



<http://dx.doi.org/10.11646/zootaxa.3641.4.6>

<http://zoobank.org/urn:lsid:zoobank.org:pub:A110B2DF-7A26-457F-88B6-62132092BCFF>

External morphology, chondrocranium, hyobranchial skeleton, and external and internal oral features of *Rhinoderma rufum* (Anura, Rhinodermatidae)

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The species of *Rhinoderma* Duméril & Bibron are endemic to the temperate forests of South America in southern Chile and Argentina (Formas *et al.* 1975). Both have specialized reproductive modes, *Rhinoderma darwinii* Duméril & Bibron undergoes complete embryonic and larval development in the mouth of the male: newly metamorphosed frogs are expelled into the terrestrial environment (Jorquera *et al.* 1972). In contrast, embryos of *R. rufum* (Philippi) do not remain in the male's mouth, but instead are expelled into the water as larvae (Jorquera *et al.* 1974). Jorquera *et al.* (1972, 1974) described the normal development of both species. The chondrocranial morphology and visceral skeleton of *R. darwinii* was described by Lavilla (1987) and its internal oral features by Wassersug & Heyer (1988). The table of normal development of *R. rufum* (Jorquera *et al.* 1974) emphasized the duration of each stage of development: however, some features currently used for comparative purposes in tadpole morphological studies were not included or described only briefly. In this work, I include a detailed description of the morphology, particularly of the mouthparts, of the tadpoles of *R. rufum*, and describe the chondrocranium, hyobranchial skeleton, and the internal features of the oral cavity in this species. In addition, I compare the morphology of the mouth, chondrocranium, and hyobranchial skeleton of the congeneric tadpoles, considering different modes of feeding (endotrophic in *R. darwinii* versus exotrophic in *R. rufum*). Last, I present some thoughts about the evolution of larvae of *Rhinoderma*.

Tadpoles of *Rhinoderma rufum* ($n = 10$) were collected by Emilio Pugin in Chiguayante ($36^{\circ}54' S$, $73^{\circ} 01' W$, Concepción Province, southern Chile; February 1972) and deposited in the Institute of Embryology at Universidad Austral de Chile (IEUA-011). Two tadpoles were raised in captivity until complete metamorphosis. Tadpoles were staged following the development table of Gosner (1960). The external morphology of four tadpoles of *R. darwinii* (IZUA 3528) were examined (Stage 32) for comparative purposes. The measurements (two tadpoles Stage 36) and terminology follow those of Altig & MacDiarmid (1999). The chondrocranium of *R. rufum* was studied in two cleared-and-stained tadpoles (Stage 32) following the protocol of Song & Parenti (1995) in which cartilage is stained with Alcian blue. The chondrocranial terminology follows Larson & de Sá (1998). The jaw sheaths of one tadpole (Stage 32) for each species of *Rhinoderma* were also studied under scanning electronic microscope (SEM; Leo-420). The same specimens were used to observe the labial teeth. Features of internal oral cavity were examined and photographed with a stereoscopic microscope Olympus SZ61 after having applied lugol solution (1%). Terminology of oral structures follows that of Wassersug (1976) and Wassersug & Heyer (1988).

The external description of *Rhinoderma rufum* is based on a Stage 32. In lateral view, the total length of the oval body is 31.7 mm (Fig. 1A), and the tail is 1.7 times the length of the body. The head is gently rounded with non-protruding, rounded dorsal nostrils. The interorbital distance is 134% of the internarial distance. The distance between the front edge of the nostrils and the end of the snout is 1.7 times the distance between the anterior edge of the eye and the posterior edge of the nostril. The diameter of the anterolateral eyes is 0.57 times the internarial distance. The oral disc (Fig. 2A) is anteroventral and not emarginated: the rostral gap is wide and the mental gap is absent and transparent. The marginal conical papillae are distributed in a single row over both the upper and lower lips. The supramarginal and inframarginal papillae are scarce (1 or 2), and the intramarginal papillae are absent. The dark brown upper and lower jaw sheaths are wider than long: they are well keratinized and have a serrated edge (Fig. 2B). The tips of the serrations are rounded; the length is 1.5 times its width. There are 60–70 serrations/mm. The labial tooth row formula is 2 (2) / 3. The labial teeth are three times longer than wide and their edges are jagged (Fig. 2D). There are 60–80 labial teeth/mm. The sinistral spiracular tube has an oval aperture, the length of which is 1.3 times the internarial distance; its diameter corresponds to 42% of the diameter of the eye, and its inner wall is attached to the body. The vent tube is as long as wide, and the ovoid medial opening is subsequently continuous with the margin of the ventral fin (Fig. 1C). The dorsal fin does not extend over the body, and the ventral fin starts at the distal end of the vent tube. The end of the tail is rounded, and the