



***Cochranella erminea*, a new species of Centrolenidae (Amphibia: Anura: Athesphatanura) from Amazonian Peru**

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ABSTRACT. We describe a new species of Centrolenidae, *Cochranella erminea* n. sp., from the Amazonian lowlands of the department of Junín, Peru. This new species is diagnosed from other centrolenids by having vomerine teeth, bones green in life, parietal peritoneum and pericardium white, all other visceral peritonea clear, dorsum in life viridian to olive green with abundant enameled (bright white) flecks/spots on flat warts, and scattered larger dark blue spots on warts, extensive webbing between outer fingers, snout in profile slightly sloping anteroventrally, and rounded in dorsal view, iris in life between light grey and slate gray with fine darker gray reticulations. We also present new information on the distribution of *C. truebae* and *C. ametarsia* in Peru.

KEY-WORDS. Amphibia: Anura: Centrolenidae: *Cochranella erminea* new species; glassfrog diversity, distribution, *Cochranella truebae*, *Cochranella ametarsia*, Peru.

INTRODUCTION

The Republic of Peru, a megadiverse nation and one of the largest American countries, holds about 390 species of amphibians (updated from Lehr 2002). However, the amphibian richness of Peru is certainly underestimated since many species remain undiscovered, unnamed, or unrecorded. Only 22 described species of the family Centrolenidae (popularly known as Glassfrogs) have been reported from Peru, but at least a dozen remain undescribed (Cannatella & Duellman 1982, Duellman & Schulte 1993, R. W. McDiarmid pers. comm., L. Rodríguez pers. comm., R. Schulte pers. comm., P. Venegas pers. comm., pers. obs.). The low species richness of centrolenids in Peru is certainly related to the paucity of surveys from vast areas of Peru. During a recent expedition to the Tambo River Basin, department of Junín, southeastern Peru, an undescribed species of Glassfrog was discovered. We take this opportunity to describe it.

MATERIALS AND METHODS

Characters and terminology used herein follow the definitions by Ruiz-Carranza & Lynch

(1991), and Cisneros-Heredia & McDiarmid (2006). Twenty diagnostic characters are used for ease of comparison, and follow the format of Cisneros-Heredia & McDiarmid (2006). Webbing formulae follow the method of Savage & Heyer (1967) as modified by Guayasamin et al. (2006). Eye direction angle was calculated as proposed by Wild (1994), and eye and tympanum diameters were measured following Campbell (1994). The following measurements (in millimeters) were taken with electronic digital calipers (0.05 mm accuracy and rounded to the nearest 0.1 mm): SVL, snout-vent length; HW, head width at the corners of the mouth; HL, head length as the straight line distance from the posterior corner of the mouth to the tip of the snout; ED, horizontal eye diameter; IOD, inter-orbital distance, between eyes as the straight line distance between the anterior margins of the orbits; EN, eye-nostril distance from the anterior margin of the orbit to the center of the nostril; IN, internarial distance between the nostrils; TYD, horizontal tympanum diameter; 3DW, width of disc on the third finger; TL, tibia length; FL, foot length measured from the proximal edge of the inner metatarsal tubercle to the tip of the fourth toe. Sex was determined by direct examination of the gonads, and by noting the condition of secondary sexual characters (vocal slits, nuptial pads). Digits relative lengths were determined by adpressing adjacent digits equally. Drawings were made using a camera lucida Nikon model P-IDT 1002113 attached to a stereomicroscope Nikon SMZ800. The geographic placement and elevation at collection localities were determined using GPS and altimeter.

Institutional abbreviations used are as follows: MUSM – Museo de Historia Natural, Universidad Nacional Mayor San Marcos (formerly MHNSM), Lima; USNM – National Museum of Natural History, Smithsonian Institution, Washington, D.C.; ICN – Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogota; IIAP – Instituto de Investigaciones de la Amazonía Peruana, Iquitos; QCAZ – Museo de Zoología, Pontificia Universidad Católica del Ecuador, Quito; DFCH-USFQ – Universidad San Francisco de Quito, Quito. The following specimens were examined: *Centrolene azulae*: USNM 195988 (holotype): about 3.3 km (by Tingo María – Pucallpa road) west fundo Nuevo Mundo, Cordillera Azul, 1500 m elevation, Departamento de Huánuco, Peru. *Centrolene hesperium*: USNM 292582–4 (paratypes): trail between Monte Seco and Chorro Blanco, about 2.5 km (airline) NE of Monte Seco, 1800 m elevation, department of Cajamarca, Peru. *Cochranella ametarsia*: IIAP s-n (2): Nahuapa River and Nuevo Horizonte; department of Loreto, Peru (photographs). *Cochranella euhystrix*: USNM 292587 (paratype): trail between Monte Seco and Chorro Blanco, about 2.5 km (airline) NE of Monte Seco, 1800 m elevation, department of Cajamarca, Peru; 292588 (paratype): 4 km (airline) NE of Monte Seco, 2550–2650 m elevation, department of Cajamarca, Peru. *Cochranella midas*: ICN 23755 (paratype): Santa Cecilia, 340 m elevation, province of Sucumbíos, Ecuador; USNM 342783: Pakitza, Manu National Park, ca. 57 km (airline) NW of mouth of Manu River, 350 m elevation, department of Madre de Dios, Peru; USNM 537555: Cashiriari-3, S of the Camisea River, 690 m elevation, department of Cusco, Peru; USNM 537556: San Martín-3, ca. 5 km N of the Camisea River, 474 m elevation, department of Cuzco, Peru; DFCH-D102: Tiputini Biodiversity Station, province of Orellana, Ecuador; QCAZ 22876: Yasuni, province of Orellana, Ecuador; QCAZ 20001-2: Puerto Misahualli, province of Napo, Ecuador; USNM 288437: Río Oglán, Curaray, province of Pastaza, Ecuador. *Cochranella pluvialis*: USNM 298950–2: 11 km (airline) NNE of Ollachea, 1880 m elevation, department of Puno, Peru. *Cochranella spiculata*: USNM 298176–7: 72 km (by road) N of Paucartambo, 1460 m elevation, department of Cuzco,

Peru; USNM 342772–7: 68 km (by road) NE of Paucartambo, 1700 m elevation, department of Cuzco, Peru. *Cochranella truebae*: USNM 298178–80: 72 km (by road) N of Paucartambo, 1460 m elevation, department of Cuzco, Peru; USNM 346056–9: 68 km (by road) NE of Paucartambo, 1700 m elevation, department of Cuzco, Peru.

SPECIES DESCRIPTION

A female centrolenid specimen collected in the Tambo River Basin, department of Junín, southeastern Amazonian Peru, shows a remarkable coloration pattern that together with its internal and external morphology demonstrate that it is well separated from all described species of the family Centrolenidae, and we are pleased to describe it herein as:

***Cochranella erminea* Torres-Gastello, Suárez-Segovia & Cisneros-Heredia, n. sp.**

(Figs. 1–4)

HOLOTYPE. MUSM 24056, an adult female collected at Sabetari stream (11°14'31''S, 73°31'33''W, 370 m), on the Tambo River Basin, 9 km NNE of the indigenous community of Quitepampani, province of Satipo, department of Junín, Peru, on 31 October 2005 by C. Torres.

DIAGNOSIS. *Cochranella erminea* n. sp. is diagnosed from other species in the family by the combination of the following characters: (1) vomerine teeth present; (2) bones green in life, white in preservative; (3) parietal peritoneum covered by white pigment (guanophores), extending posteriorly to the level of the liver and half of the stomach; peri-



Fig. 1. Dorsal view of the holotype of *Cochranella erminea* n. sp. in life. Upper left: Ventral view of the holotype of *Cochranella erminea* n. sp. in life, see the white parietal peritoneum extending posterior to the midlevel, and some clear visceral peritonea.

cardium covered by guanophores, all other visceral peritonea clear (= entire digestive track, gallbladder, urinary bladder, kidneys, and liver); (4) color in life: dorsum viridian to olive green with abundant enameled (bright white) flecks/spots on flat warts, and scattered larger dark blue spots on warts, upper lip bright white, point of disks of fingers and toes yellow (Fig. 1); color in preservative: dorsum grayish cream (minute melanophores under magnification), abundant small light cream flecks on flat warts, and scattered larger dark brown-purple spots on warts (Fig. 2); (5) webbing absent between fingers I and II,



Fig. 2. Dorsal view of the holotype of *Cochranella erminea* n. sp. in preservative.



Fig. 3. Dorsal view of the holotype of *Cochranella mixomaculata* Guayasamin et al., 2006. Photo by Edgar Lehr.

basal between finger III and IV, outer fingers III²⁻ – 1IV (Fig. 4); (6) webbing on feet (variation left–right) I(1–1⁻) – (2_{1/3}–2_{1/2})III – (2–2⁺)III(1⁻–1) – 2⁺IV(1_{1/2}–1_{1/3}) – 1V (Fig. 4); (7) snout in profile slightly sloping anteroventrally, and rounded in dorsal view, nostrils slightly elevated (Fig. 5); (8) dorsal skin shagreened with abundant small and scattered large warts; (9) low row of enameled ulnar and external tarsal warts; (10) condition of humeral spine in males unknown (but presumably absent); (11) ovoid tympanum oriented dorsolaterally with slight dorsal inclination; tympanic annulus distinct; supratympanic fold weak; (12) snout-vent length in female holotype 23.6 mm (Fig. 1), males unknown; (13) concealed prepollex, condition of nuptial excrescences unknown; (14) anal opening directed posteriorly at upper level of thighs, anal ornamentation consisting of abundant enameled warts (granular skin), pair of subanal tubercles absent; (15) first finger longer than second, (16) trilobed liver; (17) eye diameter larger than width of disc on finger III; (18) iris in life: between light grey and slate grey with fine darker gray reticulations; in preservative: dark gray; (19) melanophores abundant on outer fingers and toes; (20) advertisement call unknown, (21) larvae unknown.

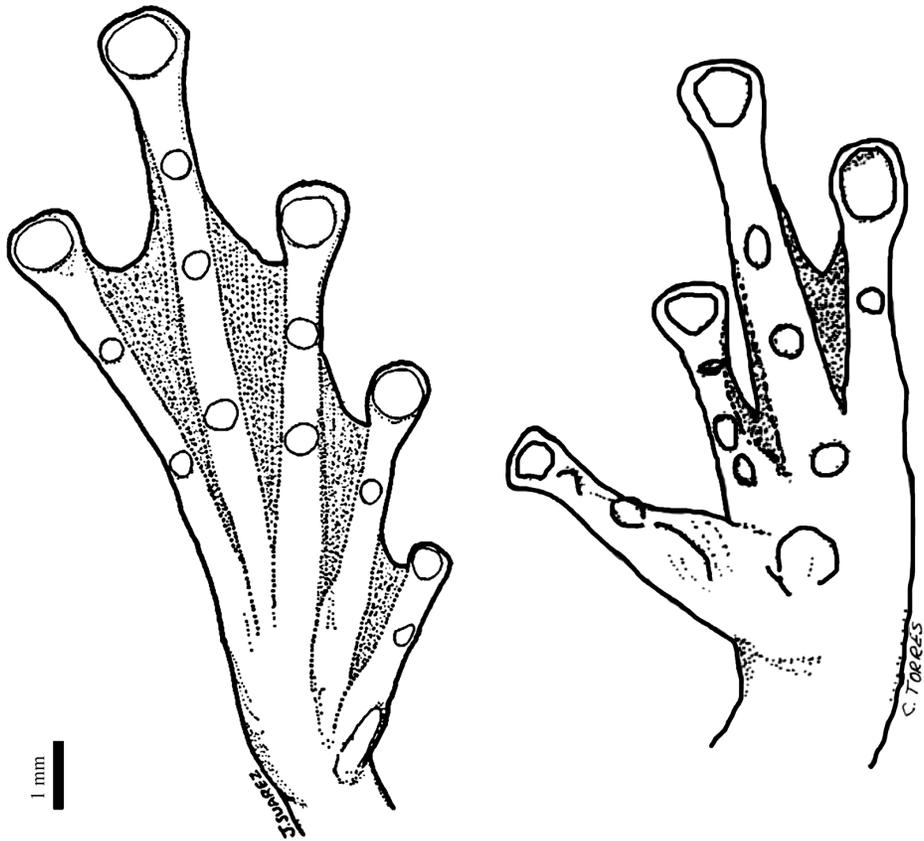


Fig. 4. Hand and feet of the holotype of *Cochranella erminea* n. sp.

COMPARISONS. *Cochranella erminea* n. sp. has three foremost characters that in combination distinguish it from any other centrolenid species: presence of extensive webbing between fingers III and IV, absence of white pigment on the visceral peritonea, and a distinctive dorsal coloration with a combination of abundant enameled spots and few dark dorsal spots (Fig. 1). Nineteen species of centrolenids are similar to *Cochranella erminea* n. sp. in having the first two characters (all part of the former *Cochranella spinosa* group, which we do not recognize because as currently defined it is certainly non-monophyletic and not useful beyond identification purposes). *Cochranella adiazeta* and *C. susatamai* differ by having a uniform green dorsum in life, and brownish iris, and they inhabit northern areas of Cordillera Central and Oriental of Colombia. *Cochranella albomaculata* differs by having yellow or cream dorsal spots or marks but no white or dark spots, and it inhabits the Pacific slopes of Colombia and Ecuador and the Atlantic and Pacific slopes in southern Central America. *Cochranella croceopodes* differs by having a uniform dull green dorsum in life, light lateral stripes, iris dull bronze with black flecks and brownish suffusion. *Cochranella duidaeana* differs by having a uniform green dorsum and a yellow-green iris, and it is known only from the southern tip of the Cerro Duida in southern Venezuela. *Cochranella euhystris* differs from *C. erminea* by lacking vomerine teeth, and having a dark greenish-black or black dorsum with light spicules, and the snout truncate

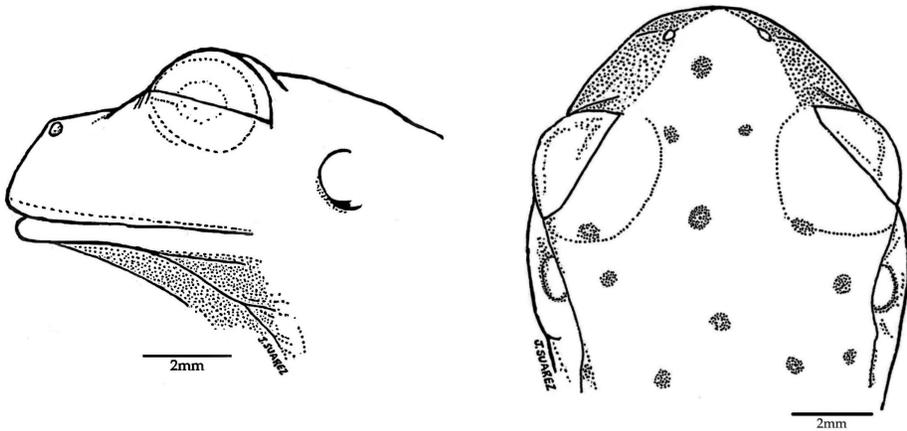


Fig. 5. Dorsal and lateral views of the head of the holotype of *Cochranella erminea* n. sp.

in dorsal and lateral views; further the adult females of *C. euhystrix* are larger (31.1–33.6 mm SVL in females *C. euhystrix* vs. 23.6 mm SVL in female *C. erminea*), and *C. euhystrix* inhabits the Pacific slopes of the northern Andes of Peru. *Cochranella flavopunctata* and *C. xanthocheiria* differ by having yellow dorsal marks and no white or dark spots,

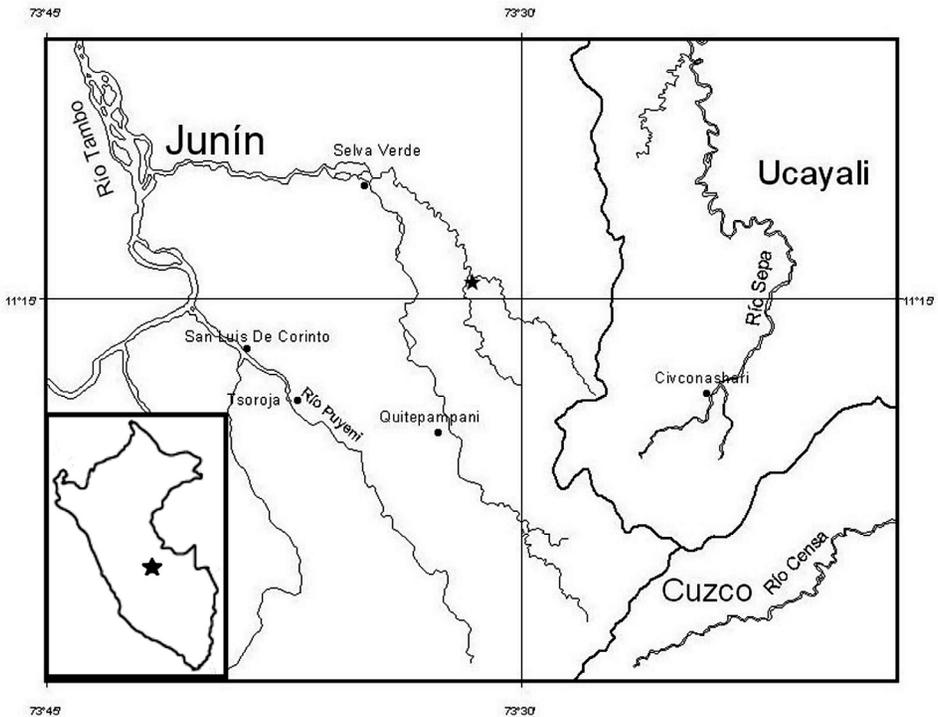


Fig. 6. Distribution of *Cochranella erminea* n. sp. in Amazonian Peru, star corresponds to the type locality. Lower left: Schematic map of Peru showing the general location of the type locality of *Cochranella erminea*.

and they inhabit the eastern slopes of Cordillera Oriental of Colombia and Ecuador (*C. flavopunctata*) or the western slopes of Cordillera Occidental (*C. xanthocheiria*). *Cochranella geijskesi* differs by having a green dorsum with a series of white spots on arms and legs, and it is only known from the south slope of the Wilhelmina Mountains, Suriname. *Cochranella megistra* is similar to *C. erminea* by having dark dorsal spots but differs by lacking white dorsal spots, having less hand webbing, and rounded snout in profile; further it inhabits the northern section of the western slopes of the Cordillera Occidental of Colombia. *Cochranella nola* differs from *C. erminea* by having a uniform green dorsum, and lacking melanophores on fingers. *Cochranella ocellifera* has ocelli-like marks on the dorsum and lacks light spots, and it has been reported from the western foothills of northern Ecuador. *Cochranella orejuela* differs by having a uniform green dorsal coloration and inhabits the Pacific slopes of southwestern Colombia. *Cochranella punctulata* differs by having yellow dorsal spots and it inhabits the eastern flanks of the Cordillera Central of Colombia. *Cochranella riveroi* differs by having a uniform dorsal coloration and it is known only from the Cerro Aracamuni, southern Venezuela. *Cochranella saxiscandens* differs from *C. erminea* by having a dull dark green to black dorsum, and bluntly rounded snout in dorsal and lateral views. *Cochranella spiculata* differs from *C. erminea* by having a dark green uniform dorsum, ulnar folds, and more webbing between fingers and toes. *Cochranella spinosa* differs by its uniform green dorsum, and by having a protruding prepollical spine, and it inhabits the Pacific slopes of Colombia and Ecuador and the Atlantic slopes of southern Central America. *Cochranella tangarana* differs from *C. erminea* by having uniform dark green dorsum and truncate snout in dorsal and lateral views.

In Peru, two additional centrolenid species are similar to *Cochranella erminea* by having dark and light spots on the dorsum: the recently described *C. mixomaculata* (Fig. 3) and *Centrolene muelleri*. *Cochranella mixomaculata* differs from *C. erminea* by lacking vomerine teeth, and having a pale green dorsum with minute widely-spaced white spots on tiny spicules and larger black spots; that in preservative turns dorsum lavender with minute white spots and dark purple spots, it has basal webbing between outer fingers, and the second finger is longer than the first. *Centrolene muelleri* was described as having dark greenish-black spots and pale yellow tubercles but it differs from *C. erminea* by lacking vomerine teeth, and having a dorsolateral row of large conical tubercles and scalloped dermal folds on the limbs.

DESCRIPTION OF THE HOLOTYPE. Adult female, SVL = 23.6 mm (Fig. 1–2). Body fairly slender. Head distinct, slightly longer than width, and wider than body; HW/HL = 0.77, HW/SVL = 0.32, HL/SVL = 0.42. Snout short, in profile slightly sloping anteroventrally, and rounded in dorsal view, EN/HL = 0.22; nostrils slightly elevated indentation at internarial region between nostrils; canthus rostralis rather indistinct, a shallow platform between the canthus rostralis; concave loreal region; lips slightly flared. Eyes large, ED/HL = 0.32, directed anterolaterally at about 55° from midline, eyes are barely viewed from below, eye diameter wider than interorbital area, IOD/ED = 0.76, EN/ED = 0.71, EN/IOD = 0.94. Ovoid tympanum oriented dorsolaterally with slight dorsal inclination; tympanic annulus distinct; supratympanic fold weak, TYD/ED = 0.35 (Fig. 4). Vomerine teeth present (4 on each side), choanae small, rather elliptical, widely separated medially; tongue elongately ovoid, not indented posteriorly, free posteriorly.

Skin of dorsal surfaces of head, body, and limbs shagreen with abundant flat warts; all ventral surfaces granular. Anal opening directed posteriorly at upper level of thighs,

anal ornamentation consisting of abundant enameled warts (granular skin), and pair of subanal tubercles absent.

Breadth of upper arm slightly wider than that of forearm. Humeral spine absent. Low row of enameled ulnar warts. Relative lengths of fingers $II < I < IV < III$; webbing absent between fingers I and II, basal between finger III and IV, outer fingers $III_2^- - IIV$ (Fig. 4); bulla absent, lateral fringes present on fingers II, III and IV but wider on outer edges of finger III and IV; finger discs slightly wide, truncate; disc on third finger equal in size to those on toes, and shorter than eye diameter, $3DW/ED = 0.35$, $3DW/TYD = 0.96$; sub-articular tubercles elliptical and elevated; supernumerary tubercles small, rather indistinct; palmar tubercle absent, tenar large, ovoid. Enlarged prepollex concealed.

Hind limbs slender; heels of adpressed limbs perpendicular to body overlap; $TL/SVL = 0.58$, $FL/SVL = 0.50$. Low row of enameled warts on the outer edge of tarsus; inner metatarsal tubercle small, elliptical, distinct, outer metatarsal tubercle absent; supernumerary tubercles absent. Webbing on feet (variation left–right) $I(1-1^-) - (2_{1/3}-2_{1/2})III - (2-2^+)III(1-1) - 2^+IV(1_{1/2}-1_{1/3}) - IV$ (Fig. 4); discs on toes slightly expanded and bluntly truncate, pointed projection on disc of toe I absent.

COLORATION IN LIFE. Head (including area below the eye and the nostrils), dorsum, flanks, and limbs viridian to olive green with abundant enameled (bright white) flecks/spots on flat warts, and scattered larger dark blue spots on warts, upper lip bright white, iris between light grey and slate gray with fine darker gray reticulations, point of disks of fingers and toes yellow (Fig. 1). Bones green. White parietal peritoneum covering the anterior half of the belly, white pericardium, all other visceral peritonea clear (Fig. 1).

COLORATION IN PRESERVATIVE. Dorsum, flanks, and legs grayish cream (minute melanophores under magnification), venter cream, abundant small light cream flecks on flat warts, and scattered larger dark brown-purple spots on warts (Fig. 2). Bones white. Parietal peritoneum covered by white pigment (guanophores), extending posteriorly to the level of the liver and covering half of the stomach; pericardium covered by guanophores, all other visceral peritonea clear.

MEASUREMENTS (in millimeters): $SVL = 23.4$; $HW = 7.6$; $HL = 9.8$; $ED = 3.1$; $IOD = 2.4$; $EN = 2.2$; $TL = 13.6$; $FL = 11.6$; $TYD = 1.2$; $IN = 2.2$; $3DW = 1.1$.

ETYMOLOGY. The specific name of *Cochranella erminea* n. sp. is derived from the Latin adjective *ermineus* meaning “white like ermine”; in allusion to the distinctive enameled (bright white) warts covering the entire dorsal surfaces of the new species (Fig. 1).

DISTRIBUTION AND NATURAL HISTORY. *Cochranella erminea* is known only from its type locality, the Sabetari stream, department of Junín, Peru (Fig. 6). This stream is located in the largest Peruvian eco-region, the Amazon tropical forest (Brack 1986). The area has suffered little human impact and it is covered by primary lowland forest with predominance of dense forest (canopy height above 15 m), and semi-dense forest with patches of bamboo (*Guadua sarcocarpa*) (S. Baldeón, pers. comm.). The holotype of *C. erminea* was found on a leaf of a 20-m fallen tree next to the stream, 30 cm above ground, at night. The stream had a slow water flow due to the season, and its bottom was rocky. *Cochranella erminea* was found syntopically with *Eleutherodactylus* cf. *buccinator* that was collected in bushes and along a stream. Other sympatric anurans include *Rhinella* sp. (aff. *margaritifera*), *Ameerega macero*, *Eleutherodactylus toftae*, *E. ventrimarmoratus*, and *Oreobates quixensis*.

DISCUSSION

Centrolenidae is a monophyletic group of anurans currently including three genera: *Centrolene*, *Cochranella*, and *Hyalinobatrachium* (Ruiz-Carranza & Lynch 1991, Darst & Cannatella 2004, Frost et al. 2006). All these genera are currently recognized as non-monophyletic units. Although *Centrolene* and *Cochranella* are differentiated by the condition of the humeral spine in males, their certain paraphyly precludes us from further conclusions. Our placement of *erminea* n. sp. in the genus “*Cochranella*” is just for convenience, and we must wait for phylogenetic studies to determine the true relationships of this species.

The species richness of Glassfrogs from Peru as reported up to July 2006 includes seven species of the genus *Centrolene*, 12 species of *Cochranella*, and three species of *Hyalinobatrachium* (Frost 2006, Guayasamin et al. 2006). The first centrolenid species known from Peru was *Cochranella ocellata* (Boulenger, 1918), described from Huancabamba, department of Pasco. Almost 60 years later, Duellman (1976) described the second and third centrolenid species from Peru, *Cochranella spiculata* (Duellman, 1976) and *Cochranella truebae* (Duellman, 1976), discussed new specimens of *Cochranella ocellata*, and reported the first Peruvian records for *Hyalinobatrachium munozorum* (Lynch & Duellman, 1973). *Cochranella truebae* remains reported only from the type-locality on the Cosñipata River; herein we report new localities for this species at 68 km (by road) NE and 72 km (by road) N of Paucartambo, 1700 and 1460 m elevation (respectively), department of Cuzco, based on specimens (USNM 346056–9, USNM 298178–80) collected by R. Reynolds et al. in September 1991. Duellman (1976) also reported what he considered the first Peruvian records for “*Centrolenella siren*” from the department of Ayacucho; however, Cannatella & Duellman (1982) re-evaluated those Peruvian “*C. siren*” and regard them as a new species, *Cochranella phenax* (Cannatella & Duellman, 1982), different from true *C. siren* (Lynch & Duellman, 1973). *Cochranella siren* inhabits only the southeastern Andean slopes of Colombia and the northeastern Andean slopes of Ecuador (Lynch & Duellman 1973, Ruiz-Carranza et al. 1996), and it is not part of the Peruvian centrolenid fauna (*contra* Rodríguez et al. 1993, Coloma et al. 2004, Frost 2006). Cannatella & Duellman (1982) also described *Cochranella pluvialis* (Cannatella & Duellman, 1982), reported the first Peruvian records for *Cochranella midas* (Lynch & Duellman, 1973) and *Hyalinobatrachium bergeri* (Cannatella, 1980), reviewed the distributional ranges of the nine Peruvian species known at that time, and reported that at least five undescribed Peruvian centrolenids were represented in museum collections. From rather isolated mountain chains in the department of Huánuco, eastern Peru, two species of Glassfrogs have been described, *Centrolene mariae* (Duellman & Toft, 1979) from the Serranía de Sira, and *Centrolene azulae* (Flores & McDiarmid, 1989) from Cordillera Azul—generic assignment *sensu* Duellman & Schulte (1993). Cadle & McDiarmid (1990) described the first centrolenid species from the Pacific slopes of the Andes in Peru (department of Cajamarca), *Centrolene hesperium* (Cadle & McDiarmid, 1990), and *Cochranella euhystrix* (Cadle & McDiarmid, 1990). Duellman & Wild (1993) reported the first country record of *Centrolene buckleyi* based on two juveniles; and Duellman & Schulte (1993) almost double the number of Peruvian centrolenids with the description of eight new species from the eastern slopes of Cordillera Central and adjacent ridges in department of San Martín, including: *Centrolene fernandoi*, *Centrolene lemniscatum*, *Centrolene muelleri*, *Cochranella chancas*, *Cochranella croceopodes*,

Cochranella saxiscandens, *Cochranella tangarana*, and *Hyalinobatrachium lemur*. Since 1993, only one species has been added to the Peruvian centrolenids, *Cochranella mixomaculata* Guayasamin, Lehr, Rodríguez & Aguilar, 2006, recently described from the Cordillera de Carpish, department of Huánuco.

Reports of *Cochranella ametarsia* are currently known from southeastern Colombia (Leticia area) and eastern Ecuador; but there are no official records of this species from Peru. One specimen of *C. ametarsia* was collected at the Nahuapa River (an affluent of the Tigre River; IAP s/n), El Cerro; and another at Nuevo Horizonte (Quebrada Vázquez, and affluent of the Tahuayo River; IAP s/n); department of Loreto, northern Amazonian Peru; both by William W. Lamar. A photograph of *C. ametarsia* from Loreto was presented by Bartlett & Bartlett (2003), but erroneously reported as *C. ritae*. *Cochranella resplendens* has been reported from Amazonian Ecuador and southeastern Colombia, but a recent collection from the Alto Cainarachi Valley, department of San Martín, provides the first record for Peru (R. Schulte, pers. comm., Twomey et al. in prep.). Thus, the number of described centrolenid species from Peru increases to 25 with the description of *Cochranella erminea* and the records of *C. ametarsia* and *C. resplendens*.

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