TAXONOMIC AND NATURAL HISTORY NOTES ON FROGS OF THE GENUS CENTROLENELLA (AMPHIBIA: CENTROLENIDAE) FROM SOUTHEASTERN BRASIL AND ADJACENT ARGENTINA

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Abstract

Three species of Centrolenella are recognized from Southeast Brasil and adjacent Argentina: eurygnatha, parvula and uranoscopa. Variation is discussed for the species considered herein as C. uranoscopa. Cochranella lutzorum, dubia, vanzolinii and albotunica are proposed to be synonyms of C. uranoscopa and C. petropolitana is herein considered a synonym of C. eurygnatha. The tadpoles of C. eurygnatha and uranoscopa are described from well-preserved specimens. Diagnoses and distributions are presented for the three species and the habitats and zoogeography of C. eurygnatha and uranoscopa are briefly discussed.

Materials are now at hand to treat the taxonomy of the Centrolenella species of Southeast Brasil that were deferred previously (Heyer, 1978). Also, this opportunity is taken to present life history and distributional data that have been gathered for members of the genus Centrolenella under discussion.

The generic names used for the species involved include Hyla, Hylella, Hylopsis, Cochranella, and Centrolenella. Taylor and Cochran (1953), in their review, used the genus name Cochranella for members of the family Centrolenidae in Brasil. Duellman (1977), following Goin (1964) used Centrolenella for all the Brazilian species of centroidenids. Recently, Lynch (1981) suggested that Hylopsis was the oldest available name for the species Duellman (1977) had listed as Centrolenella. I concur with Savage and McDiarmid (ms) that Lynch's action was inappropriate and that Centrolenella should be used for the species in question.

Acknowledgments

The material for this paper came in part as a result of numerous field trips in the Atlantic Forest system of Brasil. Field associates on these trips included Ronald I. Crombie, Maria Christina Duchêne, Annelise Gehrau, Elena, Laura, and Miriam Heyer, Frances Irish, Oswaldo Peixoto, Francisca Carolina do Val, and P. E. Vanzolini. Their cheerful companionship and aid signally contributed to this paper.
Paul Viola spent one summer sorting tadpoles in my laboratory. Without that effort, the tadpoles reported herein would still be hiding within jars of unsorted larvae.

P. E. Vanzolini (Museu de Zoologia da Universidade de São Paulo, MZUSP) and George R. Zug (National Museum of Natural History, USNM) have carefully read over the manuscript. Frances Irish drew the tadpoles.

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All these individuals, institutions, and programs are sincerely thanked for their contributions.

**TAXONOMY**

Taylor and Cochran (1953) described 10 species of centrolenids as new from SE Brasil and indicated that two previous names were of doubtful status. Taylor and Cochran placed their 10 species in two groups — a short headed group and a spatulate headed group. The short headed group members, *C. bokermanni*, *delicateissima*, *divaricans*, *eurygnatha*, and *surda* have since (Heyer, 1978) been considered a single species, *eurygnatha*. The present taxonomic questions involve *albotunica*, *dubia*, *lutzorum*, *petropolitana*, *vanzolini*, and the two species considered by Taylor and Cochran to be of uncertain status as to which group they belonged, *Hylella parvula* Boulenger, 1895, and *Hyla (Hylella) uranoscopa* Müller, 1924.

*Cochranella petropolitana* Taylor and Cochran was previously thought to be a member of the spatulate headed group (Heyer, 1978). Now that members of the spatulate headed group have been examined in detail, I believe *C. petropolitana* to be a member of the short headed species group. The rationale for this decision is presented below. This rationale is followed by discussion of examination of the types of *Hylella parvula*. Next, intraspecific variation is analyzed for recent samples of spatulate headed *Centrolenella* followed by discussion of the type specimens pertaining to the spatulate headed species, including *Hyla uranoscopa* Müller, a member of this group.

**Cochranella petropolitana** Taylor and Cochran, 1953

The type (USNM 101135) is in very poor shape and was so when described by Taylor and Cochran (“The specimen is indifferently preserved and in the region of the tip of the snout and on hand and foot the characters are somewhat obscured”. 1953:1637). Most of any possible diagnostic characters are unrecognizable. The snout region has been either destroyed through dissection or deteriorated because of poor preservation. It is impossible to determine the shape of the snout. The outer ulnar, tarsal, and foot areas are so poorly preserved that the condition of any fringes or ridges is indeterminate. Hand and foot webbing have rotted away as has the flesh of some of the digits. The only character somewhat evident in the approximate 23.1 mm SVL female is the dorsal pattern and part of it is scraped away, leaving light areas on the dorsum. These light blotches previously led me to believe that the specimen had a variegated pattern and was a member of the spatulate headed group (Heyer, 1978). In the areas of an intact dorsal pattern, the pigment cells are nearly uniformly distributed. Such a pattern is characteristic of *C. eurygnatha*. The spatulate headed members have a random or clumped distribution of pigment cells
dorsally, resulting in a variegated pattern when viewed with the unaided eye. Of the characters used by Taylor and Cochran to diagnose the species only one is distinct: venter with striae, The other diagnostic characteristics are preservation artifacts (eye tunic color, body depressed), or fall within *C. eurygnatha* as discussed previously (Heyer, 1978) (lack of anal decoration, tympanum distinctiveness and direction). The ventral striae also appear to be artifacts of preservation: the belly granules have been compressed laterally during preservation to arrive at the condition seen in the type. Thus, *Cochranella petropolitana* Taylor and Cochran is considered a synonym of *Centrolenella eurygnatha*.

**Hylella parvula** Boulenger, 1895

Boulenger (1895) described *H. parvula* on the basis of two specimens, one from Lages, Santa Catarina collected by Michaelis, the second from Theresopolis, presented by Dr. Goeldi. I do not concur with Cochran (1955: 184) that Goeldi's specimen is a *Sphaenorhynchus*, but I do agree that the specimen was from Teresópolis, Rio de Janeiro. Bokermann (1966) and Duellman (1977) listed the specimen as from Theresopolis (= Queçaba), Santa Catarina. Papavero (1973) clearly indicates that Goeldi lived at "Colonia Alpina" in Teresópolis, Rio de Janeiro from 1889-1894 and, as far as is known, did not collect in the State of Santa Catarina. Both types are *Centrolenella*, but in very different states of preservation. Michaelis' specimen is in reasonably good shape, whereas Goeldi's specimen is so desiccated that species identification is problematical. Michaelis' specimen (probably the one illustrated by Boulenger) is, thus, chosen as the lectotype of *Hylella parvula* Boulenger.

The lectotype (BMNH 1947.2.12.67) is a 17.7 mm juvenile (based on lack of vocal slits and no visible eggs through belly wall) specimen belonging to the short headed group. There is no indication of a fleshy lip ridge. The snout appears to have been rounded in profile in life. Ulnar, outer tarsal, heel or foot ridges are absent. A granular seat patch is present, and the tympani are completely hidden. All of these characters are shared with individual members of the short headed species of *Centrolenella*. The type of *parvula* differs from other short headed *Centrolenella*, however. The dorsal pattern of *parvula* is reticulate, not uniform and the reticulateness of the pattern is due to a clumped scattering of pigment cells, with areas lacking pigment cells (as in the spatulate headed species). A sample of *C. eurygnatha* from Novo Horizonte, Santa Catarina, demonstrates a range of dorsal patterns from uniformly scattered pigment cells to a pattern of distinct dark spots on a ground of uniformly scattered pigment cells. The sample of *C. eurygnatha* from Novo Horizonte has the most distinctively patterned individuals known for the species (the darkly spotted individuals clearly intergrade with uniform individuals). Even these distinctive individuals of *C. eurygnatha* differ from the clearly reticulate pattern found in the lectotype of *H. parvula*, however. At this time it seems best not to force the lectotype of *H. parvula* into the same biological species previously recognized as *C. eurygnatha* (Heyer, 1978). Thus, *parvula* is recognized as a distinct species, keeping in mind that new information based on fresh material, especially from the Lages area, could well require a revision of this taxonomic position.

The extremely poor condition of the Goeldi specimen (BMNH 1947.2.12.68) is likely the reason that Cochran (1955) thought the specimen was a member of the hylid genus *Sphaenorhynchus*, rather than a member of the family Centrolenidae. The snout shape of *Sphaenorhynchus* is distinctively and characteristically acutely protruding. The snout of the Goeldi specimen is
obtuse, as in the spatulate headed *Centrolenella* species. As Boulenger (1895) pointed out, specimens of *Sphaenorhynchus* do not have externally visible tympana; the tympanum is distinct in the Goeldi specimen and marked with white. Cochran (1955) included the Goeldi specimen under *Hyla aurantiaca orophila*. The Goeldi specimen is an approximately 16 mm SVL juvenile (no vocal slits), but clearly with the adult body form. *Sphaenorhynchus orophilus* do not metamorphose until about 18 mm SVL and at that size still have distinct tails. The dorsal pattern of the Goeldi specimen is reticulate with additional small white punctations, the same pattern as found in members of the spatulate headed *Centrolenella* species and distinct from all known *Sphaenorhynchus*. The webbing states are difficult to evaluate because of the desiccated nature of the Goeldi specimen; nonetheless, they appear to be more consistent with *Centrolenella* than *Sphaenorhynchus*. The only character that allies the Goeldi specimen with other *Centrolenella* species is the dorsal pattern, mentioned above. Other diagnostic characters, such as peripheral fringing, snout shape, and anal decoration are in such poor condition in the Goeldi specimen that they cannot be evaluated meaningfully. My best estimate is that the Goeldi specimen represents the same species represented by the spatulate headed specimens from Teresópolis discussed in the following section. Thus, Boulenger’s two specimens of *parvula* are believed to represent two distinct species of *Centrolenella*.

**Variation in Spatulate Headed Specimens**

Taylor and Cochran (1953) had a total of 6 specimens for their 4 species recognized herein as belonging to the spatulate headed group. Most of the specimens were poorly preserved at the time they studied them. Obviously, Taylor and Cochran did not have enough material to determine the degree of intraspecific variation that might be involved in any of their taxa. Adequate materials are now at hand to analyze intraspecific variation for the spatulate headed *Centrolenella* of SE Brasil. The sample sizes, adequate for present purposes, are not extensive enough to describe any patterns of geographic variation, however.

The approach used here is the same as that used previously (Heyer, 1978). The characters that Taylor and Cochran used to diagnose their taxa of spatulate headed centrolenids are examined in the samples at hand (exclusive of types), most importantly, in the samples represented by a series of males from single localities. The samples represented by more than two individuals are:

- Rio de Janeiro, environs of Rio de Janeiro — 8 males
- Rio de Janeiro, Teresópolis — 7 males, 1 female
- São Paulo, Boracéia — 6 males, 1 female
- Santa Catarina, Novo Horizonte — 9 males.

Of the characters used by Taylor and Cochran, one is not analyzed herein. Eye tunic color differences were considered an artifact of preservation for members of the short headed group (Heyer, 1978) and are so considered for members of the spatulate headed group.

**Tympanum direction**

The tympanum is directed upwards in all of the specimens examined. In most individuals, the tympanum, particularly the lower half, is directed strongly upwards. A few individual specimens from Rio de Janeiro, Boracéia,
and Novo Horizonte have the lower part of the tympanum directed more laterally than the other individuals from the same localities.

**Interorbital elevation**

Two individuals from Rio de Janeiro have elevated interorbital areas, three individuals have slightly raised interorbitals, and three individuals do not have raised interorbital areas. All individuals from Teresópolis and Boracéia either have slightly raised or not elevated interorbital areas. The Novo Horizonte specimens were all characterized as having slightly elevated interorbital areas.

**Forearm enlargement**

All individuals examined, of both sexes, have enlarged, or thickened forearms.

**Outer ulnar, tarsal, and foot folds/ridges**

The outer ulna, tarsus, and foot have distinct folds or ridges, which are better developed than in *C. eurygnatha*. The folds are often scalloped and in the more recently collected specimens outlined by brilliant white. It appears that the condition in life is for the folds to be highlighted with white, but that the white is lost in preservation after a number of years.

**Calcar**

All specimens have a calcar fold; it varies from straight to serrate with one or two areas pronounced into calcar tubercles. As for the outer ulnar, tibial and foot folds, the calcar fold is outlined by bright white in the most recently collected specimens.

**Anal decoration**

In all well preserved specimens, there are a pair of pronounced horizontal flaps under and just on either side of the anus; each flap is highlighted with white pigment in recently collected specimens. In two individuals in which the hind legs are preserved straight behind the body, there are vertical folds on either side of the anus with median ridges extending towards the midline below the anus. This latter condition is considered an artifact of preservation.

**Tympanum pattern**

All of the Teresópolis specimens have white pigment on the tympanum. Just more than half of the individuals from Rio de Janeiro, Boracéia, and Novo Horizonte also have white spots on the tympanum. The other specimens lack white pigment and the tympanum pattern is not different from the pattern surrounding the tympanum.

**Dorsal pattern**

All specimens examined had a reticulate dorsal pattern. A few individuals from Teresópolis, Boracéia, and Novo Horizonte also had white punctations or spots dorsally.

**Upper arm pigmentation**

This character varies within samples. Most specimens have a scattering of pigment cells near the elbow region. One or two individuals each from Teresópolis, Boracéia, and Novo Horizonte have a rather profuse scattering of pigment cells on the upper arm. One or two individuals each from Rio de Janeiro, Teresópolis, and Boracéia lack pigment cells on the upper arm.
Hand and foot web

Variation of hand and foot webbing, expressed in the webbing formula (Tables 1, 2) indicates that there is little, if any, difference in male foot webbing among samples from the four localities. All other individuals examined, including females, have webbing formulae that fall within the range of variation found in the males from the four localities tabled.

**TABLE 1**

Hand webbing formulae for spatulate headed *Centrolenella* samples. Standard notation except N = no web, T = trace of web only. For each sample, minimum figures above, maximum below, modal values in between.

<table>
<thead>
<tr>
<th>Location</th>
<th>I</th>
<th>N</th>
<th>II</th>
<th>T</th>
<th>III</th>
<th>2 1/4 — 2</th>
<th>2 1/2 — 2+</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 — 3+</td>
<td>2+</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2+ — 2</td>
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<td>Teserópolis</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2 1/3 — 2+</td>
<td>IV</td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
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<td>IV</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>2 3/4 — 2+</td>
<td>IV</td>
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</table>

Snout length

Snout length was measured using an ocular micrometer to determine the length of the line from mid-nostril to the eye and the length of the line from the tip of the snout to mid-nostril. The ratio of the former divided by the latter is used as an index of snout length. The large degree of within population variability of this index precludes any meaningful conclusions of interpopulation variability (Table 3). All other specimens examined fall within the range of variation exhibited by the four larger samples with the exception of a single female, MZUSP 34636, which has a calculated index of 69%.

Size and measurements

*Size.* — The ranges of males from the four larger samples exhibit considerable size overlap (Table 3). The other males examined fall within the size ranges exhibited by the males from the four larger samples. The two females examined measure 22.5 and 25.4 mm SVL.

*Measurements.* — The measurements for head length, head width, femur, tibia, and foot are given as percentages of SVL. There is notable overlap in ranges among the four larger samples (Table 3). All measurements taken on the other specimens examined, including females, fall within the ranges exhibited by the four larger samples of males.

Color in life

Color notes are only available for males from two localities. A male from Teserópolis (USNM 232350) had the following life colors: iris silver; dorsum green with white dots; sides variegated; digits yellowish; white peritoneum over heart, liver, and large intestine, guts visible ventrally through body wall between liver and large intestine. A male, USNM 232353, from
### TABLE 2

Foot webbing formulae for spatulate headed *Centrolenella* samples. Standard notation except N = no web, T = trace of web only. For each sample, minimum values above, maximum below, modal values in between.

<table>
<thead>
<tr>
<th>Location</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
<th>Sample 4</th>
<th>Sample 5</th>
<th>Sample 6</th>
<th>Sample 7</th>
<th>Sample 8</th>
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<td>2+</td>
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<td>2-</td>
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<td>1</td>
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<td>1 1/2</td>
<td>2 1/2</td>
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<td>2-</td>
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<td>Novo Horizonte</td>
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<td>2 3/4</td>
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</table>

### TABLE 3

Measurements (in mm) and ratios (in %) of males for four samples of *Centrolenella*. Ranges followed by means (in parentheses).

<table>
<thead>
<tr>
<th>Location</th>
<th>Nostril-snout/Eye-nostril</th>
<th>SVL</th>
<th>HL/SVL</th>
<th>HW/SVL</th>
<th>Femur/SVL</th>
<th>Tibia/SVL</th>
<th>Foot/SVL</th>
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<tr>
<td>Rio de Janeiro</td>
<td>83-133(94.8)</td>
<td>21.3-23.5(22.7)</td>
<td>32-36(34.2)</td>
<td>33-36(34.2)</td>
<td>51-58(53.8)</td>
<td>53-60(55.0)</td>
<td>43-48(44.8)</td>
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<td>Teresópolis</td>
<td>78-109(91.7)</td>
<td>23.3-24.8(24.0)</td>
<td>34-38(35.4)</td>
<td>33-36(34.7)</td>
<td>50-55(52.1)</td>
<td>51-54(52.7)</td>
<td>44-50(46.7)</td>
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<td>Boracéia</td>
<td>82-100.9(1.6)</td>
<td>19.8-23.5(21.8)</td>
<td>35-37(36.0)</td>
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<td>78-91 (83.3)</td>
<td>21.3-23.9(22.3)</td>
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<td>33-38(35.3)</td>
<td>49-57(52.5)</td>
<td>51-58(53.8)</td>
<td>40-47(43.7)</td>
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16 km W Pirabeiraba, Santa Catarina, had the following life colors: iris silver with gray network; dorsum green with silvery network; fingers and toes with a suggestion of orange; tops of tarsal ridge and edge of heel flap white, ulnar ridge barely white outlined; heart, liver, and intestines covered with white peritoneum. A second male from this locality, US field 7499 (to be deposited in MZUSP), had similar coloration except the thighs had an orange flesh color.

Advertisement call

Advertisement calls are available for specimens recorded at four different localities in Brazil in addition to the calls reported by Barrio (1968) from Argentina. All calls are similar in having a dominant portion of the call in the 4500-5000 Hz range and having pulsatile notes with from 3-6 discernible pulses per note (Table 4, Figure 1). There is slight variation in the number of notes per call and note duration (Table 4), but the differences could just as well be due to sampling error as due to geographic-populational differences. For example, some of the individuals recorded at Boracéia only gave one note per call during the recorded period, other individuals, recorded on different nights, gave the entire range of one to four notes per call during the recorded period. Only one short time segment was recorded for a single individual from near Campo Alegre; additional recordings would likely give a range of notes per call similar to the other samples.

![Figure 1. Advertisement calls of spatulate headed Centrolenella. Upper figure (analysed with Kay Sonograph 6061 B) sonograms (audiospectrograms) of Centrolenella, from (A) near Teresópolis, Rio de Janeiro, Brasil, recorded 7 December 1977, specimen USNM 232350, calling from plastic bag; (B) 16 km W (by road) of Pirabeiraba on BR 280 to Campo Alegre, Santa Catarina, Brasil, recorded 18 December 1978, recorded specimen not captured, specimens USNM 232353 and US field 7499 (to be deposited in MZUSP) taken from sam - strum; (C) 3 km W (by road) of Campo Alegre on BR 280 to São Bento do Sul, recorded 20 December 1978, specimen not captured, Lower figure (analyzed with Kay Digital Sonograph 7800) showing sonagram and oscillographic display of wave form (of second note shown on sonagram) of Centrolenella from Boracéia, São Paulo, Brasil, recorded 13 November 1971 by G. Miller and B. Williamson. Total length of signal analyzed with wave form of call is .053 s.](image-url)
TABLE 4

Call characteristics of spatulate headed *Centrolenella* from 5 localities. Air temperatures in degrees Celsius. See legend for Figure 1 for full locality and specimen data for Brasilian calls. Data for Argentine specimens from Barrio (1968).

<table>
<thead>
<tr>
<th>Locality</th>
<th>Air Temp.</th>
<th>Dominant Frequency in Hz</th>
<th>Number of notes per call</th>
<th>Note duration in s</th>
<th>Note Pulsative</th>
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<td>nr. Teresópolis</td>
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<td>4400-5100</td>
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<td>.05-.09</td>
<td>+</td>
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<td>3900-5100</td>
<td>1-4</td>
<td>.04-.05</td>
<td>+</td>
</tr>
<tr>
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<td>4200-4700</td>
<td>1-3</td>
<td>.04-.05</td>
<td>+</td>
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<td>+</td>
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<td>Manuel Belgrano</td>
<td>16.5</td>
<td>4000-5300</td>
<td>1-3</td>
<td>.07-.10</td>
<td>+</td>
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</tbody>
</table>

All calls, including those reported by Barrio (1968), are similar and are interpreted as belonging to a single biological species.

Summary of variation

Direct examination of the specimens available, together with analysis of variation of morphology, life color, and advertisement calls, leads to the conclusion that a single species is represented by the spatulate headed specimens examined in this study, exclusive of types.

**TYPE SPECIMENS**

*Hyla uranoscpa* Müller, 1924

I examined the type, ZM 81/1921, in Munich in September 1982, comparing it with USNM 232353, which was hand carried for comparison. The type is a well preserved female, with eggs visible through the belly wall. Measurements are: SVL 25.5; head length 8.5; head width 9.0; femur length 13.7; tibia length 13.9; foot length 11.5 mm. The (left) hand webbing formula is I N II T III 2 1/4 — 2 IV. The (right) foot webbing formula is I 1 2/3 — 2+ II 1 1/3 — 2+ III 1+ — 2 1/2 IV 2 1/3 — 1 1/2 V. All measurements and webbing conditions fall within the variation for specimens discussed above. The type and the specimen brought for comparison matched well. The dorsal pattern of the type is distinctive with a ground color of tan and the reticulate markings mauve. The type represents the same spatulate headed species discussed above and has the oldest available name for it.

*Cochranella lutzorum* Taylor and Cochran, 1953

Taylor and Cochran based this species upon a single individual (USNM 101134) without indicating the sex of the specimen; it is a female. The characters Taylor and Cochran used to diagnose *lutzorum* in the key and species diagnosis are:

1) Venter longitudinally striate anteriorly.
2) Vertical ridges curving across thighs to ventral surface behind vent.
3) Tympanum covered with skin, outline clearly visible, directed nearly vertically upward.
4) Heel to a point 2 mm beyond tip of snout.
5) Eye with white tunic.
6) No pigment on upper arm.

Character (5) is considered an artifact of preservation. The holotype is adequately preserved in the sense that no apparent rotting has taken place, but the specimen is desiccated and not well preserved enough to clearly distinguish certain features. The ventral condition is apparently an artifact of preservation in that the granules are compressed laterally anteriorly to produce the striae. The legs are preserved in a position not quite straight behind the body. As such, the anal decoration consists of pronounced vertical folds, as seen in other specimens with the legs extending straight behind the body (discussed previously). On either side of the anal flaps, there are a few vertical skin folds. These folds also appear to result from the positioning of the legs at the time of preservation. The tympanum has the same upward orientation seen in other specimens; the only difference is that the desiccated condition of the type emphasizes the tympanic annulus. The hind limb ratios are femur/SVL 55%, tibia/SVL 58%, foot/SVL 44%. These values fall within the range of variation encountered in the other spatulate headed specimens (Table 3) and are not diagnostic. Contrary to Taylor and Cochran, I find a few pigment cells on the upper arm near the elbow; the same condition as detailed previously for most of the spatulate headed specimens.

Thus, none of Taylor and Cochran's diagnostic characters for *C. lutzorum* are valid; *C. lutzorum* represents the same species as the recent specimens examined, i.e., *uranoscoopa*.

Taylor and Cochran give as the SVL for *lutzorum* 28 mm; I measure 25.8 mm. These differences are due to how much stretching of the specimen is done while in hand for measurement, due to the soft, but desiccated, nature of the holotype. The hand web formula is I N II T III 2 1/4 — 2 1/4 IV; the foot web formula is I 1 1/2 — 2+ II 1+ — 2 1/3 III 1+ — 2 1/2 IV 2 1/2 — 1+ V.

**Cochranella dubia** Taylor and Cochran, 1953

This taxon was based on a unique male specimen (USNM 96722), although Taylor and Cochran did not comment on the sex of the individual. The characters Taylor and Cochran used to diagnose *dubia* in the key and species diagnosis are:

1) Interorbital area elevated and sloping rather abruptly to base of snout.
2) Nostril nearer eye than to mid-point on lip.
3) Anal decoration lacking.
4) Heel reaching to tip of snout or slightly beyond.
5) Eye with white tunic.
6) Finger and toe disks smaller than other spatulate headed forms, sub-triangular rather than transversely oval.

The specimen had been desiccated and is now soft and in poor condition, particularly the periphery. Character (5) is an artifact of preservation, thus not a taxonomically useful character. The interorbital area of the type is elevated, but no more so than that found in the comparative samples. In contrast to Taylor and Cochran, I do not find the nostril to be nearer the eye than the tip of the snout. I measure the nostril-snout distance to be approximately 83% the eye-nostril distance and this falls within the range of the other spatulate headed specimens (Table 3). The condition of the anal region, presence of a calcar fold, as well as the state of the outer ulnar,
tibial, and foot ridging is uncertain due to the poor state of preservation of the specimen. There are certainly no obvious flaps or folds in these regions on the holotype. The hind limb ratios are femur/SVL 51%, tibia/SVL 53%, foot/SVL 46%. These values are within the range of variation of the other spatulate headed samples (Table 3) and are not diagnostic. The finger and toe disks are not as large as most of the other spatulate headed specimens. The shape differences appear to be a consequence of the size differences. The disk differences are a matter of degree (not kind) and form the small end of a disk size continuum.

The poorly preserved nature of the holotype makes unambiguous association with other specimens difficult. In fact, of all the characters that differentiate the short snouted from spatulate snouted specimens, only one is clear enough to place dubia in the spatulate headed group: the peripheral upper lip ridge. The dorsal pattern is reticulated as in the spatulate headed group (but also as in parvula). With the exception of disk size and shape, the other characters that might differentiate dubia from other spatulate headed members are herein interpreted as artifacts of preservation. The difference of disk size and shape is interpreted as being within the normal range of variation of the spatulate headed species, for which the oldest available name is uranoscopa.

Taylor and Cochran (1953) gave the SVL as 23.5 mm; I measure 22.6 mm. This difference is trivial due to the poor state of preservation of the specimen. The hand web formula is I N II T III 2 1/2 — 2 1/4 IV; the foot web formula is I 2— — 2+ II 1 1/3 — 2 1/2 III 1 2/3 — 2 1/3 IV 2 1/3 — 1 1/2 V.

**Cochranella vanzolinii** Taylor and Cochran, 1953

Taylor and Cochran (1953) based vanzolinii on a single, well preserved, male specimen (MZUSP 2952), although they did not indicate the sex of the holotype. The characters Taylor and Cochran used to differentiate vanzolinii in the key and the species diagnosis are:

1) Small size.
2) Yellow-cream spot almost covering tympanum.
3) Upper eyelid heavily pigmented with purple.
4) Lip bordered by a row of cream tubercles.
5) Upper arm very slender, forearm greatly thickened, permanently flexed (?).
6) Heel to tip of snout.
7) Very short anal flap.
8) A pair of enlarged postanal granules.
9) Internal choanae small.
10) Fingers flattened, truncate at tips, the tips only slightly wider than digits, distinctly wider than toes.

Taylor and Cochran measured the SVL as 20 mm, I measure 19.9, although an accurate measurement is impossible, as the specimen is curled in preservation. The specimen occupies the lower end of the range of size variation exhibited by other spatulate headed males from Boracéia (Table 3). The small size is interpreted herein as falling within the range of variation for the spatulate headed species and does not differentiate vanzolinii from other members of the group. A cream tympanum spot is commonly found in members of this group. This character, [as well as (3), (4), and (10)] is
characteristically found in well preserved and maintained specimens, but stood out in Taylor and Cochran's material because it was the only relatively well preserved specimen of the spatulate headed group they examined. The upper arm and forearm conditions are shared with other specimens of the comparative sample and are not diagnostic. The hind limb ratios are femur/SVL 58%, tibia/SVL 61%, and the foot/SVL 50%. All these values occupy the upper end of the range (Table 3), but appear to be part of a continuum and are also not diagnostic. The anal flap is short in the holotype but the manner of its preservation deaccentuates the anal area. I do not find any granules or anal flap differences that differ from other specimens when preservation differences are taken into account. The internal choanae appear small in the holotype, even when compared with other specimens from Boracéia. This may be due as much to the angle of observation required to see the holotype's roof of the mouth as any real differences. The differences observed in the choanae are not considered to represent specific differences. None of the characters used by Taylor and Cochran are, thus, considered diagnostic of specific differentiation between vanzolinii and the other spatulate headed forms, for which the oldest available name is uranoscopa.

The hand web formula of the holotype is I T II T III 2+ — 2+ IV; the foot web formula is I 1+ — 2 II 1 — 2 1/4 III 1 1/4 — 2 1/3 IV 2 1/2 — 1 V.

Cochranella albotunica Taylor and Cochran, 1953

_Cochranella albotunica_ was described on the basis of three "indifferently preserved" males (USNM 96557, 96559, 96723) (Taylor and Cochran did not report the sex of the specimens). Many of the specimens in the Lutz collection (the three specimens were collected by Bertha Lutz and presumably given to Cochran during her visit to Rio de Janeiro) are soft because Adolfo Lutz preferred to keep specimens in a lightly glycerinated alcohol solution rather than either alcohol or formalin. It appears that the three type specimens were desiccated either before preservation or when first preserved, then subsequently softened.

The characters Taylor and Cochran used to differentiate _albotunica_ in the key and the species diagnosis are:

1) Tympanum small, at least partly distinct, directed outward and upward.
2) Heel reaching to a point much beyond snout.
3) No row of tubercles on lip.
4) Suprascapulae very broad.
5) Large.
6) Prominent anal pads.
7) Nostrils a little closer to eye than to median point on lip.
8) Outer fingers 1/5 webbed.
9) Choanae large.

Characters (1) and (7) do not differ from the comparative samples of spatulate headed specimens. The hind limb ratios are femur/SVL 58 (holotype), 53, 54% (paratypes), tibia/SVL 58, 55, 56%, foot/SVL 47, 42, 46%. The holotype has a longer hind limb than the paratypes, but all ratios are within the range of variation of the other specimens examined (Table 3) and do not differentiate _C. albotunica_ from them. In all well preserved spatulate
headed specimens, a fleshy ridge on the upper lip accentuates the spatulate shape of the head. This ridge is either smooth or irregular. The irregular condition is the situation that Taylor and Cochran described as upper lip tubercles. The appearance as tubercles is heightened when they are highlighted with white pigment and the adjacent part of the lip ridge is not. In poorly preserved specimens, there is no indication of tubercles and the ridge itself may be difficult to distinguish. The absence of lip tubercles in *albotunica* is an artifact of preservation. The paratype USNM 96723 is obviously desiccated and the suprascapulae are very obvious. It becauses of this obviousness that they appear different from the other specimens Taylor and Cochran examined. The suprascapular condition is not considered a diagnostic character herein among the spatulate headed members. The 27 mm size of the male holotype as given by Taylor and Cochran is indeed large (compare with Table 3), even though the size of *albotunica* is referred to as both large (in key, p. 1630) and small (diagnosis, p. 1649). I measure the SVL of the holotype as 23.0 mm, the paratypes 23.1 mm (USNM 96557, Taylor and Cochran give 24 mm) and approximately 22.4 mm (USNM 96723 with damaged snout, Taylor and Cochran give as 22 mm). There is no discrepancy in measurements of the paratypes, but I believe Taylor and Cochran erred in the measurement of the holotype. When calipers are set to 27 mm and placed over the holotype, there is no way to manipulate the specimen in order to obtain a 27 mm SVL measurement. The corrected SVL of 23.0 mm falls within the range of variation found in other spatulate headed males (Table 3). I calculate the nostril-snout/eye-nostril ratios as about 85 and 83% in the holotype and paratype with undamaged snout. These values concur with Taylor and Cochran's verbal description of the nostril location and lie within the range of values found in other spatulate headed males (Table 3). The finger webbing formulae are: I N II T III 2 1/2 — 2 1/4 IV (USNM 96559, holotype), I N II T III 2 1/4 — 2+ IV (USNM 96557), and I N II T III 2 1/3 — 2 IV (USNM 96723). The finger webbing formulae of the paratypes are close to the modal values found in the other specimens (Table 1), and the finger webbing of the holotype, although reduced, is matched by other specimens (Table 1) and is not diagnostic with respect to the comparative samples. The internal choanae of the holotype do appear large, particularly in comparison with those of the holotype of *vanzolinii*, which was the comparison made in Taylor and Cochran's key. The internal choanae of the holotype of *C. albotunica* appear to be enlarged by the absence of skin surrounding the choanae because of poor preservation. The comparison with the choanae of the holotype of *C. vanzolinii* is heightened because the choanae of the latter appear small (see discussion under *C. vanzolinii*). The choanal condition is not considered diagnostic. Thus, *C. albotunica* is considered to represent the same species (i.e., *uranoscopa*) as the recent spatulate headed specimens examined.

The foot webbing formulae for *C. albotunica* are: I 1 3/4 — 2 II 1+ — 2 1/2 III 1 1/2 — 2 1/2 IV 2 1/2 — 1 1/2 V (holotype), I 1 1/3 — 2 II 1 — 2 1/4 III 1+ — 2+ IV 2+ — 1 V (paratype, USNM 96557), and I 1+ — 2 II 1+ — 2 III 1+ — 2 1/3 IV 2 1/4 — 1 1/2 V (paratype, USNM 96723).

**Taxonomic summary**

A single species is recognized for the spatulate headed forms of southeastern Brasil and adjacent Argentina. The oldest available name for this species is *Hyla uranoscopa* Müller, 1924.
LARVAE

Two distinctive centrolenid larval types have been collected recently from streams near Teresópolis, Rio de Janeiro. This fresh material is used for descriptive purposes, rather than relying on previously published, but unassigned or incorrectly assigned specimens.

The fresh materials at hand represent the two species known to occur at Teresópolis. The series contain individuals that are suggestive, but not conclusive, regarding association with adults. The following lines of evidence are used in associating names with species. The snout of one is longer than the other. As C. uranoscopa has a longer snout as adults than eurygnatha, it is assumed that the same trend would obtain in the larvae. The other evidence hinges on two stage 42 metamorphic larvae, which are clearly associable with one of the larval types and possess characteristics suggestive of the adult condition. In these specimens, the limbs have the adult appearance, and the head is beginning to take on adult form. The snouts appear similar to the short snouted C. eurygnatha. The limb fringing is much better developed in C. uranoscopa than in eurygnatha. There is no indication of limb fringing in the metamorphic specimens. The body melanophores are evenly distributed. Although no single line of evidence is conclusive, they are concordant. On this basis, the metamorphic larvae are considered to be the larvae of C. eurygnatha.

Descriptions

**Centrolenella eurygnatha**

(Fig. 2)

Larvae well muscled, almost cylindrical, maximum length, stage 42, 50.4 mm; head-body slightly depressed, length (HBL) 25-29 [range] (27.2) [mean] % total length; nostrils small, barely noticeable, about midway between eye and tip of snout; eyes dorsal, very small in stage 25-28 specimens, 3-5% HBL, moderate in stage 37-42 specimens, 9-13% HBL; snout length (tip of snout to point mid-way between eyes) 24-35 (28.9) % HBL; spiracle sinistral, mid-way on side, extremely posterior, almost at end of body; mouth parts subterminal, almost terminal, oral disk emarginate, width 24-35 (32.0) % HBL; oral disk without denticles, anterior oral disk of a large fleshy pad; lower disk with a single row of circumferential papillae, either of uniform shape or posterior papillae elongate; either a single or partial double row of bulbous papillae in posterior denticle row position; upper jaw wide, jaw teeth large;

Figure 2. The tadpole of *Centrolenella eurygnatha*, lateral view and mouthparts, stage 27. lines equal 1 mm. Drawn from USNM 232363.
anus median; tail strongly muscled, tail fins low, maximum depth of either upper or lower fin less than 1/2 maximum tail muscle depth, dorsal fin origin at body-tail juncture in small specimens, posterior to body-tail juncture in large specimens; pattern light, nondescript in preservative; irregularly dispersed pigment cells, usually denser dorsally, sometimes limited to dorsal tail musculature, but ventral head-body with a few scattered pigment cells. Description based on 17 specimens ranging from Gosner (1960) stages 25-42.

Centrolenella uranoscopa

(Fig. 3)

Larvae well muscled, almost cylindrical, maximum length, stage 41, 46.7 mm; head-body slightly depressed, length (HBL) 27-32 (30.0) % total length; nostrils small, not obvious, about midway between eye and tip of snout in small specimens, closer to eye than tip of snout in larger specimens; eyes dorsal, very small in stage 25-29 specimens, 3-6% HBL, moderate in stage 31-41 specimens, 9-15% HBL; snout length 26.42 (33.6) % HBL; spiracle sinistral, midway on side, posterior, about 4/5 distance on side; mouthparts subterminal; oral disk emarginate, width 28-36 (31.6) % HBL; tooth row formula or denticles very small, rows often incomplete; P 3
denticle row complete in small specimens, with short row of medial denticles and globose papillae on either side in moderate sized specimens and with entire row of globose papillae in large specimens, oral disk dorsally emarginate, single row of papillae elsewhere, papillae almost uniformly globose in small specimens to markedly heterogeneous with elongate posterior papillae in larger specimens; upper jaw wide, jaw teeth large; anus median; tail strongly muscled, tail fins low, maximum depth of either upper or lower fin about 1/2 maximum tail muscle depth; dorsal fin origin just posterior to body tail juncture; pattern nondescript, light or tan in preservative, irregularly dispersed pigment cells, denser dorsally, uniform on snout region in some individuals, ventral head-body lacking pigment cells. Description based on 29 specimens ranging from Gosner stages 25-41.

Figure 3. The tadpole of Centrolenella uranoscopa, lateral view and mouthparts on left of stage 31 larva, mouthparts on right of stage 25 larva, lines equal 1 mm. Drawn from specimens from lot USNM 232357.

Previously described tadpoles from southeast Brasil

Taylor and Cochran (1953) described four individual tadpoles from lot USNM 96663 from Bonito, Serra da Bocaina. They did not assign the four
tadpoles to any species. They noted one specimen was destroyed. The three remaining specimens are poorly preserved and were further damaged when taken from a vial too small for proper storage. The larval mouthparts were for all intents and purposes destroyed when the beaks were removed for illustration. The larvae are in such poor shape that identification is not practical and any further examination of the specimens will be most difficult as they will deteriorate further with additional handling. The tadpoles are *Centrolenella*.

Cochran (1955) briefly described the larvae of *Brachycephalus ephippium*. All of the specimens that she so described are *Centrolenella* tadpoles. One lot is the same (USNM 96663) as Taylor and Cochran (1953) described as *Centrolenella* (see above). The other two lots, USNM 81161 and 96463 came from Teresópolis, Rio de Janeiro. USNM 81161 is *C. uranoscopa*, USNM 96463 is *C. eurygnatha*.

Discussion

The larvae of *C. eurygnatha* and *uranoscopa* resemble each other in terms of overall appearance including size and shape. They also are similar in that there is a transition from very small eyes to moderate sized eyes around Gosner stage 30.

The species differ in several notable respects, however. The snouts of larval *C. uranoscopa* are somewhat longer than those of *C. eurygnatha*. When snout length is plotted against head-body length, it is evident that the smaller larvae have the same sized snouts; it is only in the largest larvae that snout length can be consistently differentiated in the two species as larvae. The mouthparts differ in several ways including relative placement of oral disk, development of upper fleshy lip, location of posterior disk papillae and presence or absence of denticle rows. The ontogenetic replacement of a denticle row by papillae in *C. eurygnatha* suggests a similar explanation for a row of globose papillae on the posterior disk of *C. uranoscopa* where a tooth row occurs in most other tadpoles. The position of the spiracle opening also differs between the two species.

Starrett (190) described five species of *Centrolenella* from Middle America. The species that she described are similar to the two southeast Brasilian species in overall shape and having an emarginate oral disk with an oral papillary gap, a single row of papillae on the rest of the disk margin, a median anus and sinistral spiracle. Four of the species she described had a denticle row formula of $\frac{1+1}{3}$, the fifth lacked denticles. An apparent difference is that all species figured by Starrett, which appear to be based on younger than stage 30 larvae have moderate sized eyes, rather than the very small eyes found in similar staged larvae of *C. eurygnatha* and *uranoscopa*.

The only other *Centrolenella* tadpole descriptions of which I am aware are those of two species from Santa Cecilia, Ecuador (Duellman, 1978; not illustrated). One, ascribed to *C. midas* is similar to the four species with denticles described by Starrett (1960). The other species described by Duellman, *C. munozorum*, differs from all others *Centrolenella* larvae discussed herein in having a denticle row formula of $\frac{0}{2}$ and a dextral anus.

There are too few centrolenid tadpoles described to determine whether the differences found between the two southeast Brasilian species can be used in determining the relationships of *C. eurygnatha* to *uranoscopa* and the two of them to other assemblages within the family.
Larval habitat

The described specimens of *C. eurygnatha* and *uranoscopa* were often collected in the same net samples from 1-2 m wide forest streams. The tadpoles were found in the areas of streams with accumulations of leaves, sticks, mud and other debris. None of the tadpoles were seen on the bottom surface, but were found in the net samples that picked up the bottom debris.

**Diagnoses and Distributions of Southeast Brazilian Centrolenella**

The following is a brief summary of the current proposed nomenclature and distributions of the *Centrolenella* in southeast Brazil and adjacent Argentina. A diagnosis is also included for each species to facilitate their identification. The distributions are based only on specimens examined by me (Heyer, 1978, and this study), with the exception of the specimens from Argentina reported by Barrio (1968).

**Centrolenella eurygnatha** (Lutz)


*Cochranella surda* Taylor and Cochran, 1953:1630, Fig. 1. Type locality, Passa Quatro, Minas Gerais, Brasil. Holotype, USNM 96916, female.


**Diagnosis.** — (1) Dorsal ground pattern with regularly spaced pigment cells, rarely with additional overlay of small dark spots; (2) outer tarsus and foot with weak fold, or fold absent, white outlined in life; heel weakly granular or smooth, without fold; (3) snout rounded in profile, without upper lip ridge; (4) anal region with granular seat patch [demarcated by white pigment in live or freshly preserved specimens]; (5) advertising call group of 1-5 calls, each call composed of 1-8 distinctive pulses; (6) males 17.9 - 23.6 mm SVL, females 19.5-24.0 mm SVL; (7) modal hand webbing formula I N II T III 3- — 2 1/2 IV, modal foot webbing formula I 2 — 2 1/2 II 1 1/2 — 2 1/2 III 1 1/2 — 3- IV 3- — 2- V; (8) dorsum leaf green in life; limbs with small white dots; belly transparent; white sheath covering heart, liver, and digestive tract; iris silver green to silver bronze. Characters 1-5 distinguish *C. eurygnatha* from *parvula* and *uranoscopa*; characters 6-8 are included for comparison with other centrolenids.

**Distribution.** — Associated with the Atlantic Forest Morphoclimatic Domain from the States of Espírito Santo to Santa Catarina, Brasil (Figure 4).

Specimens examined. — Espírito Santo: Santa Teresa, Peter Weygoldt 68 (2 adults and 1 larva) (to be deposited in USNM).

Minas Gerais: Parque Nacional do Caparaó, MZUSP 57922; Passa Quatro, USNM 96916 (holotype of *surda*).
Figure 4. Distribution of Centrolenella from SE Brasil and adjacent Argentina. Solid triangles = *C. eurygnatha* and *uranoscoa* in sympatry; open circles = *C. eurygnatha*; solid hexagon = *C. parvula*; open squares = *C. uranoscoa*. ES = State of Espírito Santo, MG = State of Minas Gerais, RJ = State of Rio de Janeiro, SP = State of São Paulo, PR = State of Paraná, SC = State of Santa Catarina, RS = State of Rio Grande do Sul, M = area of Argentina including Province of Misiones.

Rio de Janeiro: Angra dos Reis, USNM 96481 (holotype of *delicatissima*); Brejo da Lapa, Itatiaia, MZUSP 53178-180, USNM 207762-774; Itatiaia, MZUSP 328 (holotype of *bokermanni*); Macieiras, Itatiaia, MZUSP 2814, 7920, 7923-28, 30810-11; Petrópolis, USNM 101135 (holotype of *metropolitana*); Rio de Janeiro, USNM 165127; Teresópolis, MZUSP 53350-57, USNM 208387-395, 232360-64 (larvae), US field 6092 (larvae), 6414 (larvae), 6416 (larvae), 6719 (larvae) (to be deposited in MZUSP); Tijuca, MZUSP 20891-94.

São Paulo: Boracéia, MZUSP 30788-0809, 37588-594, 37769, 37775-782, USNM 208712-733; Campos do Jordão, MZUSP 10091; Cidade Azul, MZUSP 15153-180; Eugênio Lefevre, MZUSP 14000, USNM 207734; Fazenda do Bonito, Serra da Bocaina, MNRio 973-75 (types of *eurygnatha*, not examined),

**Centrolenella parvula** (Boulenger)

*Hylella parvula* Boulenger, 1895:646, Plate 40, Fig. 3. Type locality Lages, Santa Catarina, Brasil (restricted to this locality by choice of lectotype).

Lectotype BMNH 1947.2.12.67, juvenile.

*Diagnosis.* — (1) Dorsal ground pattern reticulated, pigment cells unevenly distributed; (2) outer tarsus and foot lacking folds, heel smooth, without fold; (3) snout slightly truncate or rounded in profile, upper lip without ridge; (4) anal region with granular seat patch; (5) advertising call unknown; (6) known from single juvenile specimen 17.7 mm SVL; (7) hand webbing formula I N II T III 2 1/2 — 2 IV, foot webbing formula I 2 — 2 II 1+ — 2 1/3 III 1+ — 2 3/4 IV 2 1/2 — 1 1/2 V; (8) life colors unknown. Characters 1-4 distinguish *C. parvula* from *eurygnatha* and *uranoscopa*; the other characters are included for consistency in comparing taxa.

*Distribution.* — Known only from the type locality (Figure 4).

Specimen examined. — Santa Catarina: Lages, BMNH 1947.2.12.67 (lectotype of parvula).

**Centrolenella uranoscopa** (Müller)

*Hyla (Hylella) uranoscopa* Müller, 1924:234. Type locality Humboldt (Flussgebiet des Rio Novo), Santa Catarina, Brasil (clarified by Bokermann, 1966, as Corupá, Santa Catarina). Holotype ZM 81/1921, female.


*Cochranella vanzolinii* Taylor and Cochran, 1953:1646, Fig. 3. Type locality Boracea [= Boracéia], São Paulo, Brasil. Holotype MZUSP 2952, male.


*Diagnosis.* — (1) Dorsal ground pattern reticulated, pigment cells unevenly distributed; (2) outer ulna, tarsus, and foot with well developed ridges, usually scalloped and highlighted by white pigment in life; heel with well developed dermal flap, highlighted by white in life; (3) snout spatulate shaped, upper lip with fleshy ridge, sometimes highlighted with white tubercles; (4) anal region with a pair of well developed horizontal flaps below and to either side of anus, highlighted by white in life; (5) advertising call of 1-3 notes, each note pulsatile, not pulsed; (6) males 19.8 - 24.8 mm SVL, females 22.5 - 25.8 mm SVL; (7) modal hand webbing formula I N II T III 2 1/3 — 2 IV, modal foot webbing formula I 1 1/2 — 2+ II 1+ — 2 1/4 III 1+ — 2 1/2 IV 2 1/2 — 1 1/2 V; (8) dorsum green with white dots or silvery
network in life; digits yellow or yellow-orange; peripheral limb ridges white outlined; belly transparent; heart, liver, and intestines covered with white peritoneum; iris silver or silver with gray network. Characters 1-5 distinguish C. uranoscopa from eurygnatha and parvula; characters 6-8 are included for comparison with other centrolenids.

Distribution. — Associated with the Atlantic Forest Morphoclimatic Domain and derivative Atlantic Forest vegetations from the States of Espírito Santo to Santa Catarina in Brasil and the Province of Misiones in Argentina (Figure 4). A second Argentine locality has recently been reported (Puerto Vilela, Provincia del Chaco) by Contreras as C. vanzolinii (1982). The specimen from this locality needs to be compared with Brasilian Centrolenella to confirm the identity.

Specimens examined. — Espírito Santo: Santa Teresa, Peter Weygoldt 74 (to be deposited in USNM).

Minas Gerais: Parque Nacional do Caparaó, MZUSP 57923.

Rio de Janeiro: Petrópolis, USNM 101134 (holotype of lutzorum); Rio de Janeiro, USNM 165128-29; Teresópolis, USNM 232349-352, 232357-59 (larvae), US field 6414 (larvae), 6416 (larvae), 6543, 6545, 6595-96, 6719 (larvae) (to be deposited in MZUSP); Tijuca, MZUSP 9925-26, 20890, 20895, USNM 164155-56.

São Paulo: Boracéia, MZUSP 2952 (holotype of vanzolinii), 2593, 34636, 30814-17, 49647, USNM 232354; Fazenda do Bonito, Serra da Bocaina, USNM 96557 (paratype of albotunica), 96559 (holotype of albotunica), 96722 (holotype of dubia), 96723 (paratype of albotunica).

Santa Catarina: Corupá, ZM 81/1921 (holotype of uranoscopa); Novo Horizonte, MZUSP 34529-536, USNM 200567; 16 km W (by road) of Pira-beiraba on BR 280 to Campo Alegre, USNM 232353, US field 7499 (to be deposited in MZUSP).

Argentina: Misiones: near Manuel Belgrano, San Antonio, CHINM 2940-41, 3015-17 (not examined).

Discussion

There is habitat separation of the two widespread species, albeit incomplete. Centrolenella eurygnatha call from smaller streams, C. uranoscopa from larger streams. The usual situation is that either one species or the other is heard calling along any given stream, although there are exceptions. Stream width data are available for only 38 specimens. Twenty seven C. eurygnatha were found along streams 1/2-2 m wide at the nearest point to a stream where the specimens were collected; only one specimen was collected along a 2-3 m wide stream (both species were calling and collected along this stream). Three C. uranoscopa were collected along 1 1/2-2 m wide streams, 7 were collected along 2-3 m wide streams.

The geographic distribution represented in Figure 4, based almost entirely on specimens personally examined, is incomplete. However, the northern and southern localities may well represent close approximations of the two widespread species latitudinal limits. The Atlantic Forests do not extend much further south than the southernmost mapped locality. Other stream associated frogs also have northern distributional limits coinciding with the northernmost locality. As noted on the map (Figure 4), distributional overlap of the two widespread species is considerable. Additional data will certainly fill in the large gaps (considerable data are already available in Brasilian collections not examined for this study) and clarify the more interior extent.
of the distributional ranges. At present, it is not known if in fact only C. eurygnatha occurs in the Serra da Mantiqueira or whether C. uranoscopa is the only species to extend in the derivative Atlantic Forest vegetation that reaches Misiones, Argentina. Once the distributional limits are known, then it may be possible to determine whether the distributions are largely defined by suitable stream habitats or whether history also has had a major influence in the distributions.

REFERENCES


