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THE GENERA *BOIRUNA* AND *CLELIA* (SERPENTES: PSEUDOBOINI) IN PARAGUAY AND ARGENTINA

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ABSTRACT

Snakes of the pseudoboine genera Clelia, which is probably polyphyletic, and Boiruna are distributed from southern Argentina, southern Brazil, and Uruguay northwards into central México. Six members occur in Paraguay and Argentina: B. maculata, Clelia bicolor, C. clelia, C. plumbea, C. quimi, and C. rustica. Historically, there has been taxonomic confusion among the larger species (B. maculata, C. clelia, C. plumbea, and C. rustica) and between the small species (C. bicolor and C. quimi). All of the species except C. rustica have distinct ontogenetic color changes. Species can be distinguished on the bases of size, color, hemipenial spines, and loreal, supralabial, and ventral scale counts. Much of the morphological evolutionary differentiation in Boiruna and Clelia seems to have taken place in the snout region, as evidenced by the differing proportions of the scales of the loreal region. Boiruna maculata has the widest ecological amplitude. It is broadly distributed in most vegetation types north of the 38th parallel in central Argentina, being absent only from the deltaic sediments of Buenos Aires Province, Argentina and the broad valleys and rolling hills of eastern Paraguay. Clelia bicolor is most common in the Paraguay and Paraná river valleys, with a few records from the Andean foothills in northern Argentina. Clelia clelia is distributed along the Río Paraguay and the lower Paraná, and is also found throughout much of eastern Paraguay. Clelia plumbea is apparently parapatric with C. clelia along the Río Paraná in southeastern Paraguay and Misiones Province, Argentina. The ranges of C. quimi to the east and C. bicolor in the west

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about in this same region without apparent overlap. There are no vouchered records of *Clelia rustica* from Paraguay. In Argentina, it is a species of temperate climates; north of the 30th parallel, it occurs in the Andean foothills and the wet forests of Misiones Province. Southwards, it is widely distributed to beyond the 40th parallel.

KEYWORDS: *Clelia*, *Boiruna*, Argentina, Paraguay, pseudoboines, colubrids.

INTRODUCTION

Two genera of snakes of the monophyletic colubrid tribe Pseudoboini, *Boiruna* (2 species) and *Clelia* (13 species), are distributed on the American mainland from México to southern Argentina, southern Brazil, and Uruguay; and on Trinidad, and Grenada and Santa Lucia in the Lesser Antilles (Bailey, 1970; Cadle, 1984; Underwood, 1993; Zaher, 1996; Franco *et al.*, 1997; Morato *et al.*, 2003; Reichle & Embert, 2005). The species of *Clelia* are probably not a monophyletic group. Zaher (1994, 1999) believes that some members of the genus (*C. bicolor*, *C. quimi*, and *C. montana*) are more closely related to a clade including *Oxyrhopus* and *Siphlophis* than they are to the other *Clelia*. We will keep them in the genus *Clelia* for the purposes of this paper.

Our knowledge of the distribution and taxonomy of these genera in southern South America consists of a tangled history of misidentifications, cryptic species, and changing generic limits. This paper traces the taxonomic history of the six members of the tribe that occur in Paraguay and Argentina that are now assigned to the genera *Clelia* and *Boiruna*.

In the past century, only Bailey (1970) and Zaher (1996) examined these species throughout their ranges; other studies were restricted to individual collections or limited geographic areas. Our observations derive from specimens from Argentina and Paraguay; the last list for Paraguay was Aquino *et al.* (1996), and, for Argentina, Giraudo & Scrocchi (2002). The main thrust of this paper is to apply the taxonomic conclusions of Zaher (1996), Franco *et al.* (1997), and Giraudo (2002) to Argentina and Paraguay. Their recognition of *Boiruna maculata*, *Clelia clelia*, *C. quimi*, and *C. plumbea* as distinct species helped clear up the confusion that has reigned for more than a century. Our records of *C. clelia* extend the known distribution 900 km southward of the locality in central Bolivia reported by Zaher (1996). We report the first records of *C. quimi* from Paraguay. Important also is the discovery that all verifiable records of "*C. rustica*" from Paraguay were based on specimens of *B. maculata*.

Boiruna and *Clelia*

Boiruna and *Clelia* are small to large snakes—the smallest species is generally less than 1 m (*C. bicolor*), and the largest approach 2.5 m in total length (*C. clelia*, *C. plumbea*). The larger species, well-known by the Brazilian common name of *mussurana*, are famous for consuming even large venomous *Crotalus* and *Bothrops*.

Most species have the normal configuration of colubrid scales. Diagnostic variation occurs in the number of body segments (reflected in ventral and subcaudal scale counts), and in the relative length of the snout, as seen in differing numbers of supralabials and in the varying proportions and positions of the loreal scale. There are two anterior temporals on each side of the head, the lower of which may or may not contact the postoculars. Species in the genera may have 17 or 19 midbody scale rows, but all of the species in the study area have 19. Dorsal scales are smooth, many with one or (usually) two apical pits (Underwood, 1993).

The species of *Clelia* and *Boiruna* generally show a striking ontogenetic color change, from hatchlings with much orange or red to adults that are dark gray or black. In our area, *Clelia rustica* is the only exception; hatchlings may have a trace of a light collar, but otherwise are colored like the adults, which usually have a ground color of some shade of olive.

The hemipenes of the species of *Boiruna* and *Clelia* have a similar shape: a long basal portion that divides distally into two equal lobes. The single basal portion is 2-3 times the length of the terminal lobes. The lobes terminate in calyculate capitula. The *sulcus spermaticus*, basally single, divides into two branches at about the middle of the organ, each branch terminating in a separate lobe. The hemipenes may have large spines or enlarged spines may be lacking (Zaher, 1996, 1999).

Study Area

The study area lies between the Tropic of Capricorn and cold temperate Patagonia. The northern por-

tion west of the Río Paraná-Paraguay is generally dry Andean foothills, intermontane Monte desert valleys, or Chaco. The latter refers to the geological formation formed by the flat outwash plain of Andean erosion. Undisturbed vegetation in the Dry Chaco is thorn forest; the Humid Chaco is palm savannah subject to seasonal flooding from large rivers, with islands of thorn forest (Cabrera, 1994). Much of the Humid Chaco has been cleared for cattle grazing.

East of the Río Paraná-Paraguay, the land is uplifted a few hundred meters above the level of the Chaco to produce rolling hills and broad river valleys originally covered with mesic, subtropical, semideciduous forest grading into wet Interior Atlantic Forest on the eastern margin. These forests have been greatly decimated, and only isolated remnants persist. An even west to east rainfall gradient in the study area (400 to 1700 mm/yr) produces deserts in the west and wet tall forests on the eastern margin.

In Argentina south of the mouth of the Río Paraná/Río de La Plata, the native vegetation of the western Andean foothills grades into the eastern temperate Pampas grasslands or Patagonian shrublands in the extreme south.

We use the following nomenclature for the different reaches of the Paraná River (Giraudó & Arzamendia, 2004): Alto Paraná above Posadas, Misiones Province, Argentina, Upper Paraná between Posadas and the junction with the Paraguay River, and Lower Paraná below this point.

METHODS

We examined Paraguayan and Argentine specimens in most collections in Paraguay, Argentina, and in the U.S. National Museum. See Material Examined in Appendix 1 for a list. Distributions were mapped from these records.

We present synonyms of published records that seem to be based on the personal experience of the authors, usually by reference to data from specimens. Some published lists that appear to be merely copies of previous lists are omitted. For Argentina, we list provinces and not the cities that may have the same name.

Many citations almost certainly apply to *Boiruna* or *Clelia* spp. in the study area, but the authors do not give enough information to distinguish the species or even the genus. The “large black species”, *B. maculata*, *C. clelia*, and *C. plumbea*, were the species most confused by early workers, but *C. rustica* was also part of the

confusion, especially in Paraguay. If the authors gave enough morphological information (e.g., scale counts), reference to museum specimens, or if the locality was definitive (e.g., a large pseudoboine in the dry Chaco = *Boiruna*), the citation is included under a species synonymy. However, if the citation appears to be a composite that cannot be untangled, or a misidentification that cannot be assigned to any species with confidence, it is listed in the section *Incertae Sedis*.

Scale counts that we considered to be useful in diagnosing the species were the number of supralabials, ventrals, and subcaudals. Ventrals are reported using the system of Dowling (1951). The numbers of the supralabials contacting the loreals were also useful in quantifying variation in the snout region (Underwood 1993). Size is estimated by snout-vent and tail lengths. Colors were observed in living and preserved specimens. We cite descriptions of Uruguayan specimens as being pertinent to the taxa that we report.

We refer to the detailed observations of Zaher (1996, 1999) and Franco *et al.* (1997) for descriptions of the hemipenes, generally only noting where our studies modify or extend their conclusions. We particularly examined hemipenes of *B. maculata*, *C. clelia*, and *C. plumbea* because of their utility in generic and specific determinations. Enlarged spines lying at the bases of the capitula between the two branches of the *sulcus spermaticus* are described as “intrasulcal”, those arrayed in three or four longitudinal rows on both sides of the *sulcus* are termed “extrasulcal”.

RESULTS

Key to Adult *Clelia* and *Boiruna* from Argentina and Paraguay

- 1a. Supralabials usually 8 (Appendix 1); dorsal color medium brown or gray, not black, and paler on sides; hemipenes with 2 or more pairs of intrasulcal spines (Appendix 2); small species, adults usually less than 1 m in total length 2
- 1b. Supralabials usually 7; dorsal color olive, gray, or black, not noticeably paler on sides in large adults; variable number of intrasulcal spines on hemipenis; adults greater than 1 m in total length 3
- 2a. Ventrals less than 180 in males, less than 190 in females; edge of dorsal dark color on sides of head sharply defined at dorsal edge of supralabials *Clelia bicolor*
- 2b. Ventrals more than 180 in males, more than 195 in females; edge of dorsal dark color gradually in-

- vading supralabials, becoming paler towards the lip *Clelia quimi*
- 3a. Posterior ventral scales with dark pigment covering entire scale; intrasulcal spines lacking on hemipenis *Boiruna maculata*
- 3b. Posterior ventral scales pigmented only on lateral portions; intrasulcal spines present or not (Appendix 2); central portion of all ventral scales clear white, ivory, or yellow 4
- 4a. Dorsal adult coloration a uniform dark gray or black; indications of a light collar in small adults; venter white or ivory; a single pair of intrasulcal spines or none (Appendix 2) 5
- 4b. Dorsal adult coloration usually a reticulum formed by dark bases and borders of paler brown or olive scales, rarely unicolor; no indication of a light collar in adults; venter yellow, rarely spotted with black; usually two or more pairs of intrasulcal spines *Clelia rustica*
- 5a. Ventrals more than 210 in males and more than 225 in females; border of dark dorsal body coloration forming a straight line on the lateral tips of the ventrals (Fig. 1); loreal scale often small or missing, usually contacting only the second supralabial (Appendix 3); hemipenes without spines *Clelia plumbea*
- 5b. Ventrals less than 215 in males and less than 220 in females; border of dark dorsal coloration forming a serrate line on the lateral tips of the ventrals (Fig. 1); loreal scale normal, contacting the second and third supralabials; hemipenes with spines *Clelia clelia*

Key to Small Juvenile *Clelia* and *Boiruna* from Argentina and Paraguay

- 1a. Hatchlings gray, brown, or red dorsally without dark vertebral stripe 2
- 1b. Hatchlings laterally red or orange with dark vertebral stripe at least three scales wide 4
- 2a. Dorsal color gray or olive; collar present or not; black mark on base of dorsal scales ... *Clelia rustica*
- 2b. Dorsal color bright red with broad white nuchal collar and a black head (Fig. 10); black may be present on tips of dorsal scales 3
- 3a. Ventrals more than 210 in males and more than 225 in females; loreal scale often small or missing, usually contacting only the second supralabial (Appendix 3, Fig. 2) *Clelia plumbea*
- 3b. Ventrals less than 215 in males and less than 220 in females; loreal scale normal, contacting the second and third supralabials *Clelia clelia*

- 4a. Hatchlings greater than 300 mm total length (Fig. 3); usually 7 supralabials (Appendix 1); 212-247 ventrals *Boiruna maculata*
- 4b. Hatchlings less than 250 mm total length; usually 8 supralabials; 165-205 ventrals 5
- 5a. Ventrals less than 180 in males, less than 190 in females (Appendix 4) *Clelia bicolor*
- 5b. Ventrals more than 180 in males, more than 195 in females *Clelia quimi*

Boiruna maculata (Boulenger 1896)

- Oxyrhopus maculatus* Boulenger, 1896: Original description, type locality: Uruguay
- Oxyrhopus occipitoluteus*; Boulenger, 1896: Asunción, Paraguay
- Oxyrhopus occipitoluteus*; Koslowski, 1898: Argentina
- Oxyrhopus Clelia* (part.); Serié, 1915: Departamento Central, Paraguay
- Pseudoboa occipitolutea*; Serié, 1921: Chaco, Argentina
- Pseudoboa maculata*; Amaral, 1925: Mendoza, Argentina
- Pseudoboa clelia*; Saporiti, 1946: Salta, Argentina
- Pseudoboa clelia*; Abalos *et al.*, 1964: Santiago del Estero, Argentina
- Pseudoboa maculata*; Abalos *et al.*, 1964: Santiago del Estero, Argentina
- Clelia clelia clelia*; Freiberg, 1968: Argentina
- Clelia occipitolutea*; Bailey, 1970: Argentina and Paraguay
- Clelia clelia clelia*; Abalos & Mischis, 1975: Argentina
- Clelia occipitolutea*; Abalos & Mischis, 1975: Argentina
- Clelia occipitolutea*; Scott & Lovett, 1975: Paraguayan Chaco
- Clelia occipitolutea*; Gallardo, 1979: Argentina
- Clelia clelia clelia*; Laurent & Terán, 1981: Tucumán, Argentina
- Clelia occipitolutea*; Laurent & Terán, 1981: Tucumán, Argentina
- Clelia clelia clelia*; Di Fonzo de Abalos & Bucher, 1981: Córdoba, Argentina
- Clelia occipitolutea*; Di Fonzo de Abalos & Bucher, 1981: Córdoba, Argentina
- Clelia clelia*; Di Fonzo de Abalos & Bucher, 1983: Córdoba, Argentina
- Clelia occipitolutea*; Di Fonzo de Abalos & Bucher, 1983: Córdoba, Argentina
- Clelia clelia clelia*; Cei, 1986: Western, central and southern Argentina
- Clelia occipitolutea* (part.); Cei, 1986: Western, central and southern Argentina
- Clelia clelia*; Böckeler, 1988: Paraguayan Chaco
- Clelia occipitolutea*; Böckeler, 1988: Paraguayan Chaco

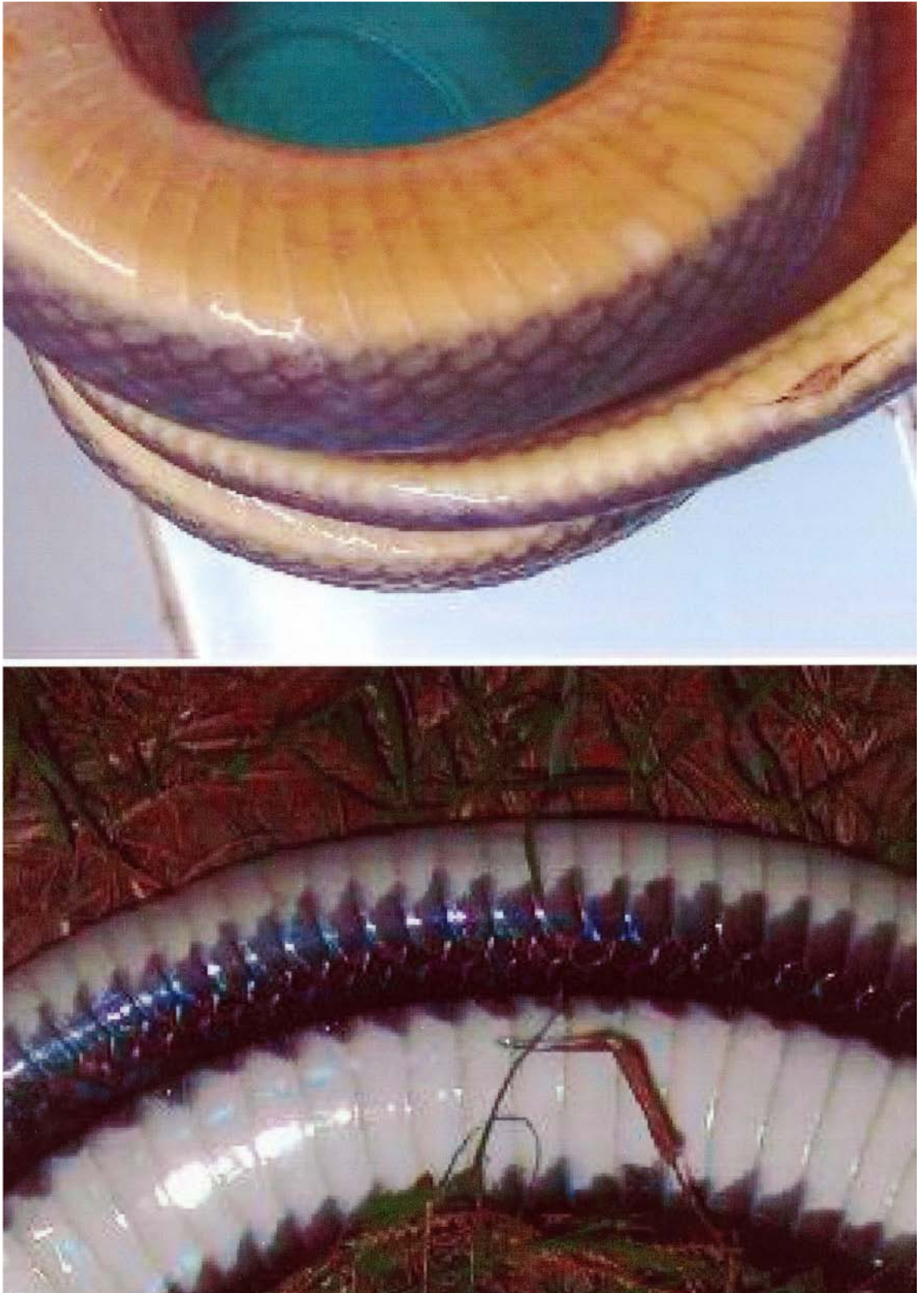


FIGURE 1. Comparison of the patterns of dorsal color incursion on the tips of the ventrals in *Celia celia* (INALI 1685, lower) and *C. plumbea* (MNHNP 3059, upper). Notice the relatively straight border in the latter compared to the toothed pattern in *C. celia*.

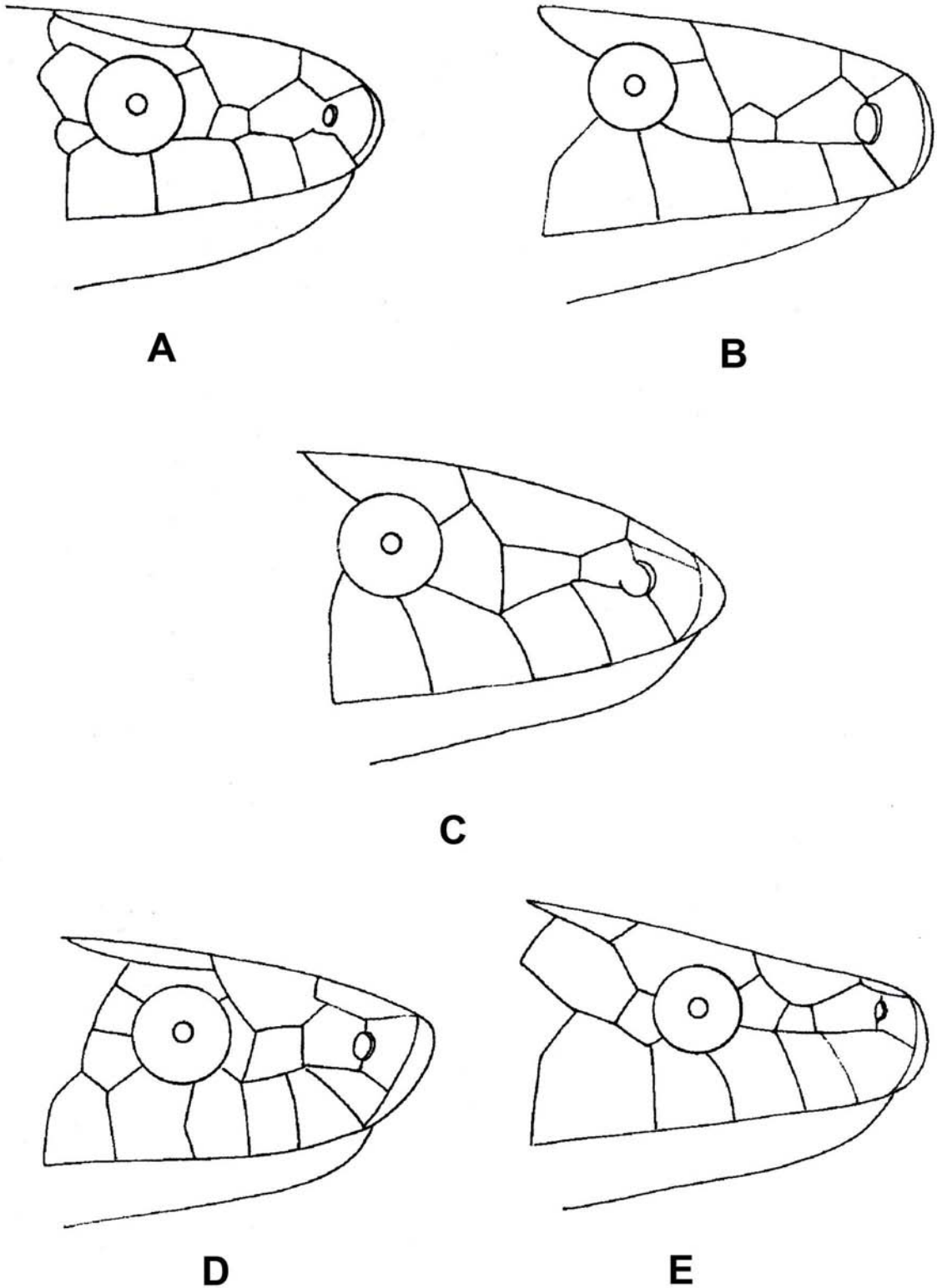


FIGURE 2. Diagrams of the lateral head squamation in *Boiruna* and *Clella*. A) *C. delia* (MNHNP 3840); B) *C. plumbea* (MNHNP 3059); C) *Boiruna maculata* (MNHNP 7674); D) *C. bicolor* (MNHNP 2616); E) *C. rustica* (FML 2766).

- Clelia clelia*; Yanosky, 1989a,b: Formosa, Argentina
Clelia occipitolutea; Yanosky, 1989b: Formosa, Argentina
Clelia clelia; Bergna & Álvarez, 1990: Northeastern Argentina
Clelia rustica; Bergna & Álvarez, 1990: Northeastern Argentina
Clelia clelia clelia (part.); Scrocchi & Viñas, 1990: Argentina
Clelia clelia; Cruz *et al.*, 1992: Salta, Argentina
Clelia clelia clelia (part.); Cei, 1993: Eastern Argentina
Clelia clelia; Yanosky *et al.*, 1993: Formosa, Argentina
Clelia spp.; Norman, 1994: Paraguayan Chaco
Clelia clelia clelia; Vuoto, 1995: Entre Ríos, Argentina
Clelia clelia clelia; Lavilla *et al.*, 1995: Salta, Argentina
Clelia clelia; Álvarez *et al.*, 1995: Departamento Itapúa, Paraguay
Clelia clelia (part.); Álvarez *et al.*, 1996: Corrientes, Chaco, and Formosa, Argentina
Clelia rustica; Álvarez *et al.*, 1996: Corrientes, Chaco, and Formosa, Argentina
Clelia clelia (part.); Aquino *et al.*, 1996: Paraguay
Clelia rustica; Aquino *et al.*, 1996: Paraguay
Boiruna maculata; Zaher, 1996: Argentina
Clelia clelia; Yanosky *et al.*, 1996: Formosa, Argentina
Boiruna maculata; Giraudo & Arzamendia, 1997b: Santa Fe, Argentina
Boiruna maculata; Leynaud & Bucher, 1999: Gran Chaco
Boiruna maculata; Cabrera, 2001: Interior Argentina
Boiruna maculata (part.); Giraudo & Scrocchi, 2002: Argentina
Boiruna maculata (part.); Giraudo, 2002: Northeastern Argentina
Boiruna maculata (part.); Álvarez *et al.*, 2002: Chaco, Formosa, and Corrientes, Argentina
Boiruna maculata (part.); Arzamendia & Giraudo, 2002: Santa Fe, Argentina
Clelia clelia; Ziegler *et al.*, 2002: Paraguayan Chaco
Boiruna maculata; Scrocchi & Giraudo, 2005: Formosa, Argentina

Taxonomic History – *Oxyrhopus maculatus* was described from Uruguay by Boulenger (1896). However, based on the high number of ventral scales, Boulenger’s *O. occipitoluteus* from Asunción, Paraguay almost certainly belongs to the same taxon, as do some of his Brazilian specimens listed under *O. cloelia*. Until recently, these three names have continued to be applied to the large species, usually with dark posterior ventrals, that is distributed from the Atlantic Ocean in southern Brazil, south through Argentina, Paraguay, and Uruguay as far La Pampa Province, Argentina, and east to the Andean foothills in Argentina.

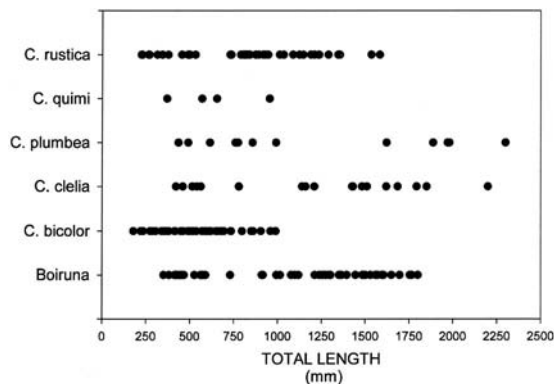


FIGURE 3. Total lengths of *Boiruna* and *Clelia* from Argentina and Paraguay.

Zaher (1996) cleared up most of the confusion when he reviewed *Clelia* throughout its range. He determined that the original description of *Brachyrruton occipitoluteum* of Duméril, Bibron, and Duméril 1854 is a synonym of *Pseudoboa coronata* Schneider 1801, and that *Oxyrhopus maculatus* Boulenger 1896 was the proper original description for this species. Zaher (1996) then used the taxon as the type species of a new genus *Boiruna*. Since then, the name *Boiruna maculata* has been widely applied in Paraguay and Argentina, although *C. clelia* has also been included under that designation in recent literature (e.g., Giraudo & Scrocchi 2002, Álvarez *et al.* 2002).

Diagnosis – *Boiruna maculata* in Paraguay and Argentina can generally be distinguished from all species of *Clelia* except *C. plumbea* by its larger number of ventrals (212-247; Appendix 4, Fig. 4). There is some overlap in the number of ventrals in female *C. clelia* (maximum 218) and female *B. maculata* (minimum 214), and male *C. clelia* (maximum 213) and male *B. maculata* (minimum 212).

A lack of spines between the arms of the divided *sulcus spermaticus* (intrasulcal spines) was one of the diagnostic characters that Zaher (1996) used to distinguish the genus *Boiruna* from *Clelia*, and these spines were lacking in all of the *B. maculata* that we examined. However, two of our 7 males of *C. clelia* are missing one or both of the usual pair of intrasulcal spines (Appendix 2).

Large juvenile and adult *B. maculata* have dark pigmentation on the entire scale in the posterior ventrals and subcaudals (Zaher, 1996; Giraudo, 2002). *Clelia rustica* may rarely have the posterior ventrals almost entirely black, but there is almost always a clear central portion. Other species of *Clelia* have mostly clear, ivory-

colored ventrals; the dark dorsal coloration invades only the lateral tips and part of the free edges of the ventrals, never covering the entire scale.

Among the larger species, the average *B. maculata* is slightly longer than *C. rustica* and shorter than *C. clelia* and *C. plumbea* (Fig. 3). The tail of *B. maculata* is relatively shorter than all others except female *C. rustica* (Fig. 5). Like *C. clelia*, *C. plumbea*, and *C. rustica*, *B. maculata* usually has 7 supralabials on each side (Appendix 1).

The dark dorsal stripe distinguishes hatchling *B. maculata* from other hatchlings in our area except *C. bicolor* and *C. quimi*. The smaller size of hatchling *C. bicolor* (~180 mm total length) and *C. quimi* (~205 mm) should serve to separate them from *B. maculata* (~350 mm), as do the numbers of supralabials and ventrals.

Description – Detailed descriptions, drawings, and photographs of *B. maculata* in the Southern Cone are found in Boulenger (1896; as *O. maculatus* and *O. occipitoluteus*), Abalos et al. (1964; as *P. cloelia* and *P. maculata*), Achaval (1973; as *C. occipitolutea*), Cei (1986; as *C. clelia*; his *C. occipitolutea* seems to be a composite of *B. maculata*

and *C. rustica*), Böckeler (1988; as *C. clelia* and *C. occipitolutea*), Scrocchi & Viñas (1990; as *C. clelia clelia*; their paradigm included two specimens of true *C. clelia*), Lavilla et al. (1995 as *C. c. clelia*), Achaval & Olmos (1997 as *C. occipitolutea*; 2003), Giraudo (2002; one of his specimens is a *C. clelia*), Achaval & Olmos (2003), Scrocchi & Giraudo (2005), Carreira et al. (2005) and Figure 6. Zaher's (1996) description of *B. maculata* covers a wider geographic area, and the details are not always pertinent to our area.

The total lengths of the smallest and largest of 47 *B. maculata* were 351 mm and 1800 mm, respectively. There seems to be no significant difference in size between the sexes (t-test; $P > 0.75$).

Boiruna maculata in Paraguay and Argentina has 212-247 ventrals, 52-84 subcaudals, and 7 supralabials (rarely 8; Appendix 1 and 4). The single loreal scale is generally slightly smaller than that of *C. clelia*, contacting only the second supralabial in almost half of 21 specimens (Appendix 3, Fig. 2B).

Zaher (1996) gave a detailed description and photograph of the hemipenis of *B. maculata*. The sample that Zaher (1996) observed had longitudinal rows of 13-17 spines, or a total of 26-34, on both sides of the

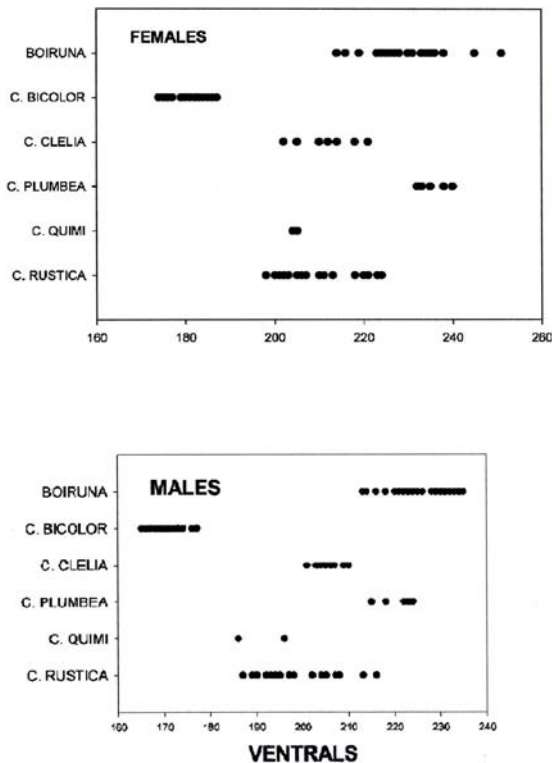


FIGURE 4. Distribution of ventral counts in female and male *Boiruna* and *Clelia* from Paraguay and Argentina.

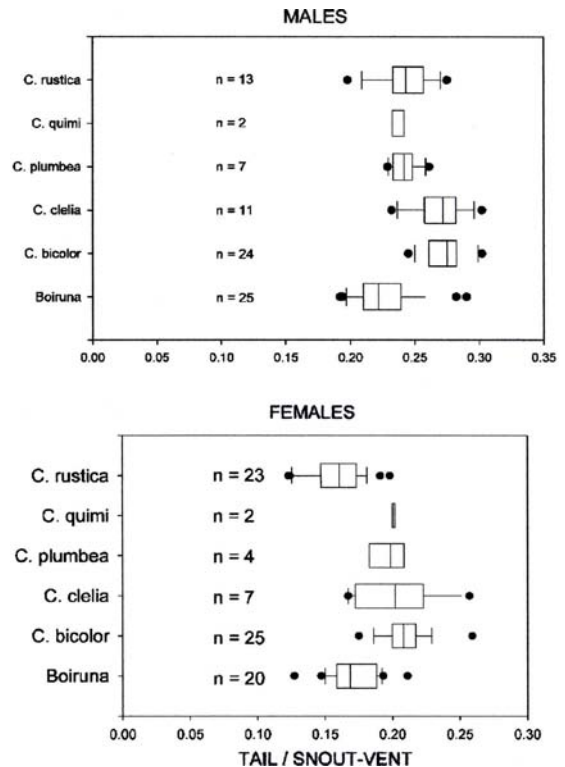


FIGURE 5. Relative tail lengths of female and male *Boiruna* and *Clelia* from Paraguay and Argentina.

sulcus spermaticus. The 13 specimens in our sample lacked intrasulcal spines and had 13-39 spines in the extrasulcal position (Appendix 2).

Hatchling *B. maculata* have the top of the head black or dark brown, fading to dusky on the supralabials. There is a pale nape band that can be white, yellow, or orange. Hatchlings from a clutch of 6 eggs from FML 13376 had either white or orange nape bands. Hatchlings have a black medial dorsal stripe 13 scale rows wide. The lateral three scale rows on each side are red or orange with black tips. The ventrals are opalescent white. The subcaudals are white with black margins where the scale pairs meet, forming a zigzag line down the underside of the tail. Lavilla *et al.* (1995), Girardo (2002), and Achaval & Olmos (1997, 2003) have photographs of juveniles. The coloration of hatchling *B. maculata* is similar to that of some hatchling *C. bicolor* (e.g., Girardo 2002), although the former is about twice as long (Fig. 3).

As the juvenile grows, the black color on the tips of the lateral scales and the scales of the nape band

expands, gradually obscuring the paler colors. The lateral scales are gray or black in most adults, although some retain a reticulated pattern of pale brown to red dark-tipped lateral body scales, especially anteriorly. A faint indication of the pale nape band can be seen in many small adults. Posterior ventrals and subcaudals gradually become uniformly black or dark gray.

Most adult *B. maculata* are a solid dark gray or black dorsally (Fig. 6). The underside of the head and anterior ventrals are clear ivory, with dark dorsal color on the tips of the anterior ventrals; this color invades the entire ventral scale on the posterior body and tail (Zaher, 1996; Girardo, 2002). Some specimens show extensive reticulated areas on the lateral, anterior portion of the body, where the dorsal scales are pale with dark edges (e.g., Cei, 1993: Plate 83-3). Specimens with this coloration are responsible for erroneous reports of *C. rustica* in Paraguay (e.g., Aquino *et al.*, 1996) and probably Argentina (e.g., Bergna & Álvarez, 1990).

Boiruna maculata shares, with *C. delia*, *C. plumbea*, and species of *Pseudoboia*, the peculiarity that some speci-



FIGURE 6. *Boiruna maculata*. FML 2494, Finca "Los Colorados", Salta Province, Argentina. A large juvenile retaining some reddish coloration on the sides. Photo by G. Scrocchi.

mens are irregularly spotted with varying amounts of white (e.g., Boulenger 1896, Cei 1993; Giraud 2002). In the most extreme cases, the snake is almost completely white with a few small pigmented patches (e.g., CENAI 2738, UNNEC 4846).

Distribution – Boulenger (1896) described *Oxyrhopus maculatus* from Uruguay and recorded *O. occipitoluteus* from Asunción, Departamento Central, Paraguay. This was the first report of *Boiruna maculata* from the study area.

Range wide, *B. maculata* is found from southeastern Bolivia and Brazil south of the Amazonian wet forest and east of the Andes, south through Paraguay, Uruguay, and Argentina (Zaher 1996; Achaval Elena 2001, as *C. occipitolutea*). In the study area, the species ranges from the northern borders of Argentina and Paraguay, south as far as 36°S latitude in Argentina (Fig. 7). It occurs in an enormous range of habitats from Monte desert and dry Chaco to the wet Atlantic forests of Misiones Province and coastal Brazil.

Clelia bicolor (Peracca 1904)

Oxyrhopus immaculatus; Peracca, 1895: Chaco, Argentina

Oxyrhopus bicolor Peracca, 1904: Original description, type locality: North of Santa Fe, Argentina

Clelia bicolor; Bailey, 1970: Argentina and Paraguay

Clelia bicolor; Abalos & Mischis, 1975: Argentina

Clelia bicolor; Talbot, 1979: Paraguay

Clelia bicolor; Yanosky, 1989a,b: Formosa, Argentina

Clelia rustica; Yanosky, 1989a,b: Formosa, Argentina (see Scrocchi & Giraud, 2005)

Clelia bicolor; Bergna & Álvarez, 1990: Northeastern Argentina

Clelia bicolor; Scrocchi & Viñas, 1990: Argentina

Clelia bicolor; Cei, 1993: Northwestern and eastern Argentina

Clelia bicolor; Yanosky *et al.*, 1993: Formosa, Argentina
Clelia rustica; Yanosky *et al.*, 1993: Formosa, Argentina (see Scrocchi & Giraud, 2005)

Clelia bicolor; Giraud & Contreras, 1994: Departamento Ñeembucu, Paraguay

Clelia bicolor; Álvarez *et al.*, 1996: Corrientes, Chaco, and Formosa, Argentina

Clelia bicolor; Couturier & Faivovich, 1996: Santa Fe, Argentina

Clelia bicolor (part.); Aquino *et al.*, 1996: Paraguay

Clelia bicolor; Yanosky *et al.*, 1996: Formosa, Argentina

Clelia rustica; Yanosky *et al.*, 1996: Formosa, Argentina (see Scrocchi & Giraud, 2005)

Clelia bicolor; Zaher, 1996: Paraguay and Argentina

Clelia bicolor; Giraud & Arzamendia, 1997b: Santa Fe, Argentina.

Clelia bicolor; Cacivio, 1999: Misiones, Argentina

Clelia bicolor; Leynaud & Bucher, 1999: Gran Chaco

Clelia bicolor; Cabrera, 2001: Interior Argentina

Clelia bicolor; Giraud & Scrocchi, 2002: Argentina

Clelia bicolor; Giraud, 2002: Northeastern Argentina

Clelia bicolor; Álvarez *et al.*, 2002: Chaco, Formosa, and Corrientes, Argentina

Clelia bicolor; Arzamendia & Giraud, 2002: Santa Fe, Argentina

Clelia bicolor; Álvarez *et al.*, 2003: Corrientes, Argentina

Clelia bicolor; Motte *et al.*, 2004: Paraguay

Clelia bicolor; Scrocchi & Giraud, 2005: Formosa, Argentina

Taxonomic History – The taxonomic history of *C. bicolor* is less confused than that of the other species. Since its original description from north of Santa Fe, Santa Fe Province, Argentina (Peracca 1904), it does not appear to have been recorded in the study area under any other specific name, except for Yanosky (1989a,b) and Yanosky *et al.* (1993, 1996). Because of the loca-

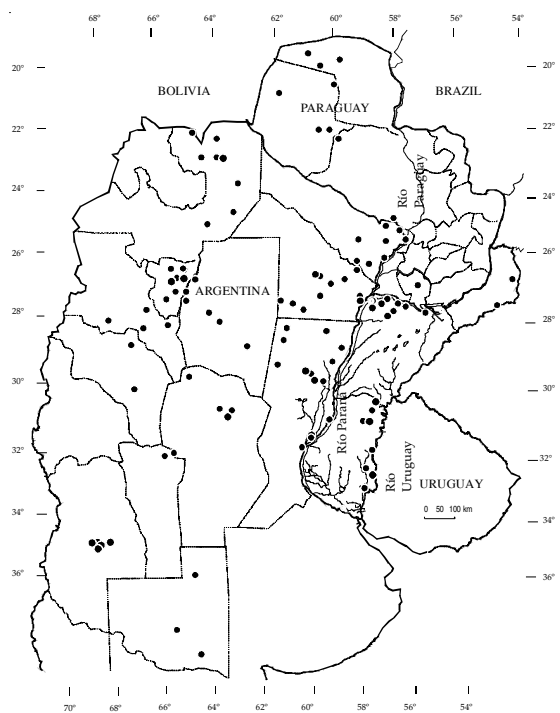


FIGURE 7. Geographic distribution of *Boiruna maculata* in Paraguay and Argentina.

tion and the low number of ventrals, Peracca (1895) appears to have also had an earlier specimen from Resistencia, Chaco Province, Argentina.

Diagnosis – *Clelia bicolor* in the study area can be distinguished from all other *Boiruna* and *Clelia* by the low number of ventral scales (163-187; Appendix 4, Fig. 4). Its gray or brown dorsum is never as dark as that of *C. clelia*, *C. plumbea*, and *Boiruna*. Except for the lateral tips of the ventrals, the venter of *C. bicolor* is always clear ivory. In *C. bicolor* of all sizes, the border between the dark dorsal head coloration and the lighter supralabials is sharp and distinct at the dorsal edge of the supralabial row (photographs in Cei, 1993; Giraudo, 2002). The general coloration of *C. bicolor* is similar to that of *C. quimi*; however, the color transition on the side of the head is more gradual in *C. quimi*, and the dark dorsal color extends further onto the supralabials (see illustration in Franco *et al.*, 1997).

Clelia bicolor is the smallest species (maximum total length 990 mm; Fig. 3). *Clelia bicolor* and *C. quimi*

generally have 8 supralabials on each side; the other *Clelia* and *Boiruna* generally have 7 (Appendix 1).

A dark dorsal stripe is seen in hatchling *C. bicolor*, *C. quimi*, and *B. maculata*. A white nape band may be distinct in hatchlings or almost lacking.

Description – Descriptions of *C. bicolor* can be found in Peracca (1904), Scrocchi & Viñas (1990), Cei (1993), Zaher (1996), Franco *et al.* (1997) and Giraudo (2002). Photographs are in Cei (1993), Giraudo (2002), Scrocchi & Giraudo (2005), and Figure 8.

Clelia bicolor is the smallest of the species under consideration; the smallest and largest of 52 specimens were 179 mm and 990 mm (Fig. 3). There is no significant difference between the lengths of the sexes (t-test; $P > 0.91$).

Clelia bicolor has fewer ventrals than any other species, but the tail is relatively long, and subcaudal counts overlap those of *C. quimi* (Appendix 4, Fig. 4). Like *C. quimi*, and in contrast to the other species, *C. bicolor* usually has 8 supralabials on each side of the head



FIGURE 8. *Clelia bicolor*. FML 15875, Saenz Peña, Chaco Province, Argentina. Photo by G. Scrocchi.

(Appendix 1). The loreal is normal-sized, usually contacting supralabials 2 and 3 (Appendix 3, Fig. 1D).

The hemipenes of our small sample of *C. bicolor* have two or three pairs of intrasulcal spines and 25-40 extrasulcal enlarged spines (Appendix 2). They are similar to the photographs in Zaher (1996, 1999).

Adult *C. bicolor* have a dark, almost black, dorsal head color that contrasts sharply with the ivory-colored supralabials. Except for the side of the head, they are colored much like *C. quimi* (Franco *et al.*, 1997, Giraud, 2002). The dorsal head color extends posteriorly as a dark dorsal stripe 9 scale rows wide. The sides are a dusky tan or gray, paler than the dorsal stripe. Underneath, the body and tail are clear ivory except for the lateral tips of the ventrals and a faint zigzag stripe of dark pigment down the center of the tail.

The largest snakes tend to be paler and more gray than the smaller specimens, which tend to be brown. *Clelia bicolor* never shows the large, irregular white patches seen in some other species.

Hatchlings have a dark head dorsum, which color extends along the back of the body as an almost black stripe 3 scale rows wide (photograph in Giraud, 2002). Lateral body scales are orange or red, and the venter is white. They usually have a white or orange collar that starts behind the parietals and extends posteriorly 3-4 scale rows. However even in hatchlings, the collar may be only faintly indicated. The collar is often partially or completely divided by the dark dorsal color; in extreme cases it may be reduced to a pair of white patches on the nape. The collar is gradually lost through ontogeny, although a faint indication may be seen even in some large adults.

Juveniles and young adults are tan laterally, sometimes with a pinkish hue (photograph in Giraud, 2002). As the snake grows, the dark dorsal color invades the sides, until, in the largest specimens, it extends to the tips of the ventral scales (Cei, 1993). In the intermediate sizes, the lateral scales become reticulate, similar to the coloration in *C. rustica*.

Distribution – *Clelia bicolor* is restricted to the Paraguay-Paraná river drainages in Brazil, Paraguay, and Argentina (Fig. 9). The presence of *C. bicolor* in Tucumán Province needs to be confirmed. The locality cited by Zaher (1996; FML 0819) for Escaba, Río Marapa, is probably incorrect; no other specimens have been taken from this well-collected locality. The Horco Molle, Tucumán Province locality (CENAI 3806) may be correct. Isolated northern records from Jujuy Province have been recently reconfirmed (INBIAL 312, Jorge Baldo, pers. comm.)

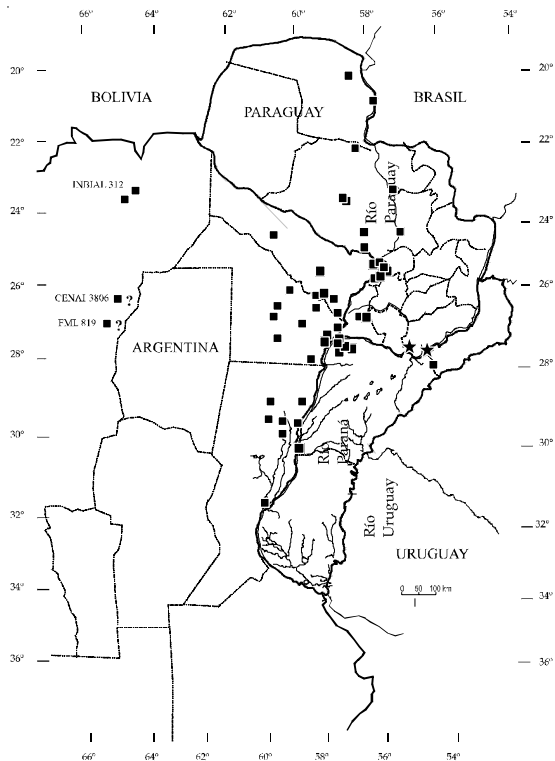


FIGURE 9. Geographic distribution of *Clelia bicolor* (squares) and *C. quimi* (stars) in Argentina and Paraguay.

Peruvian records referred to *C. bicolor* (Dixon & Soini, 1986; Vanzolini, 1986) probably refer to a different species (Strussman & Sazima, 1993). The old Butantan record (IB 1818) from Pelotas, Rio Grande do Sul in coastal southern Brazil is probably also incorrect (Bailey, 1970; Franco *et al.*, 1997). Bailey's (1970) citation of San Luis Province, Argentina is distant from any other record and needs confirmation (Giraud, 2002; Giraud & Scrocchi, 2002).

Most of the habitat of *C. bicolor* is Chaco, either dry forest or that subject to flooding. The Misiones Province, Argentina record by Cacivio (1999) extended the known range up the Paraná River into an area of transition between Humid Chaco and wet Atlantic Forest.

Clelia clelia (Daudin 1803)

Coluber clelia Daudin, 1803: Original description, type locality: Surinam

Brachyrhynchum occipitoluteum; Boettger, 1885: Paraguay
Oxyrhopus Clelia (part.); Serié, 1915: Department Central, Paraguay

Clelia clelia clelia; Bailey, 1970: Argentina and Paraguay
Clelia clelia clelia (part.); Scrocchi & Viñas, 1990:
 Corrientes, Argentina and Department San
 Pedro, Paraguay
Clelia clelia clelia (part.); Cei, 1993: Northwestern and
 eastern Argentina
Clelia clelia (part.); Aquino *et al.*, 1996: 6 departments in
 Paraguay
Boiruna maculata (part.); Giraudo & Scrocchi, 2002:
 Argentina
Boiruna maculata (part.); Giraudo, 2002: Northeastern
 Argentina
Boiruna maculata (part.); Arzamendia & Giraudo, 2002:
 Santa Fe, Argentina
Boiruna maculata (part.); Álvarez *et al.*, 2002: Corrientes,
 Argentina
Clelia clelia; Motte *et al.*, 2004: Paraguay

Taxonomic History – Because of the low number of ventrals, Boettger's (1885) *Brachyrhynchum occipitoluteum* from Paraguay is probably the first record of *C. clelia* from the study area. Subsequently, from 1914 to 1979, a number of checklists recorded the species "clelia" under the genera *Oxyrhopus*, *Pseudoboa*, and *Clelia*. However, all or most of those citations, here placed in *Incertae Sedis*, were composites of two or more species (*B. maculata*, *C. clelia*, *C. plumbea*, and even *C. rustica*), and they may not have included any true *C. clelia*. Bailey (1970) was probably the only author during this period that had a clear concept of the limits of *C. clelia clelia*. Starting in about 1985, the taxa *C. occipitolutea* (= *Boiruna maculata*) and true *C. clelia* became confused under the name *C. clelia* (e.g., Scrocchi & Viñas, 1990).

Two papers were pivotal in determining the concept of *C. clelia* in Paraguay and Argentina. Scrocchi & Viñas (1990) codified the reigning confusion, explicitly combining all Argentine specimens of *C. occipitolutea* and *C. clelia* into one taxon: *C. c. clelia*. This taxonomy prevailed until Zaher (1996) showed that the correct name for *C. occipitolutea* was *Boiruna maculata*, and many Southern Cone specimens previously dubbed *C. clelia* pertained to that species. He saw no specimens of true *C. clelia* from localities south of Santa Cruz Province, Bolivia. This led subsequent authors to the conclusion that *B. maculata* was the only member of the two taxa (*Boiruna maculata*, *C. clelia*) in Argentina and Paraguay. All citations of Argentine *B. maculata* up to the present may include *C. clelia*.

Zaher (1996) further clarified the taxonomic puzzle by recognizing *C. plumbea* as a full species instead of a subspecies of *C. clelia*. This enabled

Giraudo (2002) to separate specimens of *C. plumbea* from his *Boiruna-C. clelia* composite in northeastern Argentina. Although Giraudo (2002) recognized that specimens of *C. clelia* from northeastern Argentina fit descriptions of that species, he provisionally placed them in *B. maculata* because, according to Zaher (1996), *C. clelia* did not occur anywhere near Argentina.

Diagnosis – A low number of ventrals distinguishes most *C. clelia* from the two other large species (*B. maculata* and *C. plumbea*), although there is overlap in ventral scale counts of females of *C. clelia* (maximum 218) and *B. maculata* (minimum 214; Appendix 4, Fig. 4). Like *B. maculata*, *C. plumbea*, and *C. rustica*, *C. clelia* usually has 7 supralabials on each side (Appendix 1). The loreal of *C. clelia* is usually larger than that of *C. plumbea*, contacting supralabials 2 and 3; in *C. plumbea* the loreal seldom contacts any but the second supralabial, or it may be indistinguishably fused with the postnasal or prefrontal (Appendix 3).

The adult ventral color pattern can differentiate *C. clelia* and *B. maculata*. In *C. clelia*, the dark dorsal coloration is present at least on the lateral tips of the ventral scales. In some specimens, the dark color extends towards the midventral line along the free edge of the ventral scale, but the center of the scale is usually free of dark pigment. Exceptionally the entire free border of posterior ventrals may be pigmented, but the entire ventral is never completely dark-colored as in *B. maculata*.

Giraudo (2002) discovered a color pattern detail that separates adult *C. clelia* and *C. plumbea*. Both species are dark gray or black dorsally, with largely ivory venters. However, in *C. plumbea*, the border between the dark dorsal color and the ivory venter forms a straight line on the lateral tips of the ventrals (Fig. 1, photograph in Giraudo, 2002). In *C. clelia*, this border is dentate, with the dark color extending further on the free margin of the ventral than it does on the base of the scale (Fig. 1; photograph in Kempff Mercado, 1975).

Coloration in hatchling *C. clelia* and *C. plumbea* are similar. Both have uniformly red dorsal body scales, a black spot on the anterior dorsum, preceded by a white nape band and a black head cap (Fig. 10). Ventral surfaces are mostly white with some black pigment under the tail and on the chin. Hatchlings of *B. maculata*, *C. bicolor* and *C. quimi* may have red lateral scales, a white collar, and a dark head cap; but they also have a dark stripe the same color as the head cap down the center of the back.

Description—There are no descriptions of *C. clelia* from the Southern Cone that are not mixed with those of other large species, usually *B. maculata* or *C. plumbea*. Zaher's (1996) description is uncontaminated by observations on other species, but it is sketchy and covers the species throughout its huge distribution. His southernmost specimens were from central Bolivia. Kempff Mercado (1975) has a photograph of a Bolivian specimen, and Figure 11 is an Argentine specimen.

Clelia clelia vies with *C. plumbea* for being the largest member of the genus (Fig. 3). The total lengths of the smallest and largest of 19 *C. clelia* were 421 mm and 2200 mm. In our sample, there is no difference in size between the sexes (t-test; $P > 0.52$).

Clelia clelia in Argentina and Paraguay has 193–218 ventrals, 62–88 subcaudals, and generally 7 supralabials (rarely 8 or 9; Appendix 1 and 4, Fig. 4). The loreal scale is of a size normal for most colubrids, contacting the second and third supralabials (Appendix 3, Fig. 2A).

The hemipenis of *C. clelia*, illustrated and described by Zaher (1996), shows a large degree of variation. With one exception, our specimens have a relatively low number of extrasulcal spines (15–22; Appendix 2). A specimen from northeastern Paraguay (MNHP 6695) that is geographically and ecologically isolated from the remainder of our sample has 37 extrasulcal spines (Fig. 12). The *C. clelia* hemipenis illustrated by Zaher (1996: Plate 4) from French Guiana is spineless except for a pair of extremely large extrasulcal spines. This hemipenis is so different from any that we observed that it may belong to a separate species; alternatively, it may belong to a hybrid or intergrade with *C. plumbea*, which has a spineless hemipenis.

The number of intrasulcal spines is also variable (Appendix 2). Most specimens have a single pair of spines, but MNHNP 3957 has only a single intrasulcal spine, and FML 11964 has none. The intrasulcal spines are unusually large in MNHNP 8489 from Paraguay.

Adult *C. clelia* are a uniform dark gray or black dorsally, with an essentially ivory-colored venter. Supralabials and infralabials are dusky, forming a transition between the dorsal and ventral colors. The lateral tips of the ventrals are dark like the dorsum. In some specimens, the dark color extends towards the midventral line along the free edge of the ventral scale. The center of the ventral scale is usually free of dark pigment. Exceptionally, the entire free border of posterior ventrals may be pigmented, but the entire ventral scale is never completely dark-colored. The un-

derside of the tail often has a dark zigzag stripe where the pairs of subcaudals meet.

As in *B. maculata*, *C. plumbea*, and some *Pseudoboa*, occasional specimens of *C. clelia* can have large irregular blotches of white pigment.

Hatchling *C. clelia* have a bright red body dorsum and a white venter. A black cap covers the head, extending latero-ventrally as dusky coloration on the supralabials and mental. The cap may only reach the anterior tips of the parietals, or it may cover them. A white nape band follows the black cap, extending 3–4 scale rows posterior to the parietals. A black blotch 6–9 scale rows long and extending down the sides of the neck follows the white band. The underside of the tail may have a dark zigzag down the center and the tip may be black. A black-and-white photograph is in Dixon & Soini (1986).

As the juveniles grow, black pigment appears on the free tip of each dorsal scale. The pattern results in an overall darkening of the red body and white collar, but it never appears reticulate, as it may in juveniles of all of the other species except *C. plumbea*. The mid-dorsal scales begin to darken first, but there is never a distinct middorsal stripe as in juvenile *B. maculata*, *C. bicolor*, and *C. quimi*. Further extension of the dark pigment results in the unicolor dorsum seen in adults. Faint indications of the white collar may persist in small adults.

Distribution—*Clelia clelia* has the widest distribution of any pseudoboine snake—indeed it has one of the largest ranges of any New World snake. From the northern limits in central México it extends south through Paraguay to central Argentina (Bailey, 1970). It is widespread in tropical México, Central America, and South America north of the Amazon River, but Zaher (1996) had only four records south of the Amazon, in Perú and Bolivia. Our recognition that *C. clelia* occurs in Argentina and Paraguay extends the accepted distribution more than 900 km south of Santa Cruz, Bolivia to Santa Fe Province, Argentina.

Strussman & Sazima (1993) recorded the species from the Panatana of western Brazil, and it may occur in the poorly sampled area where Bolivia, Brazil, and Paraguay come together. However, the Strussman & Sazima specimens may be *B. maculata*, which may also occur in the area.

In Paraguay and Argentina, *C. clelia* is found along the Río Paraguay in the upper Chaco, usually in areas subject to occasional flooding. The distribution extends eastward along large tributaries into moist forests in eastern Paraguay.



FIGURE 10. Juvenile *Clelia plumbea*. INALI 387, Aristóbulo del Valle, Misiones Province, Argentina. Photo by A. Giraudo.



FIGURE 11. *Clelia clelia*. INALI 1685, Puerto Piracúa, Santa Fe Province, Argentina. Photo by A. Giraudo.

***Clelia plumbea* (Wied-Neuwied 1820)**

Coluber plumbeus Wied-Neuwied, 1820: Type locality:

Between Cabo Frio and Rio São João, Brazil

Clelia clelia plumbea; Bailey, 1970: Misiones, Argentina

Clelia clelia plumbea; Abalos & Mischis, 1975: Argentina

Clelia clelia; Acosta *et al.*, 1994: Misiones, Argentina.

Clelia clelia clelia; Duré Rodas, 1995: Eastern Paraguay

Clelia clelia ssp. (part.); Chebez, 1996: Misiones, Argentina

Clelia clelia (part.); Aquino *et al.*, 1996: Paraguay

Clelia plumbea; Zaher, 1996; Asunción, Paraguay (incorrect locality)

Clelia plumbea; Giraudo & Scrocchi, 2002: Argentina

Clelia plumbea; Giraudo, 2002: Northeastern Argentina

Taxonomic History – It is difficult to say if the earlier workers on Paraguayan–Argentinean snakes had specimens of *C. plumbea* that they did not distinguish from *Boiruna* or *C. clelia*. The first explicit recognition of the taxon in the area was Bailey (1970), who considered it

a subspecies of *C. clelia*. He did not explain the large area of apparent overlap between *C. clelia clelia* and *C. c. plumbea* in southern Brazil and eastern Argentina. Zaher (1996) cleared up that confusion by recognizing that *C. plumbea* was a valid species. He recorded a specimen from Asunción, Paraguay; however the locality is probably incorrect.

Abalos & Mischis (1975) first recorded the species from Argentina, but its presence was not acknowledged again until Giraudo (2002) and Giraudo & Scrocchi (2002) recognized it in northeastern Argentina.

Diagnosis – Adult *C. plumbea* differ from *Boiruna* in having dark pigmentation only on the outer lateral tips of the ventral scales; *Boiruna* has posterior ventrals that are completely covered with dark pigmentation. They may be distinguished from *C. clelia* by the higher number of ventrals (Appendix 4, Fig. 4) and by the straight line (dentate in *C. clelia*) on the tips of the ventrals demarking the change between the dark dorsal color and the ivory venter (Fig. 1; Giraudo, 2002). The smallest species (*C. bicolor*, *C. quimi*) also have fewer ventrals. Ventral counts for the intermediate-sized form, *C. rustica*, overlap slightly with counts for *C. plumbea* (Appendix 4, Fig. 4).

Clelia plumbea tends to have a smaller loreal than the other species (Fig. 2B); it was the only species that occasionally lacked a loreal when it was fused with either the posterior nasal or the prefrontal (Appendix 3). In all but one specimen, the loreal was absent or only contacted the second supralabial; in one specimen, the loreal touched supralabials 2 and 3 on both sides of the head. In *B. maculata* and *C. rustica*, about half of the loreals contacted one scale and half touched two supralabials; in the rest of the species the loreal always had a joint suture with two or even three supralabials.

Hatchling *C. plumbea* are colored like *C. clelia*, with a red body, white venter and nape band, and a black dorsal head and neck spot (photograph in Giraudo, 2002; Fig. 10). Ontogenic color changes proceed as in *C. clelia*. They lack the dark dorsal stripe of *B. maculata* and *C. bicolor*, and are not uniformly colored like hatchling *C. rustica*.

Description – Giraudo (2002) has the only description of *C. plumbea* from the study area. *Clelia plumbea* may be longest species of *Clelia*; in our collection, the shortest and longest were 435 mm and 2300 mm total length. Zaher (1996) recorded a female with a total length of 2585 mm. There is probably no significant difference



FIGURE 12. Geographic distribution of *Clelia clelia* (squares) and *C. plumbea* (filled circles) in Argentina and Paraguay.

in length between the sexes (t-test; $P > 0.07$), although the largest specimens are usually females.

Clelia plumbea has a relatively high number of ventrals (215-240) and subcaudals (69-90; Appendix 4, Fig. 4). They usually have 7 supralabials on each side (Appendix 1). The relatively small loreal is discussed in the Diagnosis above.

The hemipenis of *C. plumbea* entirely lacks enlarged spines (Appendix 2, Zaher, 1996 with photograph, 1999).

Adults are very similar in color to *C. clelia*, with a dark gray or black dorsum and ventral scales that are mostly ivory with dark tips. A dark zigzag is usually present along the suture where the pairs of subcaudals meet. The supraoculars are dusky and there may be some melanin on the infralabials and mental. Like some related species, specimens may be irregularly spotted with white. We see no differences between the coloration and ontogeny of coloration of juvenile *C. clelia* and *C. plumbea*; see the former description and Giraudo (2002) for details.

Distribution – Although Bailey (1970) recognized the presence of *Clelia plumbea* in Misiones Province, Argentina, Zaher (1996) had the first published report of a specimen from the study area. However, the Instituto Butantan specimen (IB 10100) from “Assunción” is almost certainly an incorrect locality. All of the other records from the study area are in the wet Atlantic forests close to the Parana River (Fig. 12).

***Clelia quimi* Franco, Marquez and Puerto 1997**

Clelia bicolor (part.); Aquino *et al.*, 1996: Departamento Itapúa, Paraguay

Clelia quimi Franco, Marques, y Puerto, 1997: Type locality: Itu, São Paulo, Brazil

Clelia quimi; Giraudo, 1999: Posadas, Misiones Province, Argentina

Clelia quimi; Giraudo & Scrocchi, 2002: Argentina

Clelia quimi; Giraudo, 2002: Northeastern Argentina

Clelia quimi; Giraudo & Arzamendia, 2004: Río Paraná drainage, Argentina

Taxonomic History – *Clelia quimi* was described from southern Brazil (Franco *et al.*, 1997). In the past, populations of this species have been confused with *C. bicolor*.

Diagnosis – The low number of ventrals (186-205) distinguishes *C. quimi* from *B. maculata* and *C. plumbea* (Ap-

pendix 4, Fig. 4). It seems to invariably have 8 supralabials on each side, in contrast to *B. maculata*, *C. clelia*, *C. plumbea*, and *C. rustica*, which usually have 7 (Franco *et al.*, 1997; Appendix 1). It is a medium-sized species (maximum total length 1277 mm; Fig. 3, Franco *et al.*, 1997).

Clelia quimi is most similar to *C. bicolor* in size, color, and squamation; it differs in having a higher number of ventrals (186-205 vs. 165-177) and in details of coloration. The line of demarcation on the sides of the head between the dark dorsal color and the light ventral color is sharp and distinct on the dorsal border of the supralabials in *C. bicolor*; in *C. quimi* the dorsal color fades gradually, continuing as a dusky color over the entire supralabial (Franco *et al.*, 1997).

Description – *Clelia quimi* is a medium-sized species; our four specimens were 370-955 in total length (Fig. 3), although Franco *et al.* (1997) had a specimen 1277 mm long. *Clelia quimi* has a relatively low number of ventrals (186-205) and subcaudals (60-74) (Appendix 4, Fig. 4). *Clelia quimi* has 8 supralabials on each side of the head (Appendix 1). The loreal is like the stereotypic colubrid pattern in size and position, contacting 2 supralabials (Appendix 3).

The hemipenis of *C. quimi* is illustrated in Franco *et al.* (1997) and Zaher (1999). It most resembles the hemipenes of *C. bicolor* and *C. rustica*; all three species have more than one pair of enlarged intrasulcal spines (Appendix 2).

Except for the differences in the color pattern on the side of the head described in the Diagnosis, adult *C. quimi* are colored very much like *C. bicolor*. The dorsal dark stripe is 9 scale rows wide, the paler (pink?) sides are reticulate and the venter is clear. Indications of a pale collar may persist, especially on the sides of the neck. The large, irregular white patches found in some other pseudoboines have not been seen in *C. quimi*.

The coloration of a live specimen described as “adult” by Franco *et al.* (1997) is probably a large juvenile (total length 480 mm). It had a dark head and vertebral stripe 7 scale rows wide, with scarlet sides of the body and a white venter. The supralabials were paler than the head dorsum.

The coloration of live hatchlings has not been published. Franco *et al.* (1997) described a color pattern of a preserved juvenile that was very similar to that of *C. bicolor* and *B. maculata*; consisting of a dark head, a light nape band interrupted dorsally, a dark dorsal stripe, and pink (red?) sides. These authors did not mention the ventral color.

Distribution – Giraud (1999) recorded the first specimen known from our area, from Posadas, Misiones Province, Argentina. The two specimens in the MNHNP from Departamento Itapúa are the first records from Paraguay. The two localities are on the upper Parana River in wet Atlantic forest (Fig. 9).

Clelia rustica (Cope 1878)

- Oxyrbopus rusticus* Cope, 1878[1877]: Type locality: Argentina
- Oxyrbopus rusticus*; Boulenger, 1896: Argentina
- Oxyrbopus rusticus*; Berg, 1898; Argentina
- Oxyrbopus maculatus*; Boettger, 1898: Buenos Aires, Argentina
- Oxyrbopus rusticus*; Boettger, 1898: Buenos Aires, Argentina
- Oxyrbopus rusticus*; Koslowski, 1898: Argentina
- Pseudoboa rustica*; Serié, 1921: Argentina
- Pseudoboa rustica*; Serié, 1936: Argentina
- Pseudoboa rustica*; Saporiti, 1946: La Pampa, Argentina
- Pseudoboa rustica*; Amaral, 1925: Tucumán, Argentina
- Clelia rustica*; Bailey 1970: Argentina
- Clelia rustica*; Abalos & Mischis, 1975: Argentina
- Clelia rustica*; Gallardo, 1976: Buenos Aires, Argentina
- Clelia rustica*; Gallardo, 1977: Buenos Aires, Argentina
- Clelia rustica*; Laurent & Terán, 1981: Tucumán, Argentina
- Clelia rustica*; Miranda *et al.*, 1983: Buenos Aires, Argentina
- Clelia rustica*; Halloy and Laurent, 1984: Northern Argentina
- Clelia rustica*; Ceï, 1986: Argentina
- Clelia rustica*; Scrocchi & Viñas, 1990: Argentina
- Clelia rustica*; Ceï, 1993: Argentina
- Clelia rustica*; Chebez, 1996: Misiones, Argentina
- Clelia rustica*; Zaher, 1996: Argentina
- Clelia rustica*; Giraud & Arzamendia, 1997a: Mendoza, Argentina
- Clelia rustica*; Giraud & Arzamendia, 1997b: Santa Fe, Argentina
- Clelia rustica*; Leynaud & Bucher, 1999: Gran Chaco, Argentina and Paraguay
- Clelia rustica*; Cabrera, 2001: Interior Argentina
- Clelia rustica*; Giraud & Scrocchi, 2002: Argentina
- Clelia rustica*; Giraud, 2002: Northeastern Argentina
- Clelia rustica*; Arzamendia & Giraud, 2002: Santa Fe, Argentina
- Clelia rustica*; Scolaro, 2005: Patagonia.

Taxonomic History – After Cope (1878) described *C. rustica* from Argentina, it was discovered in southern Brazil and Uruguay, but all of the records from “Paraguay” are suspect, as we have seen no specimens from the country. It almost certainly occurs in southeastern Paraguay, and Bertoni (1914) may have observed it, but Schouten (1931, 1937) and Gatti (1955) seemed to be simply copying Bertoni. The *C. rustica* record in Aquino *et al.* (1996) is based on a specimen that has been reidentified as *B. maculata*. This publication is probably the source of the erroneous Paraguayan Chaco record in Leynaud & Bucher (1999), showing the errors that can be made by uncritically using museum lists without examining the specimens.

Diagnosis – The reticulate dorsal color pattern and olive ground color can distinguish all specimens of *C. rustica*, except the rare unicolor exceptions, from the other species treated here (Fig. 13). Hatchlings may lack the pale nuchal collar that is present in all of the other species. In contrast to *C. bicolor* and *C. quimi*, *C. rustica* usually has 7 supralabials (Appendix 1). The snout is short, and the loreal scale often touches the first supralabial, a condition seen only rarely in *Boiruna* and not at all in the other species (Appendix 3).

Many or all of the various records of *C. rustica* from Paraguay are probably based on specimens of *Boiruna* with a *rustica*-like reticulate pattern on the sides of the body. True *C. rustica* have a uniform dorsal pattern (Fig. 13), and lack the broad dark dorsal stripe present in these *Boiruna*.

The hemipenis of *C. rustica* is spined, not spineless as in *C. plumbea*, with usually two pairs of intrasulcal spines (Zaher, 1996); *C. clelia* and *Boiruna* never have more than one pair of intrasulcal spines (Appendix 2).

Description – Descriptions of *C. rustica* can be found in Cope (1878), Achaval (1973), Gallardo (1977), Ceï (1986, 1993), Scrocchi & Viñas (1990), Zaher (1996), Achaval & Olmos (1997, 2003), Giraud (2002), and Carreira *et al.* (2005). Photographs of adults are in Ceï (1993) Achaval & Olmos (1997, 2003), and Scolaro (2005), Halloy and Laurent (1984) and Yanosky (1989a) have the same photograph of a large juvenile, and Giraud (2002) has a photograph of the venter of a preserved juvenile.

Clelia rustica is middle-sized, being larger than *C. bicolor* and *C. quimi* but smaller than *Boiruna*, *C. clelia*, and *C. plumbea* (Fig. 3). Total lengths of the smallest and largest *C. rustica* that we observed were 224 mm and 1583 mm, respectively.



FIGURE 13. *Clelia rustica*. FML long-term captive, vicinity of Tucumán, Tucumán Province, Argentina. Photo by G. Scrocchi.

Ventral counts for *C. rustica* (187-224) overlap those of all of the other species except *C. bicolor* (Appendix 4, Fig. 4). *Clelia rustica* has a relatively short tail; tail proportions are shorter than those of *C. bicolor*, *C. plumbea*, *C. quimi*, and probably *C. clelia* (Fig. 5). The species has a lower range of subcaudal counts (45-69; Appendix 4) than any of the other species considered here.

The hemipenis of *C. rustica* is illustrated in Zaher (1996). According to him, there are two pairs of intrasulcal spines and 16-17 enlarged spines on each side of the *sulcus*. We found more variation in our small sample, with fewer extrasulcal spines and 1-3 pairs of intrasulcal spines (Appendix 2).

Juvenile and adult *C. rustica* are similarly colored. Only the very smallest specimens may have a white collar (Gallardo, 1977). The dorsal ground color is usually a clear to dark yellowish-olive, with contrasting dark pigment on the bases the scales. The scales on the dorsum of the head may be edged in black. The dark pigment may be quite diffuse and occasional specimens may be almost unicolor (CENAI 3303, 3063; see Cei, 1993). Ventral scales are more yellow than the dorsal ground color. In contrast to other Southern Cone species of *Clelia* and *Boiruna*, where dark pigment invades the ventrals along their lateral and free margins,

C. rustica may or may not have black pigment along the bases of the ventrals (Zaher, 1996). In extreme cases the ventrals may be almost entirely black (photograph of CENAI 3083 in Giraudo, 2002: Plate 6). The large, irregular white patches found in other large pseudoboines are not seen in *C. rustica*.

Distribution – The first member of the *Clelia-Boiruna* group to be reported from the area was Cope's (1878) original description of *Oxyrhopus rusticus* (now *Clelia rustica*) from the Page Expedition to Argentina and Paraguay. Cope's specimen probably came from present-day Argentina.

Clelia rustica is endemic to the Southern Cone, including Uruguay (Achaval Elena, 2001). It is a temperate forest and steppe species that enters the tropical zone only in the cool Atlantic Forest and the foothills of the Andes in northern Argentina (Fig. 14). The "*C. rustica*" cited by Yanosky *et al.*, (1996) for Formosa, Argentina is a *C. bicolor* (Scrocchi & Giraudo, 2005). The species is the southernmost member of the genus *Clelia* (Marcus *et al.*, 2000).

A reviewer raised the intriguing possibility that the newly described *Clelia langeri* (Reichle & Embert, 2005) from Bolivia might be present among the snakes in northwestern Argentina that we identified as

C. rustica. We reexamined 57 specimens of *C. rustica* in the collection of the Fundación Miguel Lillo (FML) from the provinces of Jujuy, Salta, and Tucumán. None had the two pairs of loreals and 21 nuchal scale rows that distinguish *C. langeri* from all other *Clelia*, and their ventral and subcaudal numbers were much lower than those of *C. langeri*.

Incertae Sedis

- Oxyrhopus Cloelia*; Berg, 1898; Argentina
Oxyrhopus Cloelia; Koslowski, 1898: Argentina
Oxyrhopus maculatus; Koslowski, 1898: Argentina
Oxyrhopus Cloelia; Bertoni, 1913: Paraguay
Oxyrhopus Cloelia; Bertoni, 1914: Paraguay
Oxyrhopus occipitoluteus; Bertoni, 1914: Paraguay
Oxyrhopus rusticus; Bertoni, 1914: Paraguay?
Oxyrhopus Cloelia; Bertoni, 1921: Paraguay
Pseudoboa cloelia; Serié, 1919: Argentina
Pseudoboa maculata; Serié, 1919: Argentina
Pseudoboa cloelia; Serié, 1921: Argentina
Pseudoboa maculata; Serié, 1921: Argentina
Pseudoboa cloelia; Schouten, 1931: Paraguay
Pseudoboa rusticus; Schouten, 1931: Paraguay
Pseudoboa cloelia; Serié, 1936: Argentina
Pseudoboa maculata; Serié, 1936: Argentina
Pseudoboa occipitolutea; Serié, 1936: Chaco, Argentina
Pseudoboa cloelia; Schouten, 1937: Paraguay
Pseudoboa rusticus; Schouten, 1937: Paraguay
Pseudoboa occipitoluteus; Schouten, 1937: Paraguay
Oxyrhopus Cloelia; Bertoni, 1939: Paraguay
Pseudoboa cloelia; Freiberg, 1939: Entre Ríos, Argentina
Pseudoboa maculata; Freiberg, 1939; Entre Ríos, Argentina
Pseudoboa occipitolutea; Freiberg, 1939; Entre Ríos, Argentina
Pseudoboa cloelia; Abalos, 1949: Argentina
Pseudoboa cloelia; Fernández Barrán & Freiberg, 1951. Argentina
Pseudoboa cloelia; Gatti, 1955: Paraguay
Pseudoboa occipitolutea; Gatti, 1955: Paraguay
Pseudoboa rustica; Gatti, 1955: Paraguay
Clelia occipitolutea; Talbot, 1979: Paraguay
Clelia clelia; Talbot, 1979: Paraguay
Clelia clelia; Gallardo, 1979: Argentina
Clelia clelia; López & Álvarez, 1985: Corrientes, Argentina
Clelia sp.; López & Álvarez, 1985: Corrientes, Argentina
Clelia clelia clelia; Ceí, 1986: Western, central, and southern Argentina

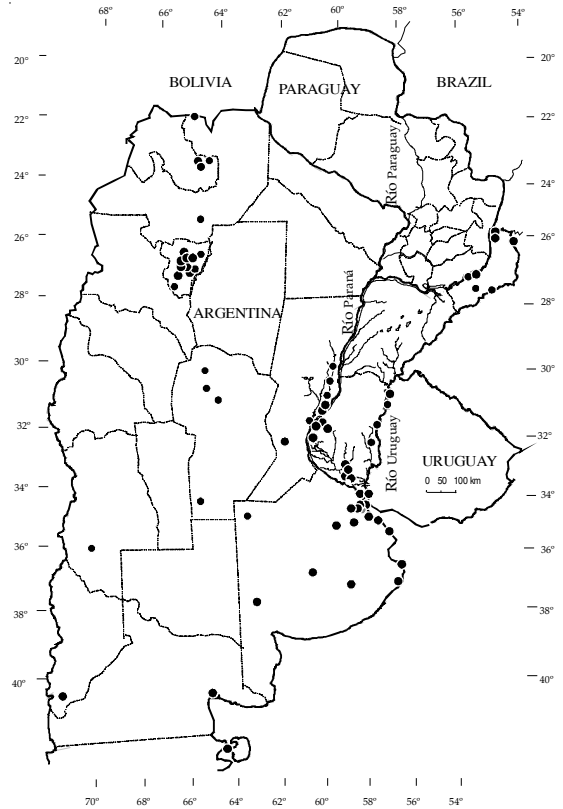


FIGURE 14. Geographic distribution of *Clelia rustica* in Argentina.

- Clelia clelia clelia*; Ceí, 1993: Northwestern and eastern Argentina
Clelia clelia ssp.; Chebez, 1996: Misiones, Argentina

Discussion – *Clelia clelia* has the largest geographical distribution of the species in our study area, but *B. maculata* has the widest ecological amplitude, tolerating xerophytic habitats in the Monte Desert and the dry Chaco, but also penetrating wet habitats in the Humid Chaco and, in Argentina, the forests of Misiones Province and the Mesopotamian Region between the Paraná and Uruguay rivers. The two species are sympatric in the Humid Chaco along the Paraguay and Paraná rivers. *Boiruna maculata* seems to be less common in wet forests and areas subject to inundation along the large rivers, where it may be replaced by *Clelia clelia* or *Clelia plumbea* (Figs. 7 and 12).

As described by Giraud (2002), the zone of transition along the Upper Paraná River (below Posadas), between the western open plant formations of the Humid Chaco and the eastern wet Atlantic forests, is an important area of mixing and parapatry for various pairs of snake species and subspecies.

Two pairs of species of *Clelia* are parapatric in this region. *Clelia clelia* in the Upper Paraná is replaced by *C. plumbea* in the Alto Paraná watershed, and sympatry is unknown (Fig. 12). In fact, parapatry between *C. clelia* to the west and *C. plumbea* to the east seems to be the pattern throughout their ranges (Zaher, 1996). *Clelia bicolor* also seems to be parapatric with *C. quimi* in this same part of the Paraná River.

To a large degree, the distribution of *C. rustica* is parapatric to that of *C. bicolor*; *C. rustica* being a species of cooler forest and steppe, and *C. bicolor* inhabiting the warmer, drier Chaco habitats. The distributions of the two species overlap each other only in extreme northern Argentina in the Andean foothill province of Jujuy, possibly in Tucumán and Salta, and on the Lower Paraná (Figs. 9 and 14).

The variation in the size and position of the scales of the snout, especially the loreal region may be of phylogenetic and ecological importance (Appendix 3, Fig. 2). *Clelia clelia*, *C. bicolor*, and *C. quimi* have a single loreal of "normal" colubrid size and position, that is, it spans parts of the second and third supralabials. In our species, we detected two distinct trends away from this configuration: A tendency to reduce or eliminate the loreal (*B. maculata*, *C. plumbea*), and a tendency to both reduce the loreal and shorten the length of the snout, so that the loreal often contacts the first supralabial (*C. rustica*). A third trend is seen in the recently described Bolivian species, *C. langeri*, which has two loreals (Reichle & Embert, 2005). The ecological significance of these differences in number, size, and position of the loreal is not clear.

With regards to the loreal, *B. maculata* is the most variable species. It has a somewhat reduced loreal; about half the time, the loreal is completely included in the second supralabial; in two instances, there was the tendency for the loreal to be in a more forward position, contacting the first supralabial. *Clelia rustica* also shows reduction in loreal size; the loreal contacts only a single supralabial in almost 1/3 of the examples. A more forward loreal position is common; in the majority of cases, the loreal contacts the first supralabial. In *C. plumbea*, the loreal is most reduced; in the majority of cases it contacts only the second supralabial, and it is occasionally missing, its position being filled by extensions of either the prefrontal or postnasal or both (Appendix 3, Fig. 2).

A major character that Zaher (1996) used to diagnose the new genus *Boiruna* was the absence of enlarged spines in the intrasulcal region of the hemipenis, contrasting it with their presence in the genus *Clelia*. Two of our specimens of *C. clelia* also lacked one or both of these spines (Appendix 2).

RESUMO

As serpentes dos gêneros pseudoboínos Boiruna e Clelia, este último provavelmente não monofilético, estão distribuídas desde o sul da Argentina, Brasil e Uruguai até o centro do México. Seis de seus membros ocorrem no Paraguai e na Argentina: B. maculata, Clelia bicolor, C. clelia, C. plumbea, C. quimi, e C. rustica. Historicamente, existiram confusões entre as espécies de maior tamanho (B. maculata, C. clelia, C. plumbea e C. rustica) e entre as espécies pequenas (C. bicolor e C. quimi). Todas as espécies, exceto C. rustica, possuem mudanças ontogenéticas na sua coloração. As espécies podem ser diferenciadas através do seu tamanho, cor, espinhos do hemipenis, e número de escamas loreais, supralabiais, e ventrais. A maior parte da diferenciação evolutiva em Boiruna e Clelia parecem ter ocorrido na região anterior da cabeça, pelo que mostram as diferentes proporções das escamas da região loreal. Boiruna maculata é a espécie de maior amplitude ecológica; é encontrada na maioria das formações vegetais existentes ao norte do paralelo 38 no centro da Argentina, ausente apenas na região de sedimentos deltaicos da província de Buenos Aires, Argentina, e nos amplos vales e colinas onduladas do leste do Paraguai. Clelia bicolor é mais comum nos vales dos rios Paraguai e Paraná, e com alguns registros na base dos Andes no norte da Argentina. Clelia clelia distribui-se ao longo do Rio Paraguai e do baixo Paraná, e quase todo o leste do Paraguai. Clelia plumbea aparentemente é parápatrida de C. clelia ao longo do rio Paraná no sudeste do Paraguai e na província de Misiones, Argentina. O extremo leste da distribuição de C. quimi limita-se com o extremo oeste da distribuição de C. bicolor na mesma região sem que, aparentemente, haja superposição. Não existe material de referência que prove a presença de Clelia rustica no Paraguai. Na Argentina, ela é uma espécie encontrada em áreas temperadas; ao norte do paralelo 30, é encontrada na base dos Andes e nas florestas úmidas da província de Misiones. Ao sul, está amplamente distribuída além do paralelo 40.

PALAVRAS-CHAVE: *Clelia*, *Boiruna*, Argentina, Paraguay, pseudoboínos, colubrids.

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APPENDIX 1

Material Examined

CENAI, Colección Herpetológica del Instituto Nacional de Microbiología, deposited in MACN
 CFA, Colección “Félix Azara”, deposited in MACN
 CIES, Centro de Investigaciones Ecológicas Subtropicales, Parque Nacional Iguazú, Argentina
 CUNAM, Universidad Nacional de Misiones, Posadas, Argentina
 FML, Fundación Miguel Lillo, Tucumán, Argentina
 INALI, Instituto Nacional de Limnología, Santo Tomé, Argentina
 INBIAL, Instituto de Biología de la Altura, San Salvador de Jujuy, Argentina
 MACN, Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina
 MAI, Museo Ambiental de Itaipú, Hernandarias, Paraguay
 MFA, Museo Provincial de Ciencias Naturales, Santa Fé, Argentina
 MLP, Museo de La Plata, La Plata, Argentina
 MNHNP, Museo Nacional de Historia Natural del Paraguay, San Lorenzo, Paraguay
 MSR, Museo de Historia Natural de San Rafael, San Rafael, Argentina
 PNEP, Parque Nacional “El Palmar”, Entre Ríos, Argentina
 UNNEC, Universidad Nacional del Nordeste, Corrientes, Argentina
 USNM, United States National Museum, Washington, D.C., USA

Boiruna maculata – ARGENTINA: MACN 4350; Catamarca: Andagalá, 17.6 km S, FML 685; Monte Potrero, FML 462; Siján, CENAI 1972 (2); Villa San Roque, Tinogasta, FML 1677; Chaco: Colonia Benítez, CENAI 1413, MACN 4550; Coronel Du Graty, CENAI 2251; El Colorado, 10 km S, FML 1081; Gancedo, CENAI 2244; Hermoso Campo, CENAI 2201; Machagai, CENAI 3072, 3576; Margarita Belén, CENAI 1170; Napanay, MACN 33034; Parque Nacional Chaco, UNNEC 4846-4847; Resistencia, MACN 4381; Sáenz Peña, CENAI 2382; Villa Berthet, CENAI 2619, 3623; Córdoba: Cañada de Luque, CENAI 1168, INALI 693; Lucio V. Mansilla, CENAI 1169; Maquinista Gallini, MACN 33033; Obispo Trejo, CENAI 1590; Corrientes: Cerrudo Cué, UNNEC 24, 477; Corrientes, CENAI 2625, 3101, 3136, UNNEC 6240-6241; Estero Valenzuela, CFA s/n; Itatí, CENAI 3330; Ituzaingó, FML 210; Laguna Paiva, CFA 620; Rincón de Vences, UNNEC 294; Ruta 12, between Itá Ibaté and crossing to Berón de Astrada, INALI 96; Yahapé, MFA 156; Entre Ríos: MACN 6983; Concepción del Uruguay, MACN 3667; Gualeguaychú, CENAI 1552; Los Conquistadores, MACN 23563; Nueva Vizcaya, CENAI 3060; Parque Nacional El Palmar, PNEP 51; Pronunciamiento, CENAI 3432; San Jaime, MACN 27952; Villa Federal, CENAI 2407; Formosa: Bouvier, UNNEC 4720; Clorinda, CENAI 3014; Colonia Pastoril, UNNEC 5084; El Colorado, CENAI 2900; Estero Pirané, FML 522; Formosa, CENAI 3022; Parque Nacional Pilcomayo, INALI 561; Reserva Ecológica El Bagual, FML 11238, 11241, 11248, 11249, 11252, 11560, 13376, INALI 1148, MACN 36843; General Taboada: Puente Negro, FML 444; Jujuy: MACN 3100; La Pampa: Conhelo, MACN 5878-5879; Lihué Calel, MACN 33035; Pichimahuida, MACN 34587; La Rioja: Los Molinos, FML 9468; Patquía*, CENAI 2354, USNM 73410; Mendoza: near Cerro Bola, MSR 665; Colonia Colmer, MSR 269; El Escorial, MSR 592; Cañon del Atuel, MSR 896; Los Reyunos, MSR 793; Mendoza, USNM 11388; Rama Caída, MSR 15; Valle del Rincón del Atuel, MSR 55; Misiones: El Soberbio, CFA 389; between San Pedro and B. de Irigoyen, MACN 12691; Tobuna, MACN 12710; Salta: Coronel Cornejo, MACN s/n; Finca Los Colorados, FML 2494, 6543; Hickman, FML 476; Joaquín V. Gonzales, FML 2191, 2226; La Unión, CENAI 2844; Orán, CENAI 2738; Padre Lozano, CENAI 1622, 1754, 1830; Río Baritú, FML 1284; San Luis: MACN 4698; La Unión, MACN 1410; Lafinur, FML 7187; San Luis del Palmar, UNNEC 522; Santa Fe: MACN 3868, 9427, MFA 344; Avellaneda, CENAI 2966; El Nochero, MACN 2363; Helvecia, island in front, MFA 160; La Gallareta, km 60, MFA 159; La Gama, MACN 36661; Laguna de los Ubajais, FML 1377; Las Garcitas, MACN 33032; Las Guampitas, 5 km S Espín, MACN 1872, 1876, 8620; Est. Los Tábanos, CENAI 3508; Ruta 98, 26 km W intersection with Ruta 11, INALI 1024; San José del Rincón, MFA 252, 344; Santa Fe, MACN 43; Tostado, CENAI 1593; Villa Minetti, ~40 km N, FML 6862; Santiago del Estero: Fernández, MACN 34368, 34369; La Banda, FML 579; Monte Bello, FML 898; Pellegrini, FML 2138; Tacañitas, MACN 7269; Tucumán: MACN 943; Aguilares, FML 1869; Amaicha del Llano, FML 1432; Atahona, FML 758; Banda del Río Salí, FML 1458, 1883;

Carbón Pozo, FML 694; El Timbó, FML 6076; Estancia La Princesa, FML 6091; Las Talitas, FML 1459, 13546; San Agustín, FML 2401; San Miguel de Tucumán, FML 470, 489, 1556, 1831, 1871, 2336, 2644, 6882, 12389-12393, MACN 4317; San Pablo, FML 1470; Santa Barbara, FML 1860; Trinidad FML 1871; Villa Mariano Moreno, FML 13668.

PARAGUAY: MNHNP 9412; Alto Paraguay: Agua Dulce, MNHNP 6553, 9792; Madrejón, MNHNP 2617, 2619; Mayor Pablo Lagerenza, MNHNP 7674; Parque Nacional Defensores del Chaco, línea 2, MNHNP 7937; Parra Cué, MNHNP 9186; Tribu Nueva, Cerro León, MNHNP 2625; Boquerón: Filadelfia, MNHNP 2622-2624, 3061, 6549, 10014, USNM 342099; Filadelfia, 30 km N, MNHNP 3058; Fortín Toledo, MNHNP 3841; Ruta TransChaco, 30 km S turnoff to Filadelfia, MNHNP 2618; Parque Nacional Teniente Enciso, Fortín Nueva Asunción, MNHNP 3062; Itapúa: Yacyretá, UNNEC 453; Misiones: 2 km NW San Ignacio, MNHNP 3060; Ñeembucú: MNHNP 9458; Presidente Hayes: La Golondrina, USNM 342100.

Clelia bicolor – ARGENTINA: Chaco: FML 1801, 1924; MACN 312; Basail, UNNEC 177, 207; Campo Milano, CFA 270; Colonia Benítez, CENAI 1306; Colonia Las Mercedes, UNNEC 39, 153, 545; General San Martín, MACN s/n; Las Palmas, MACN 14995; Pampa del Indio, CENAI 3126; Parque Nacional Chaco, UNNEC 200; Resistencia, INALI 54; Saenz Peña, CENAI 2382, FML 1800, 15875; Selvas del Río de Oro, MACN 33036; Villa Berthet, CENAI 2369, MACN 3507; Corrientes: Corrientes, CFA 141, 629, UNNEC 119, INALI 48; EL Perichón, UNNEC 556; Estero Valenzuela, CFA s/n (2); Granja Yatay, CFA 400, INALI 864; Laguna Brava, UNNEC 236, 237, 307; Laguna Pampín, CFA 310, 724; Rincón del Guayquiraró, INALI 36; Río Santa Lucía, MACN 29543; San Cayetano, CENAI 3784, CFA 630; San Luis del Palmar, UNNEC 836; Formosa: Clorinda, CENAI 2132, 2862, UNNEC 314; El Colorado, CENAI 2938; km 1301 Ruta Nacional 86, CFA 583; Las Lomitas, INALI 927; Mayor Villafañé, MACN 34495, 34496; Paraje Nandhy Verá, CFA 210; Pironé, MACN 37406; Reserva Ecológica El Bagual, FML 11323, 11409, 11417-20, 11432, 11435, 11436, 11443; Jujuy: Arroyo Sauzalito, near intersection Ruta Nacional 34 and Ruta Provincial 1, INBIAL 312; Calilegua, MACN s/n; Ledesma, CENAI 2369, 3507; Yuto, CENAI 3594-6; La Rioja: Patquía*, USNM 73410; Misiones: San José, FML 8475; Santa Fe: MACN 27228; Estancia Las Gamas, MACN 36658-36660; Fortín Olmos, INALI 1023; Las Guampilás, MACN 8621; 80 km W Reconquista, MACN 27229; Romang, INALI 1522; Ruta 98, 1 km W Ruta 11, INALI 1601; Ubajay, MACN 2334; Vera, INALI 160; Tucumán: Escaba, Río Marapa, FML 819 (erroneous locality); Horco Molle, CENAI 3806.

PARAGUAY: MNHNP 94444, 9449, 9535; Alto Paraguay: Potrerito, MNHNP 5783, 5784; Puerto Guaraní, MACN 614; Central: Asunción, MACN 5801-5804, MNHNP 2613-2614, 3752; Luque, MNHNP 9166; San Lorenzo MNHNP 6556, 7684, 8481; Ypacaraí, MNHNP 6555; Concepción: 2 km E Concepción, USNM 342096; Cordillera: San Bernardino, MNHNP 3942; Ñeembucu: Estancia San Antonio, MNHNP 6674; Estancia Yacaré, MNHNP 6678, 6685; Presidente Hayes: Estancia La Golondrina, MNHNP 2621, 9144, 9225, 9226, 9230; Estancia La Victoria, km 234, MNHNP 2616; Estancia Santa Catalina, km 330, MNHNP 5785; Loma Verde, 3 km E, MNHNP 4582; Rancho Carandá, MNHNP 7942; Ruta 9, 24°43'59"S, 57°56'02"W, MNHNP 6575; Ruta 11, km 113, MNHNP 6550; Ruta 11, km 323, MNHNP 6552; Ruta to General Bruguéz, MNHNP 7516, 7657; Ruta TransChaco, 8 km N Puente Remanso, MNHNP 2615; Ruta TransChaco, 223 km NW Villa Hayes, USNM 342097-342098; San Pedro: Guajhó, Casado, MACN 1772-1773; Villa del Rosario, MNHNP 2620.

Clelia delia – ARGENTINA: Chaco: Resistencia, FML 7543; Corrientes: Corrientes, CENAI 3101; Yaceretá, UNNEC 578; Parque Nacional Mburucuyá, UNNEC 6798; Villa Olivari, CFA 810; Formosa: MACN 847; Formosa, CENAI 3022; Parque Nacional Pilcomayo, INALI 880; Santa Fe: Avellaneda, CENAI 2966; Puerto Piracúa, INALI 1685.

PARAGUAY: Caaguazú: Coronel Oviedo, 5 km N, MNHNP 2626; Caazapá: Estancia La Golondrina, MNHNP 9217; Canendeyu: Estancia Ybycui, MNHNP 6695; Central: Asunción, MNHNP 3085; Itapúa: Yacyretá, MNHNP 4660, 4721, 4722; 4956, 8370, FML 11964; Ñeembucu: Tacuará, 8 km NE, MNHNP 8840; Presidente Hayes: Road to Falcón, MNHNP 8489; Puerto Fonciere, MNHNP 3957; Río Montelindo, 2.3 km W Río Paraguay, MNHNP 6284; Ruta TransChaco, between Kms 100-150, MNHNP 3908; San Pedro: Carumbé, FML 719.

Clelia plumbea – ARGENTINA: Misiones: Aristóbulo del Valle, INALI 172, 173, 387, FML 6713, 6714; 2 de Mayo, CENAI 2674; Parque Nacional Iguazú, CENAI 3878, CIES 11, 55, 66, 126, 214, 217, 344; Ruta 12, near access to Puerto Piray, CFA 579; Santiago de Liniers, INALI 434; near Wanda, CIES 228. PARAGUAY: Alto Paraná: Vivero Forestal Itaipú, MBI 38; Itapúa: Arroyo Pirapó, MNHNP 3059.

Clelia quimi – ARGENTINA: Misiones: Posadas, CUNAM 323. PARAGUAY: Itapúa: Yaciretá, MNHNP 4723, 4724, 4866.

Clelia rustica – ARGENTINA: Buenos Aires: MACN 29055, USNM 345440; Altos del Talar, CENAI 1390; Bella Vista, MACN 8024; Buenos Aires, MACN 314, 11372, 29356, 29357; Burzaco, MACN 7359; Campo de Mayo, MACN 2843; Cañuelas, MACN 31551; Colonia Manuel Viana, MACN 6922; Don Torquato, MACN 27466; Ezeiza, MACN 34483, 34524, 34577, s/n; Florida, MACN 10175, 10845; Hudson, MACN 32555; Hurlingham, MACN 9972, 10930; Isla Martín García, MACN 1194(3), 8967(2); José E. Paz, MACN 24803; Justo Villegas, MACN 30273; La Ferrere, CENAI 2399; La Plata, FML 13507, MLP s/n; La Salada, MACN 13821; Los Talas, MACN 526; Macedo, CENAI 1430; Magdalena, CENAI 3216, 3303, MACN 28430; Moreno, MACN 24889; Nuñez, CENAI 1998; Olavarría, 25 km NE, MACN 28563; Olivos, MACN 34553; Puente Roca entre Castelar y Morón, MACN 29934; Punta Lara, MLP s/n; Reserva Nacional Otamendi, CFA 52; San Clemente del Tuyá, CENAI 2887; San Justo, CENAI 2040; San Miguel, MACN 2663, 11341; Sierra de la Ventana, CENAI 2904; MACN 33555, 34583; Tandil, CENAI 2038, FML 1605; Tortuguitas, CENAI 3297; Chubut: MACN 5147; Península Valdés, Istmo Carlos Ameghino, CENAI 3875; Córdoba: La Cumbre, 4 km N, MACN 24799; Cerro Negro, FML 263; Córdoba, CENAI 3097; San Antonio de Litín, CENAI 3444, 3445, 3446; Villa Valeria, CENAI 3610; Entre Ríos: Colonia Delta, CENAI 2086, 2252, 2253, 2254; Parque Pre-Delta, INALI 1462; Ibicucito, CENAI 2081; Medanos, 8 km N, INALI 1488; Medanos, 13 km SE, INALI 1492; Paraná, INALI 1352; Paranacito, MACN 21164; Parque San Martín, INALI 861; Pronunciamento, CENAI 3432; Puerto Ibicuy, INALI 1558; Puerto Yerúa, CENAI 3601; Salto Grande, MACN 1881; Ubajay, MACN 10230; Viale, INALI, 1011; Jujuy: MACN 5780; Abra Colorada, FML 666, 1249; El Monolito, FML 596; Yuto, FML 217; Mendoza: Ruta 186, 5 km E Ruta 40, CFA 226; Misiones: MACN 3752, 3753; Capiovy, CENAI 2825; El Bonito, FML 678; Oberá, CENAI 3056, 3063, MACN s/n; Puerto Gisela, CENAI 1763; Puerto Iguazú, INALI 1202; Salto del Uruguai, MACN 34478, 36267; San Antonio, UNNEC 6021; Neuquén: Paso Miranda, 4 km NE, MACN 36784, 36785; Río Negro: San Antonio Oeste, MACN 30316; Salta: Balderrama, FML 1043; Departamento Santa Victoria, FML 742; Sierra de Metán, FML 1021; Yacones, FML 1021; Santa Fe: Alejandra, 20 km S, MACN 29047; Departamento La Capital, MFA 475; Las Rosas, MACN 27321; Ruta 1, km 87, INALI 426; San Joaquín, INALI 477; Santa Rosa, INALI 458; Santa Rosa, 15 km S, INALI 1343; Santa Fe, CFA s/n, INALI 190, 632, 660; Santo Tomé, MFA 334, 351, 464; Tucumán: Aguas Chiquitas, Sierra de Medina, FML 1299, 1303; Camino del Perú, FML 1658; Dique El Cadillal, FML 11846; El Ceibal, San Pablo, FML 1433; El Potrerillo, El Mollar, FML 1884; El Siambón, FML 6355; Río San Javier, FML 7683, 8646; Horco Molle, FML 745, 2702; Quebrada de Lules, FML 859, 2218, 2378, 7610; Río Pueblo Viejo, FML 1116; San Miguel de Tucumán, CENAI 1764, FML 469, 1157, 1311, 1682, 1835, 2011, 2247, 2318, 2354; San Pablo, FML 2002; Tafi Viejo, FML 1396, 1434, 1456, 1471, 1518, 2345, 11838, USNM 64129; Yerba Buena, FML 746, 786, 844, 852, 983, 1514, 1538, 1673, 1936, 2004, 2033, 2035, 2239, 2764, 2766, 10171, 13548.

*The herpetological records from “Argentina: La Rioja: Patquía” continue to plague the literature (Dixon & Hendricks 1979; Scrocchi 1990, Girauco & Scrocchi 1998, 2002). As noted by the latter authors, “this [Patquía] reference is based on specimens from Estancia Breyer... In Estancia Breyer, there was a herpetological collection with material coming from different localities. Later, the various specimens were deposited in different museums of the United States, and they were recorded as having been collected in La Rioja.” (Girauco & Scrocchi 2002:4). There are also specimens in the MACN. *Boiruna* may occur at Patquía, but *C. bicolor* almost certainly does not.

APPENDIX 2

Distribution of counts of supralabials of *Boiruna* and *Clelia* in Paraguay and Argentina. Counts are the sum of scales on the right and left sides of the head. *n* is the number of snakes examined for this character.

	<i>n</i>	<i>Supralabials</i>			
		14	15	16	17
<i>Boiruna maculata</i>	31	29	3	—	—
<i>Clelia bicolor</i>	45	1	1	42	1
<i>Clelia clelia</i>	20	15	—	4	1
<i>Clelia plumbea</i>	6	6	—	—	—
<i>Clelia quimi</i>	4	—	—	4	—
<i>Clelia rustica</i>	20	19	1	—	—

APPENDIX 3

Numbers and distribution of enlarged spines on hemipenes of *Boiruna* and *Clelia* in Paraguay and Argentina. Intrasulcal spines are those between the arms of the divided *sulcus spermaticus*. Extrasulcal spines are the enlarged spines on both sides of the undivided portion of the *sulcus*. *n* is the number of snakes examined for these characters.

Species	<i>n</i>	Intrasulcal Spines						Extrasulcal Spines
		0	1	2	4	6	7	
<i>Boiruna maculata</i>	14	14	—	—	—	—	—	13-39
<i>Clelia bicolor</i>	5	—	—	—	2	3	—	25-40
<i>Clelia clelia</i>	8	1	1	6	—	—	—	15-22 (37*)
<i>Clelia plumbea</i>	1	1	—	—	—	—	—	0
<i>Clelia quimi</i>	1**	—	—	—	1**	—	—	(34)**
<i>Clelia rustica</i>	5	—	—	1	2	1	1	21-32

* MNHNP 6695 from a locality isolated from the rest of the sample has almost twice as many hemipenial spines as any other *Clelia clelia* in our sample.

** Data from illustration in Franco *et al.* (1997).

APPENDIX 4

The numbers of the supralabials contacted by the loreal scale on each side of the head in *Boiruna* and *Clelia* from Argentina and Paraguay. The supralabials are numbered from anterior to posterior. *n* is the number of snakes examined for this character.

Species	<i>n</i>	Supralabial Numbers Contacted by Loreal					
		0	1	1,2	2	1,2,3	2,3
<i>Boiruna maculata</i>	22	—	—	2	21	2	19
<i>Clelia bicolor</i>	37	—	—	—	—	—	74
<i>Clelia clelia</i>	17	—	—	—	—	—	34
<i>Clelia plumbea</i>	9	4	—	—	12	—	2
<i>Clelia quimi</i>	3	—	—	—	—	—	6
<i>Clelia rustica</i>	45	—	1	56	20	1	12

APPENDIX 5

Counts of ventral and subcaudal scales for *Boiruna* and *Clelia* in Argentina and Paraguay. *n* is the number of snakes examined for these characters.

	<i>n</i>	Ventrals		<i>n</i>	Subcaudals	
		Median	Range		Median	Range
MALES						
<i>Boiruna maculata</i>	30	222	212-235	44	73	61-84
<i>Clelia bicolor</i>	25	168	163-175	24	66	59-74
<i>Clelia clelia</i>	15	201	193-213	12	82	75-88
<i>Clelia plumbea</i>	9	222	214-223	9	83	79-90
<i>Clelia quimi</i>	2	190	184-196	2	73	71-74
<i>Clelia rustica</i>	22	194	187-216	16	66	59-69
FEMALES						
<i>Boiruna maculata</i>	25	228	214-247	41	61	52-70
<i>Clelia bicolor</i>	28	179	170-187	27	55	51-61
<i>Clelia clelia</i>	11	208	194-218	10	69	62-74
<i>Clelia plumbea</i>	7	233	226-240	4	73	69-74
<i>Clelia quimi</i>	2	203	202-203	2	61	60-62
<i>Clelia rustica</i>	28	206	198-224	23	52	45-58