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Two New Species of *Centrolenella*, with a Brief Review of the Genus in Perú and Bolivia

Author(s): David C. Cannatella and William E. Duellman

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Museum of Natural History and Department of Systematics and Ecology, The University of Kansas, Lawrence, KS 66045, USA

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TWO NEW SPECIES OF *CENTROLENELLA*, WITH A BRIEF REVIEW OF THE GENUS IN PERÚ AND BOLIVIA

DAVID C. CANNATELLA AND WILLIAM E. DUELLMAN

ABSTRACT: Ten species of centrolenid frogs of the genus *Centrolenella* are recorded from Perú and Bolivia. Two species are named as new—*C. pluvialis* and *C. phenax*, both from cloud forests on the Amazonian slopes of the Andes in central and southern Perú. Limited material indicates the presence of five undescribed species in Perú. A key to the identification of named species is provided.

Key words: Anura; Centrolenidae; *Centrolenella*; Perú; Bolivia

It is becoming apparent that centrolenid frogs of the genus *Centrolenella* are highly diverse in the American tropics, especially in the cloud forests on the slopes of the Andes. Duellman (1977) listed 55 species of *Centrolenella*. Ten additional species have been named since that list (taxa named through 1974), and we are aware of many other new species awaiting description.

The purpose of this paper is to summarize our existing knowledge of this genus in the southwestern part of its range

in Perú and Bolivia. We describe two new species, review the status of the species already described, and provide a key for their identification. The definition of characters and arrangement of diagnoses follow Lynch and Duellman (1973); the webbing formula follows Savage and Heyer (1967). Natural history and color data are from the field notes of William E. Duellman. Acronyms for museum collections are: AMNH, American Museum of Natural History; BMNH, British Museum (Natural History); KU, University

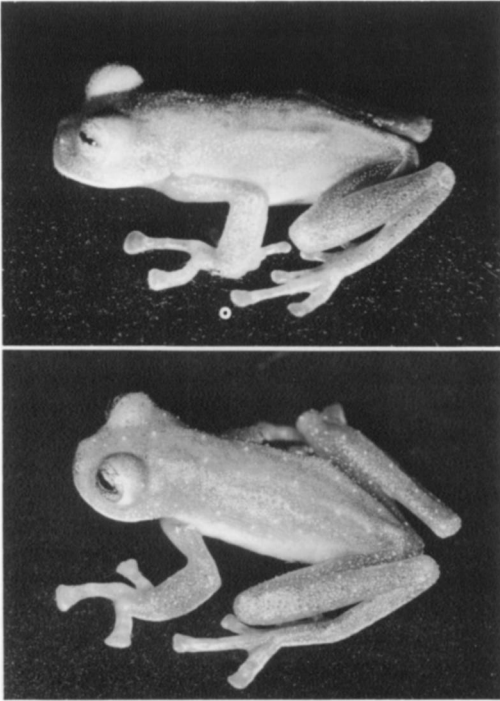


FIG. 1.—Top: *Centrolenella phenax*, KU 162263, holotype, adult male, SVL 21.8 mm. Bottom: *Centrolenella pluvialis*, KU 173224, holotype, adult male, SVL 25.6 mm.

of Kansas Museum of Natural History; LSU, Louisiana State University Museum of Zoology.

Centrolenella pluvialis sp. nov.

Holotype.—KU 173224 (Fig. 1), adult male, 25.6 mm SVL, from Pistipata, Río Umasbamba (= Río Santa María), 12 km SE Huyro, 1820 m, Departamento Cuzco, Perú (72°30' W, 13°03' S), obtained on 10 January 1977, by David C. Cannatella and William E. Duellman.

Paratypes.—KU 173225–27, same data as the holotype.

Referred specimens.—KU 173488 (cleared and stained skeleton), LSU 32464, Perú: Cuzco: Huyro.

Diagnosis.—(1) Prevomerine teeth absent; (2) color of bones in life unknown; (3) anterior half of parietal peritoneum white, elsewhere clear; visceral perito-

neum clear; (4) color in life green with pale cream dorsal flecks; in preservative, lavender with white spots; (5) modal webbing formula of fingers II 2⁺–3⁺ III 2.5–2.5 IV; (6) modal webbing formula of toes I 1.5–2⁺ II 1.5–2.5 III 1.5–3⁻ IV 3⁻–2⁻ V; (7) snout weakly truncate in dorsal and lateral views; (8) dorsal skin spiculate; (9) limbs lacking dermal folds; (10) humeral spine absent; (11) lower three-fourths of tympanum visible, dorsolaterally oriented with weak posterior inclination.

Ten species of Andean *Centrolenella* also have spiculate, lavender dorsal surfaces: Of these, *C. buckleyi*, *C. lynchi*, *C. johnelsi* and *C. grandisonae* differ from *C. pluvialis* by having humeral spines present in the males. *Centrolenella truebae* and *C. megacheira* can be distinguished from the new species by the dark flecks on the dorsum. *Centrolenella spiculata* differs by having prevomerine teeth and more extensive webbing; *C. ocellata* has large dorsal ocelli and a snout that is round in lateral profile. *Centrolenella siren* can be distinguished from *C. pluvialis* by a more truncate snout and yellow dorsal spots. *Centrolenella bejaranoi* differs from *C. pluvialis* in that the first finger is shorter than the second and the white dorsal spots in *C. pluvialis* are much larger than those of *C. bejaranoi*. Furthermore, the distribution of the white pigment of the parietal peritoneum is much more extensive in *C. pluvialis*.

Description.—Adult males of moderate size for centrolenid frogs; SVL 24.9–26.5 mm (\bar{x} = 25.4, n = 5); females unknown. Head slightly wider than body; snout short, weakly truncate in dorsal and lateral views; canthus round; loreal region concave; lips not flared; nostrils nearly terminal on snout, not flared, directed laterally; internarial region slightly concave. Eye moderately large, directed anterolaterally. Supratympanic fold distinct; lower three-fourths of tympanum visible, dorsolaterally oriented with weak posterior inclination. Prevomerine teeth absent; choanae round; tongue circular, with

slight indentation posteriorly; vocal slits present in males, extending from angle of jaw to midlateral edge of tongue.

Humeral spine absent; dermal folds lacking; order of fingers from shortest to longest 1=2-4-3; fingers barely webbed, with slight fringe and truncate discs; webbing formula II (2-2⁺)-3⁺ III (2.5-3)-2.5 IV; subarticular tubercles small, round, single; supernumerary tubercles absent; palmar tubercle round, single; thenar tubercle elliptical.

Hind limbs slender; tibia length 58.1-59.6% of SVL; tarsal fold absent; inner metatarsal tubercle small, flattened, elliptical; outer metatarsal tubercle absent; subarticular tubercles small, round; supernumerary tubercles absent; toes about one-half webbed; webbing formula I (1.5-2⁺)-2⁺ II (1⁺-1.5)-(2⁺-2.5) III 1.5-(2.5-3⁻) IV (3⁻-3⁺)-2⁻ V; discs rounded to weakly truncate, smaller than those on fingers.

Skin on dorsal surfaces of body and limbs bearing spicules of heterogenous sizes; spicules also present on upper eyelids, dorsal surface of snout, upper lip below the eye, and on the heels and anal region; skin of belly and ventral thighs granular; pair of large distinct subanal tubercles present; anal opening directed posteriorly at upper level of thighs; anal tubercles present, spiculate.

Color in preservative.—Dorsal surfaces lavender with white spots. Upper labial stripe with distinct white pigment. Ventral surfaces white or translucent.

Color in life.—Dorsal surfaces green with pale cream flecks; labial stripe and discs cream; anterior half of parietal peritoneum white, elsewhere clear; visceral peritoneum clear; color of bones unknown. Iris pale bronze with black flecks.

Distribution.—The species is known only from the type locality on the eastern slopes of the Andes in southern Perú (Fig. 2, locality 13).

Etymology.—The specific epithet (Latin) is an adjective meaning "of rain", and alludes to the rainy conditions coincident with centrolenid calling activity.

Remarks.—The type locality, the Cooperativa Pistipata, consists of coffee and tea plantations with remnants of cloud forest. The frogs were taken near our campsite at a bridge over the Río Umabamba (Río Santa María). They were calling on a rainy night, on herbs on a dripping cliff and from the upper sides of leaves over water, all adjacent to the river. The call is a shrill "bree-ee-ee-ee-ee". The egg clutches were on the tips of the upper surfaces of the leaves. This area is also the type locality of *Eleutherodactylus mendax* (Duellman, 1978).

Centrolenella phenax sp. nov.

Holotype.—KU 162263 (Fig. 1), adult male, 21.8 mm SVL, from Tutumbaro, Río Piene, 1840 m, Departamento Ayacucho, Perú (73°55' W, 12°42' S), obtained on 20 February 1975, by William E. Duellman and John E. Simmons.

Paratypes.—KU 162264, 162266-67, obtained on 20-21 February 1975, same locality and collectors as the holotype.

Diagnosis.—(1) Prevomerine teeth absent; (2) bones green in life; (3) parietal and visceral peritoneum clear; (4) in life, dorsal surfaces dark green with creamy white flecks; in preservative, lavender with white spots; (5) very scant webbing between fingers III-IV; (6) modal webbing formula of toes I 2-2.5 II 1.5-3 III 1.5-3⁺ IV 3-2⁻ V; (7) snout weakly truncate in dorsal and lateral views; (8) dorsal skin spiculate (see Discussion); (9) limbs lacking dermal folds; (10) humeral spine absent; (11) lower four-fifths of tympanum visible, dorsolaterally inclined with weak posterior orientation.

As noted in the account of *C. pluvialis*, several other species possess lavender spiculate dorsa: *Centrolenella buckleyi*, *C. lynchi*, *C. johnelsi* and *C. grandisonae* differ from *C. phenax* in having humeral spines in the males. Dark dorsal flecks distinguish *C. truebae* and *C. megacheira* from this new species. *Centrolenella ocellata* has large dorsal ocelli, a snout that is round in lateral profile, a longer snout, more vertically oriented

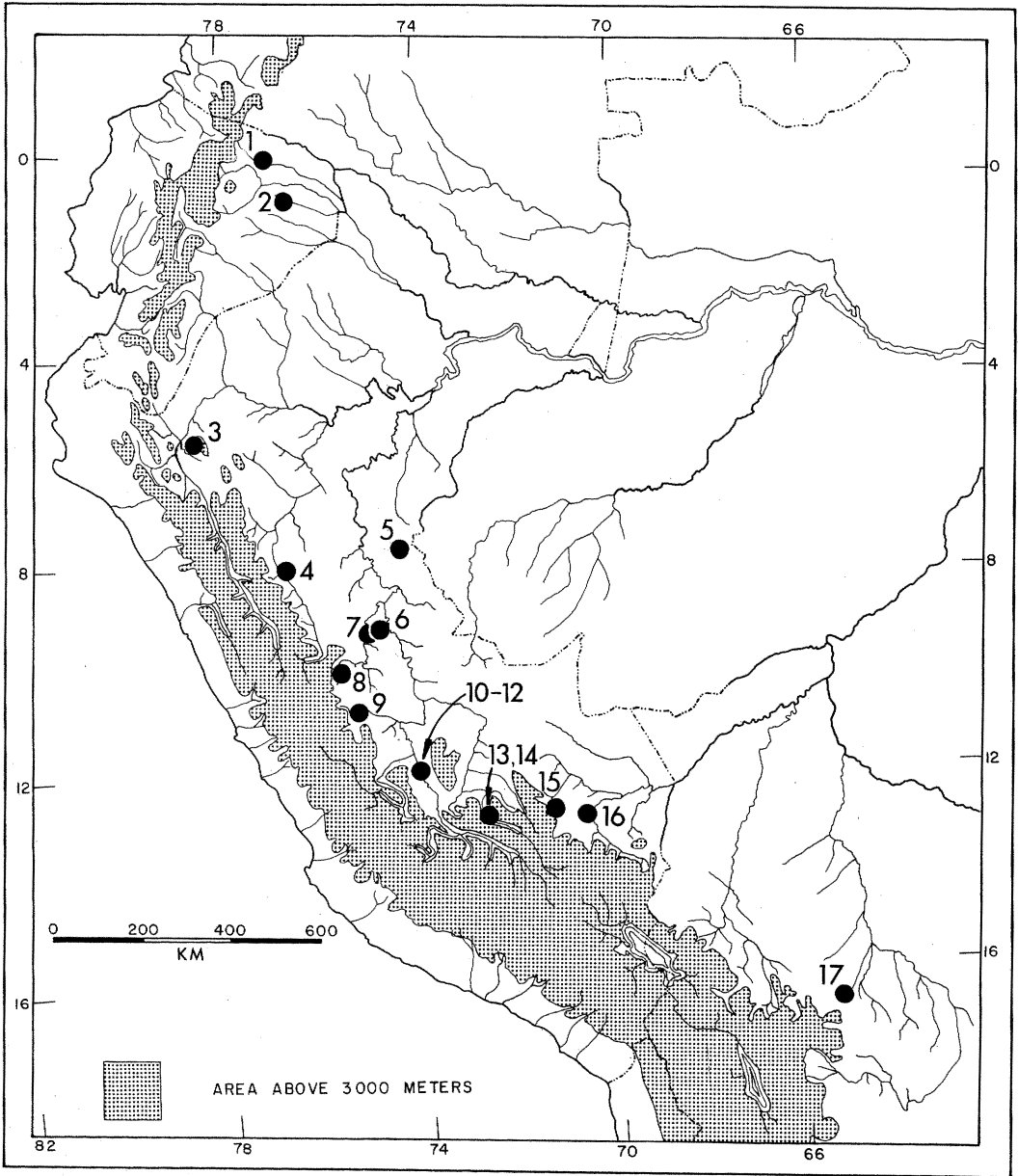


FIG. 2.—Map of Ecuador, Perú and Bolivia showing localities of *Centrolenella* (complete citations in text): 1, Santa Cecilia; 2, Río Yasuni; 3, Cordillera Colón; 4, Tocache; 5, Utiquinia-Tapiche; 6, Serranía de Sira; 7, Finca Panguana; 8, Huancabamba; 9, Valle de Perene; 10, Tutumbaro; 11, Huanhuachayoc; 12, San José; 13, Pistipata; 14, Huyro; 15, Río Cosñipata; 16, Quincemil, 40 km E; 17, Villa Tunari, 58.1 km SW.

tympanum, and relatively longer tibia; tibia length/SVL = 63.3 and 65.6% in the two specimens of *ocellata*, in contrast to 56.0–57.9% in *phenax*. Also, the combi-

nation of clear visceral and parietal peritoneum distinguishes *C. phenax* from these other centrolenids, except for some specimens of *C. spiculata* (see Discus-

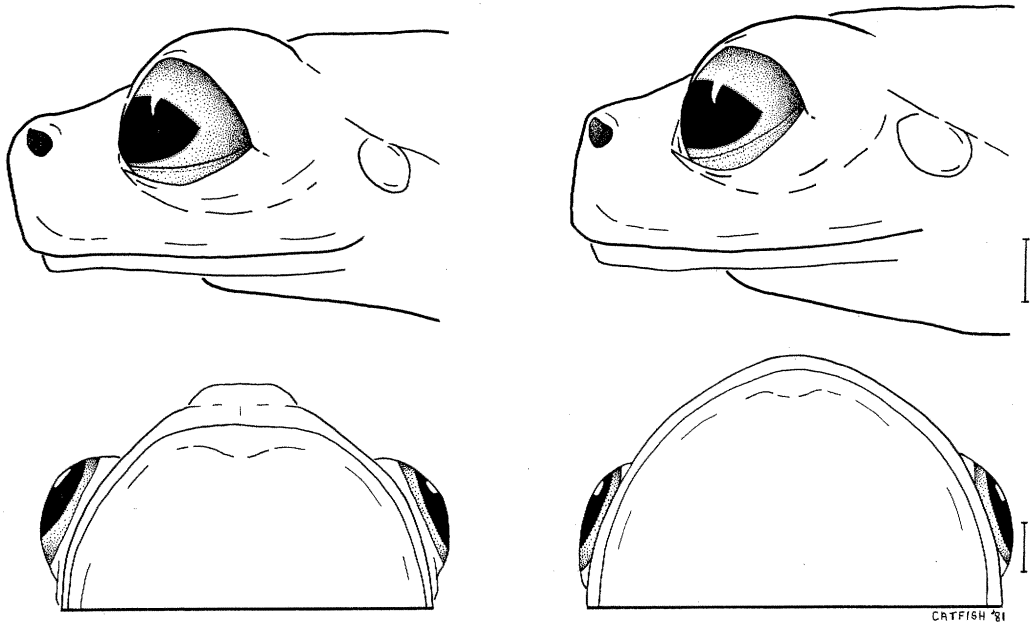


FIG. 3.—Lateral and ventral views of the head of *C. siren* (KU 146610, holotype), left, and *C. phenax* (KU 162264, paratype), right, illustrating differences in the shape of the snout. Scale equals 1 mm.

sion). However, *C. spiculata* possesses prevomerine teeth and more extensive webbing than *C. phenax*. *Centrolenella bejaranoi* has only a small portion of the parietal peritoneum pigmented, and it also differs from *C. phenax* in that the first finger is shorter than the second. Furthermore, in *C. phenax* the dorsal spots encompass a spicule and the surrounding flat area. In *C. bejaranoi*, the dorsal spots are much smaller and associated only with the upraised portion of the spicule proper. *Centrolenella phenax* differs from *C. pluvialis* in being a much smaller frog, with less webbing and no white peritoneal pigments or white band on the upper lip.

Centrolenella phenax was tentatively referred to *C. siren* by Duellman (1976), who noted that the Ecuadorian specimens had yellow spots, whereas the Peruvian specimens had white spots. Comparison of recently collected series of *C. siren* from Ecuador reveals the following consistent differences between the two

species: *Centrolenella siren* has yellow spots (white in *C. phenax*), a sharply truncate snout (subtruncate and slightly longer, Fig. 3), and white parietal peritoneum (clear). The spots in *C. siren* are seen under close examination to be small masses of white pigment in preserved specimens. In *C. phenax*, the spots are formed instead by the simple absence of the purplish melanophores from the area, rather than the presence of discrete spots of pigment.

Description.—Adult males of small size for centrolenid frogs; SVL 20.2–22.1 mm ($\bar{x} = 21.3, n = 4$). Head slightly wider than body; snout short, weakly truncate in dorsal and lateral views; canthus round; loreal region slightly depressed; lips not flared; nostrils almost terminal on snout, slightly protuberant, directed anterolaterally; internarial region depressed. Eye moderately large, directed anterolaterally. Supratympanic fold not distinct; lower four-fifths of tympanum visible, dorsolaterally inclined and with weak posterior

orientation. Prevomerine teeth absent, dentigerous processes questionably present in some; choanae round; tongue round with slight posterior indentation; vocal slits present in males, extending from angle of jaw to midlateral margin of tongue.

Humeral spine absent; dermal folds absent on forelimbs; order of fingers from shortest to longest 1=2-4-3; only scant webbing between fingers III and IV; fringes on fingers absent; finger discs broad, subtruncate; subarticular tubercles small, round, single; supernumerary tubercles absent; palmar tubercle round, single; thenar tubercle elliptical.

Hind limbs slender; tibia length 56.0-57.9% of SVL; dermal folds absent on hindlimbs; inner metatarsal tubercle elliptical, flattened; outer metatarsal tubercle absent; subarticular tubercles small, round; supernumerary tubercles absent; toes about one-third to one-half webbed; webbing formula I (2-2⁺)-2.5 II (1.5-1.75)-(2.75-3) III (1⁺-1.5)-(3-3⁺) IV (3⁻-3⁺)-(2⁻-2) V; discs rounded, smaller than those on fingers.

Skin on dorsal surfaces finely spiculate; spicules also on limbs, eyelids, tympanic region, and posterior portion of upper lip. Skin of belly and ventral thighs granular; flanks smooth. Anal opening directed posteriorly at upper level of thighs; a few small spicules in anal region; pair of large, indistinct subanal tubercles present.

Color in preservative.—Dorsal surfaces lavender with white spots; ventral surfaces translucent.

Color in life.—Dorsal surfaces dark green with minute creamy white flecks. Vocal sac green; bones green. Iris silvery white with black reticulations.

Distribution.—The species is known from the type locality (Fig. 2, locality 10).

Etymology.—The specific name *phenax* (Greek) is a noun in apposition, and signifies an imposter, in reference to the superficial resemblance of this species to *C. siren*.

Remarks.—On the two days when the specimens were taken, the range of tem-

perature was 14.0-28.5 C, and total rainfall was 13.5 mm. Tutumbaro is a tiny village about 5 km south of Ayna. The locality is in disturbed cloud forest in a river valley with bamboo, ferns and elephant ear plants (*Xanthosoma*), but no tree ferns and few bromeliads.

The frogs were calling at night from the upper sides of leaves of herbs and elephant ear plants within 1 m of a slow stream. *Centrolenella bergeri* was collected syntopically with *C. phenax* at this site.

DISCUSSION

The possibility always exists that isolated populations that are named as species are really nothing more than geographic variants. However, we note that the diagnostic characters used herein, with the exception of the peritoneal pigmentation, are invariant within species, assuming that one examines adults of the same sex. This observation holds true even for widespread species such as *C. fleischmanni*, *C. prosoblepon* and *C. buckleyi*.

We have found that the spiculate dorsal skin and the extent of the parietal pigmentation—two of the diagnostic characters—may be variable within some species. Examination of KU holdings of *C. buckleyi*, *C. grandisonae*, *C. lynchi*, *C. megacheira* and *C. truebae* demonstrates that in each of these species, the males are spiculate but the females possess no spicules, or only a few in the tympanic and postocular regions. Also, juveniles of the species have few or no spicules. An example of a spiculate dorsum can be seen in Fig. 1. Many, but not all, of the males of *C. buckleyi* are extensively spiculate. The non-spiculate males lack greatly distended vocal sacs, indicating that they were either not calling or not in breeding condition at the time of capture. This suggests that the degree of spiculation in males is related to breeding condition. These observations do not exclude skin texture as a useful taxonomic character. Rather, one must exercise

caution in comparing specimens of different sexes or breeding condition.

We have found also that the extent of white parietal peritoneal pigment is intra- and interpopulationally variable in two species. Two of five specimens of *C. spiculata* (LSU 25978–82) from the same population lack any white pigment on the parietal peritoneum or behind the eye. The other three specimens have the opaque white layer covering about half of the parietal peritoneum, and also behind the eyes. Other specimens of the same species (KU 162283–84) from another locality lack white pigment. At least two populations of *C. buckleyi* lack white pigment entirely, but among other populations the white pigment may be present immediately ventral to the heart only, or may cover up to half of the parietal peritoneum. In contrast, there is no variation with some species for which large sample sizes are available (e.g., *C. siren*, more than 60 specimens examined).

The variation noted above suggests that while the white pigment and the skin texture can be useful in diagnosing species, the diagnosis should not be based solely on these characters; furthermore, when large samples are available, the variation should be carefully assessed. The two species described herein can be properly diagnosed without reference to the extent of the peritoneal pigments.

Savage (1967) distinguished three groups of *Centrolenella* in Central America. Lynch and Duellman (1973) pointed out that several Ecuadorian centrolenids did not fit comfortably into Savage's groups. Likewise, some of the Peruvian frogs are not referable to these groups. At least three Peruvian species (*C. phenax*, *C. truebae* and *C. mariae*) differ trenchantly from other centrolenids in the lack of both parietal and visceral peritoneal pigments. (*C. truebae* and *C. mariae* were originally described as having white parietal peritoneum.) Furthermore, some specimens of *C. spiculata* and *C. buckleyi* likewise lack these pigments, and *C.*

bejaranoi has white pigment only on the portion of the parietal peritoneum immediately ventral to the heart (Cannatella, 1980). In view of the difficulty of assigning with confidence many of the South American *Centrolenella* to any of Savage's groups, it seems best to refrain from speculating on relationships of these two new species.

The following eight species have been recorded also from Perú and Bolivia. These brief accounts summarize the distribution (Fig. 2) and the specimens examined.

Centrolenella bejaranoi.—Known only from the type locality in the Yungas region of Bolivia. For description see Cannatella (1980). We have examined the type series, KU 182369–71, from 58.1 km (by road) SW Villa Tunari, 1980 m, Depto. Cochabamba, Bolivia 17°11' S, 65°50' W.

Centrolenella bergeri.—Known only from three localities in the cloud forests of Bolivia and southern Perú. We have examined the type series (KU 182363–68) and an egg clutch (KU 182372), all from the same locality as *C. bejaranoi*. In addition we have seen the following specimens from Perú: KU 162248–50, Cuzco: Río Cosñipata, 4 km SW Santa Isabel, 1700 m; KU 162251–58, 162259–60 (eggs), Ayacucho: Tutumbaro, Río Piene, 1840 m. For description see Cannatella (1980).

Centrolenella mariae.—We examined the only known specimen, the holotype, KU 174713 from Perú: Huánuco: Serranía de Sira, ±1550 m. A description is given in Duellman and Toft (1979).

Centrolenella midas.—Toft and Duellman (1979) noted without comment the occurrence of this species in Perú. The specimens (KU 172165–66, Perú: Huánuco: Finca Panguana, Río Lullapichis, 4–5 km upstream from Río Pachitea, 200 m) are the first reported from Perú and represent a significant range extension from the type locality in northern Ecuador. For a description see Lynch and Duellman (1973).

Centrolenella munozorum.—The range of this species of *Centrolenella* is sur-

passed only by that of *C. fleischmanni*. It is found in the Amazonian lowlands from northern Ecuador to southern Perú. We have examined the following in addition to the Ecuadorian specimens listed by Lynch and Duellman (1973): KU 154749, 172167–69, Perú: Huánuco: Finca Panguana, Río Lullapichis, 4–5 km upstream from Río Pachitea, ± 200 m; KU 152488–89, 155493–97, 155524 (larvae), 175504, Ecuador: Napo: Santa Cecilia, 340 m; KU 175215, Ecuador: Napo: Río Yasuni (200 km upstream from Río Napo); LSU 32468–73, Perú: Cuzco: 40 km E Quincemil. The latter specimens represent a significant southward range extension. Lynch and Duellman (1973) included a description of the species. Some of the specimens listed by Duellman (1976) have been referred to *C. bergeri* by Cannatella (1980).

Centrolenella ocellata.—The following Peruvian specimens were examined: LSU 25989–90, Ayacucho: Huanhuachayoc on Tambo-Valle de Apurimac Trail, 1630 m; BMNH 1912.11.1.19, Pasco: Huancabamba, 1700 m; AMNH 95216, Valle de Perene, 1200 m. Duellman (1976) provided a diagnosis based on the holotype. A female (KU 162262) with a SVL of 24.5 mm was referred to *C. ocellata* by Duellman (1976). This specimen, and KU 162265 (a juvenile), resemble *C. ocellata* in having many white spots on the shank and a hint of spots (although not really ocelli) on the dorsum. The specimens superficially resemble *C. phenax* in having a weakly truncate snout (round in *ocellata*) and clear parietal peritoneum (white in *ocellata*); however, the specimens differ from *C. phenax* in the shape of the head and several other rather subjective features; for this reason, we refer them tentatively to a possibly undescribed species.

Centrolenella spiculata.—AMNH 172250–51 from Perú: Valle de Perene, 1200 m represent the third record of this species, known from southern and central montane forests in Perú. Other specimens examined are LSU 25978–82, Ayacucho: San José, Río Santa Rosa, 1000 m,

and KU 162283–84, Cuzco: Río Cosñipata, 4 km SW Santa Isabel, 1700 m. For a description see Duellman (1976).

Centrolenella truebae.—Known only from the type locality in southern Perú—the Río Cosñipata, 4 km SW Santa Isabel, 1700 m, 13°05' S, 71°18' W, KU 162268–82. Duellman (1976) provided a description of the species.

In addition to the one undescribed species listed under *ocellata*, we are aware of four undescribed species from Perú represented by four poorly preserved individuals: AMNH 42630 and 42631 from Tocache, 457–762 m; AMNH 43577 from the Perú-Brasil frontier, Utiquinia-Tapiche; and LSU 37104, from Depto. Amazonas, Prov. Bagua, Cordillera Colón, SE La Peca, 1799–1867 m. Owing to the poor state of preservation of these specimens, we defer from describing them until better material becomes available.

Sympatry of species of *Centrolenella* occurs at the following localities (by number, Fig. 2): 1, 7 (*munozorum*, *midas*), 4 (two undescribed species), 9 (*ocellata*, *spiculata*), 10 (*bergeri*, *phenax*), 15 (*bergeri*, *spiculata*, *truebae*, one undescribed species), 17 (*bejaranoi*, *bergeri*).

KEY TO CENTROLENELLA OF PERÚ AND BOLIVIA

1. Dorsum in life pale green with diffuse yellow spots, in preservative creamy white; visceral peritoneum white, parietal peritoneum clear 2
- Dorsum in life green, with or without pale or dark flecks; in preservative lavender; visceral peritoneum clear 3
2. Snout subtruncate in lateral view; webbing formula of fingers III 2.25–2⁺ IV; webbing formula of toes I 1.5–2⁻ II 1.5–2 III 1.25–2.5 IV 2.75–1.5 V; SVL of males 22.7–26.5 mm *C. bergeri*
- Snout round in lateral view; webbing formula of fingers III 1.5–

- 1.25 IV; webbing formula of toes I 0—1 II 0—1.5 III 1—2 IV 2⁻—1 V; SVL of males 18.8—20.5 mm
..... *C. munozororum*
3. Dorsal pattern of many greenish black (dark purple in preservative) spots and a few cream flecks
..... *C. truebae*
Dorsum uniform green or marked with pale spots or flecks 4
4. Large pale dorsal spots (about one mm diameter), generally bordered by ring of dark pigment 5
Dorsum uniform green or with small (much less than 1 mm) pale spots 6
5. Prevomerine teeth present; first finger about as long as second; parietal peritoneum clear *C. mariae*
Prevomerine teeth absent; first finger distinctly shorter than second; parietal peritoneum white
..... *C. ocellata*
6. Outer fingers moderately to extensively webbed (III 2—2⁻ IV); prevomerine teeth present 9
Outer fingers scantily webbed (III 2.5—2⁺ IV or less); prevomerine teeth absent 7
7. Pale spots closely spaced (about 1 mm or less apart), encompassing spicule only; first finger shorter than second *C. bejaranoi*
Pale spots widely spaced (about 2–4 mm apart), encompassing spicule and surrounding skin; first finger about equal to second 8
8. Parietal peritoneum clear; spicules on dorsum generally homogeneous in size; dorsal spots distinctive; SVL of males 20.2–22.1 mm *C. phenax*
Parietal peritoneum white; spicules on dorsum distinctly heterogeneous in size; dorsal spots not distinctive; SVL of males 24.9–26.5 mm *C. pluvialis*
9. Dorsal skin spiculate; finger disc at least twice width of finger
..... *C. spiculata*
Dorsal skin not spiculate; finger discs only slightly wider than finger *C. midas*

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Museum of Natural History and Department of Systematics and Ecology, The University of Kansas, Lawrence, KS 66045, USA