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Two New Species of Colubrid Snakes of the Genus *Clelia* from Brazil

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ABSTRACT.—**Two new species of *Clelia* are described from Brazil: *Clelia quimi* sp. n., from southern, southeastern, and west-central Brazil, and *Clelia montana* sp. n., which is probably restricted to the highlands of northwestern São Paulo and southern Minas Gerais. *Clelia quimi* appears to be closely related to *C. bicolor*, being distinguished from the latter by the number of ventral scales and the color of the supralabials. *Clelia montana* sp. n. seems allied to *C. rustica*, differing from the latter by the numbers of supra- and infralabials and the generalized color pattern.**

The genus *Clelia* Fitzinger, 1826, is currently included in the subfamily Xenodontinae Bonaparte, 1845, and in the tribe Pseudoboini Jenner and Dowling, 1985. The inclusion of this genus in the Pseudoboini is based mainly on hemipenis morphology (Jenner and Dowling, 1985). Geographical congruency and the immunologic distance of albumins also support *Clelia*'s relationship with the other nine genera included in this tribe (Jenner and Dowling, 1985). The genus *Clelia* is distributed through most of the Neotropical region, from southern Mexico (Bailey, 1970) to about 42°S, east of the Andes in Argentina (Bailey, 1970; Schrocchi and Viñas, 1990).

Bailey (1970) recognized six species: *C. bicolor* (Peracca, 1904); *C. clelia* (Daudin, 1803), with two subspecies *C. c. clelia* (Daudin, 1803) and *C. c. plumbea* (Wied, 1820); *C. equatoriana* (Amaral, 1924); *C. rustica* (Cope, 1878); *C. scytalina* (Cope, 1867); and *C. occipitolutea* (Duméril, Bibron and Duméril, 1854). Recently, Underwood (1993) described *Clelia errabunda* from Saint Lucia Island (Antilles). When Scrocchi and Viñas (1990) studied the species of this genus in Argentina, they synonymized *C. occipitolutea* with *C. c. clelia*. If this synonymization is accepted, there would be two very different species named *C. c. clelia* in Brazil. This issue is currently being studied by H. Zaher (pers. comm.).

Among the species currently considered, three have been recorded for Brazil: *C. clelia*, found in forest formations (Bailey, 1970; Cunha and Nascimento, 1978) and in the Pantanal wetlands (Strüssmann and Sazima, 1993); *C. rustica*, apparently limited to the colder regions in the southern parts of the country (Bailey, 1970); and

TABLE 1. Scale counts for number of scales in *Clelia quimi* sp. n., *C. bicolor*, *C. montana* sp. n. and *C. rustica*. (V = ventrals; SC = subcaudals; SL = supralabials; IL = infralabials). Number of individuals in brackets.

	Clelia quimi		*Clelia bicolor*		*Clelia montana*		*Clelia rustica*	
	♂	♀	♂	♀	♂	♀	♂	♀
V	184–200	193–207	165–175	174–185	201–211	209–218	201–212	214–225
(n)	(34)	(29)	(8)	(15)	(5)	(7)	(11)	(16)
SC	66–79	58–71	64–68	57–61	53–57	46–49	52–64	44–54
(n)	(29)	(26)	(7)	(14)	(4)	(6)	(9)	(13)
SL	8/8		8/8		8/8		7/7 (23)	
(n)	(63)		(22)		(12)		8/8 (02)	
IL	9/9 (60)		9/9 (17)		8/8 (11)		9/9 (18)	
(n)	8/8 (01)		8/9 (01)		7/7 (01)		8/8 (06)	
	10/9 (01)		9/10 (01)				9/8 (01)	
	8/9 (01)		10/10 (02)					

C. bicolor, found in the Pantanal Matogrossense and its boundaries (Bailey, 1970; Strüssmann and Sazima, 1993). These three species invariably have 19 rows of dorsal scales; the other species (*C. scytalina*, *C. equatoriana*, and *C. errabunda*) have 17.

A detailed examination of the specimens of the genus *Clelia* in the herpetological collection of Instituto Butantan has revealed the existence of two new species having 19 scale rows at midbody.

MATERIALS AND METHODS

We examined 128 specimens (*C. bicolor*, *C. rustica*, and the two new species, as listed in the appendix) in the herpetological collections of the Instituto Butantan (IB) and Museu de História Natural da Universidade Estadual de Campinas (ZUEC), with regard to pholidosis and morphometrics. The book of colors by Villalobos-Domingues and Villalobos (1946) was followed in describing the color pattern in life. The ventral scales were counted according to the method proposed by Vanzolini et al. (1980). The hemipenes were prepared according to the method described by Pesantes (1994). Data on feeding and reproduction were also obtained. Means are reported as ± [SD].

Clelia quimi sp. n.
Figs. 1 and 3

Holotype.—IB 53743, adult male, from Santo Antônio farm, city of Itu (23°16'S 47°19'W), state of São Paulo (SP), Brazil, received by Instituto Butantan (IB) on 27 March 1990, sent by L. M. Gelpe.

Paratypes.—BRAZIL: SÃO PAULO: São José dos Campos, IB 18747, ♂, received 22 February 1960; IB 24981, ♀, received 10 April 1965; Salto, IB 22662, ♀, received 28 January 1963; São Paulo, IB 2924, ♀, received April 1917; Suzano, IB 30673, ♀, received 6 February 1970; Rio Claro, IB 32133, ♂, and IB 32135, ♀, received 28 April 1971; Taubaté, IB 32911, ♀ received 3 March 1972; Araraquara, IB 53693, ♂, received 19 December 1989.

Diagnosis.—*Clelia quimi* is distinguishable from *C. scytalina*, *C. equatoriana* and *C. errabunda* by 19 rows of mid-dorsal scales while other species have 17.

Clelia quimi can be distinguished from *C. clelia* (*sensu* Bailey, 1970) because the new species has 8 supralabials, while *C. clelia* has 7, rarely 8 (Bailey, 1970; Cei, 1986; Cunha and Nascimento, 1978; Scrocchi and Viñas, 1990). Neonates of *C. quimi* have a white nape collar, a dark vertebral stripe, and an immaculate venter, whereas neonates of *C. clelia* (*sensu* Bailey, 1970) lack a vertebral stripe.

Clelia quimi is distinguishable from *C. bicolor* by the greater number of ventral scales (Table 1). The latter has the supralabials with a well delineated light region, while in the new species the dorsal pattern of head reaches these shields (Fig. 1).

Clelia quimi can be distinguished from *C. montana* sp. n. because the former has 9 (rather than 8) infralabials, a more prominent head, a sharp snout, fewer ventrals, and more subcaudals (Table 1). Furthermore, the adult of *C. montana* has a distinct light collar (Fig. 2) and red eyes.

Holotype Description.—An adult male, preserved in alcohol, hemipenes everted, the right one removed for illustration. Head little distinct from neck, length 31.7 mm; greatest head width 17.4 mm; head width/head length ratio 0.55. Total length (TL) 1090 mm. Tail length 230 mm. Tail/total length ratio 0.21. Dorsal scales smooth with two apical pits. Dorsal scales in 19/19/17 rows, reducing by the loss of fourth row on each side above level of ventrals 123 and 126, respectively. Ventrals 199. Cloacal scale undivided. Subcaudals in 76 pairs. Head scutellation typical of other colubrids. Rostral shield

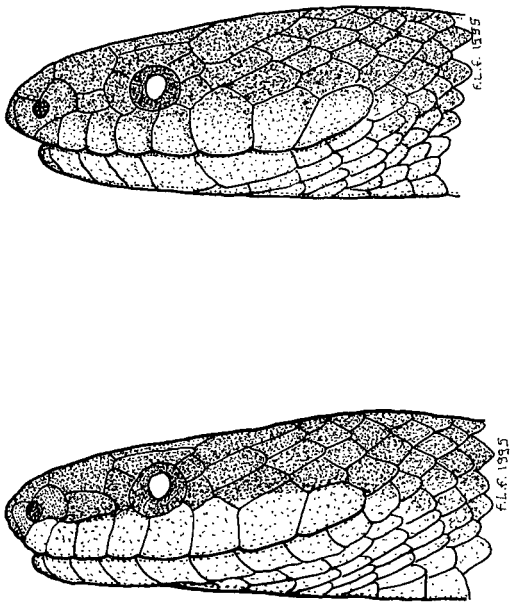

FIG. 1. Lateral view of the heads of *Clelia quimi* (IB 24323) (above) and *C. bicolor* (IB 37361) (below) (1.9×).

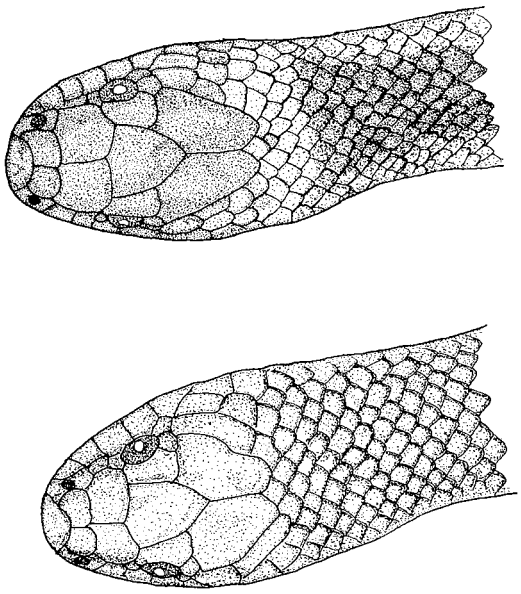

FIG. 2. Dorsal view of head of *Clelia montana* (IB 22505) (above) and *C. rustica* (IB 30440) (below) (1.4×).

twice as wide as high, internasals slightly rounded and somewhat shorter than prefrontals. Prefrontals rectangular, somewhat longer than wide, each in contact with internasal, nasal, loreal, preocular, supraocular, and frontal. Frontal hexagonal, anterior apex somewhat distinct, longer than wide, and shorter than parietals. Supraoculars approximately twice as long as wide, narrower anteriorly, not protruding over eyes. Parietal length/width ratio 1.68. Interparietal suture as long as frontal scale, shorter than distance from frontal to tip of snout. Nasal divided, longer than high. Loreal rectangular, longer than high. One preocular, twice as high as long. Two postoculars on right side, lower about ⅔ size of upper; on left side, lower fused with fifth supralabial. Temporals 2 + 3, the anterior somewhat longer than posterior ones. Upper posterior temporal on left side merged with neighboring scale. Supralabials 8/8, second and third touching loreal, fourth and fifth touching eye; posteriormost four larger than anterior ones. Infralabials 9/9, first pair in contact on distal border of mental, first four in contact with anterior chin shields, and fifth (and largest pair) contacting posterior chin shields. Posterior chin shields longer than anterior ones. Eye diameter 2.5 times distance from eye to tip of snout. Pupil vertical.

Coloration in Alcohol.—Dorsum dark brown becoming progressively lighter on the lateral part of the body. Venter cream-colored; paraventral coloring slightly invading the lateral parts of the ventrals. Dorsum of head the same color as the body. Supralabials with dark upper borders, becoming lighter toward the edge of mouth. Infralabials and mental region, the same light color as the venter.

Coloration in Life.—An adult female specimen (480 mm TL), from Morro Agudo-SP (IB 54883). The dorsum with a dark vertebral stripe (S-3-2, according to Villalobos-Domingues and Villalobos, 1946), seven scale rows wide; the paraventral region scarlet (S-5-7), 5 scale rows wide. Dorsal side of head the same color as the vertebral region. Supralabials somewhat lighter than dorsal side of the head. Ventral region white.

Ontogenetic Variation of Coloring.—The adults do not vary in coloration. However, as in other species of *Clelia*, there is ontogenetic variation. Preserved in alcohol, the juvenile has a well defined vertebral stripe, 3 or 4 scale rows wide. The lateral and paraventral regions are rosy. There is an incomplete white collar, evident only laterally. The infralabials occasionally have dark coloring on the upper edges.

Size and Dentition.—Snout-vent length ranges from 205 to 1030 mm (N = 57, $\bar{x}$ = 661 ± 223 mm), tail length from 50 to 247 mm (N = 53, $\bar{x}$ = 158 ± 54 mm). Three specimens (IB 22490, IB 30242 and IB 33131) were examined in order to characterize the dentition of *Clelia quimi*. They have 12–13 prediastemal maxillary teeth and two grooved fangs somewhat larger than the anterior teeth; the diastema about twice as long as the space between the maxillary teeth; 18–19

mandibular teeth; 9–10 palatine teeth; and 15–17 pterygoid teeth.

Natural History.—The following food residues were found in the digestive tract of five adult individuals (TL > 650 mm): IB 22490, a snake of the species *Helicops modestus*; IB 29906 and IB 33062, two rodents of the family Cricetidae; and IB 1813 and IB 18747, unidentified mammalian hair. A juvenile (TL 280 mm), IB 28257, contained the tail of a gymnophthalmid lizard. Two females (IB 27447, IB 30029), received in June, possessed ovarian follicles at the beginning of vitellogenesis. Females with oviductal eggs were received in September (IB 8752), October (IB 27128, IB 34293), and November (IB 41066). The total number of eggs ranged from 9 to 17. Egg length is about 40 mm.

Etymology.—The specific epithet *quimi* is in honor of Joaquim "Quim" Cavalheiro, laboratory assistant in the "Laboratório de Herpetologia do Instituto Butantan." His knowledge, gathered diligently over the years, has greatly contributed to the studies of snakes at this Institute.

Clelia montana sp. n.
Figs. 2 and 4

Holotype.—IB 22505, adult male, from the city of Guaratinguetá (22°49'S; 45°93'W), Sodré mill, state of São Paulo, Brazil. Received at Instituto Butantan on 27 November 1962, sent by J. Moreira.

Paratypes.—BRAZIL: SÃO PAULO: Campos do Jordão, IB 9013, ♀, received 4 February 1935; IB 46145, ♀, received 27 February 1984; IB 33818, ♀, received 5 March 1973; MINAS GERAIS, Camanducaia, IB 24640, ♂, and IB 24641, ♀, received 26 January 1965; Poços de Caldas, IB 43072, ♂, received 26 May 1980; IB 52908, ♂, received 18 April 1989.

Diagnosis.—*Clelia montana* can be distingued from *C. equatoriana*, *C. errabunda*, and *C. scytalina* because the new species has invariably 19 rows of dorsal scales in mid-body while the other species have 17.

Clelia montana is distinguishable from *C. clelia* (*sensu* Bailey, 1970) because the latter has 7 supralabials, rarely 8 (Bailey, 1970; Cei, 1986; Cunha and Nascimento, 1978; Scrocchi and Viñas, 1990), while the new species has 8 supralabials. Neonates of *C. montana* have a white collar, a dark vertebral stripe, and an immaculate venter, whereas neonates of *C. clelia* (*sensu* Bailey, 1970) lack a vertebral stripe.

Clelia montana is distinguishable from *Clelia rustica* by having 8 rather than 7 supralabials, absence of reticulated dorsal pattern, presence of light collar, and red eyes in the new species (Fig. 2).

Clelia montana can be distinguished from *C. bicolor* by the greater number of ventrals and lesser number of subcaudals (Table 1). The latter also has the supralabials with a well defined light region (Fig. 1), while in the new species, the dorsal color part of the head extends onto these shields (Fig. 1).

Holotype Description.—An adult male, preserved in alcohol. Head not distinct from neck. Head length 26.5 mm; greatest head width 15.5 mm; head width/head length ratio 0.58. Total length (TL) 946 mm; tail length 157 mm; tail/total length ratio 0.16. Dorsal scales smooth with two apical pits. Dorsal scales in 19/19/17 rows, reducing by the loss of the fourth on each side above the level of ventrals 166 and 169, respectively. Ventral scales 201; cloacal scale undivided; subcaudals scales in 53 pairs. Head scutellation typical of other colubrids. Rostral shild twice as wide as high. Internasals shilds slightly rounded, shorter than prefrontals. Prefrontals shilds pentagonal, as wide as long, each in contact with internasal, nasal, loreal, preocular, supraocular, and frontal. Frontal hexagonal, somewhat longer than wide and shorter the parietals. Supraoculars longer than wide, narrower anteriorly, not protruding over the eyes. Parietal length/width ratio 1.49. Interparietal suture shorter than frontal length and longer than distance from frontal to tip of snout. Nasal divided, longer than higher. Loreal small, rectangular, a little longer than high. One preocular, twice as high as wide. Two postoculars, approximately same size; lower one larger than upper one. Temporals 2 + 3, the anterior somewhat longer than posterior ones. Supralabials 8/8, second and third in contact with loreal, fourth and fifth in contact with eye, posteriormost four larger than anterior ones. Infralabials 8/8, first pair in contact with each other on distal edge of mental, first four in contact with anterior chin shields, and fifth (and largest pair) contacting posterior chin shields. The anterior chin shields longer than the posterior ones. Eye diameter approximately half distance from eye to tip of snout. Pupil vertical.

Coloration in Alcohol.—Dorsum dark brown, paraventrals slightly lighter. Venter cream-colored; paraventral coloring slightly extending to lateral parts of the ventrals. Posterior part of head the same color as the body; nuchal region with an inconspicuous light collar. Supralabials the same color as the paraventral region.

Coloration in Life.—An adult female specimen (901 mm TL) from Sapucaia Mirim, Minas Gerais (IB 54601). A dark brown vertebral stripe on the dorsum (S-3-2, according to Villalobos-Domingues and Villalobos, 1946), that extends from the collar to the tail tip, five scales rows wide. Lateral region dark brown (SSO-5-3), five scale rows wide. Paraventrals orange brown

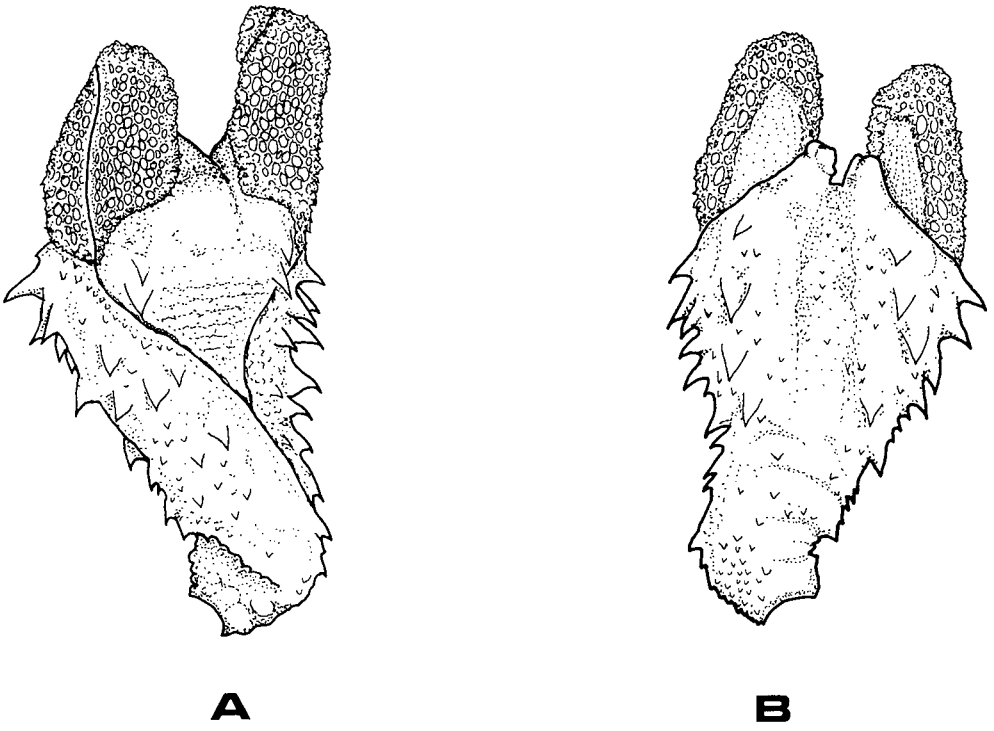

FIG. 3. Hemipenis of *Clelia quimi* (IB 53743). left: Sulcate side; right: Asulcate side (2.4×).

(SSO-7-11), two scale rows wide and extending onto the lateral borders of the ventrals. Dorsal side of head the same color as the vertebral region, with a distinct light collar (SO-8-2) four scale wide. Supralabials light (O-13-3). Eyes red. Ventrals white up to the cloaca. Subcaudals with the proximal region the same color as the paraventrals.

Ontogenetic Variation in Color.—There is no evident variation in adults, but there is ontogenetic variation. When preserved in alcohol, juveniles are predominantly pink, with a narrow, dark brown longitudinal vertebral stripe, 3 to 7 scale rows wide. The collar is light and dorsally complete, not reaching the parietals, thus the anterior end of the head color is consistent with the dorsal stripe. The supralabials are light, and the ventral side of head lacks dark pigmentation.

Size and Dentition.—Snout-vent length ranges from 790 to 940 mm (N = 7, $\bar{x}$ = 869 ± 56 mm) and tail length from 115 to 155 mm (N = 6, $\bar{x}$ = 138 ± 14 mm). Three specimens of *Clelia montana* (IB 24640, IB 43072, IB 46145) had 11–12 prediastemal maxillary teeth and two grooved fangs a little larger than the anterior teeth; the diastema approximately twice as long as the space between the maxillary teeth; 15–17 mandibular teeth; 8–9 palatine teeth and 12 pterygoid teeth.

Natural History.—A tail of *Liophis jaegeri* was found in the digestive tract of a juvenile (284 mm TL) (ZUEC 1387). Two specimens had eggs in the oviduct. One of them came to IB in January (IB 24641) and the other one came in February (IB 46145). The total clutch size in oviduct is 7 and 11, respectively. The egg length is approximately 40 mm.

Etymology.—The especific epithet *montana* refers to the fact that all the specimens were collected in the mountainous regions of Serra da Mantiqueira, Serra do Cervo (Poços de Caldas outskirts), and Serra da Bocaina.

DISCUSSION

According to Jenner and Dowling (1985), the tribe Pseudoboini is mainly defined by the morphology of the hemipenis. This organ is characterized as being bilobate and bicapitate, with a forked centrifugal sulcus, distal calyces and proximal spines; by this definition the new species would be included in this tribe.

A detailed analysis of the tribe Pseudoboini, which allows the definition of the genera considered here, is not yet available. The current taxonomic arrangement is that proposed by Bailey (1970). Therefore, we have chosen to include both of the new species in *Clelia* due to the cur-

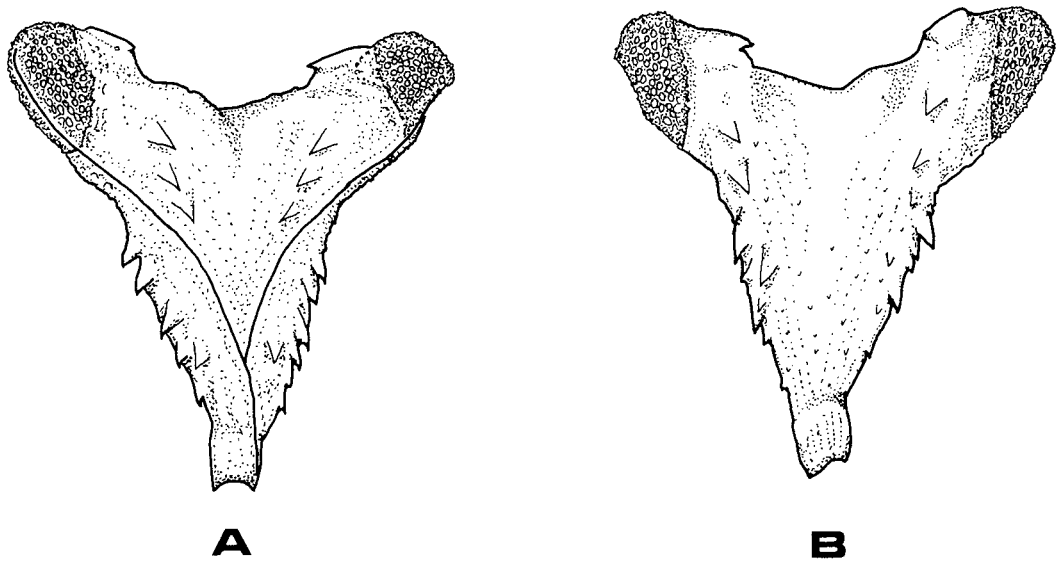

FIG. 4. Hemipenis of *Clelia montana* (IB 24640). left: Sulcate side; right: Asulcate side (2.3×).

rent allocation of species with which the main comparisons were made.

We can divide the species having nineteen dorsal scale rows into three groups according to the hemipenis morphology. The first group consists of *C. c. clelia*, *C. bicolor*, and *C. quimi*, which have a hemipenis with a maximum width approximately half its length, and parallel or convergent lobes (Fig. 3). The second group consist of only *C. c. plumbea*, a species with a hemipenis similar to the previous group except that it lacks spines. The third group is consists of *C. rustica* and *C. montana*, which have a hemipenis with its maximum width approximately the same as its length, and with divergent lobes (Fig. 4). We must point out that the classification in groups is based on primary similarities, which do not necessarily reflect the phylogenetic history.

Clelia quimi seems allied to *C. bicolor*, and *C. montana* to *C. rustica*, because of similarities in head shape, size, morphology of the hemipenis, and coloration of hatchings (Figs. 1–4).

Red eyes are found in various species of the genus *Oxyrhopus*, Wagler, 1830. However, none of the species of this genus display ontogenetic variation in coloration unlike snakes of the genus *Clelia*. Furthermore, adult specimens of *Oxyrhopus* usually have a red, yellow, or orange dorsum that may or may not be interrupted by dark transverse bands. This makes the inclusion of *C. montana* in such a genus unlikely.

Clelia quimi and *C. bicolor* are allopatric (Fig. 5). The former is mainly found in highlands, in the Southern Plateau, Atlantic Plateau and Central Plateau while *C. bicolor* occurs in lowlands of the Platine Plains (Planície Platina), Chaco, Pantanal, and their boundaries (Fig. 5).

Clelia rustica is found in Argentina, Uruguay and southern Brazil (Fig. 5), in both lowlands and highlands. Some specimens (IB 10462, IB 3075, IB 30496) have been reported from São Paulo and Minas Gerais. We doubt the provenience of IB 10462 and IB 3075, because their localities are in the climatic zone characterized as hot tropical, which is unlikely to be favorable for the species. Although the provenance of IB 30496 might also be questioned, it originates from the highlands of the Serra da Bocaina, where the climate is basically mild mesothermic, similar to other areas where *C. rustica* is found. *Clelia montana* is restricted to the high areas of Serra do Cervo (region of Poços de Caldas), Serra da Mantiqueira and Serra da Bocaina (Fig. 5), where the climate is similar to that of southern Brazil. This pattern of distribution suggests that cooler climates are favorable to these two species.

The number of infralabials in *C. rustica* (Table 1) varies if compared with those obtained by Scrocchi and Viñas (1990). The specimens examined here usually have 9 infralabials and only rarely 8. Conversely, Scrocchi and Viñas (1990) usually find 8 and rarely 9 in Argentina. The neonates of *C. rustica* in Argentina have color patterns similar to the adults (G. Scrocchi, pers. comm.). Among all the juveniles of *C. rustica* we examined, only one (IB 8812), from Argentina, corresponds to the description by G. Scrocchi. The other juveniles from Brazil, have a dark head, clear collar and narrow longitudi-

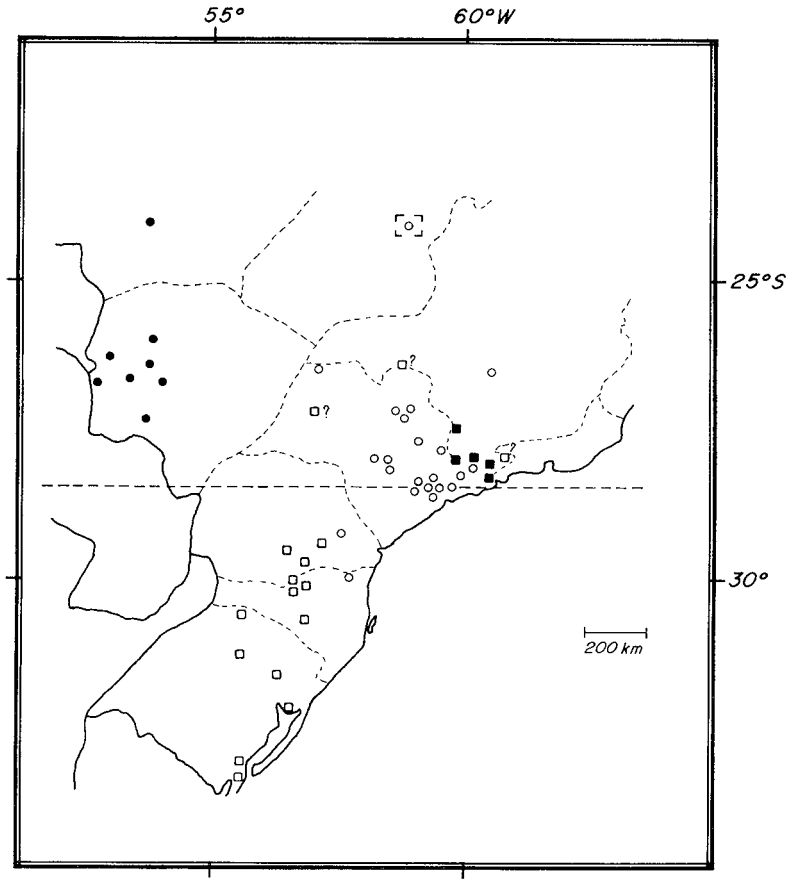

FIG. 5. Distribution of specimens examined of locality records of *Clelia quimi* (○), *C. bicolor* (●), *C. montana* (■) and *C. rustica* (□).

nal vertebral stripe (approximately 3 scale rows wide). Thus, it is possible that *C. rustica* presents intraspecific geographic variation or is composed of more than one species.

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APPENDIX. Specimens examined but not included in type series.

Clelia bicolor—BRASIL: RIO GRANDE DO SUL: Pelotas (IB 1818), Bailey, 1970 (locality probably in error); MATO GROSSO DO SUL: Agachi (IB 7716), Aquidauana (IB 4859, IB 15513, IB 18574, IB 18617), Guia Lopes (IB 14272), Miranda (IB 6147, IB 9080, IB 9084, IB 10079, IB 14201), Rio Nabileque (IB 37361), Porto Esperança (IB 10440, IB 25960), Sabóia (IB 16847), Taunai (IB 4553, IB 6333, IB 12731, IB 12899, IB 12900); MATO GROSSO: Cuiabá (IB 24600, IB 32206).

Clelia quimi—BRASIL: DISTRITO FEDERAL: Brasilia (IB 20627); ESPÍRITO SANTO: Itá (IB 9249); MINAS GERAIS: Calciolândia (IB 40016); SÃO PAULO: Agudos (IB 40747), Aluminio (IB 22762), Araguá (IB 8752), Barra Bonita (IB 48816, IB 48851), Botucatu (IB 40380), Calmon Viana (IB 19753, IB 19754), Fernandópolis (IB 42617), Guarulhos (IB 14331, IB 25605, IB 25606, IB 41154), Itu (IB 33039), Jaboticabal (IB 33216), Jundiaí (IB 42616, IB 44141), Mogi das Cruzes (IB 23020), Mogi Guaçu (IB 27442), Mogi Mirim (IB 1813), Osasco (IB 30029), Pindamonhangaba (IB 22490, IB 24323), Ribeirão Preto (IB 44183), Rio Claro (IB 32133), Santa Lúcia (IB 30242), Santana de Parnaíba (IB 46208), São Bernardo do Campo (IB 22445, IB 24633), São José dos Campos (IB 28257, IB 28484), São Paulo (IB 380, IB 630, IB 711, IB 880, IB 1350, IB 2924, IB 9074, IB 18919, IB 26906, IB 32261, IB 33131, Sorocaba (IB 9515, IB 21523), Taubaté (IB 12752, IB 40461, IB 40748, IB 43130), Tremembé (IB 32031); PARANÁ: Ponta Grossa (IB 420); SANTA CATARINA: São Bento do Sul (IB 5453).

Clelia rustica—ARGENTINA: CÓRDOBA: Córdoba (IB 347); JUJUY: Jujuy (IB 8812); BUENOS AIRES: Buenos Aires (IB 45878); BRASIL: MINAS GERAIS: Uberaba (IB 10462); SÃO PAULO: Glicério (IB 3075), São José do Barreiro, Serra da Bocaina, 1700 m (IB 30496), Marechal Male (IB 7877), Ponta Grossa (IB 23722), Rio Azul (IB 15759); RIO GRANDE DO SUL: Alfredo Chaves (IB 10088), Espumoso (IB 19584), Itatiba do Sul (IB 34315), Pelotas (IB 1787, IB 1789, IB 1790, IB 1791, IB 1812, IB 1819), Porto Alegre, Ilha da Pintada (IB 2546), Rio das Antas (IB 4544), Rio Grande (IB 12749); SANTA CATARINA: Adolfo Konder (IB 14979), Calmon (IB 15677), Ipoméia (IB 15692), Lages (IB 47110), Porto União (IB 30440).