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## A NEW SPECIES OF THE GENUS *OREOPHRYNELLA* (ANURA; BUFONIDAE) FROM THE GUIANA HIGHLANDS

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### ABSTRACT

*Oreophrynella weiassipuensis* sp. nov. is described from Wei-Assipu-tepui on the Guyana-Brazil border. The new species is distinguished from other species of the genus by the presence of well developed post-orbital crests, toe webbing, dorsal skin minutely granular with scattered large tubercles, and reddish brown dorsal and ventral coloration.

KEYWORDS: Anura, Bufonidae, *Oreophrynella*, new species, Pantepui, Guiana Shield, Guyana, Brazil.

### INTRODUCTION

The bufonids of the genus *Oreophrynella* are a group of noteworthy small toads, endemic to the highlands of the Guiana Region in northeastern South America. Members of this genus are frogs of small size (< 26 mm SVL), characterized by opposable digits of the foot, tuberculate dorsal skin, and direct development (McDiarmid, 1971; McDiarmid and Gorzula, 1989; Señaris *et al.*, 1994).

The genus was created by Boulenger (1895a, b) for the newly described species *O. quelchii* from the summit of Mount Roraima. Boulenger (1900) described a second species of the genus, *O. macconnelli*, from the forest at the base of Mount Roraima at 1067 m. Almost 90 years later a third species, *O. huberi*,

was described from the summit of Cerro El Sol (Diego-Aransay and Gorzula, 1987), a tepui which is not part of the Roraima formation. Señaris *et al.* (1994) reviewed the Guiana highland bufonids and described two additional species, *O. nigra* from Kukenán and Yuruaní tepuis, and *O. vasquezzi* from Ilú-tepui. Finally Señaris (1995) described *O. cryptica* from Auyán-tepui.

On July 2000 a speleological expedition to Wei-Assipu-tepui, conducted by members of the Italian and Venezuelan speleological societies (Carreño *et al.*, 2002; Villarreal *et al.*, 2002), collected a small but interesting collection of amphibians, including two specimens of the genus *Oreophrynella*, one of them corresponding to *O. quelchii* and the other one to a new remarkable species described below.

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## MATERIALS AND METHODS

Measurements were made to the nearest 0.1 mm using a Mitutoyo digital caliper. The numbered diagnosis follows the format of Señaris *et al.* (1994) and Señaris (1995). Two different types of cephalic crests are recognized in *Oreophrynella*: frontoparietal crests, located on the outer border of the frontoparietal, and postorbital crests, extending from the posterior margin of the eye, around the tympanic region to below the eye.

In *Oreophrynella* the digits of the hand and foot are joined at their bases by a fleshy extension of thick skin continuous with the sole. This thickened integumental connection between the digits differs from the webbing which connects the fingers or toes in other frogs (e.g. hylids, centrolenids, ranids). Nevertheless, we use the term “webbing” to refer this particular structure in *Oreophrynella*.

The holotype of the new species was compared with the type series of *O. cryptica*, *O. huberi*, *O. nigra*, *O. vasquezzi*, material from the type locality of *O. quelchii* (Appendix), and published descriptions of *O. macconnelli*.

Museum abbreviations are: MHNLS, Museo de Historia Natural La Salle, Caracas, and EBRG, Estación Biológica de Rancho Grande, Maracay.

## RESULTS

### *Oreophrynella weiassipuensis* sp. nov

(Figs. 1-4)

*Oreophrynella* sp. Villarreal, Señaris and DoNascimento, 2002.

*Holotype*. MHNLS #15913 (Fig. 1), Wei-Assipu-tepui, Sima de los Guácharos, 280 m north of the heliport, 2280 m a.s.l. (coordinates of the heliport 5°13'1"N, 60°42'19"W), Brazil-Guyana border, collected by Juan Nolla and Joaquim Astor on 25 July 2000.

*Etymology*. The specific epithet *weiassipuensis* refers to the name of the locality where the species was collected.

*Diagnosis*. A species of the genus *Oreophrynella* that can be distinguished of the other species by following combination of characters: 1) frontoparietal crests absent; post orbital crests well developed; 2) dorsal skin minutely granular with scattered large tubercles, especially on the upper eyelids and flanks; 3) ventral skin granular, with few small tubercles; 4) webbing of



**FIGURE 1.** Holotype of *Oreophrynella weiassipuensis*, MHNLS 15913, 21.2 mm SVL.

hand and foot well developed; 5) in life dorsum reddish brown with scattered darker brown marks and a fine dark mid-dorsal line; flanks dark brown; dorsum of hands light brown with minute reddish brown spots; 6) throat and chest reddish brown; belly slightly darker than the remaining ventral surface; fingers and toes light brown ventrally.

*Description of the holotype*. Adult male; head about as long as wide (HL/HW=1.05), slightly wider at corners of mouth than at the tympanic region; head length 35.8% of SVL; eye-nostril distance 59.3% of eye diameter; snout with an anteromedial fleshy projection of rounded tip and wide basally, truncate in lateral view (Figs. 2-3); canthus rostralis distinct, angular, short; loreal region vertical, smooth; nostrils protuberant, smooth, directed laterally, located near the anterior edge of the snout; internarial area concave; interorbital distance approximately equal to upper eyelid width, with scattered tubercles, other tubercles along the canthus rostralis. Premaxillae, maxillae, and vomer edentate; choanae small, round; tongue large, oval, narrowing anteriorly, about 30% longer than wide, attached anteriorly. Tympanum and axillary membrane absent. Forelimbs long, slender; hands with fingers short, flattened, tips slightly expanded; relative lengths of fingers 1<2<4<3; basal webbing between fingers; palm and webbing completely covered with small, flat, round tubercles; inner and outer tubercles conspicuous,

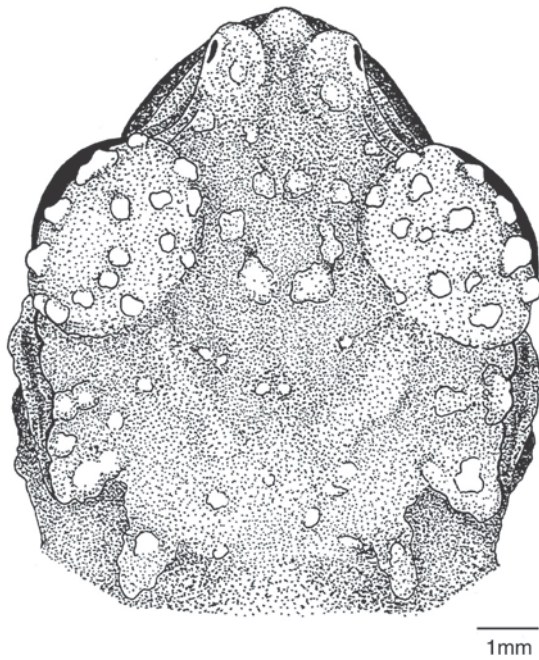


FIGURE 2. *Oreophrynella weiasipuensis* (MHNS 15913, holotype): dorsal view of the head.

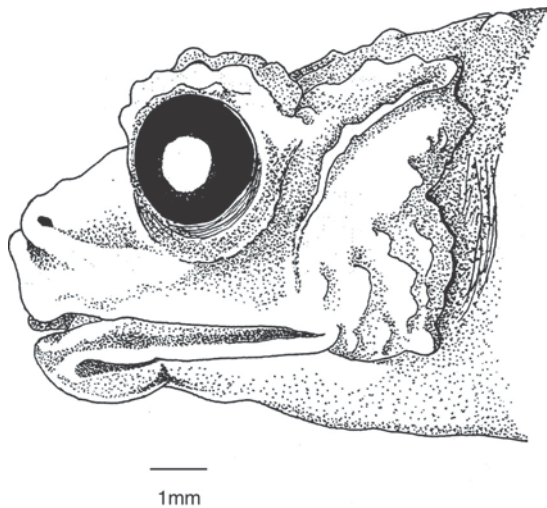


FIGURE 3. *Oreophrynella weiasipuensis* (MHNS 15913, holotype): lateral view of the head.

large, rounded, similar in size. Subarticular tubercles conspicuous, somewhat elliptical or ovoid. (Fig. 4A). Hindlimbs long, slender; foot with short, somewhat flattened toes; the first three toes united at the base, opposed to the other two; relative lengths of toes  $2=3<5<1<4$ ; sole completely tuberculate, with a large, elongate inner metatarsal tubercle, and smaller, round subarticular tubercles (Fig. 4B). When the hindlimb is

extended forward along the body, the knee reaches the shoulder. Dorsal skin minutely granular with scattered large, rounded or oval tubercles; upper eyelids with large, rounded, elevated tubercles, with those close to the external margin aligned in a distinct row (Fig. 1); limbs with a greater density of large rounded tubercles. Ventral skin granular with scattered small flattened tubercles. Cloacal opening directed posteriorly at level of the thighs.

*Color in preservative.* Dorsum reddish brown with a thin dark brown mid dorsal line and small spots, slightly darker in the occipital region, eyelids, and flanks; nostril area lighter than background coloration. Loreal region and postorbital area reddish brown with irregular darker brown bars surrounding the postorbital crests. Limbs light reddish brown with darker tubercles; hands and feet light brown dorsally with numerous minute brown spots that delimited the margins of the fingers and toes. Throat, chest, and ventral surfaces of limbs light reddish brown; flanks and cloacal area dark brown with some lighter tubercles; palms and soles light brown with a gray wash.

*Color in life.* The same pattern described above, but more intense and contrasting.

*Measurements of the holotype.* SVL 21.2; head length 7.6; head width 7.7; eye diameter 2.7; thigh length 9.1; tibia length 7.7; eye-nostril distance 1.6; interorbital distance 2.2; width of eyelid 2.0.

*Distribution and ecology.* *Oreophrynella weiasipuensis* is known only from the type locality on Wei-Assipu-tepui on the frontier between Brazil and Guyana. It was collected on moss in a wet forest at the bottom of a large chasm. Other anurans found on the summit of the Wei-Assipu-tepui include *Colostethus* sp., *Oreophrynella quelchii*, three undescribed species of *Stefania* (*goini* group) and *Tepuihyla* sp. (Villarreal *et al.*, 2002).

*Comparisons with other species.* *Oreophrynella weiasipuensis* can be distinguished from all other species of the genus by the well developed webbing and the reddish brown dorsal and ventral coloration. Furthermore, *O. weiasipuensis* differs from *O. macconnelli*, *O. nigra*, *O. quelchii*, and *O. vasquezzi* by the presence of postorbital crests and dorsal skin with a low or medium density of tubercles. *Oreophrynella weiasipuensis* differs from *O. cryptica* and *O. huberi* by the absence of frontoparietal crests (Figs. 5A-C) and the reddish brown dorsal and ventral coloration.

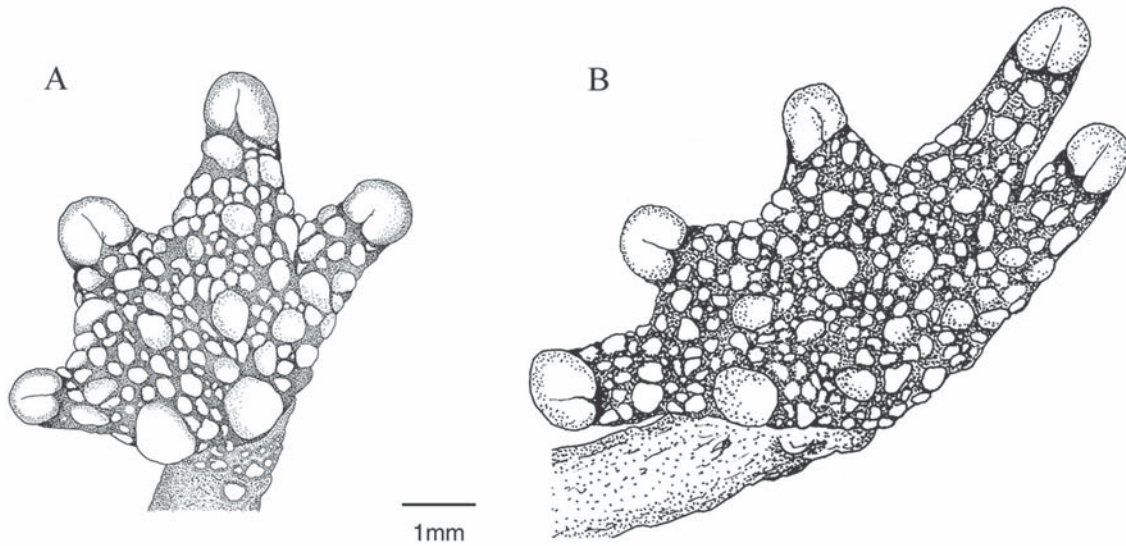


FIGURE 4. (A) Ventral view of the hand and (B) foot of *Oreophrynella weiasipuensis* (MHNS 15913, holotype).

## DISCUSSION

The bufonid genus *Oreophrynella* is one of the most characteristic components of the anurofauna of the Guiana Region. McDiarmid (1971) considered *Oreophrynella* a very specialized frog, restricted to the Guiana Shield. The genus currently consists of seven species, five inhabiting the summits and slopes of the Roraima chain (*O. macconnelli*, *O. nigra*, *O. quelchii*, *O. vasquezzi*, and *O. weiasipuensis*) and the remaining two species (*O. cryptica* and *O. huberi*) known from the summits of Auyán-tepui and Cerro El Sol, respectively. Another undescribed species is known from the northeastern slope of Mount Ayanganna in Guyana (Lathrop and MacCulloch, pers. comm.).

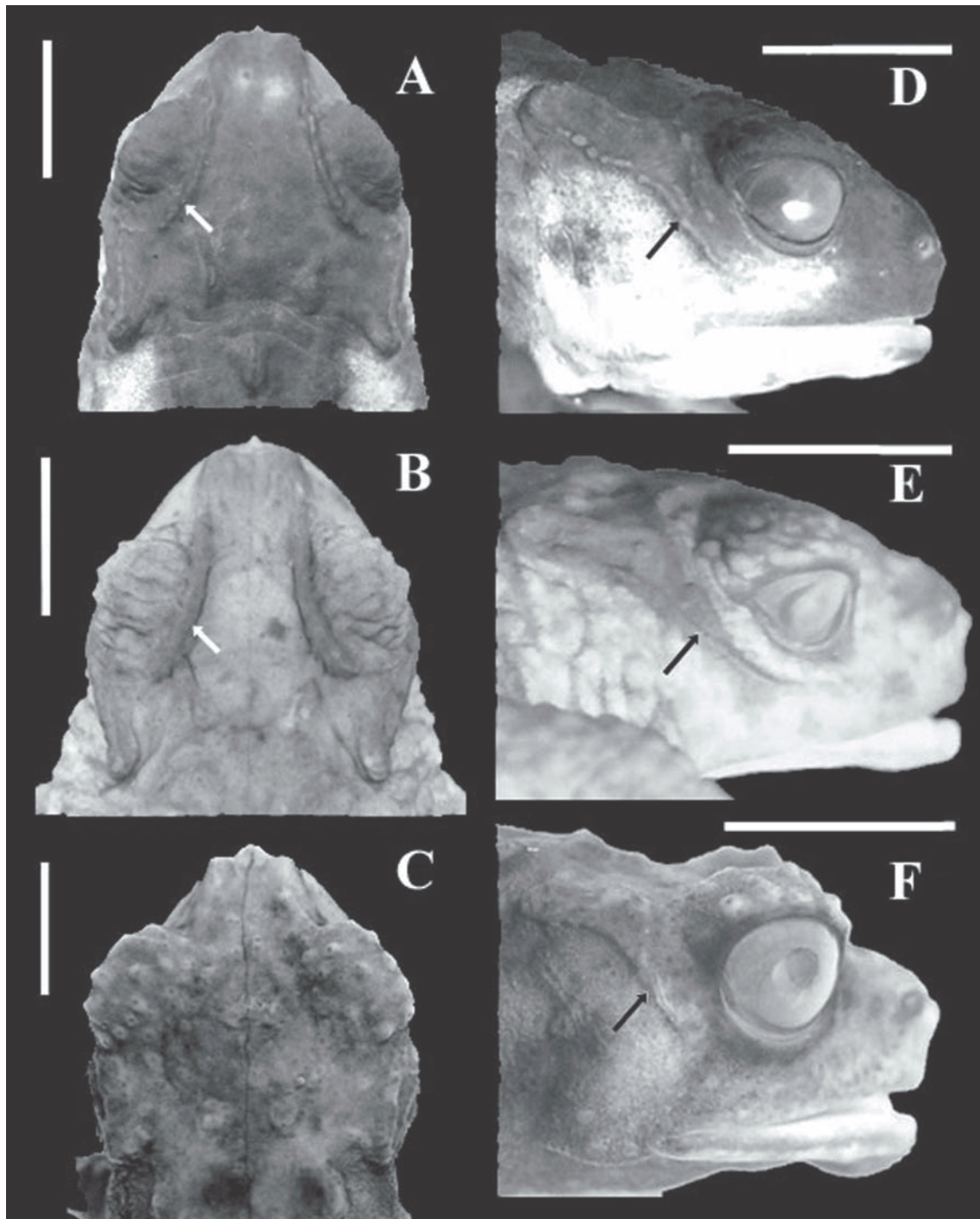
Rivero (1970) and Hoogmoed (1979) postulated that *Oreophrynella* derived from a paleo-fauna that evolved in an ancient sandstone plain during the Mesozoic or Tertiary, followed by intensive erosional dissection (Plateau Theory). Besides its origin, Señaris *et al.* (1994) discussed the great morphological similarity between neighboring species of the Roraima chain summits and considered the lowering of South American tropical temperature during the glacial periods in the Pleistocene (Van der Hammen, 1974) as a possible cause of the descent of the lower limit of the highland tepui ecosystems to at least 500 m below its present location, allowing contact between different *Oreophrynella* populations for hybridization and/or genetic flux, followed by a period of speciation. This theory would explain the resemblance among *O. quelchii*,

*O. nigra*, and *O. vasquezzi*, which occur on adjacent peaks of the Roraima chain (Señaris *et al.*, 1994), or *O. cryptica* and *O. huberi* from Auyán-tepui and Cerro El Sol, respectively (Señaris, 1995). However, this proposal does not seem to totally explain the distributions of *O. macconnelli* and *O. weiasipuensis*, the latter very similar to *O. cryptica* and *O. huberi*. *Oreophrynella cryptica*, *O. huberi*, and *O. weiasipuensis* share well developed cranial crests (restricted to the post orbital area in *O. weiasipuensis*) (Figs. 5D-F) and less tuberculate dorsal skin than other species. *Oreophrynella weiasipuensis* and *O. huberi* share a reddish dorsal coloration, in contrast with the dark brown or black color of the other species. The great similarity between *O. cryptica*, *O. huberi*, and *O. weiasipuensis* suggests a possible relationship between them. However, we are uncertain about the presumed derived condition of these two characters and any conclusion about the relationships of *Oreophrynella* species is merely speculative at this point.

Most species of *Oreophrynella* are endemic to a single mountain, except *O. nigra* which occurs on both Kukenán-tepui and Yuruaní-tepui (Gorzula and Señaris, 1999; Mägdefrau and Mägdefrau, 2000; McDiarmid and Gorzula, 1989; Señaris *et al.* 1994) and *O. quelchii* from Roraima and Wei-Assipu-tepui (Villarreal *et al.*, 2002). Roraima and Wei-Assipu-tepui are very close (2.5 km between summits) and linked by a ridge of medium altitude. Kukenán and Yuruaní are also in close proximity to each other (3.5-4 km). Myers and Donnelly (2001) suggested a past faunal interchange by a system of ridges connecting the ba-

ses of some northwestern tepuis, to explain the presence of some shared species. This hypothesis could also be applied to the eastern region, where adjacent

mountains connected by upland ridges (1600-2100 m) share the same *Oreophrynella* species, e.g. Kukenán and Yuruani (*O. cryptica*), and Roraima and Wei-Assipu-tepui



**FIGURE 5.** Dorsal and lateral views of the head. (A and D) *Oreophrynella cryptica* (MHNLS 12916, holotype); (B and E) *O. huberi* (MHNLS 11147, paratype); (C and F) *O. weiassipuensis* (MHNLS 15913, holotype). Arrows indicate frontoparietal crest (A-B) and postorbital crest (D-F). Scale 3 mm.

(*O. quelchii*). Nevertheless, this hypothesis fails to explain what conditions favored this interchange only in the past.

The presence of *Oreophrynella quelchii* and *O. weiasipuensensis* on Wei-Assipu-tepui represents the first known case of two species of the genus sympatric (Villarreal *et al.*, 2002), although occupying different habitats. *Oreophrynella quelchii* was observed in a bare rocky area, while *O. weiasipuensensis* was found in a forested area at the bottom of a large pit (Villarreal *et al.*, 2002); it is possible that *O. weiasipuensensis* is restricted to this habitat.

## RESUMO

*Describe-se Oreophrynella weiasipuensensis sp. nov. proveniente de Wei-Assipu-tepui, na fronteira da Guayana com o Brasil. A nova espécie distingue-se das outras espécies do gênero pela presença de cristas pós-orbitais bem desenvolvidas, membrana entre os artelhos, pele no dorso coberta por grânulos e ornamentada por grandes tubérculos esparsos, coloração do dorso e do ventre marrom avermelhada.*

**PALAVRAS-CHAVE:** Anura, Bufonidae, *Oreophrynella*, new species, Pantepui, Guiana Shield, Guyana, Brazil.

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**APPENDIX****Material Examined**

*Oreophrynella cryptica*. VENEZUELA. Bolívar State: Sector este, cima del Auyán-tepui (05°53'36"N-62°29'12"W), 1750 m a.s.l.: EBRG 2956, MHNLS 12916.

*Oreophrynella huberi*. VENEZUELA. Bolívar State: Cerro El Sol, N of Auyán-tepui (6°06'N-62°32'W), 1700 m a.s.l.: MHNLS 11147-11148.

*Oreophrynella quelchii*. VENEZUELA. Bolívar State: Cerro Roraima, 2750 m a.s.l.: MHNLS 10456-10484. Cima del Roraima, 2640 m a.s.l.: MHNLS 11310-11328. GUYANA-BRAZIL: Wei-Assipu-tepui, (5°13'1"N-60°42'19"W) 2400 m a.s.l.: MHNLS 15912.

*Oreophrynella vasquezii*. VENEZUELA. Bolívar State: Ilú-tepui (5° 25'N-60°58'W), 2650 m a.s.l.: MHNLS 10238-10245, 10156-10162

*Oreophrynella nigra*. VENEZUELA. Bolívar State: Kukenán-tepui I (9°51'N-60°48'W), 2500 m a.s.l.: MHNLS 10489-10520. Yuruaní-tepui (5°19'N-60°51'W), 2300 m a.s.l.: MHNLS 11162-11164.