

Hylid or microhylid? No evidence for the occurrence of *Trachycephalus mesophaeus* (Anura, Hylidae) in Argentina

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Abstract: A recent publication reported the Atlantic Forest endemic hylid *Trachycephalus mesophaeus* for the Chacoan ecoregion in Argentina. In this paper, we analyzed the voucher specimen and showed that it is a misidentified specimen of the Asiatic microhylid *Kaloula pulchra*, a species commonly commercialized in the pet trade worldwide. Therefore, there is no evidence for the occurrence of *T. mesophaeus* in Argentina.

Key words: Hylidae, Hylinae, Lophyohylini, Microhylidae, *Kaloula*, bizarre taxonomy

Resumen: **Hírido o microhírido? No hay evidencia de la presencia de *Trachycephalus mesophaeus* (Anura, Hylidae) en Argentina.** Una publicación reciente reportó al hírido endémico del Bosque Atlántico *Trachycephalus mesophaeus* para la ecoregión Chaqueña en Argentina. En este trabajo, analizamos el espécimen de referencia y demostramos que se trata de un ejemplar incorrectamente determinado del microhírido asiático *Kaloula pulchra*, una especie comercializada a nivel mundial. De esta forma, no existe evidencia para considerar que *T. mesophaeus* esté presente en Argentina.

Palabras clave: Hylidae, Hylinae, Lophyohylini, Microhylidae, *Kaloula*, taxonomía bizarra

INTRODUCTION

The hylid lophyohyline genus *Trachycephalus* Tschudi, 1838 includes 17 species (Blotto *et al.*, in press) distributed from Mexico to central-eastern Argentina (Frost, 2020). Faivovich *et al.* (2005) recovered the type species of *Trachycephalus*, *T. nigromaculatus* Tschudi, 1838, nested among species of *Phrynohyas* Fitzinger, 1843, and redefined *Trachycephalus* to also include all species formerly included in that genus.

Two species of *Trachycephalus* have been considered to be present in Argentina: *Trachycephalus dibernardoi* Kwet & Solé, 2008 and *T. typhonius* (Linnaeus, 1758). The former was initially reported by Carrizo (1989) as *Phrynohyas imitatrix* (Miranda-Ribeiro, 1926) for the interior Atlantic Forest in the province of Misiones, and subsequently considered to be *T. dibernardoi* by Kwet & Solé (2008). More recently, Blotto *et al.* (in press) suggested that the distinction between both species needs to be reassessed. *Trachycephalus typhonius* has been recorded in Argentina (as *Phrynohyas venulosa* or *Trachycephalus venulosus*; see Lavilla *et al.*,

2010), in the provinces of Chaco, Corrientes, Entre Ríos, Formosa, Jujuy, Misiones, Salta, Santa Fe, and Santiago del Estero (Vellard, 1948; Cei, 1956, 1980; Martínez-Achenbach, 1961; Lavilla and Scrocchi, 1988). This species has a wide distribution, reaching Central America (Frost, 2020), and still requires a considerable taxonomic effort to elucidate how many different species are included under the name (Lavilla *et al.*, 2010; Ron *et al.*, 2016; Ferraro *et al.*, 2018; Blotto *et al.*, in press).

THE NEW RECORD

Recently, Garcia-Marsà *et al.* (2020) reported a third species of *Trachycephalus* for Argentina, *T. mesophaeus* (Hensel, 1867), based on a single specimen (CFA-An-88; Scientific collection of Fundación de Historia Natural “Félix de Azara”, amphibians; Ciudad de Buenos Aires, Argentina) informed as collected in Las Lomitas, province of Formosa, on October 3, 1986. *Trachycephalus mesophaeus* (Fig. 1 A-D) is a species known to occur in the Atlantic Forest of Southeastern and Eastern Brazil, from the states of Rio Grande

do Sul to Pernambuco (e.g., Kwet *et al.*, 2010; Haddad *et al.*, 2013). Garcia-Marsà *et al.* (2020) identified the specimen explicitly based on color pattern, and, very likely (see below) on the fact that the specimen had a label identifying it as "*Trachycephalus* sp." The authors pondered the possibility that it could belong to "a still unknown population of the *T. typhonius* complex". However, as they concluded that the specimen showed "all morphological attributes of *T. mesophaeus*", they considered it to belong to this species.

Once they established the identification of the specimen, Garcia-Marsà *et al.* (2020) discussed possible reasons why *T. mesophaeus* has not been collected in recent years in Argentina. They considered that the species might be difficult to find, and as the Chacoan ecoregion is still poorly explored, they hypothesized that perhaps there are still healthy populations of *T. mesophaeus* in the Chacoan ecoregion. Alternatively, they discussed the possibility that the species has been locally extinct due to the substantial degradation of this ecoregion. Garcia-Marsà *et al.* (2020) also discussed the biogeographic significance of their finding of an Atlantic Forest-endemic species in the transition zone of the humid and dry portions of the Chacoan ecoregion. They considered that it was not uncommon, based on the evidence of past connections between the Atlantic Forest and the Amazon basin. They further suggested that their finding of a "relictual population" of *T. mesophaeus* could reflect the past, widespread distribution of gallery forests and associated fauna.

THE SPECIMEN

The photographs provided by Garcia-Marsà *et al.* (2020: fig. 2) of the specimen that they identified as *T. mesophaeus* show a frog that has the following remarkable characters (all the information for *Trachycephalus* is from Duellman, 1971; Paolillo & Cerdá, 1981; Pombal *et al.*, 2003; Gordo *et al.*, 2013; Nunes *et al.*, 2013; Blotto *et al.*, in press): (1) A large, darkly-pigmented single subgular vocal sac (vocal sacs in *Trachycephalus* are paired, bilateral or, less commonly, bilobular). (2) Absence of a tympanic membrane (all species of *Trachycephalus* have a prominent tympanic membrane). (3) Foot and hand webbing basal or absent (all species of *Trachycephalus* have a considerable amount of foot webbing, and evident hand webbing). (4) Non-expanded discs (all species of *Trachycephalus* have prominent discs in hands and feet). (5) Absence of nuptial

pads, despite being an adult male as revealed by the dark-colored vocal sac (present in all species of *Trachycephalus*). (6) Presence of an expanded, spade-like inner metatarsal tubercle (oval, not expanded in *Trachycephalus*). (7) Short hindlimbs (hindlimbs proportionally larger in *Trachycephalus*). Briefly: the specimen does not even remotely look like a hylid, nor is it similar to any other anuran species occurring in Argentina.

The study of the specimen CFA-An-88 (Fig. 1 E, F), besides corroborating all the characters that are evident in the published photographs, indicates that the specimen lacks maxillary and premaxillary teeth, and that it has two noticeable palatal folds. This combination of characters is only known to occur in anurans of the families Brevicipitidae and Microhylidae (Parker, 1934; Laurent, 1986).

From a purely taxonomic perspective, the specimen in question cannot be associated with Brevicipitidae as it lacks the very characteristic body shape and reduced mouth of the species in this family (see Channing & Rödel, 2019), thus pointing at the widely-distributed, diverse family Microhylidae (690 species; Frost, 2020). This family currently includes 13 (de Sá *et al.*, 2012; Peloso *et al.* 2016) or 12 subfamilies (Tu *et al.* 2018; Streicher *et al.*, 2020). Although there has been considerable progress in defining its major clades, recent discussions on the phylogenetic relationships of the family have barely referred to phenotypic evidence or taxonomic aspects. For this reason, the taxonomic identification of a microhylid without locality data could be challenging. Fortunately, this was not the case, as this specimen belongs to one of the microhylid species most commonly available in the pet trade: *Kaloula pulchra* Gray, 1831.

Among microhylids, the specimen is attributable to the microhyline *Kaloula pulchra* due to the combination of the following characters (compare Figs. 1 E, F and 1 G, H): Snout-vent length of 50–60 mm (the specimen is quite contorted and it is difficult to make a precise measurement) congruent with the size interval reported for adult males of this species, 54–72 mm, vs. smaller SVL in adult males of Adelastinae, Chaperininae, Hoplophryinae, Melanobatrachinae, and most species of Astero-phryinae, Cophylinae, Gastrophryinae, and Scaphiophryinae); robust body; head wider than long with truncated snout (vs. acute, sub-triangular in Gastrophryinae, Kalophryinae and Otophryinae); tympanic membrane absent; supratympanic fold present; absence of

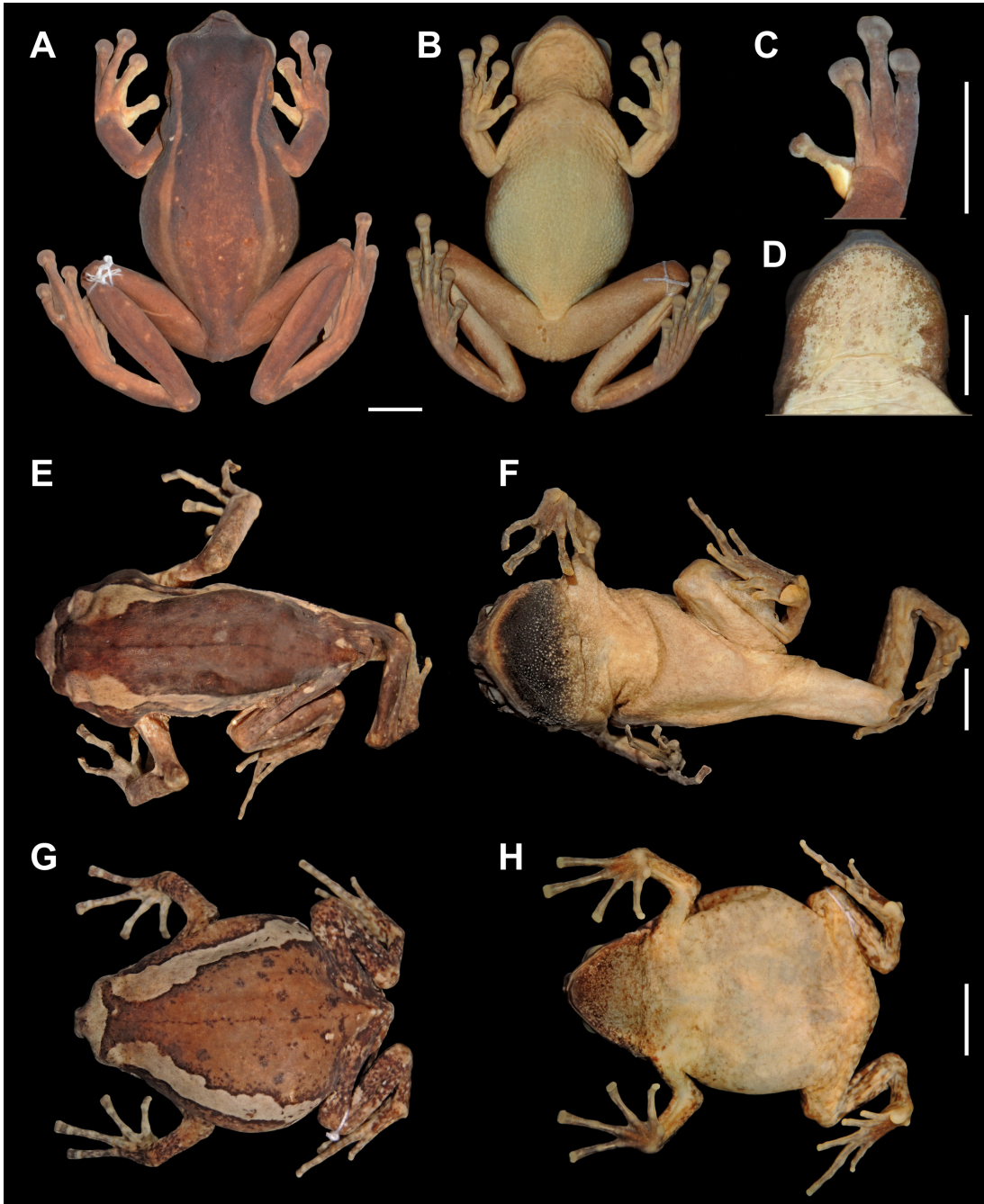


Fig. 1. **A–B:** Adult female of the hylid *Trachycephalus mesophaeus* LGE 10538 (Brazil: Rio Grande do Sul: Terra de Areia). **C:** Detail of nuptial pad, and **D:** gular region in ventral view of an adult male *T. mesophaeus* LGE 22305 (Brazil: São Paulo: Ubatuba). Vocal sacs are paired, lateral, and almost entirely restricted to the post-tympanic region, with little subgular development, as evidenced by the lack of dark pigmentation in the area. **E–F:** Adult male of the microhylid *Kaloula pulchra* (CFA-An-88), the specimen identified as *T. mesophaeus* by Garcia-Marsà et al. (2020). **G–H:** Adult male *Kaloula pulchra* MACN-He 39171 (pet trade), a properly fixed and preserved specimen. Scale bars: 1 cm. Abbreviations not used in the main text: LGE: Laboratorio de Genética Evolutiva, Instituto de Biología Subtropical, Universidad Nacional de Misiones, Posadas, Misiones, Argentina.

maxillary, premaxillary, and vomerine teeth (vs. presence of teeth in Dycophinae and most non-minute Cophylinae); two palatal folds; proportionally small hindlimbs; presence of a spade-like inner metatarsal tubercle; finger tips not expanded (vs. greatly expanded in many members of Asterophryinae, Cophylinae, Scaphiophryinae and Phrynomerinae); dark brown, smooth dorsal skin with light paired lateral bands; darkly-pigmented single subgular vocal sac (Parker, 1934; Inger, 1966; Zweifel, 1986; Glaw & Vences, 2007; Du Preez & Carruthers, 2009; Rittmeyer *et al.*, 2012; Zug, 2015; Vassilieva *et al.*, 2016; Garg & Biju, 2019).

The distinctive dorsal pattern of the specimen, which consists of two light bands on the dorsolateral margins of the body, is also present in *K. mediolineata*, *Uperodon anamalaiensis*, and *U. taprobanicus* (Microhylinae) and *Phrynomantis bifasciatus* (Phrynomerinae). *Kaloula pulchra* differs from *K. mediolineata*, by the lack of a posterior middle-back stripe (Taylor, 1962), from the two species of *Uperodon* by its larger SVL and non-expanded discs in hands (Garg *et al.*, 2018), and from *Phrynomantis bifasciatus*, for its lighter coloration, lack of ventral white blotches, larger forelimbs, longer toes, and dark gular pigmentation in adult males (Du Preez & Carruthers, 2009; Channing & Rödel, 2019).

LAYERS OF CONFUSION

Kaloula pulchra is a widely-distributed species, ranging from northern India to Vietnam, through Bangladesh, Myanmar, southern China, Thailand, and Laos, and south to Cambodia, Malaysia, Singapore, and Indonesia, and it has been introduced in the Philippines (Kuangyang *et al.*, 2016; Pili *et al.*, 2020; Frost, 2020). This species has been extensively commercialized in the pet trade, and imported to Argentina at least during the 1990s.

The specimen of *Kaloula pulchra* that Garcia-Marsà *et al.* (2020) misidentified as *Trachycephalus mesophaeus* is in a jar with a label indicating it as “*Trachycephalus* sp. Las Lomitas, Formosa. Col: José Sorooca. 03/10/1995.” It is worth noting that there is no other specimen of this genus collected in Formosa housed in the collection of Fundación de Historia Natural Félix de Azara, although another species, *T. typhoni* has been collected in Las Lomitas (M. Duré, pers. comm.), and nearby localities in Formosa (e.g., Pozo del Tigre, MACN-He 54611; Colección Nacional de Herpetología, Museo Argentino de

Ciencias Naturales “Bernardino Rivadavia”-CONICET, Ciudad de Buenos Aires, Argentina). Furthermore, S. Bogan (pers. comm.) indicated that the specimen was accessioned as part of material sporadically donated by the collector. Clearly, at some point, there was a human error, the label was associated with the wrong specimen, and triggered a series of confusions that ended up with Garcia-Marsà *et al.* (2020) wrongly reporting *T. mesophaeus* for the first time in Argentina. Nevertheless, the fact that the manuscript reporting the “new” record, including illustrations of the remarkably misidentified specimen, found its way through the conventional filters of scientific publication, is worrisome.

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