

## NOTES ON GEOGRAPHIC DISTRIBUTION

### Amphibia, Anura, Centrolenidae: *Cochranella orejuela*, first country records from Ecuador.

Mario H. Yáñez-Muñoz<sup>1</sup>  
Diego F. Cisneros-Heredia<sup>1,2</sup>

<sup>1</sup> Museo Ecuatoriano de Ciencias Naturales, Sección Vertebrados, División de Herpetología. Calle Rumipamba 341 y Ave. de Los Shyris (Parque La Carolina), Quito, Ecuador. E-mail: mayamu@hotmail.com or m.yanez@mecn.gov.ec

<sup>2</sup> King's College London, Department of Geography, Strand, London WC2R 2LS, United Kingdom.

Knowledge about the diversity of Ecuadorian centrolenids has increased notably over the past four years. Recent contributions include descriptions of new species, taxonomic revisions, and reports of distributional extensions at national and local levels (Guayasamin and Bonaccorso 2004; Cisneros-Heredia and McDiarmid 2005; 2006a; 2006b; 2007a; 2007b; Cisneros-Heredia and Guayasamin 2006; Guayasamin et al. 2006a; 2006b; Bustamante et al. 2007; Cisneros-Heredia 2007; Cisneros-Heredia and Meza-Ramos 2007; Cisneros-Heredia and Yáñez-Muñoz 2007a; 2007b; Guayasamin and Trueb 2007). However, many areas across Ecuador remain unexplored or poorly sampled and several specimens remain unidentified in museum collections. Recent expeditions carried out by the *Museo Ecuatoriano de Ciencias Naturales* to foothill areas in northwestern Ecuador resulted in the collection of three specimens of a species previously unreported for Ecuador, *Cochranella orejuela*, which we report herein.

Specimens are deposited at the *División de Herpetología, Museo Ecuatoriano de Ciencias Naturales*, Quito, Ecuador (DHMECN). In addition, one of us (DFCH) examined two type specimens of *Cochranella orejuela* at The University of Kansas, Natural History Museum, Lawrence, USA: KU 145081 (holotype, adult male) and KU 145080 (paratype, adult female), collected between El Tambo and La Costa, department of Cauca, Colombia, at 800 m, elevation on 17 August 1937. We follow Sierra (1999) and Cisneros-Heredia (2006; 2007) for vegetation and biogeographic classifications. Characters, terminology, and taxonomic arrangements follow Cisneros-Heredia and McDiarmid (2007b).

*Cochranella orejuela* (Duellman & Burrowes, 1989) was previously known to inhabit the Pacific foothills and low montane Andean regions of southwestern Colombia between 800 and 1250 m elevation, with two localities at the departments of Cauca and Nariño (Duellman and Burrowes 1989) and a third one at the department of Valle del Cauca (Castro et al. 2004). *Cochranella orejuela* was recently collected in three localities at the province of Pichincha, northwestern Ecuador: DHMECN 04309 (Figure 1) from the Bosque Protector Mashpi (78°52'2.32" W 00°10'2.34" N; 1200 m), collected by M. H. Yáñez-Muñoz and C. Castro M., on 02 May 2007 (Figure 2); DHMECN 04551 from the River Chalpi (78°51'28.87" W 00°13'32.38" N; 615 m) and DHMECN 04552 from the River Anope (78°48'58.34" W 00°12'45.54" N; 1080 m), both at the surroundings of the town of Saguangal, collected by M. Herrera-M, S. Villamarín C. and J. Rivadeneira R., on 23 June 2007 (Figure 2).



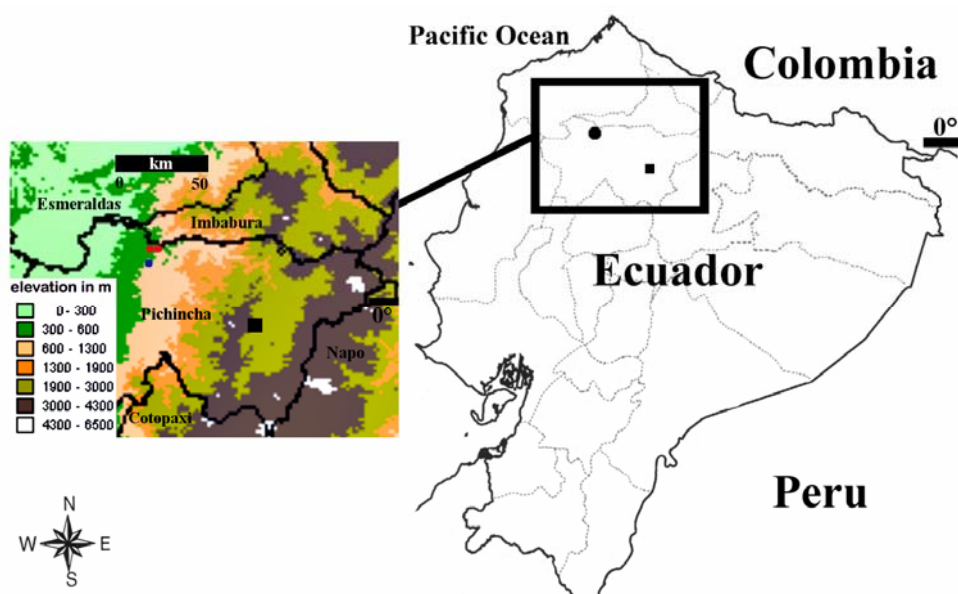
**Figure 1.** An adult female of *Cochranella orejuela* from the Bosque Protector Mashpi, province of Pichincha, Ecuador (DHMECN 04309). Photo by M. H. Yáñez-Muñoz.

## NOTES ON GEOGRAPHIC DISTRIBUTION

The three localities are part of the Chocó biogeographic region and are covered by Foothill Evergreen Non-Seasonal forests. They constitute the first records of *Cochranella orejuela* in Ecuador, extending its distributional range ca. 140 km south from the nearest known locality (Pialapí, department of Nariño, Colombia), and its lower altitudinal level down to 615 m elevation.

All specimens are adult females. The specimen collected at Mashpi (DHMECN 04309) was found at night sitting on the upper side of a leaf next to a waterfall ca. 1.5 m above water. Specimens from

the Chalpi and Anope rivers (DHMECN 04551–2) were collected by electro-fishing during the day along the steepest part of the streams, next to waterfalls (frogs were presumably resting on rocks along the streams). All three specimens are morphologically similar to specimens of the type series. *Cochranella orejuela* was sympatric at Mashpi with *Centrolene prosoblepon* and an undescribed species of *Cochranella* that will be described elsewhere and that we refer to as *Cochranella* sp. N11 (Table 1), and with *C. prosoblepon* and *Hyalinobatrachium* cf. *valerioi* at the surroundings of Saguangal.



**Figure 2.** Right: Map of Ecuador showing the general location (black dot) of the new localities for *Cochranella orejuela*. Left: Map of the enlarged area showing the three localities for *Cochranella orejuela* in Ecuador; blue dot, Mashpi; red dots, surroundings of Saguangal. Square corresponds to Quito, capital of Ecuador. Precise locations can be visualized in Google Earth by downloading the Supporting Online Material file (<http://www.cisneros-heredia.org/centrolenidae/orejuela/orejuela.kmz>).

Two of the Ecuadorian localities of *Cochranella orejuela* are in foothill areas on the base of the Andes (800–1100 m elevation) and one is in lowland areas (< 800 m). Six Ecuadorian glassfrogs also occur in lowland and foothill areas, such as *Cochranella orejuela*, while ten species are exclusive to the foothills and 15 to the lowlands (Table 1; Cisneros-Heredia and McDiarmid 2007b). Knowledge on the Ecuadorian foothill areas is very limited and few scientific expeditions have explored them, with

most glassfrog species from these areas been reported or described recently (Table 1; Cisneros-Heredia, 2007; Cisneros-Heredia and McDiarmid 2007a; 2007b; Cisneros-Heredia and Meza-Ramos 2007; Cisneros-Heredia and Yáñez-Muñoz 2007). More research is needed to have a better understanding of the diversity, distribution, ecology, and evolution of the amphibian communities from the Andean foothills, one of the most threatened areas in Ecuador due to habitat loss and fragmentation (Sierra 1999).

## NOTES ON GEOGRAPHIC DISTRIBUTION

**Table 1.** Glassfrogs (Anura: Centrolenidae) from lowland (0 to 800 m elevation) and foothill areas (800 to 1100 m elevation) of Ecuador. Different background shades represent different altitudinal distributions: white = species exclusive from the lowlands; light gray = species that inhabit lowlands and foothills; dark gray = species exclusive from the foothills. Superscripts on the distribution section are for: *Geopolitical Endemism*: <sup>E</sup> = Endemic to Ecuador; <sup>E-C</sup> = Endemic to Ecuador and Colombia; <sup>E-P</sup> = Endemic to Ecuador and Peru; <sup>E-C-P</sup> = Endemic to Ecuador, Colombia, and Peru. *Biogeographic Endemism*: <sup>WE</sup> = Endemic to the West Ecuadorian biogeographic region. <sup>CH</sup> = Endemic to the Chococoan biogeographic region.

Species	Distribution	First source of information
<i>Centrolene callistommum</i>	Pacific lowlands <sup>E/CH</sup>	Guayasamin and Trueb (2007)
<i>Centrolene litorale</i>	Pacific lowlands <sup>E-C/CH</sup>	Grant and Morales (2004)
<i>Centrolene</i> sp. “Palenque” <sup>1</sup>	Pacific lowlands <sup>E/WE</sup>	Cisneros-Heredia and McDiarmid (2007b)
<i>Cochranella albomaculata</i>	Pacific lowlands	Guayasamin et al. (2006b)
<i>Cochranella mache</i>	Pacific lowlands <sup>E/WE</sup>	Guayasamin and Bonaccorso (2004)
<i>Cochranella pulverata</i>	Pacific lowlands	Bustamante et al. (2007)
<i>Cochranella spinosa</i>	Pacific lowlands	Duellman and Burrowes (1989)
<i>Hyalinobatrachium aureoguttatum</i>	Pacific lowlands <sup>CH</sup>	Bustamante et al. (2007)
<i>Hyalinobatrachium fleischmanni</i>	Pacific lowlands	Noble (1924)
<i>Centrolene ilex</i>	Pacific lowlands and western foothills	Guayasamin et al. (2006b)
<i>Centrolene prosoblepon</i>	Pacific lowlands and western foothills	Boulenger (1898)
<i>Cochranella orejuela</i>	Pacific lowlands and western foothills <sup>E-C/CH</sup>	This work
<i>Hyalinobatrachium valerioi</i> <sup>2</sup>	Pacific lowlands and western foothills	Duellman and Burrowes (1989)
<i>Cochranella</i> sp. N11 <sup>3</sup>	Pacific lowlands and western foothills <sup>E/CH</sup>	D. F. Cisneros-Heredia, M. H. Yáñez-Muñoz and H. M. Ortega-Andrade (unpubl.)
<i>Centrolene lynchi</i>	Western foothills <sup>E-C</sup>	Lynch and Duellman (1973), Duellman (1980)
<i>Nymphargus buenaventura</i>	Western foothills <sup>E/WE</sup>	Cisneros-Heredia and Yáñez-Muñoz (2007b)
<i>Centrolene grandisonae</i>	Western foothills (marginally) <sup>E-C</sup>	Duellman (1980)
<i>Centrolene durrellorum</i>	Eastern foothills <sup>E</sup>	Cisneros-Heredia (2007)
<i>Centrolene</i> sp. N4 <sup>4</sup>	Eastern foothills <sup>E-P</sup>	D. F. Cisneros-Heredia, P. J. Venegas, M. Rada and R. Schulte (unpubl.)
<i>Cochranella flavopunctata</i>	Eastern foothills <sup>E-C</sup>	Lynch and Duellman (1973)
<i>Cochranella puyoense</i>	Eastern foothills <sup>E</sup>	Flores and McDiarmid (1989)
<i>Nymphargus cochranae</i>	Eastern foothills <sup>E-C?</sup>	Goin (1961)
<i>Nymphargus laurae</i>	Eastern foothills <sup>E</sup>	Cisneros-Heredia and McDiarmid (2007b)
<i>Hyalinobatrachium ruedai</i> <sup>5</sup>	Eastern foothills <sup>E-C</sup>	Cisneros-Heredia and McDiarmid (2007a)
<i>Cochranella amelie</i>	Amazonian lowlands and eastern foothills <sup>E</sup>	Cisneros-Heredia and Meza-Ramos (2007)
<i>Cochranella ametarsia</i> <sup>6</sup>	Amazonian lowlands	Guayasamin et al. (2006a)
<i>Cochranella midas</i>	Amazonian lowlands	Lynch and Duellman (1973)
<i>Cochranella resplendens</i>	Amazonian lowlands <sup>E-C-P</sup>	Lynch and Duellman (1973)
<i>Cochranella</i> sp. N1 <sup>7</sup>	Amazonian lowlands <sup>E</sup>	M. Bustamante and J. M. Guayasamin (unpubl.)
<i>Hyalinobatrachium</i> sp. N12 <sup>8</sup>	Amazonian lowlands	Yáñez-Muñoz and Chimbo (2007)
<i>Hyalinobatrachium munozorum</i>	Amazonian lowlands <sup>E-C-P</sup>	Lynch and Duellman (1973)

### Notes

<sup>1</sup> Putative new species from the West Ecuadorian Region (Río Palenque Scientific Center), apparently related to *Centrolene litorale*, being studied by R. W. McDiarmid and D. F. Cisneros-Heredia.

<sup>2</sup> It includes populations referred as *Hyalinobatrachium* sp. A and sp. B by Cisneros-Heredia and McDiarmid (2007a). These Ecuadorian populations differ in some coloration and morphological characters between them and also from Central American populations of *H. valerioi*, but the differences are continuous or on characters that exhibit large intraspecific variation. Further analyses, including molecular data, are needed to clarify if these populations belong to one (*H. valerioi*) or more species.

<sup>3</sup> Putative new species from the Chococoan Region, apparently related to *Cochranella spinosa*, being studied by D. F. Cisneros-Heredia, M. H. Yáñez-Muñoz and H. M. Ortega-Andrade.

<sup>4</sup> Putative new species from the southeastern Andean foothills of Ecuador and northeastern Andean foothills of Peru being studied by D. F. Cisneros-Heredia, P. J. Venegas, M. Rada and R. Schulte.

<sup>5</sup> Cited as *Hyalinobatrachium* sp. Z1 in Cisneros-Heredia and McDiarmid (2006a: Table 5).

<sup>6</sup> Cited as *Cochranella* sp. Z2 in Cisneros-Heredia and McDiarmid (2006a: Table 5). Possibly conspecific with *Cochranella oyampiensis* (Cisneros-Heredia and McDiarmid 2007b; Kok and Castroviejo 2008).

<sup>7</sup> Putative new species from the northern Amazonian lowlands (Cuyabeno), being studied by J. M. Guayasamin and M. Bustamante.

<sup>8</sup> A population from the northern Amazonian lowlands apparently related or conspecific with *Hyalinobatrachium iaspidiense*.

## NOTES ON GEOGRAPHIC DISTRIBUTION

### Acknowledgments

Expeditions by MHYM to Mashpi and Saguangal were funded by the *Fondo Ambiental del I. Municipio del Distrito Metropolitano de Quito* as part of the project *Monitoreo biológico: una herramienta para el manejo adaptativo de las áreas protegidas y bosques protectores del Distrito Metropolitano de Quito, DMQ*. We thank Carlos Carrera and Patricio Mena-Valenzuela, coordinators of the *Museo Ecuatoriano de Ciencias Naturales*, for constant support; Santiago Castroviejo-Fisher and Juan M. Guayasamin for their helpful comments on the manuscript; Carlos Castro, Mauricio Herrera-Madrid, Santiago Villamarín C., and Juan Rivadeneira for field companionship and collecting some of the specimens; and John Jairo Mueses-C. for providing information on material deposited at the *Instituto de Ciencias Naturales* (ICN), Bogotá, Colombia. DFCH's research was supported by María Elena Heredia, Laura Heredia, *Museo Ecuatoriano de Ciencias Naturales*, and grants from the Russel E. Train Education for Nature Program of the World Wildlife Fund WWF, the Natural History Museum–The University of Kansas, and the "Fernando Ortíz-Crespo" Endangered Species Program managed by EcoCiencia, Conservation International, and the Royal Netherlands Embassy. DFCH is especially thankful to Linda Trueb, William E. Duellman, and Juan M. Guayasamin (Natural History Museum, The University of Kansas) for the invitation to visit KU and to Elisa Bonaccorso and Juan M. Guayasamin for their hospitality at Lawrence. Research and collecting permits were provided by *Ministerio del Ambiente del Ecuador*.

### References

- Boulenger, G. A. 1898. An account of the reptiles and batrachians collected by Mr. W.F.H. Rosenberg in western Ecuador. Proceedings of the Zoological Society of London 1898(1): 107–126.
- Bustamante, M. R., D. F. Cisneros-Heredia, M. H. Yáñez-Muñoz, H. M. Ortega-Andrade, and J. M. Guayasamin. 2007. Amphibia, Centrolenidae, *Cochranella pulverata*, *Hyalinobatrachium aureoguttatum*: Distribution extension, Ecuador. Check List 3(3): 271–276.
- Castro, F., J. Lynch, and T. Grant. 2004. *Cochranella orejuela*. 2007 IUCN Red List of Threatened Species. Electronic database accesible at: <http://www.iucnredlist.org>. IUCN, Gland, Switzerland. Captured on November 2007.
- Cisneros-Heredia, D. F. 2006. Distribution and ecology of the Western Ecuador frog *Leptodactylus labrosus* (Amphibia: Anura: Leptodactylidae). Zoological Research 27(3): 225–234.
- Cisneros-Heredia, D. F. 2007. Distribution and natural history of the Ecuadorian snake *Dipsas andiana* (Boulenger, 1896) (Colubridae: Dipsadinae) with considerations on its conservation status. Russian Journal of Herpetology 14(3): 199–202.
- Cisneros-Heredia, D. F. 2007. A new species of glassfrog of the genus *Centrolene* from the foothills of Cordillera Oriental of Ecuador. Herpetozoa 20(1/2): 27–34.
- Cisneros-Heredia, D. F. and J. M. Guayasamin. 2006. Amphibia, Anura, Centrolenidae, *Centrolene mariaelenae*: Distribution extension, Ecuador. Check List 2(3): 93–95.
- Cisneros-Heredia, D. F. and R. W. McDiarmid. 2005. Amphibia, Centrolenidae, *Centrolene peristictum*, *Centrolene prosoblepon*, *Cochranella cochranae*, *Cochranella midas*, *Cochranella resplendens*, *Cochranella spinosa*, *Hyalinobatrachium muñozorum*: Range extensions and new provincial records. Check List 1(1): 18–22.
- Cisneros-Heredia, D. F. and R. W. McDiarmid. 2006a. A new species of the genus *Centrolene* (Amphibia: Anura: Centrolenidae) from Ecuador with comments on the taxonomy and biogeography of glassfrogs. Zootaxa 1244: 1–32.
- Cisneros-Heredia, D. F. and R. W. McDiarmid. 2006b. Review of the taxonomy and conservation status of the Ecuadorian glassfrog *Centrolenella puyoensis* Flores & McDiarmid (Amphibia: Anura: Centrolenidae). Zootaxa 1361: 21–31.
- Cisneros-Heredia, D. F. and R. W. McDiarmid. 2007a. Primer registro de *Hyalinobatrachium ruedai* (Amphibia: Centrolenidae) en Ecuador, con notas sobre otras especies congénicas. Herpetotrópicos 3(1): 21–28.
- Cisneros-Heredia, D. F. and R. W. McDiarmid. 2007b. Revision of the characters of Centrolenidae (Amphibia: Anura: Athesphatanura), with comments on its taxonomy and the description of new taxa of glassfrogs. Zootaxa 1572: 1–82.
- Cisneros-Heredia, D. F. and P. Meza-Ramos. 2007. An enigmatic new species of glassfrog (Amphibia: Anura: Centrolenidae) from the Amazonian Andean slopes of Ecuador. Zootaxa 1485: 33–41.
- Cisneros-Heredia, D. F. and M. H. Yáñez-Muñoz. 2007a. Amphibia, Anura, Centrolenidae, *Centrolene balionotum*, *Centrolene geckoideum*, *Cochranella cariticommatata*: Distribution extension, new provincial records, Ecuador. Check List 3(1): 39–42.
- Cisneros-Heredia, D. F. and M. H. Yáñez-Muñoz. 2007b. A new species of Glassfrog (Centrolenidae)

## NOTES ON GEOGRAPHIC DISTRIBUTION

- from the southern Andean foothills on the west Ecuadorian region. South American Journal of Herpetology 2(1): 1–10.
- Duellman W. E. 1980. The identity of *Centrolenella grandisonae* Cochran and Groin (Anura: Centrolenidae). Transactions of the Kansas Academy of Sciences 83: 26–32.
- Duellman, W. E. and P. A. Burrowes. 1989. New species of frogs, *Centrolenella*, from the Pacific versant of Ecuador and southern Colombia. Occasional Papers of the Museum of Natural History, University of Kansas 132: 1–14.
- Flores G. and R. W. McDiarmid. 1989. Two new species of South American *Centrolenella* (Anura: Centrolenidae) related to *C. mariae*. Herpetologica 45: 401–411.
- Goin, C. J. 1961. Three new centrolenid frogs from Ecuador. Zoologischer Anzeiger 166: 95–104.
- Grant, T. and M. Morales. 2004. *Centrolene litorale*. In IUCN 2004, 2004 IUCN Red List of Threatened Species. Electronic database accessible at <http://www.iucnredlist.org>. Captured on October 2007.
- Guayasamin, J. M. and E. Bonnaccorso. 2004. A new species of glass frog (Centrolenidae: *Cochranella*) from the lowlands of northwestern Ecuador, with comments on the *Cochranella granulosa* group. Herpetologica 60(4): 485–494.
- Guayasamin, J. M., M. R. Bustamante, D. Almeida-Reinoso, and W. C. Funk. 2006a. Glass frogs (Centrolenidae) of Yanayacu Biological Station, Ecuador, with the description of a new species and comments on Centrolenid systematics. Zoological Journal of the Linnaean Society 147: 489–513.
- Guayasamin, J. M., D. F. Cisneros-Heredia, M. H. Yáñez-Muñoz, and M. Bustamante. 2006b. Amphibia, Centrolenidae, *Centrolene ilex*, *Centrolene litorale*, *Centrolene medemi*, *Cochranella albomaculata*, *Cochranella ametarsia*: Range extensions and new country records. Check List 2(1): 24–26.
- Guayasamin, J. M. and L. Trueb. 2007. A new species of glassfrog (Anura: Centrolenidae) from the lowlands of northwestern Ecuador, with comments on centrolenid osteology. Zootaxa 1447: 27–45.
- Kok, P. J. R. and S. Castroviejo-Fisher. 2008. Glassfrogs (Anura: Centrolenidae) of Kaieteur National Park, Guyana, with notes on the distribution and taxonomy of some species of the family in the Guiana Shield. Zootaxa 1680: 25–53.
- Lynch, J. D. and W. E. Duellman. 1973. A review of the centrolenid frogs of Ecuador, with descriptions of new species. Occasional Papers of the Museum of Natural History, University of Kansas 16: 1–66.
- Noble, G. K. 1924. Some Neotropical batrachians preserved in the United States National Museum with a note on the secondary sexual characters of these and other amphibians. Proceedings of the Biological Society of Washington 37: 65–72.
- Sierra, R. 1999. Propuesta preliminar de un sistema de clasificación de vegetación para el Ecuador Continental. Quito, Proyecto INEFAN/GEF-BIRF EcoCiencia. 194 p.
- Yáñez-Muñoz, M. H. and A. Chimbo. 2007. Anfibios y Reptiles, p. 96–99 In R. Borman, C. Vriesendorp, W. S. Alverson, D. K. Moskovits, D. F. Stotz, and Á. del Campo (ed.). Ecuador: Territorio Cofan Dureno. Rapid Biological Inventories Report 19. The Field Museum, Chicago.

Received December 2007

Accepted February 2008

Published online March 2008