



The tadpole of the toadlet *Scaphiophryne marmorata* from Madagascar

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The genus *Scaphiophryne* Boulenger comprises eight species of microhylid toadlets (Vences *et al.* 2003; Glos *et al.* 2005), all of which are endemic to Madagascar. They are characterized by a unique larval morphology, intermediate between Orton's (1953) types II and IV (Blommers-Schlösser 1975; Wassersug 1984). Recently, Grosjean *et al.* (2007) provided a comparative study of larval morphology of the genus, and found evidence for two morphological subgroups based on larval characters. Tadpoles remained unknown for only two species, *Scaphiophryne boribory* Vences, Raxworthy, Nussbaum & Glaw, and *S. marmorata* Boulenger.

Three tadpoles of *S. marmorata* were collected by M. Vences, H. Kurrer and L. du Preez on 7 February 2006 close to Andasibe (18°56'S/48°25'E, 915 m a.s.l.), in a large temporary pond of about 15 m diameter and maximum water depth of 1 m, at the edge of rainforest. They were found syntopically with larvae of *Paradoxophyla palmata* and *Boophis pauliani*. Identity of one of these specimens (ZSM 554/2008) was verified by DNA barcoding; the sequence of a fragment of the 16S rRNA gene has the Genbank accession number EU717878 and was identical to a sequence of an adult specimen from the same locality (accession AY834191). Vouchers were deposited in the Zoologische Staatssammlung München, Germany (ZSM). We here provide a detailed description of these larvae, based mainly on one specimen at stage 39, ZSM 555/2008 (field number ZCMV 3602). Measurements were taken using a stereo microscope (Zeiss Stereo Discovery) using landmarks as in Grosjean *et al.* (2007).

Total length (TL) 38.1 mm, body length (BL) 14.2 mm, maximum width of body (BW) 12.8 mm, maximum height of body (BH) 9.8 mm, maximum diameter of eye (ED) 1.5 mm, rostro-narial distance (RN) 2.8 mm, nario-pupilar distance (NP) 1.4 mm, internarial distance (NN) 1.3 mm, interpupilar distance (PP) 6.8 mm, distance from tip of snout to opening of spiracle (SS) 11.8 mm, tail muscle height (TMH) 4.0 mm, tail muscle width (TMW) 2.9 mm, maximum height of upper tail fin (UF) 4.2 mm, distance from snout to beginning of upper tail fin (SU) 12.8 mm, oral disc width (ODW) 4.1 mm. In dorsal view (Fig. 1A), body circular, widest at the level of gills, snout truncate. In profile, (Fig. 1B), body depressed, almost flat dorsally and ventrally, BW 127% of BH, highest at the level of the intestine, snout small and round. Eyes moderately small, ED 10.6% of BL, not bulging the epidermis being far from the underlying organs, not visible in ventral view, positioned posterodorsally and directed laterally. No pineal ocellus. Nares not open, positioned dorsally, closer to pupils than to snout, RN 197% of NP, very close to each other, NN 19% of PP; a transversal depression anterolaterally to each nare on the integument. Spiracle (not seen on this specimen, observed on the specimen at stage 40, ZSM 554/2008; field number ZCMV 3601) sinistral but very low, conical, moderately sized, entirely attached to body wall, inner wall absent, orientated slightly more posteriorly than posterodorsally, closer to end of body than to tip of snout, SS 83% of BL; spiracular opening elliptical elongate, situated closer to opening of vent tube than to the insertion of hindlimb. Tail musculature moderately weak, TMH 41% of BH, TMW 22% of BW, its maximal height reached at its beginning, gradually tapering, almost reaching tail tip. Upper tail fin high, convex on most part then abruptly decreasing to follow the caudal muscle near the extremity of the tail, not extending onto body, SU 90% of BL; lower tail fin moderate, straight but decreasing in height towards the tip of the tail; tail tip very fine and slightly curved downward. Anal tube large and short, medial, roughly conical, directed posteroventrally, posterior part linked to ventral tail fin, opening medial. Neither lateral line nor glands visible.

Oral disc (Fig. 1C) in position and orientation subterminal, emargination very low, of moderate size, ODW 29% of BL and 32% of BW; lower labium triangular two submarginal papillae on the left side laterally to the lower beak, three on a line laterally on each side of the lower labium triangular. One row of marginal papillae (malformed; see Fig. 1); two round and short, submarginal papillae slightly smaller. No denticulate papillae. No keratodonts. Jaw sheaths of moderate breadth, white, very finely serrated, upper jaw sheath a large arch, lower jaw sheath semicircular.

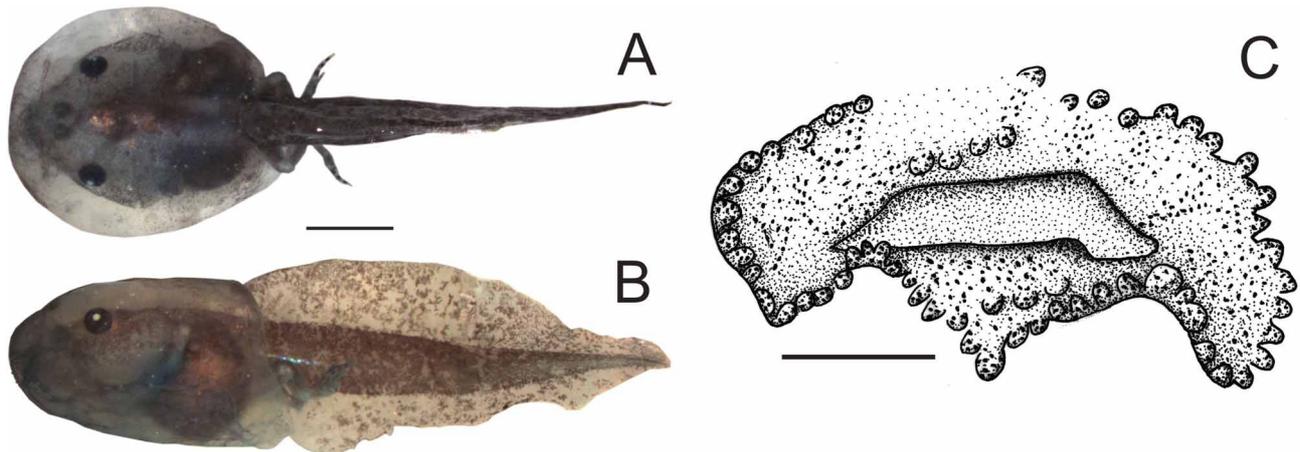


FIGURE 1. Dorsal (A) and lateral (B) views, and drawing of oral disc (C), of a tadpole of *Scaphiophryne marmorata* (ZSM 555/2008) from Andasibe. Scale bars are 5 mm (A–B) and 1 mm (C). Note that the row of marginal papillae on the upper labium is partly malformed (continuous and in a single row in the normal condition).

Tadpole transparent, all underlying organs visible. External tegument of upper side slightly smoked with tiny melanophores; underlying tissues speckled with brown melanophores. Posterior part of the upper flank identical to the dorsum, the remaining of flanks immaculate. Ventral side immaculate. Oral disc with small spots; central part of papillae black, their outline immaculate. Caudal muscle grey brown with some rare and small immaculate areas. Upper fin with a dense network of reticulation, lower fin less coloured. Limbs grey, toes with dark bands.

The ratios taken on 2 tadpoles at stages 40–41 (ZSM 554/2008, BL are 10.34 mm and 11.69 mm respectively, TL of the stage 41 is 34.0 mm), vary in the following proportions: BW 127% of BH; ED 11.7–12.7% of BL; RN 67–106% of NP; NN 24–26% of PP; SS 75% of BL for the stage 41; TMH 50% of BH; TMH 46% of maximum tail height (MTH), TMW 27–30% of BH; UF 31% of MTH; SU 91–96% of BL; maximum height of lower tail fin (LF) 33% of MTH; MTH 108% of BH, point of maximum height of tail located before the middle of tail length (40% of the length); ODW 28–33% of BL; ODW 35–43% of BW. All the unique ratios relative to the caudal muscle and the fins are scored from the stage 41 only. The row of marginal papillae of the oral disc is continuous around it (normal condition). One submarginal papilla on the left side laterally to the lower beak only (stage 41), one on the right side, two on the left (stage 40). Nares are opened, small and rimmed by stage 40. The distance between integument and internal organs decreases greatly and progressively between stages 39 and 41, the eyes are bulging by stage 40.

The tadpole of *S. marmorata* clearly fits into the large tadpoles group (subgenus *Scaphiophryne*) rather than the small tadpoles group (subgenus *Pseudohemisus*). This is based on its large size (TL up to 38 mm), skin distant from inner organs, position of nares, oral disc soft, spiracle attachment and position, and upper fin not extending onto body (Grosjean *et al.* 2007). Characters of buccal cavity which also distinguish the two lineages could not be verified due to the low number of available specimens. Larval features thus agree with the phylogenetic position of *S. marmorata* in the subgenus *Scaphiophryne* as indicated by molecular data (Glos *et al.* 2005). A comprehensive comparison of larval morphology in this group will require a larger sample size for *S. marmorata* and discovery of the yet unknown tadpole of *S. boribory*.

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