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NOTES ON THE SOUTH AMERICAN FROG GENUS *EDALORHINA*

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The bizarre little frogs of this group were first made known to science as "*E. perezii*, n.g., n. sp." by Don Marcos Jiménez de la Espada in 1871, after his journey from Quito to the Río Napo in Ecuador. This trip, taken in order to trace the route of Orellana in his discovery of the Amazon, revealed a rich frog fauna. Prof. Orton, of Williams College, working in the opposite direction, also collected frogs of this group, and they were reported as *Bubonias plicifrons*, new genus, new species, by Cope in 1874. His specimens were taken at Nauta, on the Marañón in Peru. By 1882 material from various sources had accumulated in the British Museum, and in Boulenger's "Catalogue of Batrachia Salientia" (in which he synonymized Cope's genus with that of Jiménez de la Espada, but recognized both their species and added one of his own, *E. buckleyi*) the range of the group was extraordinarily well blocked out on a basis of 10 specimens and was in no way altered by the report of a specimen by Muller in 1884.

Thirty years later Boulenger described a fourth species (*E. nasuta*), on a basis of three specimens from just south of the previously known range of the group in Peru. Thirty more years elapsed, and Myers announced the receipt of a virtual topotype of the first-named form, adding the statement "records of it are extremely rare."

As the entire literature contains references to only 15 specimens, and as I have examined 36 additional specimens in the collection of the American Museum of Natural History, and one in the United States National Museum, some report on these would be in order.

Six Ecuadorian specimens, from three localities, are due to the activities of Carlos Olalla and son. Thirty Peruvian specimens, from 12 localities, are due to the activity and the generosity of Dr. Harvey Bassler. This additional material only slightly increases the range of the genus, which may be stated as follows: north to San José Abajo, Ecuador (probably = San José de Motí, on a small northern tributary of the Napo, and practically on the Equator); west to Baños, Ecuador, altitude 1831 meters; east to Iquitos, Peru, altitude 106 meters; south to Valle, Peru (latitude 8° S., in the Huallaga basin), and to Huancabamba, Peru, altitude 1900 meters (latitude 10° S., in the Ucayali basin). It is virtually certain that the range will be extended to the Putumayo drainage in Colombia, probably to the upper Yavarí drainage in Brazil, and possibly to the upper Beni drainage in Bolivia.

Two generic names have been based on species of this group:

Edalorhina JIMÉNEZ DE LA ESPADA, 1871, Jour. Sci. Acad. Lisboa, vol. 3, p. 58 (monotype *E. perezii* Jiménez de la Espada, *loc. cit.*).

Bubonias COPE, 1874, Proc. Acad. Nat. Sci. Philadelphia, vol. 26, p. 124 (monotype *B. plicifrons* Cope, *loc. cit.*).

The following specific names have been based on specimens of this group:

Edalorhina perezii JIMÉNEZ DE LA ESPADA, 1871, *loc. cit.* Banks of the Río Napo, Ecuador; type or cotypes presumably in Spain. 1875, Vert. Viaje Pacifico, p. 160, pl. 1, fig. 5. BOULENGER, 1882, Catalogue of the Batrachia Salientia . . . in the . . . British Museum, ed. 2, p. 227, pl. 16, fig. 2. MULLER, 1884, Verh. Nat. Gesellsch. Basel, vol. 7, p. 281. TREWAVAS, 1933, Phil. Trans. Roy. Soc. London, vol. B222, p. 424, figs. 15–16 (hyoid and larynx). MYERS, 1942, Proc. Biol. Soc. Washington, vol. 55, p. 151.

Bubonias plicifrons COPE, 1874, *loc. cit.* Nauta, Peru; two cotypes, not yet located in any museum. 1889, Bull. U. S. Natl. Mus., vol. 34, pl. 71, figs. 30–31 (skull and shoulder girdle).

Edalorhina buckleyi BOULENGER, 1882, *op. cit.*, pl. 16, fig. 1. Canelos, Ecuador; type a male in the British Museum.

Edalorhina nasuta BOULENGER, 1912, Ann. Mag. Nat. Hist., ser. 8, vol. 10, no. 8, p. 190. Huancabamba, Peru "above 3000 feet"; cotypes three specimens in the British Museum.

As will be shown hereinafter, I regard *plicifrons* and *buckleyi* as conspecific with *perezii*: it therefore follows that I regard *Bubonias* as congeneric with *Edalorhina*.

***Edalorhina perezii* Jiménez de la Espada**

The type of *perezii*, as described and figured by Jiménez de la Espada, had a dermal ridge between the eyes, lacked longitudinal

warts on the dorsum, and had vomerine teeth. The types of *plicifrons*, as described by Cope, lacked the dermal ridge between

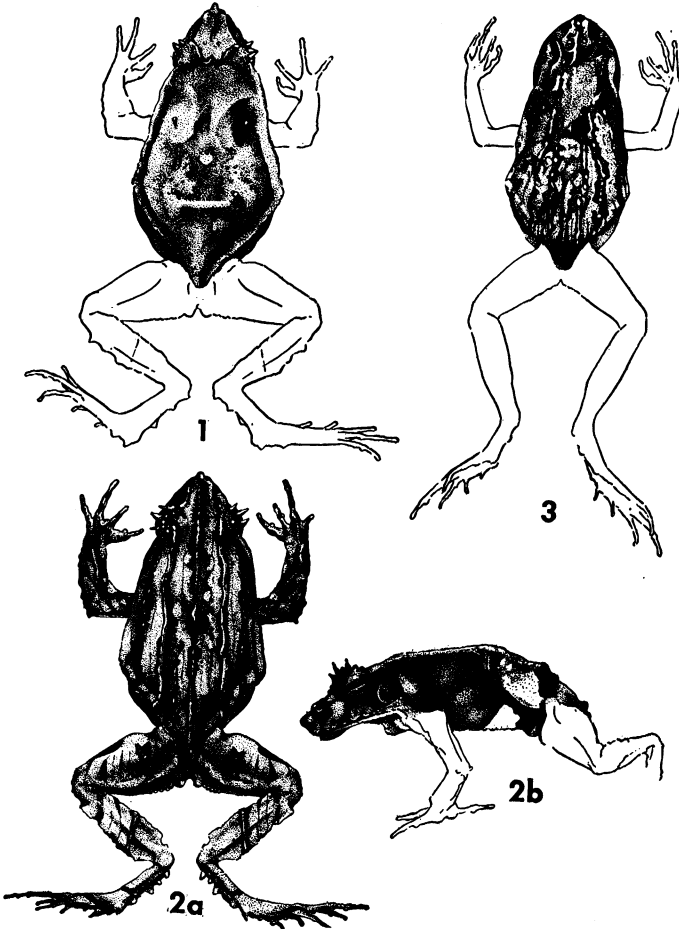


FIG. 1. *Edalorhina perezii* (typical variety). A.M.N.H. No. 52843. Baños, Ecuador. Natural size.

FIG. 2. *Edalorhina perezii* (*plicifrons-buckleyi* variety). A.M.N.H. No. 52847. Canelos, Ecuador. A. Dorsal view. B. Lateral view. Natural size.

FIG. 3. *Edalorhina perezii* (intermediate variety). A.M.N.H. No. 42586. Pampa Hermosa, Peru. Natural size.

the eyes, had longitudinal warts on the dorsum, and lacked vomerine teeth. The type of *buckleyi*, as described and figured by Boulenger, resembled the types of *plicifrons*, but had vomerine

teeth. The American Museum collection has specimens that resemble the types of *perezi* but that lack vomerine teeth. They thus display a hitherto unreported fourth combination of characters.

The interocular dermal ridge and relatively smooth dorsum of the *perezi* variety are illustrated by fig. 1 (a specimen from Baños); the dorsal dermal characters of the *plicifrons-buckleyi* variety are shown by figure 2 (a topotype of *buckleyi* from Canelos). The majority of the collection can easily be allocated to one or the other of these two varieties, but three are somewhat intermediate. One of these, from Pampa Hermosa, is illustrated by figure 3. The "*perezi*" type of warting is present in 86.6 per cent of the Ecuadorian specimens, and in 62.5 per cent of the Peruvian ones (the three Peruvian intermediates have been more or less arbitrarily assigned to the "*plicifrons*" type).

In *Edalorhina* the vomerine teeth are never well developed; at most there are a few teeth on the tips of the backwardly projecting prevomers. They are frequently present on one of the two paired bones and absent on the other. Complete absence of vomerine teeth was noted in 6.6 per cent of Ecuadorian specimens and in 37.5 per cent of Peruvian specimens.

Although Cope's Peruvian types of *plicifrons* were said to have the toes free, the American Museum specimens from Peru agree with the forms described from Ecuador in having a rudimentary web. This is, however, more obvious in some states of preservation than in others.

To some extent specimens from Ecuador differ from specimens from Peru in the degree of development of a wart on the tip of the snout (compare figs. 1 and 2 with fig. 3). In the majority of specimens from both countries this structure exists but is poorly developed. It seems to be absent only in some Peruvian specimens, and well developed only in some Ecuadorian specimens. A dermal appendage on the snout is, however, a conspicuous feature of a form of *Edalorhina* at the southern end of the generic range in Peru.

The accompanying table (table 1) of known specimens is arranged in four columns to show the four combinations of the two sorts of dorsal warting with presence versus complete absence of vomerine teeth. For the 34 American Museum specimens and the single National Museum specimen, the museum number is given, and the sex (if adult). The 12 specimens from the litera-

TABLE 1
LIST OF KNOWN SPECIMENS OF *Edalorhina perezii*

	"perezii" Warts		"plicifrons" Warts	
	Vomerine Teeth Present	Vomerine Teeth Absent	Vomerine Teeth Present	Vomerine Teeth Absent
ECUADOR				
San José Abajo	22183 ♂	—	—	—
Avila, 500 m.	"Myers"	—	—	—
"Napo"	"Espada"	—	—	—
Baños	52843 ♂	—	—	—
Canelos	52844 ♂	—	"Boul." ♂	—
Canelos	52845 ♂	—	—	—
Canelos	52846 ♀	—	—	52847 ♂
Canelos	"Boul." ♀	—	—	—
Canelos	"Boul." ♀	—	—	—
Canelos	"Boul." ♀	—	—	—
Sarayacu	"Boul." ♂	—	—	—
"Ecuador"	"Boul." ♀	—	—	—
"Ecuador"	"Muller"	—	—	—
PERU				
Río Marañon				
Iquitos	43623 ♂	—	—	—
Nauta	—	—	—	"Cope"
Nauta	—	—	—	"Cope"
Río Huallaga				
Valle	42956 yg.	—	42957 ♀ int.	42958 ♂ int.
Valle	42959 ♀	—	42961 ♀	—
Valle	42960 ♂	—	—	—
Valle	42962 yg.	—	—	—
Río Ucayali				
Pampa Hermosa	42101 ♀	—	—	42353 yg.
Pampa Hermosa	42129 ♀	—	—	42586 ♀ int.
Pampa Hermosa	42130 ♀	—	—	—
Campo Santa Clara	127182 ^a ♂	—	—	—
Cashiboya	43456 ♀	43390 ♀	43385 ♀	—
Upper Río Cushabatay	—	—	43428 ♀	43432 ♂
Río Pisqui	43272 ♀	—	43563 ♂	—
Punga (tributary of Río Tapiche)	—	42927 ♀	—	—
Río Bombo (tributary of Río Tapiche)	42902 ♀	—	—	—
Peru-Brazil frontier (Río Tapiche)	—	42909 ♀	—	—
Peru-Brazil frontier (Río Utoquinia)	—	43140 ♂	—	—
Puerto Mairo (Río Pachitea)	"Boul." ♀	—	—	—
Monte Alegre (Río Pachitea)	43039 ♀	43032 ♀	43028 ♀	—
Monte Alegre (Río Pachitea)	—	43040 ♂	—	—

^a U.S.N.M. number.

ture are denoted by "*Espada*," etc., and sex is given if mentioned by the authors.

The Ecuadorian localities are arranged from north to south (see accompanying map, fig. 5); those from Peru are arranged by the main river valleys.

The first column shows the provenance and sex of 27 (17 American Museum) specimens that agree, in the characters considered, with the description of *perezi*. The second column does the same for six American Museum specimens that agree with the description of *perezi* in dorsal warting but that completely lack vomerine teeth. The third column lists the type of *buckleyi* and six American Museum specimens, one of which (denoted by the abbreviation "int.") does not quite agree in the dorsal warting. The fourth column lists the cotypes of *plicifrons* and five American Museum specimens, two of which are aberrant in the direction of *perezi* (also marked "int.").

The first column contains 27 specimens, the second six, the third seven, the fourth seven (in terms of personally examined American Museum specimens, 17-6-6-5). There is a fair geographical spread of each category, except for column two which contains only Río Ucayali specimens. The "*perezi*" warting versus the "*plicifrons*" warting comes out in a ratio of 33:14 (American Museum specimens 23:11). Presence versus complete absence of vomerine teeth comes out 34:13 (American Museum specimens 23:11). These ratios are not precisely the typical Mendelian 9:3:3:1 of a dihybrid cross nor the 3:1 of a monohybrid cross. But only 47 specimens are known; they are widely scattered samples from a range of over 10° of latitude, the collection may not be random sampling, and intermediates might be shifted from one column to another. It is quite possible that the specimens in the first column are double dominants, that those in the last are double recessives, and that those in the two middle columns show one dominant and one recessive character.

I therefore relegate to the synonymy of *perezi* Jiménez de la Espada the specific names *plicifrons* Cope and *buckleyi* Boulenger, and refrain from describing as a fourth species the specimens in column two.

***Edalorhina nasuta* Boulenger**

This species is represented in the Bassler collection by two males, A.M.N.H. Nos. 43006, 43007, 33 and 32 mm. long, respec-

tively, from Monte Alegre, Río Pachitea (Ucayali basin), Peru. Both have vomerine teeth, as did Boulenger's three types from Huancabamba, which is farther south and higher up in the basin of the Pachitea. Boulenger's largest specimen was 38 mm. long.

The nature of the dorsal warting, in the form of an "X," and the fleshy, sharply pointed, projection on the snout (shown in the drawings of No. 43006, fig. 4) are the only known differences between this form and *perezi*. The five specimens all have the interocular dermal ridge of typical *perezi*. A glance at the bottom of

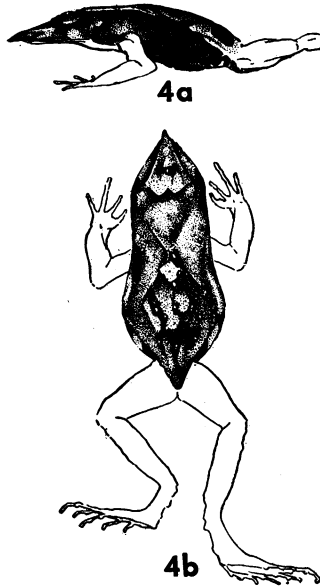


FIG. 4. *Edalorhina nasuta*. A.M.N.H. No. 43006. Monte Alegre, Peru. A. Lateral view. B. Dorsal view. Natural size.

the tabulation of *perezi* specimens will show that three of the four variants of *perezi* occur with *nasuta* at Monte Alegre.

After having placed *plicifrons* in the synonymy of *perezi*, for the reasons given, I find it somewhat difficult to explain why I have not done the same for *nasuta*. However, it is an extremely peripheral form, and no intermediate specimens are known. I therefore leave it in the status in which I found it, a distinct species.

tion, but does not indicate that *Edalorhina* is ancestral to *Physalaemus*.

The peculiar dermal developments on the eyelids, etc., are *sui generis*. Males have a horny plate on the thumb, and another, separate, one on the carpal tubercle. Males lack the external pigmented vocal sac, so markedly developed in *Physalaemus*. The omosternum is cartilaginous with a circular anterior expansion. The sternal style is bony, and the posterior, cartilaginous part of the sternum is bifurcate. The quadratojugal is in sutural contact with the maxilla. The prevomer has a backwardly and medially directed process, which usually bears teeth. The terminal phalanges are simple. The tympanic membrane is well developed. A brilliantly colored, but not precisely delimited inguinal gland is present. The toes have dermal fringes and are slightly webbed at the base. There are two metatarsal tubercles but neither is of the flattened, digging type. The hyoid and laryngeal skeleton of *E. perezii*, as reported by Trewavas, resembles that of *Physalaemus cuvieri* more than it does that of any other known leptodactylid frog. The musculature of the throat also resembles that of *P. cuvieri*, but the origins of the right and left sternohyoideus muscles are well separated (in contact in *Physalaemus*), and the interhyoideus posterior has a superficial layer with fibers running obliquely forward and medially (unique in Leptodactylidae).

These characters indicate (a) a common ancestry for *Edalorhina* and *Physalaemus* (that might be *Leptodactylus*, and that might also have given rise to *Pleurodema*; cf. Parker, 1927), *Edalorhina* retaining more of the *Leptodactylus*-like traits; (b) a certain divergence or specialization on the part of *Edalorhina*, in a direction away from either *Physalaemus* or *Pleurodema*.

Edalorhina pustulata Shreve (1941, p. 80), based on Museum of Comparative Zoölogy No. 7666, taken at Guayaquil, Ecuador, by C. T. Brues, in 1913, does not seem to me to be congeneric with the species considered above.

Judging from the description of the external anatomy and dentition of the unique type, it does not have any close similarity to either *perezii* or to *nasuta*. The description does, however, indicate a high degree of similarity with one, and with only one, known species from northwestern South America, *Engystomops pustulosus*, and I suggest that its relationships lie in that direction rather than with the species here allocated to *Edalorhina*.

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