

A new species of tree frog from the Andes of southeastern Peru (Anura: Hylidae: *Hyla*)

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Abstract. A new species of *Hyla* is described from cloud forests of the Cosñipata Valley in southern Peru. The new species lacks webbing in hands and has vestigial webbing between toes III and IV, is readily distinguished from any other species of Andean *Hyla*, and is not clearly assignable to any species group. The new species seems to be a secretive, bromeliad-dweller.

Introduction

Some areas of the Andean cloud forests have been moderately well surveyed in the last three decades, thereby bringing the number of amphibians discovered to a figure never expected before. However, large tracts of forests lack proper herpetological inventories. Consequently, range extensions, new species, and specimens of doubtful taxonomic status are a common outcome of any fieldwork in these areas. Considerable effort has been exerted in recent years in the Andes of northern Peru (e.g. Duellman, 2000; Duellman and Wild, 1993; Duellman and Pramuk, 1999) and central Peru (e.g. Lehr, 2002) to investigate the herpetofauna of these areas. In contrast, the Andes of southeastern Peru remain greatly unexplored from a herpetological standpoint, and the knowledge of the amphibian forest communities in this area urgently needs to be expanded. The literature dealing specifically with the amphibians and reptiles of this broad and highly diverse region is almost anecdotal. Apart from some old contributions, the majority of the more recent papers deal totally or partially with the description of some anuran species collected by field parties from the University of Kansas during the 1970s (e.g. Duellman and Fritts, 1972; Du-

ellman, 1976, 1978a, 1978b, 1987; Duellman and Ochoa, 1991; Duellman et al., 1997; Lynch, 1975; Cannatella and Duellman, 1982). Other contributions have focused on the diversity of the herpetofauna. Cadle and Patton (1988) analyzed the altitudinal distribution of amphibians and reptiles in the departments of Cusco and Puno. More recently Catenazzi and Rodríguez (2001) pointed out the high diversity of amphibians in the cloud forests of the upper part of the Manu National Park (Cusco). Finally, Rodríguez (2001) and Icochea et al. (2001) carried out several rapid evaluations of the herpetofauna in the Cordillera de Vilcabamba (Cusco). However, much taxonomic work on the rich amphibian faunas inhabiting the Andean montane forests of southern Peru is still to be done.

Tree frogs of the family Hylidae often constitute the most important part of Neotropical lowland anuran communities. However, in the Andean cloud forests, hylids are rarely the dominant component, and members of the genera *Hyla* and *Gastrotheca* are the most common hylids. The genus *Hyla* in the Andes has been divided into eight species groups (Duellman et al., 1997). Only three of these groups are represented in Peru. The *H. armata* group consists only of two species, *H. armata* in Peru and Bolivia and *H. charazani* in Bolivia (De la Riva et al., 2000). The *H. bogotensis* group is a speciose group with only one representative in Peru, *H. phyllognatha*, which ranges from Colombia in the north to the Peruvian De-

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partment of Cusco in the south (Rodríguez et al., 1993). Finally, the *H. pulchella* group is a widespread, diverse group in southern South America, with lowland and Andean representatives (Duellman et al., 1997; Faivovich et al., 2004). According to Duellman et al. (1997), the *H. pulchella* group has four Andean species occurring in Bolivia (*H. albonigra*, *H. andina*, *H. balzani*, and *H. marianitae*) and three in Peru (*H. balzani*, *H. melanopleura*, and *H. palaestes*). Additionally, *H. aperomea*, a member of the mostly lowland *H. minima* group, is restricted to cloud forests at elevations of 1330–1850 m in the central and northern Peruvian Andes (Duellman, 1982). Thus, as far as it is known, the Andean fauna of Peruvian *Hyla* consists of six species (although other primarily lowland species may reach well above 1000 m altitude).

During a herpetological survey of the cloud forests of the Cosñipata valley, in the Department of Cusco, the second author obtained two specimens of a distinctive, unidentified species of *Hyla*. The aim of this paper is to contribute to the knowledge of the amphibian fauna of the Andes of southern Peru by describing this new species of tree frog.

Material and methods

Coordinates were obtained by means of a Garmin Etrex GPS. Specimens were fixed in 10% formalin and preserved in 70% ethanol. Measurements were taken with a digital caliper to the nearest 0.1 mm. Specimens are deposited at the Museo de Historia Natural de la Universidad Nacional de San Antonio Abad del Cusco (MHNC, Cusco, Peru) and at the Museo Nacional de Ciencias Naturales (MNCN, Madrid, Spain).

Results

Description of Hyla antoniiochoai sp. n.
(figs. 1–2)

Holotype. MHNC N°0068, an adult female from Esperanza, Cosñipata Valley, Departamento

de Cusco, Peru, 13°11.350'S/71°35.092'W, 2845 m, obtained on 4 March 2003 by Juan Carlos Chaparro.

Paratype. MNCN 42013, a juvenile from Esperanza, Cosñipata Valley, Departamento Cusco, Peru, 13°10.991'S/071°36.487'W, 2817 m, obtained on 29 January 2003 by Armando Mendoza.

Diagnosis. A small (SVL 27.8 mm) *Hyla* characterized by: (1) Snout pointed and truncate in dorsal view, truncate in lateral view (fig. 1); (2) skin on dorsum finely rugose, that of venter coarsely granular; (3) width of disc of Finger III approximately equal to diameter of tympanum; (4) fingers long, not webbed (fig. 2); (5) axillary membrane absent; (6) toes with basal webbing only between toes III and IV (fig. 2); (7) tarsal fold absent (fig. 2); (8) dentigerous processes of vomers about the same length as choanae, situated obliquely between them; (9) dorsal colour pattern uniformly beige; (10) posterior surface of thighs beige; (11) throat and chest white, venter fleshy-cream; (12) iris bronze-red with fine black reticulation.

Hyla antoniiochoai is unique in having vestigial webbing only between toes III and IV; no other Peruvian or Bolivian *Hyla* has feet almost unwebbed. This feature makes *H. antoniiochoai* unmistakable.

Description of the holotype. An adult female 27.8 mm in snout-vent length (SVL); body and limbs moderately slender; head wider than long, its length (measured from rictus to tip of snout) 27.3% of SVL; head width (measured at level of rictus) 32.0% of SVL; head length 85.3% of head width; head moderately high in lateral profile; snout truncate in dorsal and lateral view; tip of snout with a faint medial depression between the nostrils, from level of nostrils to border of lip; nostrils close to tip of snout; canthus rostralis well marked, curved; loreal region concave; tympanum separated from eye by a distance of about 1.5 times the diameter of tympanum; diameter of tympanum 57.6% of eye length. Vomerine odontophores



Figure 1. Living holotype of *Hyla antoniochoai* sp. nov. (27.8 mm in SVL).

small, placed obliquely between oval choanae; tongue rounded, attached posteriorly to floor of mouth. Forelimbs moderately slender; axillary membrane absent; fingers long; webbing and lateral fringes absent; width of finger III about equal to diameter of tympanum; relative length of fingers $I=II<IV<III$; palmar tubercles translucent, barely evident; thenar tubercle oval, about twice the size of round palmar tubercle; distal subarticular tubercles of fingers II and IV bifid; palmar supernumerary tubercles large, round (fig. 2). Hind limbs moderately slender; tibia length 54.3% of SVL; foot length 47.8% of SVL; foot length 88.0% of tibia length; tarsal fold absent; relative length of toes $I<II<III<V<IV$; width of discs of toes of the same size as those of fingers; lateral fringes absent on toes; webbing absent except for vestigial web between toes III and IV; plantar tubercles translucent, barely evident; inner metatarsal tu-

bercle oval, about twice the size of round outer metatarsal tubercle; distal subarticular tubercles of toes III, IV, and V bifid; plantar supernumerary tubercles large, round (fig. 2). Skin on dorsum and dorsal surfaces of head and limbs finely rugose; skin of venter and ventral surfaces of thighs coarsely granular. Cloacal opening unornamented.

Colour in life pinkish-beige above, with minute dark brown flecks; throat and chest white; venter fleshy-beige; area around eye and canthus rostralis gray; eye reddish-bronze with black reticulations. In preservative, head and dorsum greenish-gray with fine dark brown flecks; canthus rostralis dark gray; dorsal surfaces of limbs beige; throat dirty cream; ventral surfaces of limbs cream; flanks and venter gray, translucent (internal organs visible); all skin, especially on ventral surfaces, with numerous, minute black melanophores.

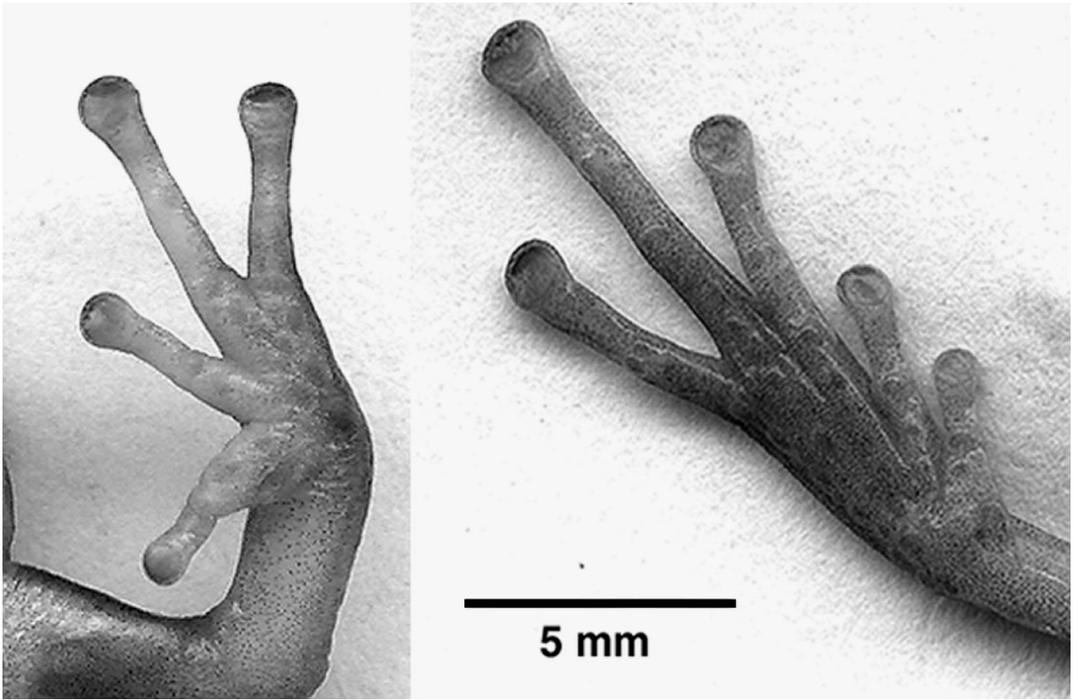


Figure 2. Palmar and plantar surfaces of *Hyla antoniochoai* sp. nov. (holotype).

Measurements in mm (holotype followed by paratype in parentheses). SVL 27.8 (18.8); head length 7.5 (5.6); head 8.9 (6.6); eye-nostril distance 2.8 (2.2); internarial distance 1.8 (1.3); interorbital distance 2.3 (1.8); eye length 2.6 (2.0); tympanum diameter 1.5 (0.9); tibia length (from knee to heel) 15.1 (9.7); foot length (from proximal border of inner metatarsal tubercle to tip of toe IV) 13.3 (8.2).

Distribution. Known only from the type locality (fig. 3). Holotype and paratype were collected in the same general area, near the locality of Esperanza.

Ecology, behavior. Specimens were found in cloud forest during the rainy season. *Hyla antoniochoai* seems to be a secretive species living in bromeliads (which would be a unique feature among Peruvian species of *Hyla*), and the almost complete absence of palmar webbing might suggest a mostly arboreal, non-swimming lifestyle. The holotype contains immature white ovarian eggs, developed fat bodies, and undevel-

oped oviducts. This physical condition indicates that the specimen, collected at the end of the wet season, was probably ready to lay eggs in the following days or weeks. This specimen was found at night within a fallen bromeliad of the genus *Catopsis*, near a stream. The paratype was in an area without water bodies. Floristic composition of the area includes plants in the genera *Miconia*, *Ruagea*, *Myrica*, *Fuchsia*, *Clusia*, *Alnus*, *Calceolaria*, *Peperomia*, *Muehlenbeckia*, *Oreocallis*, *Fragaria*, *Lachemilla*, *Rubus*, *Psychotria*, *Meliosma*, *Agalinis*, *Alonsoa*, *Leuocarpus*, *Phasalis*, *Solanum*, *Pilea*, *Valeriana*, *Viola*, *Cyathea*, *Diplopterygium*, *Polypodium*, *Histiopteris*, as well as orchids and bamboos.

Other species of anurans that could be identified in the area of the type locality of *Hyla antoniochoai* are *Gastrotheca excubitor*, *Hyla armata*, *Eleutherodactylus rhabdolaemus*, *Phrynopus peruvianus*, and *P. cophites*. Additional information on the general characteristics of the area of the Cosñipata Valley was provided by Duellman (1978).

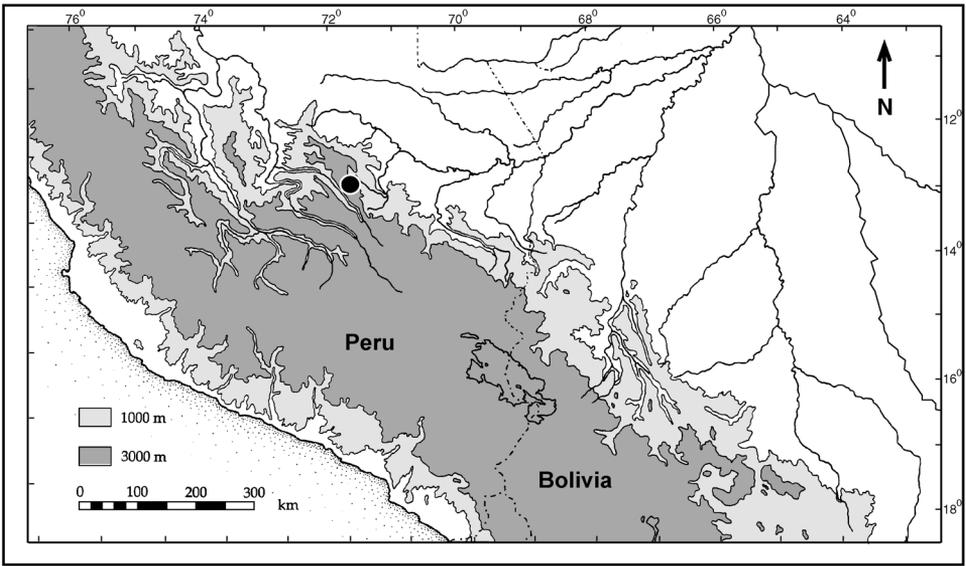


Figure 3. Distribution of *Hyla antoniochoai* sp. nov.

Remarks. The tadpole and the advertisement call of *H. antoniochoai* are unknown. The juvenile paratype is externally similar to the holotype but has a few brown bars on limbs.

Etymology. The specific name is a patronym for Antonio Ochoa, a specialist in scorpions and formerly also devoted to herpetology, as a tribute to the friendship and the many hours of fieldwork shared with the second author.

Discussion

Before describing a new species, some synonyms and poorly known species must be examined to avoid further taxonomic confusion. *Hyla antoniochoai* might remain in the future as a poorly known species as a result of its apparent rarity. Given the affinities of the cloud forest amphibian fauna of southeastern Peru with that of northwestern and central Bolivia, the finding of an unidentified, rare species of *Hyla* in Cusco led us to hypothesise if it could be *Hyla chlorostea*, a Bolivian species known only from the holotype and of unknown relationships. Duellman et al. (1997) placed *H. chlorostea* in its own species group but did not

make detailed comparisons with other species. Comparisons of *H. antoniochoai* with the holotype of *H. chlorostea* (USNM 257811) discarded their conspecificity. Among other characters, *Hyla antoniochoai* can be readily distinguished from *H. chlorostea* by having vestigial webbing between toes III and IV, lacking a tarsal fold, and by having a proportionally larger tympanum. A detailed study on the taxonomic status of *H. chlorostea* is beyond the scope of this paper; however, it seems to be related to *H. armata*.

All Andean species of *Hyla* from Peru and Bolivia are remarkably different from *H. antoniochoai*. Superficially, the most similar species is *H. aperomea*, from the Andean slopes of the Departments of Amazonas, Huánuco, and San Martín (Duellman, 1982; Rodríguez et al., 1993), which differs from *H. antoniochoai* mainly by having fingers about half webbed and toes about three fourths webbed, and a yellowish tan dorsum with brown markings. *Hyla aperomea* is a member of the perplexing, vast array of similar “small yellow hylas” (Duellman, 1982) with 15 pairs of chromosomes, belonging to several ill-defined species groups that oc-

cur mostly in the lowlands, and it does not seem particularly closely related to *H. antoniichoai*.

Hyla antoniichoai cannot be assigned to any of the eight Andean groups of *Hyla* recognized and defined by Duellman et al. (1997). All groups of Andean *Hyla* have webbed toes, from one third in the *H. larinopygion* group to two thirds in the *H. columbiana* group (Duellman et al., 1997). Essentially, nothing is known concerning the variation and sexual dimorphism within *H. antoniichoai*. A study of the relationships of this species will require further work in the Andean forests of southern Peru to collect additional specimens. There is no information on the biology of this species, but it is plausible that bromeliads are used to complete the reproductive cycle, as in some other Neotropical *Hyla*, such as the Middle American species *Hyla picadoi* and *H. zeteki*; these species are superficially similar to *H. antoniichoai* and they also have reduced webbing, albeit not to the extent shown by *H. antoniichoai* (see Duellman, 2001).

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References

Cadle, J.E., Patton, J.L. (1988): Distribution patterns of some amphibians, reptiles, and mammals of the eastern Andean slope of southern Peru. In: Proceedings

- of a workshop on Neotropical distribution patterns, p. 225-244. Heyer, W.R., Vanzolini, P.E., Eds, Academia Brasileira de Ciências, Rio de Janeiro.
- Cannatella, D.C., Duellman, W.E. (1982): Two new species of *Centrolenella*, with a brief review of the genus in Peru and Bolivia. *Herpetologica* **38**: 380-388.
- Catenazzi, A., Rodríguez, L.O. (2001): Diversidad, distribución y abundancia de anuros de la parte alta de la Reserva de Biosfera del Manu. In: El Manu y otras experiencias de investigación y manejo de bosques neotropicales, p. 53-57. Rodríguez, L.O., Ed., Promanu-Inaena-Apeco.-Unesco-Mab. Cusco.
- De la Riva, I., Köhler, J., Lötters, S., Reichle, S. (2000): Ten years of research on Bolivian amphibians: updated checklist, distribution, taxonomic problems, literature and iconography. *Rev. Esp. Herp.* **14**: 19-164.
- Duellman, W.E. (1976): *Centrolenid* frogs from Perú. *Occ. Pap. Mus. Nat. Hist. Univ. Kansas* **52**: 1-11.
- Duellman, W.E. (1978): New species of leptodactylid frogs of the genus *Eleutherodactylus* from the Cosñipata Valley, Perú. *Proc. Biol. Soc. Wash.* **91**: 418-430.
- Duellman, W.E. (1978): Three new species of *Eleutherodactylus* from Amazonia Perú (Amphibia: Anura: Leptodactylidae). *Herpetologica* **34**: 264-270.
- Duellman, W.E. (1982): A new species of small yellow *Hyla* from Perú (Anura: Hylidae). *Amphibia-Reptilia* **3**: 153-160.
- Duellman, W.E. (1987): Two new species of marsupial frogs (Anura: Hylidae) from Peru. *Copeia* **1987**: 903-909.
- Duellman, W.E. (2000): Leptodactylid frogs of the genus *Phrynopus* in northern Peru with descriptions of three new species. *Herpetologica* **56**: 273-285.
- Duellman, W.E. (2001): Hylid frogs of Middle America. Society for the Study of Amphibians and Reptiles, Ithaca.
- Duellman, W.E., Fritts, T.H. (1972): A taxonomic review of the southern Andean marsupial frogs (Hylidae: Gastrotheca). *Occ. Pap. Mus. Nat. Hist. Univ. Kansas* **9**: 1-37.
- Duellman, W.E., Ochoa, M.O. (1991): A new species of Bufo (Anura: Bufonidae) from the Andes of southern Peru. *Copeia* **1991**: 137-141.
- Duellman, W.E., Pramuk, J.B. (1999): Frogs of the genus *Eleutherodactylus* (Anura: Leptodactylidae) in the Andes of northern Peru. *Sci. Pap. Nat. Hist. Mus. Univ. Kansas* **13**: 1-78.
- Duellman, W.E., Wild, E.R. (1993): Anuran amphibians from the Cordillera de Huancabamba, northern Peru: systematics, ecology, and biogeography. *Occ. Pap. Mus. Nat. Hist. Univ. Kansas* **157**: 1-53.
- Duellman, W.E., De la Riva, I., Wild, E.R. (1997): Frogs of the *Hyla armata* and *Hyla pulchella* groups in the Andes of South America, with definitions and analyses of phylogenetic relationships of Andean groups of *Hyla*. *Sci. Pap. Nat. Hist. Mus. Univ. Kansas* **3**: 1-41.
- Faivovich, J., García, P.C.A., Ananias, F., Lanari, L., Basso, N.G., Wheeler, W.C. (2004): A molecular perspective on the phylogeny of the *Hyla pulchella* species group (Anura, Hylidae). *Mol. Phyl. Evol.* **32**: 938-950.

- Icochea, J., Quispitupac, E., Portilla, A., Ponce, E. (2001): Amphibians and reptiles of the southern Vilcabamba region, Peru. In: Biological and social assessments of the Cordillera de Vilcabamba, Peru, p. 131-137. Alonso, L.E., Alonso, A., Schulenberg, T.S., Dallmeier, F., Eds, RAP Working Papers 12, Smithsonian Institution/MAB, Washington.
- Lehr, E. (2002): Amphibien und Reptilien in Peru. – Die Herpetofauna entlang des 10. Breitengrades von Peru: Arterfassung, Taxonomie, ökologische Bemerkungen und biogeographische Beziehungen. Natur und Tier Verlag (NTV Wissenschaft), Münster.
- Lynch, J.D. (1975): A review of the Andean leptodactylid frog genus *Phrynopus*. Occ. Pap. Mus. Nat. Hist. Univ. Kansas **35**: 1-51.
- Rodríguez, L.O. (2001): The herpetofauna of the northern Cordillera de Vilcabamba, Peru. In: Biological and social assessments of the Cordillera de Vilcabamba, Peru, p. 127-130. Alonso, L.E., Alonso, A., Schulenberg, T.S., Dallmeier, F., Eds, RAP Working Papers 12, Smithsonian Institution/MAB, Washington.
- Rodríguez, L.O., Córdova, J.H., Icochea, J. (1993): Lista preliminar de los anfibios del Perú. Publicaciones del Museo de Historia Natural, UNMSM (A) **45**: 1-22.

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