

The tadpole of *Chiasmocleis schubarti* Bokermann, 1952 (Amphibia, Anura: Microhylidae)

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The genus *Chiasmocleis* Méhely comprises 29 species distributed from Panama to tropical South America clustered in five clades: *C. albopunctata*, *C. bassleri*, *C. hudsoni*, *C. shudikarensis* and *C. ventrimaculata* (Peloso *et al.* 2014). *Chiasmocleis schubarti* Bokermann belongs to the *C. albopunctata* clade, which also includes *C. alagoana* Cruz, Caramaschi, and Freire, *C. albopunctata* (Boettger), *C. capixaba* Cruz, Caramaschi, and Izecksohn, *C. lacrimae* Peloso, Sturaro, Forlani, Gaucher, Motta, and Wheeler, *C. leucosticta* (Boulenger), and possibly other morphologically and/or molecularly related species that have never been included in a phylogenetic analysis in a broader context (e.g., *C. atlantica* Cruz, Caramaschi and Izecksohn, *C. cordeiroi* Caramaschi & Pimenta, *C. crucis* Caramaschi & Pimenta, *C. gnoma* Canedo, Dixo and Pombal and *C. mantiqueira* Cruz, Feio and Cassini) (Cruz *et al.* 2007). Within these species, *C. alagoana*, *C. albopunctata*, *C. lacrimae*, *C. leucosticta* and *C. mantiqueira* have their larval forms described (Wogel *et al.* 2004; Nascimento & Skuk 2006; Oliveira-Filho & Giareta 2006; Langone *et al.* 2007; Santana *et al.* 2012).

Chiasmocleis schubarti is known from Atlantic forest fragments in the states of Espírito Santo, Minas Gerais and Bahia, eastern Brazil (Pimenta & Silvano 2002). Herein, we describe its tadpole.

Tadpoles of *C. schubarti* (stages 27–42; Gosner 1960) were collected in a temporary pond, surrounded by semi-deciduous gallery forest, at Parque Estadual do Pico do Itambé (43°18'27"S, 18°25'15"W; 1080 m a. s. l.; Datum WGS 84), County of Santo Antônio do Itambé, state of Minas Gerais, at the southeastern portion of the Espinhaço Range, southeastern Brazil, in December 2012. Presence in our samples of pre-metamorphic tadpoles already exhibiting small irregular white blotches on outer surfaces of arms and forearms, also present in adults (in preservative), allowed us to confirm species identity. Moreover, *C. schubarti* is the only Microhylidae species known for this locality.

We euthanized tadpoles in 5% lidocaine, then fixed and preserved in 10% formalin. Voucher lots are housed in the Tadpole Collection of the Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, state of Minas Gerais, Brazil. External morphology descriptions, measurements and proportions were based on 38 tadpoles in stages 34–38 (lots UFMG 1545 and 1563). Terminology and measurements follow Altig & McDiarmid (1999) and Pinheiro *et al.* (2012): total length (TL), body length (BL), tail length (TAL), maximum tail height (MTH), tail muscle height (TMH), tail muscle width (TMW), interorbital distance (IOD), body height (BH), body width (BW), body width at eyes level (BWE), eye diameter (ED), eye-snout distance (ESD), oral apparatus width (OAW), dorsal fin height (DFH), ventral fin height (VFH) and dorsal-fin insertion angle (DFiA). All measurements were taken with aid of ImageTool version 3.00. To obtain high quality photos we used an adjustable platform to support tadpoles immersed on water. Values are presented as mean ± SD (range).

Data about morphological features of known tadpoles of the *C. albopunctata* clade and of a morphologically similar species (*C. mantiqueira*) were obtained from their original descriptions. For *Chiasmocleis mantiqueira* the lot UFMG 1283 was also analyzed.

Description. Maximum total length 20.6 mm, at stage 38. **Body** depressed (BH/BW = 0.69–0.76), rounded in dorsal view, triangular depressed in lateral view, from 0.32 to 0.38 times total length (Fig. 1A, B). **Snout** semicircular in dorsal view, and slightly rounded in lateral view. **Eyes** from 0.14 to 0.18 times body width, laterally located (IOD/BWE = 1.00). **Nares** absent. A dorsal nasolacrimal groove from anterior margin of the eye to anterior region of snout (Fig. 1D). **Spiracle** midventral on lower abdomen, broad-opening in posterior third of the body (anteriorly to vent tube). Its external wall projecting over the vent tube, and with lateral flaps extending in direction to limbs (Fig. 1F). **Intestinal tube** circularly coiled, switchback point located at center of abdominal region. **Vent tube** medial, posteroventrally directed

(Fig. 1C), narrow, entirely fused to the ventral fin, opening at its external margin; ventral and dorsal walls of the same length. **Oral apparatus** from 0.33 to 0.39 times body width, lacking keratinized mouthparts and papillae; two small semicircular dermal flaps with smooth edges pendant over terminal oral apparatus and separated by an inverted, U-shaped medial notch (Fig. 1E). **Tail** height from 0.36 to 0.47 times tail length; slender musculature ($\text{TMH/BH} = 0.42\text{--}0.58$); with a thickening of dermis on its anterior half (Fig. 1A); ventral fin higher than dorsal ($\text{DFH/VFH} = 0.62\text{--}0.80$); tail tip in a distinct flagellum. Dorsal fin height from 0.09 to 0.14 times tail length, with a slightly convex external margin; emerging on the posterior third of the body at a median slope ($\text{DFiA} = 22.5^\circ$); maximum height at the middle third of the tail. Ventral fin height from 0.12 to 0.20 times tail length, with a slightly convex external margin; originates at the vent tube level.

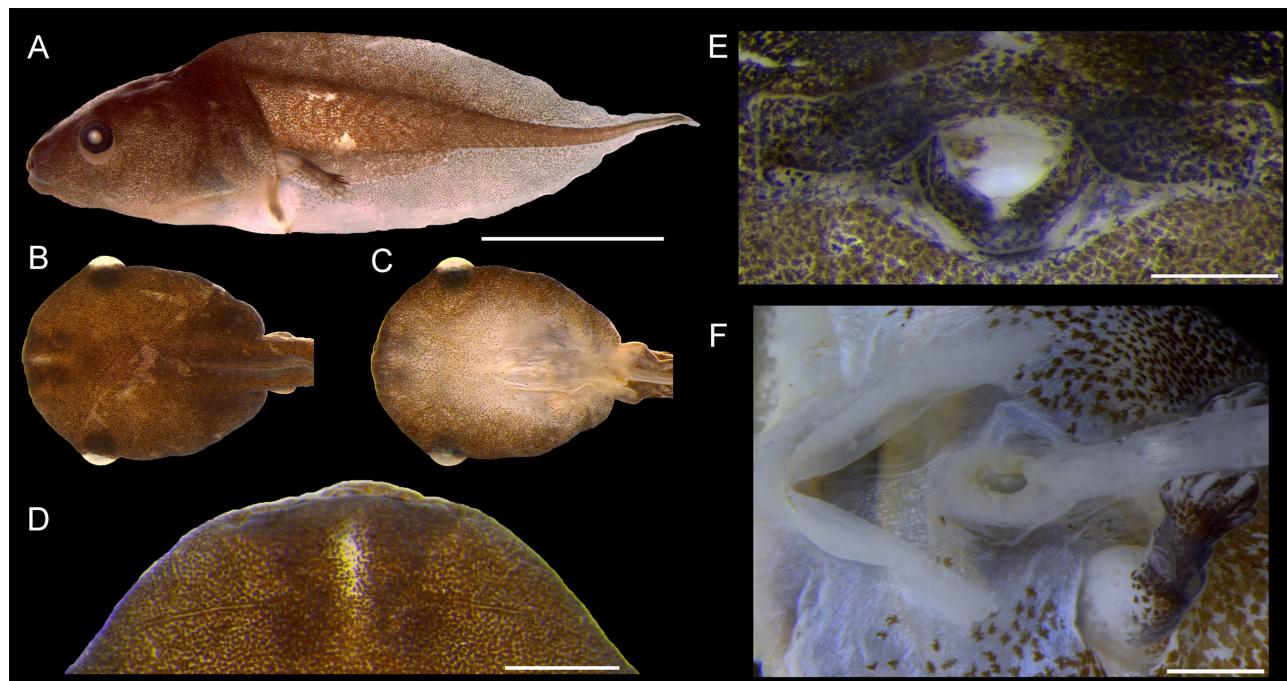


FIGURE 1. Tadpole of *Chiasmocleis schubarti* at stage 37 of Gosner (1960): (A) Lateral view; (B) dorsal view; (C) ventral view (scale = 5.0 mm); (D) detail of anterior portion of body, showing the nasolacrimal groove (scale = 0.5 mm); (E) oral apparatus (scale = 0.5 mm); (F) detail of spiracle and vent tube in ventral view. These structures were pushed forward with the aid of a pin, therefore their limits become more visible (scale = 1.0 mm).

Color of fixed specimens. Dorsum brown with homogeneously distributed melanophores. A white dorsum small spot in the middle of snout. Nasolacrimal groove light brown. Venter cream with melanophores that become scarcer in the final third of the body, giving a translucent appearance to this region. Tail musculature brown with homogeneously distributed melanophores. Fins translucent finely reticulated by melanophores, mainly on its anterior half. External margin of ventral fin without melanophores. Thickened region of tail opaque.

Variation. Nasolacrimal groove is poorly developed in initial development stages (27-29). This structure is well developed from stage 30 to 38, when it begins to regress and nostrils begin to appear. Nostrils are fully formed in stage 41 and they are small, circular, and dorsally positioned. Most preserved individuals have white (without pigments) scratches of different types in the body and tail.

Measurements (in mm). TL: 18.5 ± 1.0 (16.7–20.6); BL: 6.6 ± 0.3 (5.9–7.1); TAL: 11.9 ± 0.8 (10.5–13.7); MTH: 5.1 ± 0.4 (4.0–5.9); TMH: 1.8 ± 0.1 (1.6–2.0); TMW: 1.4 ± 0.1 (1.3–1.6); IOD, BW and BWE: 5.5 ± 0.2 (4.8–5.9); BH: 3.9 ± 0.2 (3.4–4.3); ED: 0.9 ± 0.1 (0.7–1.0); ESD: 3.5 ± 0.2 (3.1–3.8); OAW: 2.0 ± 0.1 (1.8–2.1); DFH: 1.4 ± 0.1 (1.0–1.7); VFH: 2.0 ± 0.2 (1.3–2.5).

Natural history notes. Adult males and females were registered in November and December 2012 with the aid of pitfall traps placed near the pond where tadpoles were collected. However, there was no record of males in calling activity. In November, the tadpoles were very small, in initial development stages (25). Tadpoles were found swimming in the middle of the water column at a temporary lentic environment with emergent vegetation, surrounded by semi-deciduous gallery forest.

Tadpoles of *Chiasmocleis schubarti* are very similar to those of *C. albopunctata* clade and to *C. mantiqueira*.

However, *C. schubarti* differs from *C. lacrimae* by the absence of a light-cream pair of curved bracket-shaped lines between the eyes (present in *C. lacrimae*). Nevertheless, some *C. lacrimae* tadpoles lack this blotch (Wogel *et al.* 2004). *C. schubarti* differs from *C. albopunctata* by presenting maximum tail height in the anterior third of the tail (in the posterior third of the tail in *C. albopunctata*), by presenting external margin of dorsal fin slightly curved (decreasing abruptly before the flagellum in *C. albopunctata*), by the absence of warty ornamentation at the border of oral flaps (present in *C. albopunctata*), and by the absence of marbled tail pattern (present in *C. albopunctata*) (Oliveira-Filho & Giareta 2006). There are no reliable diagnostic characters that distinguish the tadpoles of *C. schubarti* from tadpoles of *C. alagoana*, *C. leucosticta* and *C. mantiqueira*.

The presence of the thickening of dermis on anterior half of tail and of the nasolacrimal grooves is only mentioned for *C. leucosticta* (Langone *et al.* 2007). Nevertheless, these characters are present in *C. alagoana* (could be observed in the illustration of the original description) and in the analyzed individuals of *C. mantiqueira* and probably occur in other species of *C. albopunctata* clade. The thickening of dermis was also reported for *Chiasmocleis shudikarensis* (*C. shudikarensis* clade *sensu* Peloso *et al.* 2014) (Menin *et al.* 2011), *Elachistocleis panamensis* (Vera Candioti 2006) and *Dermatonotus muelleri* (Lavilla 1992) and illustrated for several species of Microhylidae (Langone *et al.* 2007). It is possible that this thickening could provide support at the base of tail for the beating of the tail flagellum, as the proximal part of the tail remains static while the distal part moves vigorously (pers. obs). The nasolacrimal grooves was also reported for other Neotropical Microhylidae, as *Ctenophryne atterrima*, *Dasyops schirchi* and *Otophryne pyburni* (Donnelly *et al.* 1990) and for the Oriental genus *Microhyla* and *Micryletta* (Chou & Lin 1997). Therefore, these characters probably have systematic importance at the family level, and thus should be carefully analyzed in descriptions. This study increases the knowledge about morphological diversity in genus *Chiasmocleis* and highlights the importance of characters as nasolacrimal grooves and thickened basis of the tail to the systematics of the group.

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