

DEFENSIVE BEHAVIOR OF THE ANTIOQUIA CHOCOLATE FROG (*HYLOSCIRTUS ANTIOQUIA*)

COMPORTAMIENTO DEFENSIVO DE LA RANA CHOCOLATE ANTIOQUEÑA (*HYLOSCIRTUS ANTIOQUIA*)

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Resumen.— Presentamos la descripción del comportamiento defensivo de la rana chocolate Colombiana (*Hyloscirtus antioquia*), observado en siete machos los cuales realizaron un cambio de su postura corporal. El comportamiento defensivo correspondió a la contracción del cuerpo, el ocultamiento del rostro y la protección de los ojos (cerrados), acompañados de secreciones cutáneas y un olor intenso después de que fueron capturados y manipulados. Esto sugiere que la combinación de posturas defensivas y secreciones cutáneas podría limitar la depredación en esta especie, como ocurre en otros anuros.

Palabras claves.— *Hyloscirtus*, anfibios, comportamiento defensivo, depredación, secreciones, olor, Colombia.

Abstract.— We present the description of defensive behavior in the Colombian chocolate frog (*Hyloscirtus antioquia*), observed in seven males that performed a change in body posture. The defensive behavior corresponded to body-contraction, chin-tucking, and eye protection (closed eyes), accompanied by skin secretions and an intense odor after they were captured and handled. Suggesting that the combination of defensive postures and skin secretions could limit predation in this species, as occurs in other anurans.

Key words.— *Hyloscirtus*, amphibian, defensive behavior, predation, secretions, odor, Colombia.

Predation is an important force structuring communities, especially in groups of concern such as amphibians (Albecker & Vance-Chalcraft, 2015), however, there must be a balance between food searching and predation risk in spatially and temporally shifting predator environments. In order to optimize this tradeoff, prey needs to be able to display an appropriate response based on the degree of predation risk (Albecker & Vance-Chalcraft, 2015). Anurans have evolved a broad number of defensive behaviors (Wells, 2007; Toledo et al., 2011; Ferreira et al., 2019) and are used in both tadpoles and adult frogs (Toledo et al., 2011). Toledo et al. (2011) suggest that behavior defenses include at least 30 different types of strategies, while Ferreira et al. (2019) have classified antipredator behavior in 12 categories. In both reviews the contraction category is a frequent behavior, has been documented in at least 149 species of anurans, mainly from the Hylidae (N= 48) and Bufonidae (N= 25) families. Contraction behavior is described as the contraction of all limbs and arching

of the body and is usually associated with ventral flexion of the head, eyes either opened or closed and skin secretions (Toledo et al., 2011; Ferreira et al., 2019).

Based on above, we describe the post-metamorphic defensive behavior of the Antioquia chocolate frog (*Hyloscirtus antioquia*), a Vulnerable species (IUCN, 2018) distributed in the northern sections of the Cordillera Central of Colombia (Rivera-Correa & Faivovich, 2013). Its habitat is the cloud forest of the high mountains where they inhabit in or alongside streams and puddles or wetlands perched up to 3 meters high. Their elevation range consists of the upper limit at 3,200 meters and the lower limit at 2,500 meters (Rivera-Correa & Faivovich, 2013). This species has been only recorded in the Departamento de Antioquia on the Cordillera Central and it is probably the southern geographic limits are the Arma and Samaná rivers canyons. The genus *Hyloscirtus* contains 38 species of stream-

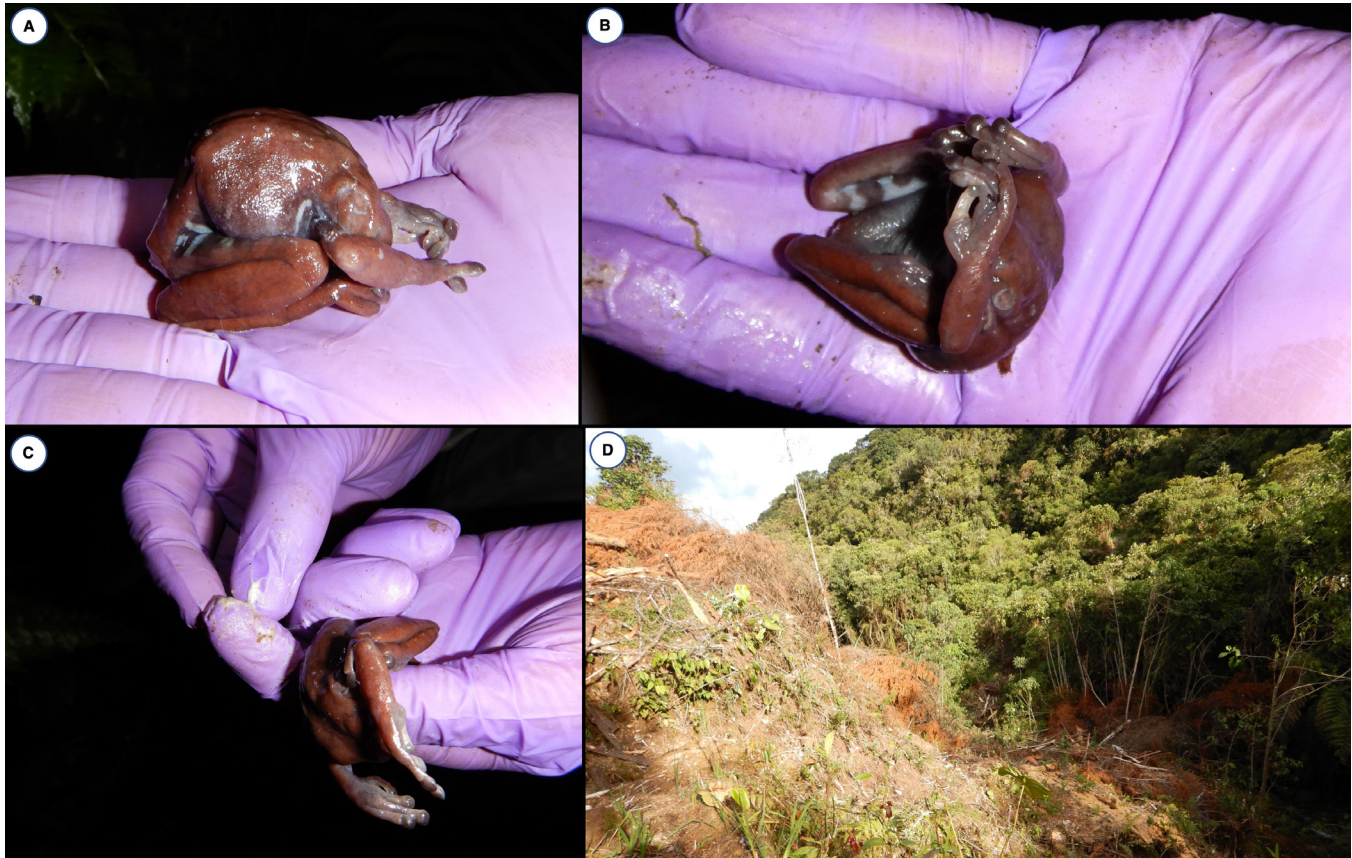


Figura 1. (A-B) Comportamiento defensivo de *Hyloscirtus antioquia*. (C) En los guantes se aprecia la secreción blanquecina y pegajosa que produce esta especie al ser capturada. (D) pérdida de hábitat por deforestación en la segunda localidad.

Figure 1. (A-B) Defensive behavior of *Hyloscirtus antioquia*. (C) On the gloves, the sticky whitish secretion produced by this species when captured can be seen. (D) habitat loss by wood clearance in the second locality.

dwelling treefrogs divided into the *H. armatus*, *H. bogotensis*, and *H. larinopygion* groups, and only the defensive behavior of *H. larinopygion*, the sister species of *H. antioquia*, has been reported (Duarte-Marín et al., 2019).

We documented the defensive behavior displayed by *H. antioquia* in seven individuals between 18:00 and 23:00 hours in the months of November (2020), January, March, August and November (2021) in two localities (N 5.7006, W -75.25082, 2742 m and N 5.6923, -75.23752, 2559 m, WGS84) of the Páramo de Sonsón (Sonsón, Antioquia). The individuals were found calling on the vegetation, captured and handled to be measured, weighed, photographed, the temperature was taken, and released in the same place.

The frogs had a snout-vent length (SVL) mean of $58.09 \pm SD$, 3.14 mm, a weight mean of 12.37 ± 0.61 g, a perch temperature mean $13.1^\circ\text{C} \pm 0.75^\circ\text{C}$, and body temperature mean $15.3^\circ\text{C} \pm$

2.68°C . As a result of the capture and manipulation, all frogs remained motionless in the following posture for approximately five minutes even after being released on the ground. Individuals folded their limbs as close to their body, curled their body up and tucked their head between their forelimbs, keeping their snout pointed towards the ground and their eyes closed (Fig. 1A-B). The stance is similar to that described by Toledo et al. (2011) and Ferreira et al. (2019) on body contraction, chin-tucking, and eye protection. Duarte-Marín et al., (2019) reported body contraction in *H. larinopygion*, the sister species of *H. antioquia*. However, this posture differed between species, with a notable body arching observed in the Antioquia chocolate frog. These differences could be associated with the type of stimulus, the frequency, and the duration of the stimulus (Williams et al., 2000). The frogs emitted an intense odor when captured, even in the absence of defensive behavior, shared strategy with *H. larinopygion* (Duarte-Marín et al., 2019). Likewise, we observed the presence of a whitish viscous secretion, which caused the gloves to stick

(Fig. 1C). Both the smell and the secretion had been reported by Rivera-Correa & Faivovich (2013) in the description of the species. They even indicate that the secretion is bitter, although we have no way to support this, they also describe a body-color change that was not observed by us. We also did not hear any type of distress call as has been recorded in the sister species *Hyloscirtus larinopygion* (Duarte-Marín et al., 2019).

On the basis of our observations, we encourage future studies to reveal if the behavior of *H. antioquia* in conjunction with the presence of the secretion and the odor really discourages potential predators. Furthermore, if these compounds can have some effect on microbiota, pathogens, and specifically on *Batrachochytrium dendrobatidis*, and what is the effect of this odor on other conspecifics and heterospecifics? We expect that a large number of future questions in chemical ecology and behavioral ecology will be resolved in the near future. However, unfortunately for future studies of this species, the second locality reported in this study was deforested (Fig. 1D) and frogs have not been recorded again on this small stream, which shows why this species is under threat.

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