LONG-STANDING MISIDENTIFICATION OF *RHINELLA ICTERICA* (SPIX, 1824) SPECIMENS FROM PARAGUAY

IDENTIFICACIÓN ERRÓNEA DE LARGA DATA DE ESPECÍMENES DE *RHINELLA ICTERICA* (SPIX, 1824) DE PARAGUAY

Andrea Caballero-Gini[1,2], Francisco Brusquetti[2], Nicolás Martínez[3], Martín O. Pereyra[1] & Diego Baldo[1]

[1]*Laboratorio de Genética Evolutiva "Claudio Juan Bidau", Instituto de Biología Subtropical (CONICET-UNaM), Facultad de Ciencias Exactas Químicas y Naturales, Universidad Nacional de Misiones, Félix de Azara 1552, Posadas, Misiones, Argentina*

[2]*Instituto de Investigación Biológica del Paraguay, Del Escudo 1607, Asunción, Paraguay*

[3]*Museo Nacional de Historia Natural del Paraguay, Ruta PY-02, Km 10.5, San Lorenzo 111421, Paraguay*

**Correspondence: ancgini@gmail.com*

Received: 2022-11-24. **Accepted**: 2023-01-09. **Published:** 2023-03-09.

Editor: Felipe Rabanal, Chile.

Resumo.– Neste trabalho reanalisamos espécimes do Paraguai atribuídos à espécie *Rhinella icterica* dos departamentos de Canindeyú e Amambay localizados na ecorregião do Cerrado. Com base na avaliação dos caracteres morfológicos externos, concluímos que eles devem ser atribuídos à espécie *Rhinella cerradensis*. Por outro lado, consideramos que não há evidências de que a espécie *R. icterica* seja encontrada no país.

Palavras chave.– Anura, Bufonidae, grupo *Rhinella marina*, Cerrado.

Resumen. – En este trabajo reanalizamos especímenes de Paraguay asignados a la especie Rhinella icterica provenientes de los departamentos de Canindeyú y Amambay ubicados en la ecorregión del Cerrado. En base a la evaluación de caracteres morfológicos externos concluimos que los mismos deben ser asignados a la especie *Rhinella cerradensis*. Por otro lado, consideramos que no hay evidencia de que la especie *R. icterica* se encuentre en el país.

Palabras clave. – Anura, Bufonidae, grupo *Rhinella marina*, Cerrado.

Abstract.– In this work, we reanalyzed specimens from Paraguay assigned to the species *Rhinella icterica* from the departments of Canindeyú and Amambay located in the Cerrado ecoregion. Based on the evaluation of external morphological characters, we conclude that they should be assigned to the species *Rhinella cerradensis*. On the other hand, we consider that there is no evidence that *R. icterica* is present in the country.

Key words.– Anura, Bufonidae, *Rhinella marina* species group, Cerrado.

The genus *Rhinella* Fitzinger, 1826 comprises 92 species distributed in North, Central, and South America (Frost, 2022). In Paraguay, eight species are known to occur (Brusquetti & Lavilla, 2006; Pereyra et al., 2021a, 2021b): *R. azarai* (Gallardo, 1965), *R. bergi* (Céspedez, 2000), *R. diptycha* (Cope, 1862), *R. dorbignyi* (Duméril and Bibron, 1841), *R. icterica* (Spix, 1824), *R. major* (Müller and Hellmich, 1936), *R. ornata* (Spix, 1824), and *R. scitula* (Caramaschi & Niemeyer, 2003). *Rhinella icterica* is a large robust toad (females can reach up to 190 mm), with heavily developed cephalic crests (Cei, 1980; Kwet & Di-Bernardo, 1999), and is a member of the *Rhinella marina* Group (Pereyra et al., 2021a). The distribution of the species covers southern, northeastern, and a portion of central Brazil (Rio Grande do Sul north to Bahia, Minas Gerais, and Goiás); Misiones province, Argentina, and isolated populations in eastern Paraguay (Frost, 2022).

Rhinella icterica was first cited for Paraguay in Frost (1985), and then in Aquino et al. (1996), however, no reference material

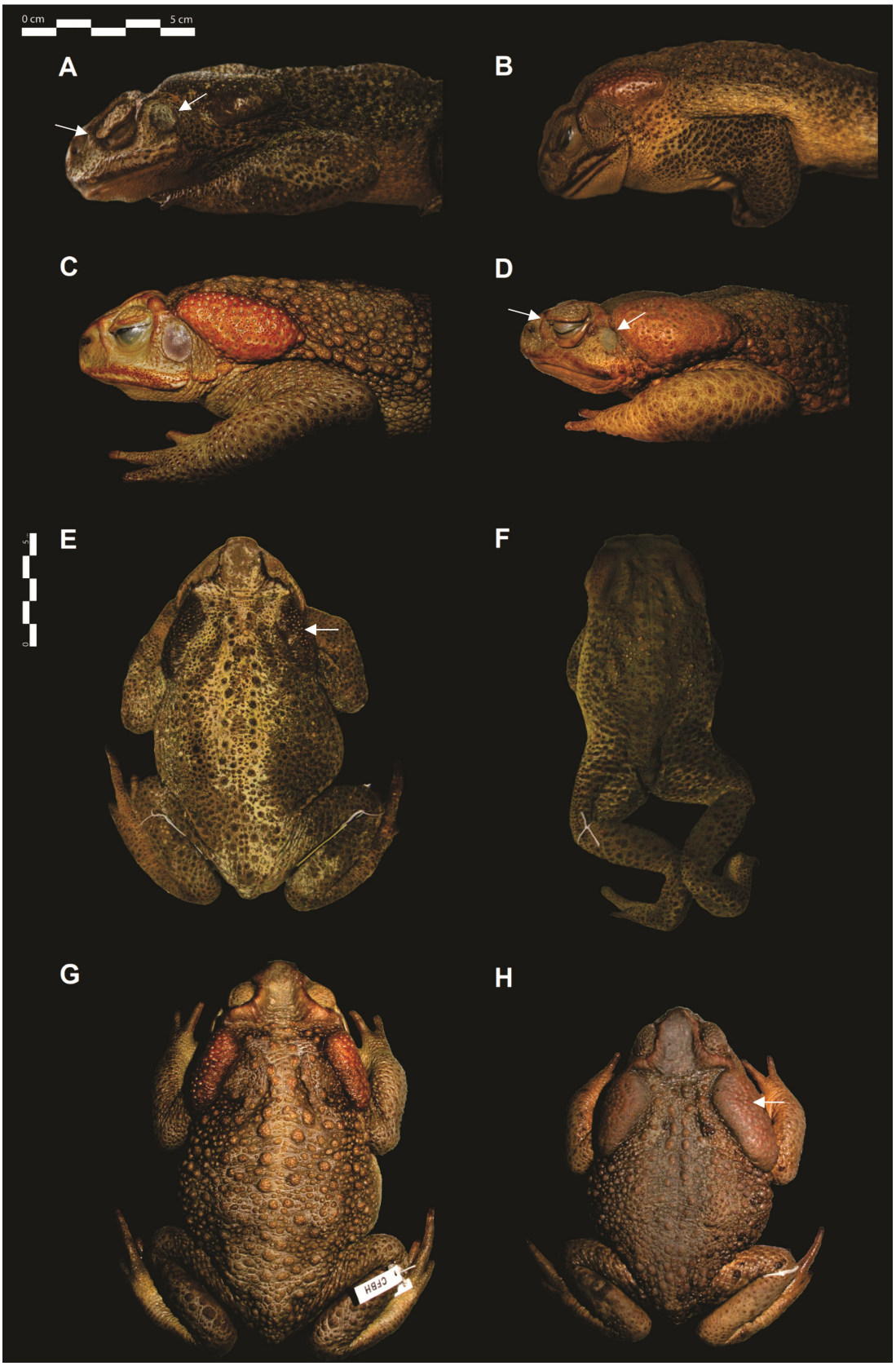

Figura 1. Vista lateral de *Rhinella cerradensis* (A) MNHNPy 6338 del Parque Nacional Cerro Corá, Departamento de Amambay, Paraguay, las flechas blancas señalan la cresta pre-ocular y tímpano sin pliegue; (B) MNHNPy 9328 de la Reserva Natural de Bosque Mbaracayú, Puesto Aguara Ñú, Departamento de Canindeyú, Paraguay; (C) CFBH 20517, Jaborandi, Bahia, Brasil; (D) R. icterica CFBH 37279, Tanguá, Rio de Janeiro, Brasil, las flechas blancas señalan la cresta pre-ocular y tímpano con pliegue. Vista dorsal de *R. cerradensis* (E) MNHNPy 6338, flecha blanca señala la glándula parotoidea; (F) MNHNPy 9328; (G) CFBH 20517; y de *Rhinella icterica* (H) CFBH 37279, flecha blanca señala la glándula parotoidea.

Figure 1. Lateral view of *Rhinella cerradensis* specimens (A) MNHNPy 6338, Parque Nacional Cerro Corá, Amambay department; Paraguay, white arrows showing the pre-ocular crest and the tympanum without folded skin; (B) MNHNPy 9328, Reserva Natural de Bosque Mbaracayú, Puesto Aguara Ñú, Canindeyú department, Paraguay; (C) CFBH 20517, Jaborandi, Bahia state, Brazil; and (D) *R. icterica* specimen, CFBH 37279, Tanguá, Rio de Janeiro state, Brazil, white arrows showing the pre-ocular crest and the tympanum with folded skin. Dorsal view of *R. cerradensis* specimens (E) MNHNPy 6338, white arrow showing the parotoid gland; (F) MNHNPy 9328; (G) CFBH 20517; and (H) R. icterica specimen CFBH 37279, white arrow showing the parotoid gland.

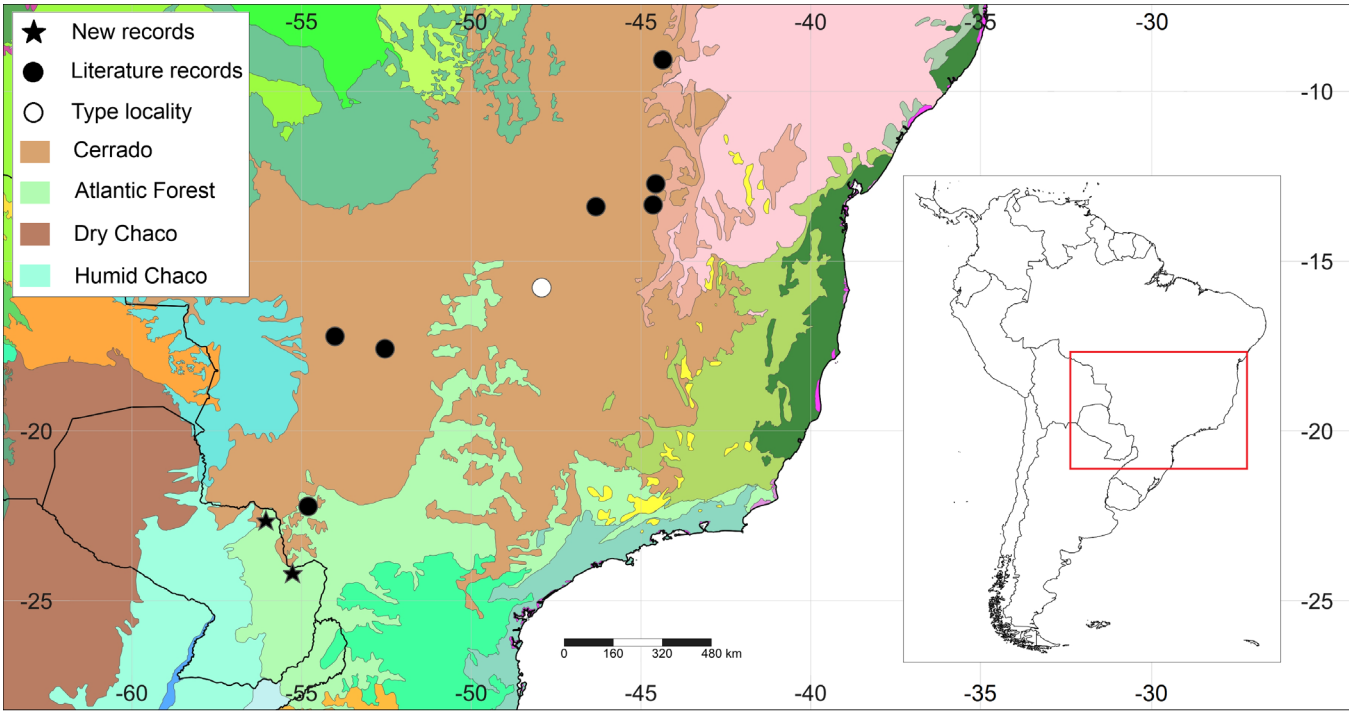

Figura 2. Mapa de distribución de *Rhinella cerradensis* (círculos negros), localidad tipo Brasilia, Distrito Federal (círculo blanco), nuevos registros de la ecorregión del Cerrado en Paraguay (estrellas).

Figure 2. Distribution map of *Rhinella cerradensis* (black dots); type locality, Brasília, Distrito Federal (white dot); new records from the Cerrado ecoregion in Paraguay (stars).

was provided in either. The presence of the species was formally confirmed in Brusquetti & Lavilla (2006) based on two specimens deposited in the Museo Nacional de Historia Natural del Paraguay: MNHNPy 6338 from Parque Nacional Cerro Corá, Amambay department, and MNHNPy 9328 from Reserva Natural de Bosque Mbaracayú, Puesto Aguara Ñú, Canindeyú department. These localities correspond to the southern limits of the Cerrado ecoregion *sensu* Dinerstein et al. (1995). Subsequently, Maciel et al. (2007) described *R. cerradensis,* a large species of the *R. marina* Group morphologically similar to *R. icterica, R. marina, R. poeppigii, R. diptycha,* and *R. jimi* but distinguishable by the well-developed cranial crests and parotoid gland, shape of the head and body sizes (Maciel et al., 2007).

Rhinella cerradensis is known from northeastern to central-western Brazil, in the Cerrado ecoregion (Maciel et al., 2007; Maciel et al., 2010; Santana et al., 2010), with a population in the Municipality of Dourados, State of Mato Grosso do Sul, close to the records of *R. icterica* from Paraguay. Although the presence of *R. cerradensis* in Paraguay is plausible, the taxonomic identity of the specimens from eastern Paraguay has never been reassessed and the name *R. icterica* has been maintained until now (Motte et al., 2009; Weiler et al., 2013; Cacciali et al., 2015; Motte et al., 2019; Cabral et al., 2020).

Considering the geographic localization of the records of *R. icterica* from Paraguay and the morphological similarities between *R. icterica* and *R. cerradensis*, we re-analyzed both specimens to clarify their identity. Based on the diagnostic characters proposed by Maciel et al. (2007), we compared the Paraguayan specimens with others of *R. icterica* and *R. cerradensis* housed in the Amphibian Collection Célio F. B. Haddad (CFBH), Departamento de Zoologia, I.B., Universidade Estadual Paulista, Rio Claro, São Paulo, Brazil.

Both specimens from Paraguay (MNHNPy 6338, 9328) present the character states that diagnose *R. cerradensis* from *R. icterica:* less developed preocular crest (Figs. 1A-D), tympanum without folded skin (present in *R. icterica,* Figs. 1A-D), smaller parotoid glands (Figs. 1E-H), and narrower head (Figs. 1E-H). According to these comparisons, we confirm the presence of *R. cerradensis* in eastern Paraguay in small incursions of Cerrado ecoregion in the departments of Amambay and Canindeyú (Fig. 2) extending the species distribution 130 km W (Amambay record), 220 km S (Canindeyú record) from the nearest records in Mato Grosso

do Sul (Santana et al., 2010). With the reassignment of these two specimens to *R. cerradensis*, there is no evidence for the occurrence of *R. icterica* in Paraguay, and thus it must be excluded from the herpetofauna of the country.

Vera Candioti et al. (2016) and Ferraro et al. (2018) comment on the presence of a population of large toads morphologically similar to *R. cerradensis* assigned as *R.* cf. *cerradensis* in Corrientes, Argentina. It is also important to mention that in a phylogenetic analysis of the genus *Rhinella* (Pereyra et al., 2021a) specimens from Misiones, Argentina, and Rivera, Uruguay assigned as *R.* aff. *cerradensis* clustered in a different lineage than *R. cerradensis sensu stricto*. Nonetheless, the authors abstained from making taxonomic decisions considering the evidence of nuclear and/or mitochondrial introgressions and phenotypic plasticity, among others, as promoters of the morphological diversity of the group.

Since no molecular data are available for the specimens from eastern Paraguay, we cannot be unfailingly certain if they are *R. cerradensis* or are more related to the populations of Argentina and Uruguay. However, once the former species appears to be restricted to the Cerrado and the records of *R.* aff. *cerradensis* in Argentina and Uruguay correspond to the Southern Cone Mesopotamian savanna and Uruguayan savanna (Dinerstein et al., 1995) we assign the specimens from eastern Paraguay to *R. cerradensis*.

Acknowledgements.- We thank C.F.B. Haddad for allowing access to specimens under his care. A.C.G and F.B. thank the Consejo Nacional de Ciencia y Tecnología (CONACYT, Paraguay, Programa Nacional de Incentivo a Investigadores – PRONII) for financial support. M.O.P. and D.B. acknowledge the support from Agencia Nacional de Promoción Científica y Tecnológica (ANPCyT PICTs 2019-346, 2019-2519, 2019-2557 and 2019-3895) and Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET PIP 11220200102800CO). We also thank R. Clay for reviewing the English text.

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