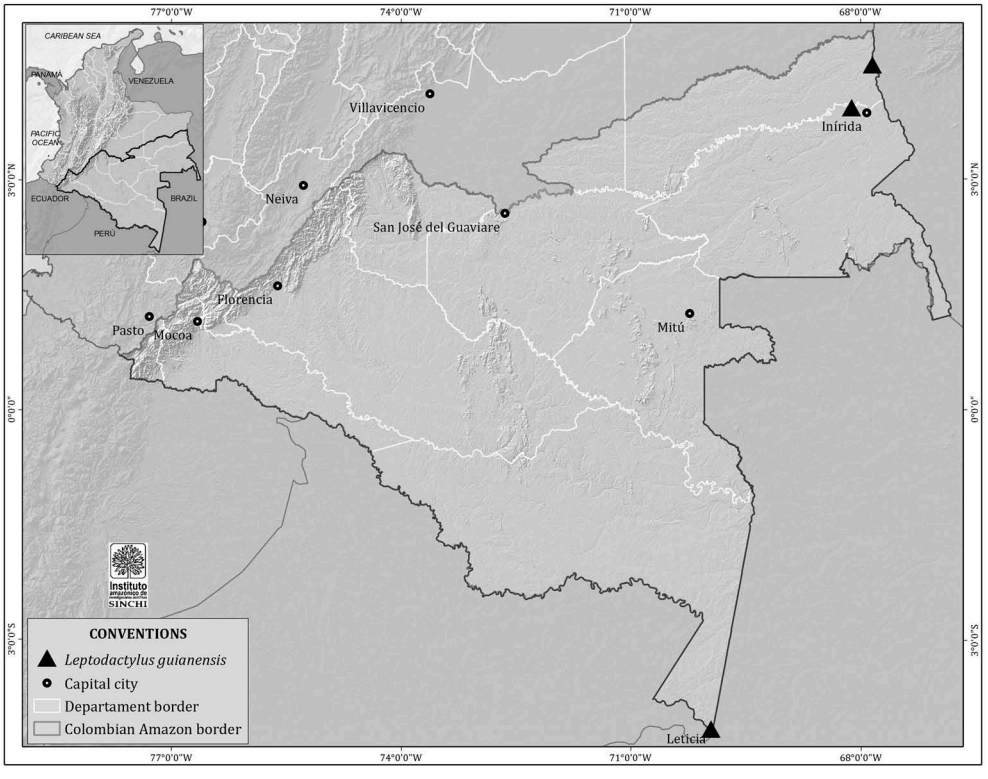

Figure 3. Triangles denote the reported distribution of *Leptodactylus guianensis* in Colombia.

The specimens we collected were active at night, moving on the ground in flooded forest areas and close to the Amazonian whitewater rivers Guaviare and Orinoco. Sampling occurred during the rainy season and in partially flooded forests; specimens were found on top of floating logs or in dry areas of riverbeds. The examined specimen of *L. bolivianus* was collected from the same locality as at least one individual of *L. guianensis* (SINCHI-A 2453).

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Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix. Voucher specimens and locality data

Leptodactylus guianensis SINCHI-A 3318–23, 5200, 5225, Department of Vichada, Municipio Cumaribo (4.417° N, 68.2° W); SINCHI-A 2453, Department of Guainía, Municipio Inírida (3.56° N, 68.07° W); ICN 46855 Department of Amazonas, Municipio Leticia, Lago Yaguarcaca (4.183° N, 69.95° W).
Leptodactylus bolivianus SINCHI-A 2335, Department of Guainía, Municipio Inírida (3.933° N, 68.117° W).