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The distribution of *Phalotris tricolor* group in Argentina and Paraguay, with notes on its taxonomy (Serpentes, Elapomorphini)

A distribuição do grupo *Phalotris* na Argentina e Paraguai, com notas sobre sua taxonomia (Serpentes, Elapomorphini)

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Abstract

The species of *tricolor* group are redefined, because currently their limits are not very clear. *Phalotris punctatus* differs from *P. tricolor* mainly by dorsal coloration ocher reddish (vs. red), black dots widespread on dorsal side (vs. immaculate), smaller size, up to 770 mm, usually 400 mm (vs. up to 940 mm, usually 500), occurring in the biomes Monte Desert and Chaco, Argentina (vs. Austral Chaco, in Paraguay and Bolivia). *Phalotris punctatus* is similar to *P. cuyanus* differing of it mainly by presence of widespread dorsal dots (vs. absent; if present, few dots on vertebral row of scales); black head ventrally (vs. immaculate white), black snout (vs. immaculate ocher); reddish vertebral zone ocher (vs. fully ocher); and distribution in northern to western Argentina, barely reaching Paraguay (vs. northern Argentina, reaching Buenos Aires and neighboring Provinces).

Keywords: Chaco, Monte, patterns, cuyanus, punctatus.

Resumo

As espécies do grupo *tricolor* são redefinidas no presente trabalho, porque seus limites não são muito claros. *Phalotris punctatus* difere de *P. tricolor* principalmente pela coloração ocre avermelhada (vs. vermelha), pontos pretos distribuídos irregularmente na face dorsal (vs. imaculada), menor porte, até 770 mm, geralmente 400 mm (vs. acima de 940 mm, geralmente 500), ocorrendo nos biomas Deserto Monte e Chaco, Argentina (vs. Chaco Austral, Paraguai e Bolívia). *Phalotris punctatus* é similar a *P. cuyanus* diferindo desta principalmente pela presença de pontuação dorsal irregularmente distribuída (vs. ausente; ou com alguns pontos somente na linha de escamas vertebrais, se presente), cabeça preta ventralmente (vs. branca imaculada), focinho preto (vs. ocre imaculada), zona vertebral ocre avermelhada (vs. somente ocre), com distribuição ao norte e leste da Argentina e, raramente, Paraguai (vs. Argentina setentrional, incluindo Buenos Aires e províncias vizinhas).

Palavras-chave: Chaco, Monte, padrões, cuyanus, punctatus.

Introduction

The *Phalotris tricolor* group is currently represented by *Phalotris cuyanus* (Cei 1984), *Phalotris matogrossensis* Lema, D'Agostini & Cappellari 2005, *Phalotris punctatus* (Lema 1979), *Phalotris sansebastiani* Jansen & Köhler

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2008, and *Phalotris tricolor* (Duméril, Bibron & Duméril 1854). The mainly difference from the other groups of *Phalotris* Cope 1862, is the dorsal pattern uniformly colored, not striped, and immaculate ventral coloration. It differs further, from other groups by the following combination of characters: medium to large size; frontal relatively long; temporals 1+1; internasal suture long; presence of nape-cervical collars usually long with three or more scales on the vertebral row; background color red or ocher; maxillary teeth 5+2; pterygoid teeth 8+10; hemipenis usually bilobed, with small spines, and *sulcus spermarticus* forked in the half of body. The species of group are distributed by Central Brazil to Bolivia, Paraguay and Argentina, by Cerrado, Chaco and Monte Desert biomes.

In this paper, we endeavored to point out and to correct species misidentifications, as Lema *et al.* (2005) and Leynaud *et al.* (2005). They used the name *P. tricolor* for specimens that correspond to *P. punctatus*, most likely following Lema *et al.* (2005), who synonymyzed *P. punctatus* with *P. tricolor,* an error corrected here. This misleading synonymy was based on the examination of fixed specimens that are discolored, which are housed in Argentinean collections and labeled as "*P. tricolor*". Nevertheless, photographs of living specimens show clear differences between these two species.

Aquino *et al.* (1996) listed "*P. punctatus*" as occurring in Paraguay, based on three specimens housed in the MHNP (not seen). Giraudo (2001) listed specimens of "*P. punctatus*" from Misiones, Argentina, and failed to find *P. tricolor* in the area.

Upon studying *P. tricolor* specimens housed in the IBSP, Lema *et al.* (2005) noted that the sample contained a new species, which they described as *P. matogrossensis*, consequently, the known distribution of *P. tricolor* became restricted to Paraguay. Jorge A. Abalos (Centro de Zoología Aplicada, Córdoba) had sent to Lema a drawing of a living specimen that had been determined by Lema *et al.* (2005) as *P. tricolor.* Cacciali and Motte (2007) reported on the occurrence of *P. matogrossensis*, a species originally described to inhabit Cerrado vegetation, in Paraguay, thus restricting the distribution of *P. tricolor* to Chaco and Monte Desert biomes in that country.

In the present paper, we redefine *P. cuyanus, P. punctatus,* and *P. tricolor*, and determine their distribution areas, after correcting the mistakes of several authors, particularly Lema *et al.* (2005). In the end, we provide a comparative table of characteristics of the studied species, and images of living specimens.

Material and methods

Acronyms of institutions follow Sabaj-Pérez (2016) excepted: AC, Cátedra de Anatomia Comparada, Universidad Nacional de Córdoba, Argentina; CENAI, Centro Nacional de Investigaciones Biológicas Malbrán, Buenos Aires, moved to MACN, kept in an isolated collection; CZA, Centro de Zoología Aplicada, Universidad Nacional de Córdoba, Argentina; MCNSJ, Museo de Ciencas Naturales de San Juan, Argentina; MHNP, Museo Nacional de Historia Natural, Asunción, Paraguay; MHNSR, Museo de Historia Natural de San Rafael, Argentina; UNNEC, Universidad Nacional del Nordeste, Corrientes, Argentina.

We analyzed data from Lema (1979), Cei (1986), Giraudo (2001), Lema *et al.* (2005), Leynaud *et al.* (2005), and Cacciali and Motte (2007). Measurements are in millimeters.

Living specimens were visualized through photographs taken by the author and colleagues, namely Adriana di Fonzo Abalos, Alejandro Giraudo, Alexander Raymond, Jorge Abalos, and José Miguel Cei. Three representatives of *P. cuyanus* from Córdoba, were kept alive during a short period in the MCP.

Species accounts

Phalotris punctatus (Lema 1979)
(Figures 1-4)

Elapomorphus punctatus Lema, 1979 (part), Rev. Bras. Biol. **39**(4):835, 837. Type-locality: Rosario de la Frontera, Salta province, Argentina.

Elapomorphus (Phalotris) punctatus ---Lema, 1984, Iheringia, Zool. (64):71, 16, Figure 4.

Phalotris punctatus ---Ferrarezzi, 1993 (part), Dissert:23. ---Giraudo, 2001 (part), Serp. Selva Paranaense:159, 166.

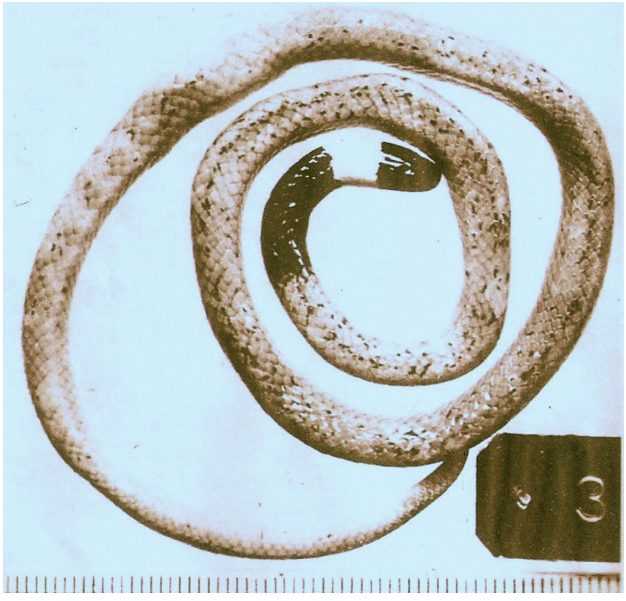


Figure 1. Paratype of *Phalotris punctatus* (MCP.3310) from Misiones, Argentina. Morph with black collar long. Photo from Lema (1979).

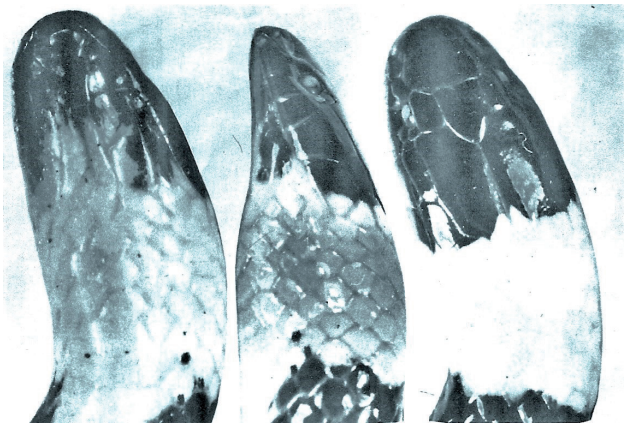


Figure 2. Paratype of *Phalotris punctatus* (MCP.3310) from Misiones, Argentina (Lema, 1979).

Figure 4. Living specimens of *Phalotris punctatus* in Corrientes, Argentina, showing the reddish coloration. Photo by Alejandro Giraudo.

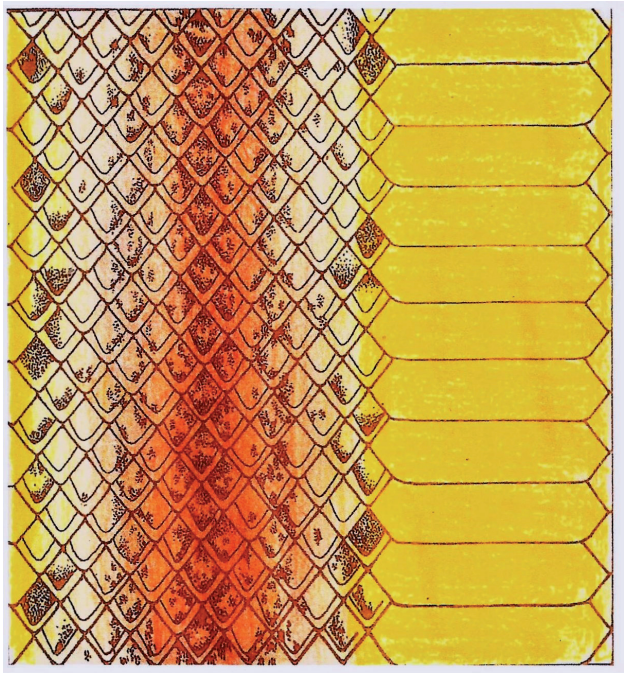


Figure 3. Paratype of *Phalotris punctatus* (FML.15) from Belén, Catamarca, Argentina (Schematic from half of trunk). Specimen with many dots and small blotches on paraventral zones; the vestigial stripes may be due to hybridization with *Phalotris bilineatus* (Duméril, Bibron & Duméril 1854), sympatric with it. (ad nat. del.).

Phalotris tricolor ---Lema, 1984 (part), Iheringia Zool. (64):63; ---Lema, D'Agostini & Cappellari, 2005 (part), Iheringia, Zool. **95**(1):66. ---Leynaud, Cabrera & Carrasco, 2005 (part), Phyllomedusa **4**(2):105, Figs. 2, 3.

Type-specimens: Holotype: MLP.579 (formerly MLP.151). Paratypes: (I) CENAI.3310 (Formosa: capital, 26º10'S-58º10'W); (II) FML.710 (Misiones: capital, 23º/27ºS-53º/55ºW); (III) FML.15 (Catamarca: Belén, 27º39'S-67º1'W); (V) MSNG w.n. (Chaco: Resistencia, 27º27'S-58º59'W). The paratype IV (MZUF.12358) is here redetermined as *P. cuyanus.*

Distribution: Rosario de la Frontera, Salta, Argentina (25º48'S-64º58'W) (Figure 5).

Diagnosis: Species similar to *P. cuyanus,* differing mainly, by the presence of black dots widespread on dorsal side, sometimes disposed in longitudinal stripes, or densely restricted to vertebral row (vs. dots absent, if present in vertebral row, with few spaced dots); head fully black, dorsally and ventrally, usually anterior also (vs. black only on pileus with snout immaculate ocher); reddish on vertebral zone, becoming ocher at lower sides (vs. fully ocher dorsally); venter yellowish (vs. whitish); tail fully cylindrical (vs. angled posterior); and labial shields, black (vs. light).

Observation: It differs from *P. tricolor* because this species presents the dorsal coloration fully ceramic red, immaculate, and venter immaculate white; head black dorsally and ventrally, with very long cervical collar, usually more than six vertebral scales, extending to ventral side. In addition, *P. tricolor* shows a different distribution, inhabiting the Boreal Chaco in Paraguay to southern Bolivia.

Distribution: Wetland Chaco to Monte, northern Argentina, in the provinces: Catamarca, Chaco, Córdoba, Corrientes, Formosa, Jujuy, Mendoza, Misiones, Salta, San Juan, Salta, and Córdoba Provinces (Figure 5).

Phalotris cuyanus (Cei 1984)
(Figures 6 - 9)

Elapomorphus punctatus Lema, 1979 (part), Rev. Bras. Biologia, **39**(4):837.

Elapomorphus cuyanus Cei, 1984, Bol. Mus. Cienc. Nat. Antrop. Moyano 4:48, pl. 1. *Type-locality:* Los Reyunos, and Rafael, Mendoza, Argentina.

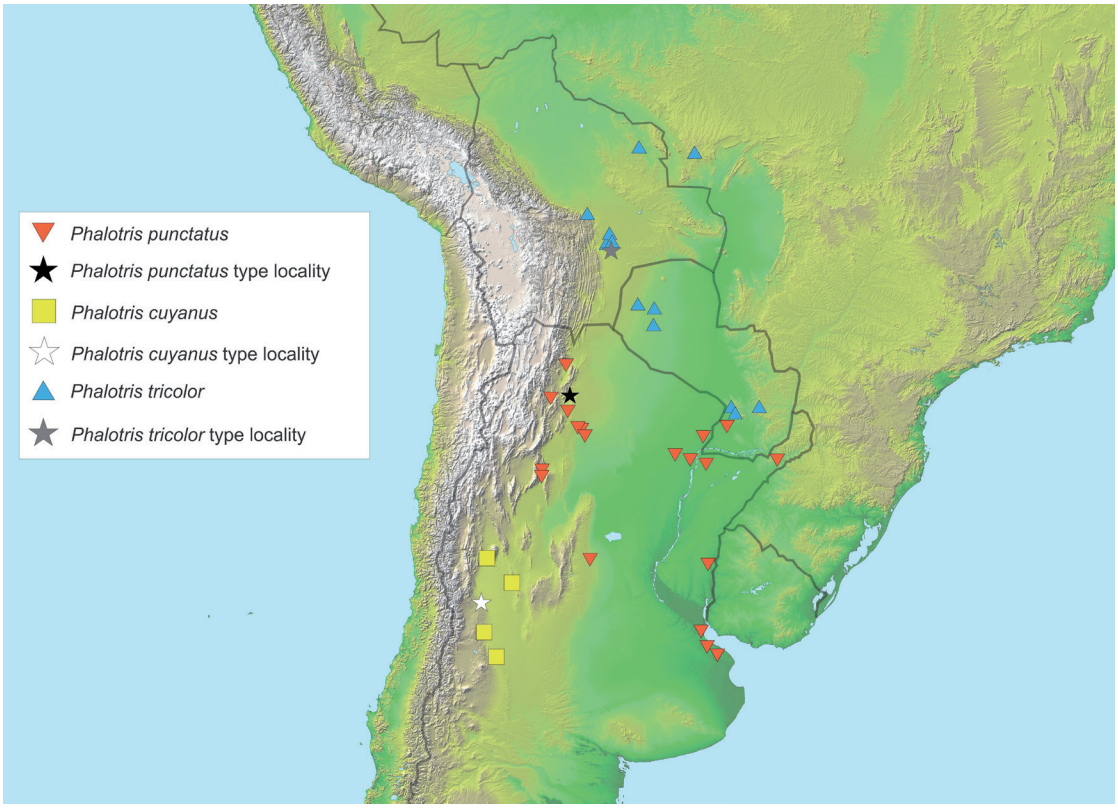


Figure 5. Distribution accounts of *Phalotris punctatus*, *P. cuyanus,* and *P. tricolor* (on NASA map).

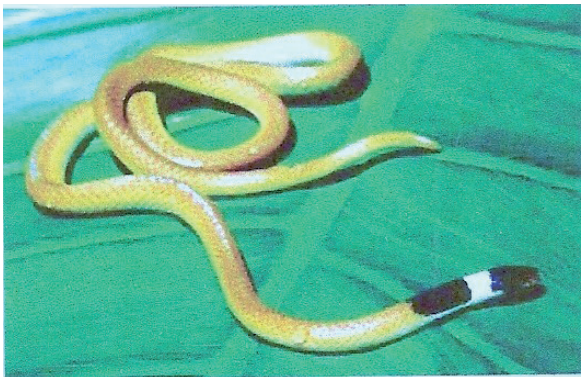


Figure 6. Living specimen of *Phalotris punctatus* from Departamento Capital, Córdoba, Argentina. Published as *P. tricolor* by Leynaud *et al.* (2005).

Phalotris cuyanus ---Ferrarezzi, 1993, Mem. Inst. Butantan, **55**(1): 23. ---Leynaud, Cabrera & Carrasco, 2005 (part), Phyllomedusa **4**(2):105.

Type-specimens: MHNSR.317, holotype, adult male, captured by H.A. Lagiglia in 20/04/1975, San Rafael, Mendoza (formerly MHNSR.300). Paratype: MZUF.12358, adult, male, from Caucete, San Juan, Argentina.

Type-locality: Distrito 25 de Mayo, 900-1000 OLS, in the region of Sierra Pintada, Los Reyunos, San Rafael, province of Mendoza, Argentina (Figure 5).

Diagnosis: Small species, with snout ocher immaculate; supralabial and infralabials immaculate whitish cream as the entire ventral side, nuchal black collar only dorsal, cervical collar longer than wide, white collar narrower than cervical, and dorsum immaculate ocher but, sometimes, with few and spaced black dots on vertebral row.

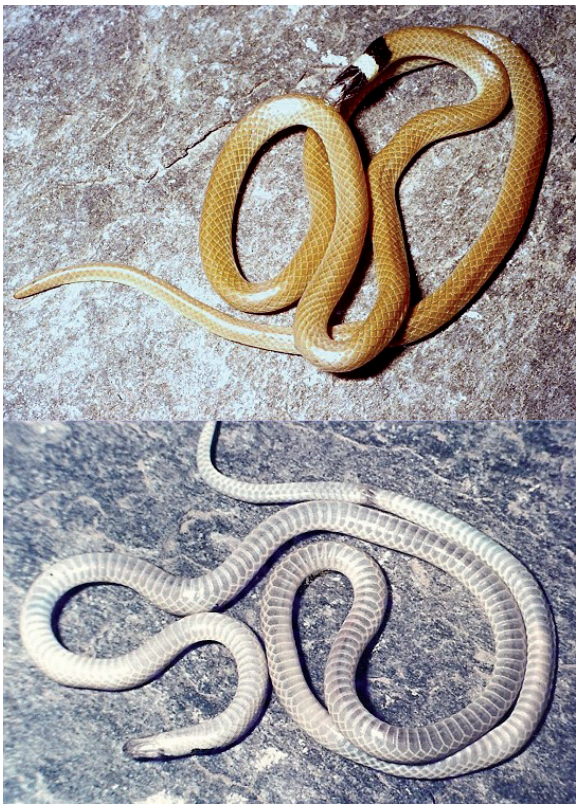
Distribution: Western Argentina, in the Provinces of Córdoba, Mendoza, San Juan, and San Luís; Monte biome. A specimen identified from Boquerón, central Paraguay, may be an error (Figure 5).

Phalotris tricolor (Duméril, Bibron & Duméril 1854) (Figures 10-11)

Elapomorphus tricolor Duméril, Bibron & Duméril, 1854, Erpet. Gén. 7:837. *Type-locality:* Santa Cruz de la Sierra, Bolivia.

Phalotris tricolor ---Cope, 1861, Proc. Ac. Sci. Phila. 13:302. ---Ferrarezzi, 1993 (part), Dissert.:23. ---Lema, D'Agostini and Cappellari, 2005 (part), Iheringia Zool. **95**(1):66.

Elapomorphus (Phalotris) tricolor ---Lema, 1984 (part), Iheringia Zool. (64):557, 17.



Figures 7 and 8. Living *Phalotris cuyanus*, paratype (MZUF.26124), from Caucete, San Juan, Argentina, adult, male. Photos by José Miguel Cei.

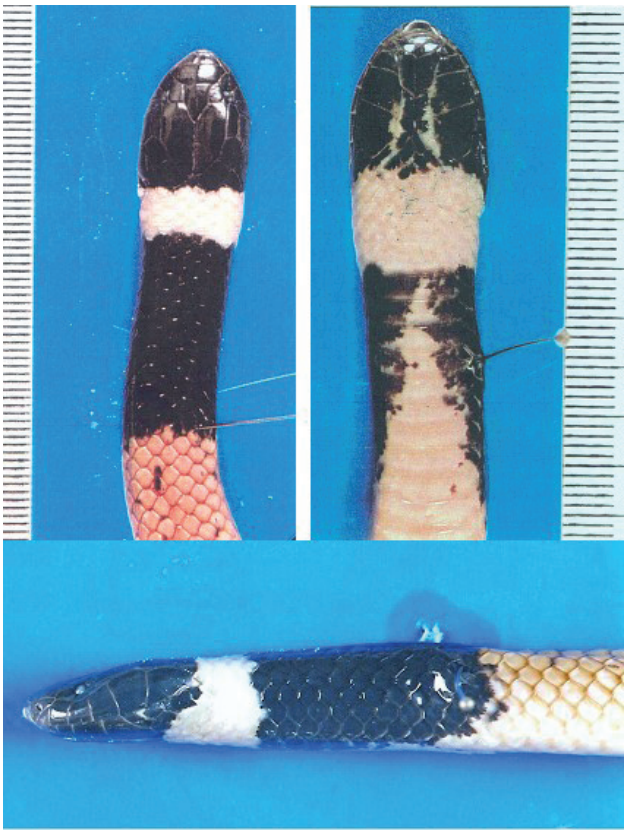


Figure 10. Head of *Phalotris tricolor* (MHNP.5161) from Boquerón, Paraguay (Lema *et al*., 2005).

Figure 9. *Phalotris cuyanus* from Córdoba, Argentina. Photo by O.M. Entiauspe Neto.

Figure 11. Living specimen of *Phalotris tricolor* from Filadelfia, northern Paraguay.

Phalotris punctatus ---Aquino, Scott and Motte, 1996, *in* Martinez (ed.), Collec. Flora, Fauna Mus. Nat. Hist. Nat. Paraguay:365. ---Leynaud and Bücher, 1999 (part), Serp. Chaco Sudamer.:27. ---Giraudo, 2001 (Part), Serp. Selva Paran.: 159, 166.

Type-specimen: MNHN.520, holotype. Duméril *et al.* (1854) did not designate a type specimen, and Lema *et al.* (2005) designated this remaining syntype as the holotype. Another specimen (MNHN.520b) was not used because it was rotten (Ivan Ineich, pers. comm.).

Table 1. Meristic data from specimens examined of *Phalotris cuyanus (*CUY) and *P. punctatus* (PUN).

Specimens	SP.	Sex	VE	SC	R_1	WNC	BCC	TAL	TOL	R_2	SVL	R_3	R_4
MHNSR.317	CUY	♂	223	34	0.152	3	5	40	442	0.09	402	0.1	11.05
CENAI.1445	CUY	♂	215	30	0.14	4	5	16	188.8	0.095	172.8	0.093	11.8
CENAI.3484	CUY	♂	217	30	0.138			30	340	0.088	310	0.097	11.3
MZUF.26124	CUY	♂	239	35	0.146								
Variation	CUY	♂	215-239	30-35	0.138-152	3-4	5	16-40	188-42	0.088-.095	172.8-402	0.093-0.1	11.05-1.8
x	CUY	♂	223.5	32.3	0.144	3.5	5	28.7	323.6	0.091	295	0.1	11.4
x^2	CUY	♂	14.9	5.7	0.4			5.4	18	0.3	17.2	0.3	3.4
UNNEC.315	PUN	♂	195	30	0.154			33	314	0.105	281	0.117	9.5
MLP.935	PUN	♂	188	29	0.154	4	7	35	392.7	0.089	357.7	0.098	11.2
CENAC.3310	PUN	♂	189	32	0.169	5	12	31	317	0.098	286	0.108	10.2
Variation	PUN	♂	188-195	29-32	0.154-0.169	4-5		31-35	314-392.7	0.089-0.105	281-357.7	0.098-0.117	9.5-11.2
x	PUN	♂	190.7	30.3	0.159	4.5	9	33	341.2	0.097	308,2	0.108	10.3
x^2	PUN	♂	13.8	5.5	0.4	2.1	3	5.7	58	0.3	17.8	0.3	3.2
MSNG w.n.	PUN	♀	216	26	0.12	4	10						
FML.15	PUN	♀	218	23	0.106	4	7	29	576	0.050	547	0.053	19.9
UNNEC.176	PUN	♀	225	23	0.102			45	770	0.058	725	0.062	17.1
FML.710	PUN	♀	221	23	0.104	4	6	28	416	0.067	388	0.072	14.9
MCN.6443	PUN	♀	222	24	0.108	4	5.5	29	429.5	0.068	400.5	0.072	14.8
Variation	PUN	♀	218-225	23-26	0.102-0.108	4	5.5-10	28-45	416-770	0.050-0.068	388-725	0.053-0.072	14.8-19.9
x	PUN	♀	220	23.8	0.108	4	7.7	34	587.3	0.058	553.3	0.062	17.3
x^2	PUN	♀	1.5	4.9	0.3	2	2.8	58	2.4	0.2	23.5	0.2	4.2
Variation	PUN	∑	188-225	23-32	0.102-0.169	4-5	5.5-12	28-45	314-770	0.050-0.105	281-725	0.053-0.117	9.5-19.9
x	PUN	∑	205.4	27.1	0.134	4.3	8.4	33.5	464.3	0.078	430.8	0.085	13.8
x^2	PUN	∑	14.3	5.2	0.4	2.1	2.9	5.8	21.5	0.3	20.8	0.3	1.9

Notes: BCC, black cervical collar; R_1, SC/VE; R_2, TAL/TOL; R_3, TAL/SVL; R_4, TOL/TAL; SC, subcaudal scales; SP, species; SVL, snout-vent length; TAL, tail length; TOL, total length; VE, ventral scales; WNC, white nucal collar; x, rate; x^2, standard deviation.

Type-locality: Ville de Santa Cruz de la Sierra, Santa Cruz Department, Bolivia (17º47'S, 61º12''W).

Diagnosis: Similar to *P. matogrossensis* and to *P. sansebastiani*, differing from them by the cervical collar longer and reaching the ventrals (vs. only on dorsals); white collar shorter than *P. matogrossensis;* snout blackish red (vs. fully red); background ceramic red (vs. brilliant red) (Table 1).

Distribution: Only in Boreal Chaco of Bolivia to Paraguay; citations for Austral Chaco must be reviewed. Bolivia: Andrés Ibanez, Angel Sandoval, Cordillera, San Bernardino, San José, Santa Cruz, Tarija. Paraguay: Areguá, Boquerón, Chaco, Presidente Hayes (Figure 5).

Discussion

Leynaud *et al.* (2005) misidentified specimens of *P. punctatus* and *P. cuyanus,* perhaps following Lema *et al.* (2005) and Cei (1986, 1993), both having made the same mistake when they listed specimens from Argentina.

Phalotris tricolor was described based on two syntypes (MNHN.520a, MNHN.520b), both from Santa Cruz de la Sierra, Bolivia. Both were in a bad state of conservation, most likely as a result of the difficulties that museums have faced during the Second World War. In fact, the second specimen had to be disposed of (Lema *et al.*, 2005). MNHN.520a is the largest specimen of the Elapomorphini known by us. It is almost one meter long, competing with other giants such as *Apostolepis flavotorquata* (Duméril, Bibron & Duméril 1854), *Phalotris mertensi* (Hoge 1955), and *Elapomorphus wuchereri* Günther 1861, the latter attaining about 1.5 m long. Despite the condition of the remainder syntype, it still has intact diagnostic characters of the species (Lema *et al.*, 2005).

Phalotris punctatus was described based on several specimens from Argentina. The holotype (MLP.579) is from Rosário de la Frontera, Salta province. There are also four paratypes: CENAI.1445, from near San Luís, which were redetermined by Leynaud *et al.* (2005) as *P. cuyanus*, and three other paratypes, FML.15 from Catamarca, CENAI.3310, from Misiones, MCNRS.6443 from Córdoba, and MSNG (without number), from Chaco. The CENAI.3484 was redetermined by Leynaud *et al.* (2005), as *P. cuyanus* in error.

According to Alejandro Giraudo (pers. comm.), live specimens of "*P. punctatus*" from Corrientes and Misiones, Argentina (Figure 5), are reddish dorsally.

The tail of *P. punctatus* is longer than the tail of *P. tricolor,* but the number of ventral scales in *P. punctatus* ranges 188-225, x=205.4 (vs. 212-216, x = 211.4, in *P. tri-*

color); the number of subcaudals in *P. punctatus* is 23-32, x=27.1 (vs. 21-32, x=35, in *P. tricolor*), being significant the mean of the examined sample.

Cei (1984, 1986, 1993) commented that *P. tricolor* and *P. punctatus* are similar in life, but are nonetheless valid species. According to Cei, *P. tricolor* is a small species, contrasting with Lema *et al.* (2005), who observed large specimens, including the syntype (MNHN.520) that has not been disposed of, which is a giant in relation to other representatives of the Tribe Elapomorphini. It seems that Leynaud and Bucher (2001) and Leynaud *et al.* (2005) attempted to differentiate between *P. tricolor* and *P. cuyanus* using only specimens of *P. cuyanus.* This assumption is evident in their Figures 2 and 3, labeled as *P. tricolor* (AC.419) and *P. cuyanus* (MHNSR.317), respectively. The latter presents the dorsal color fully ocher (Figures 8, 9); the "rojizo" (reddish) is from *P. punctatus,* whereas *P. tricolor*, fully ceramic red (Figures 10, 11).

Specimens listed from southeastern Brazil, Austral Chaco and Argentina are most likely misidentified, given that at present only *P. matogrossensis* has been found in Brazil, whereas in the Austral Chaco, only *P. punctatus* has been found. The latter has a large distribution in northern Argentina, and may include neighboring areas of Paraguay, but not the Boreal Chaco. *Phalotris cuyanus* is restricted to Monte Desert biome, in western Argentina.

Questionable specimens determined as *P. punctatus:* We have found some voucher specimens, the origin of which is questionable, as follows: SMF.20342, from Mato Grosso do Sul; AC.431 and AC.432, both as from Ribas do Rio Pardo; MZUT.1230.1 and MZUT.1230.2 from Urucum, MS; MIZST, without number, from Asunción, Paraguay. We did not see these specimens, and we recommend a reassessment of this material.

Conclusions

After redetermination of museum specimens (Appendix 1), we conclude that the distribution of the species herein studied is: Bolivia (*P. sansebastiani, P. tricolor*), Paraguay (*P. punctatus, P. tricolor*), and Argentina (*P. cuyanus, P. punctatus*). Their dorsal coloration appeared, from North to South, red, reddish, and ocher; and, in the same order, from biomes Cerrado, Chaco, Monte Desert, and Pampas, respectively. *Phalotris punctatus* is peculiar by having black dots on the dorsum, sometimes disposed longitudinally as vestigial stripes (Figure 4), and with vertebral area reddish, lower sides ocher, ventral sides immaculate yellow, and ventral portion of head black, whereas *P. cuyanus* has immaculate dorsal ocher coloration and ventral side immaculate white. Tables 1 and 2 show some differences between *P. cuyanus* and *P. punctatus,* pointing out the major difference in the number of ventral scales of males: *P. cuyanus* with 215-235 (x=223.5), and in *P. punctatus* is 188-195 (x=190.7), a significant difference. Another distinguishing characteristic is the black collar, long in both species, though usually longer in *P. punctatus* (Tables 1, 2). The white collar has rate 3.7 in *P. cuyanus,* and 4.3 in *P. punctatus*; the cervical collar, 5.2 in *P. cuyanus,* and 7.7 in *P. punctatus.* The size of these species is different also, females being larger, as follows: in *P. cuyanus,* females with 430 and males, 324, whereas, in *P. punctatus,* females with 770 and males, 400. The extension of the black collar is longer in relation to other Elapomorphini from arid regions of Boreal Chaco to Monte, e.g., *Apostolepis ambinigra* (Peters 1869), *Apostolepis breviceps* Harvey, Gonzalez-A & Scrocchi 2001, *Apostolepis intermedia* Koslowsky 1889.

Table 2. Summary of the main meristic data compared between *Phalotris cuyanus* and *Phalotris punctatus.*

	Phalotris cuyanus	***Phalotris punctatus***
Ventral scales	215-239	118-225
x, x^2	223.5, 14.9	205.4, 4.3
Subcaudal scales	30-35	23-32
x, x^2	32.3, 5.7	27.1, 5.2
Snout	ocher	blackish
Background	ocher	ocher, reddish
Pattern	immaculate	dotted

Relationships

The species of *Phalotris* from the *tricolor* group present the following basic phenotypes: (a) small specimens, dominant dorsal color ocher, and occurring from Monte Desert to Chaco domains in southern Paraguay to northern and western Argentina (*P. cuyanus, P. punctatus*); (b) larger specimens, dorsal coloration uniformly red, occurring in Boreal Chaco to Cerrado domains from Paraguay to Bolivia, and SW Brazil (*P. matogrossensis, P. sansebastiani*, *P. tricolor*, and *P. mertensi*). The similarities between *P. punctatus* and *P. cuyanus* suggest that they share a common ancestor, as well as the similarities among *P. tricolor, P. matogrossensis, P. sansebastini,* and perhaps, *P. mertensi*. The latter shows dorsal scales with black apex, as the pattern of coral-snakes (Elapidae). *Phalotris punctatus* is similar to *P. cuyanus* by presenting ocher coloration, in the former at least laterally. *Phalotris tricolor, P. matogrossensis,* and *P. mertensi* are similar by having red dorsal color. Ferrarezzi (1993) and Hofstadler-Deiques and Lema (2005) accepted the monophyly of the *tricolor* group. Perhaps *P. cuyanus* may be derived from *P. punctatus,* in dispersion to SW; and, in the same way, *P. tricolor,* from Chaco to Cerrado, to *P. matogrossensis,* in Brazil, and *P. sansebastini* in Bolivia. There are some similari-

ties between *P. punctatus* and *P. tricolor,* with sympatry in Boreal Chaco. The inclusion of *P. mertensi* in the *tricolor* group is questionable due to several aspects of the skull and the hemipenis (Hofstadler-Deiques and Lema, 2005), which resemble *Apostolepis* species, belonging, at least, to an isolated group.

The background red colored occurs from Chaco to Cerrado; the ocher from Monte Desert to Chaco. All species from Chaco are red colored dorsally. The ocher coloration provides a camouflage in the soil of semi-arid areas of western Argentina, a pre-cordilleran domain, as several another species of Squamata own to area.

Key to the species of the *tricolor* group

1. Dorsal coloration mainly ocher……..….2
   Dorsal coloration red…….....3

2. Dorsum reddish dorsally, ocher laterally, many dots widespread or in rows; head fully black; cervical collar reaching ventral portion….....*Phalotris punctatus*
   Dorsum immaculate ocher; dots, if present, only a few, forming vertebral row; head partially black, with snout ocher.....*Phalotris cuyanus*

3. Dorsal scales with black apex.....*Phalotris mertensi*
   Dorsal scales without black apex.....4

4. Black cervical collar very long, extending to venter; snout reddish black ..... *Phalotris tricolor*
   Black cervical collar short, does not reaching ventral side; snout fully red .....… 5

5. Head cap reaches the prefrontals with right margin ….....*Phalotris matogrossensis*
   Head cap reaches parietals as angle-shape margin ... .*Phalotris sansebastiani*

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Appendix 1

Voucher specimens

Abbreviations: OLS: on the level of the sea; w.l.: without locality; w.n.: without number; Specimens examined: *

Phalotris cuyanus – **ARGENTINA**: *Córdoba:* Dept. Central (MCN.9052*, MCN.9054*). *Mendoza:* Departamento Central: General Alvear, Cochi-Có, Estancia Don Paco (MHNSR.1371, MHNSR.1397); Dept. San Rafael: Los Reyunos, Distrito 25 de Mayo, on Sierra Pintada (MHNSR.317*, holotype, formerly MHNSR.300). *San Juan*: Caucete (MZUF.26124*); Departamento 9 de Julio: Dique Bello (MCN-UNSJ.276*). *San Luís:* 80 km from Departamento Capital, Misioneros Rurales (CENAI.1445*), paratype of *P. punctatus*); Los Cerrillos, Campamento Seram (CENAI.3484*).

Phalotris punctatus – **ARGENTINA**: w.l. (IBSP.21655*). *Catamarca:* Belén (FML.15, paratype*). *Chaco,* Colonia Resistencia (MSNG w.n.*, paratype). *Corrientes:* Itati, Yacaréi (UNNEC.315). *Formosa* Jujuy: Ledesma: Seccional Aguas Negras, National Park (FML.23201*). *Misiones* (FML.710*, paratype; UNNEC.3610); Campamento (MACN [CENAI.3310*]), paratype). *Salta:* Anta: Pozo Largo, 8 km S from Joaquin V. González, and 12 km E from San Javier Farm (FML.2309*), and 12 km from San Javier Farm (FML.2310); Campo Grande, Los Colorados Farm, 100 km NE from Joaquin V. González (FML.2501); Punta Arenas, Misión La Paz (UNNEC.176); Rosario de la Frontera (MLP[JW.935*], formerly MLP.151* and 579*, holotype). *San Juan:* Caucete: 8 km E (MCNSJ.271); Nueve de Júlio, Dique Bello (MCNSJ.276). PARAGUAY: *Chaco:* Faro Moro, 60 km N Tenente Montanía (MACN.31975*).

Phalotris tricolor – w.l. (USNM.32271*, IBSP.37435*). – **BOLIVIA**: *Andrés Ibanez:* Colinas del Urubó (MNKP.3009). *Ángel Sandoval***:** Comunidad San Bernardo, Pantanal (MNKP.1393). *Cordillera:* Campamento Cupesi (MNKP.3212), Instituto Agronómico Nacional, Cordillera Oriental, near Departamento Capital (MHNP.26281*), Airport (USNM.132783*). *San Bernardino* (ZSM.100.27). *San José* (CM.34846*, CM.34847). *Santa Cruz:* Cordillera, Misión San Ignacio de Velasco (ZSM.184.129, lost), Perforación (MNKP.1884); Departamento Central (ZSM.39.30, lost), Misión San Francisco (MIZST, w.n.; MZUT.1228*); Santa Cruz de la Sierra (MNHN.520a, holotype*); Villa Olimpia (MNKP.2516); Misión (IBSP.21655*). *Tarija:* Villa Montes (SMF.32612*). **PARAGUAY**: w.l. (ANSP.3307*, IBSP.19605*, NMW.21991*). *Aregua*: Departamento Central (MHNP.2627*). *Boquerón:* 7 km S from Filadelfia (MHNP.5158*); 60 km SW of Filadelfia by Ruta IX (Transchaco), km 462 (MHNP.5159*); 28 km from Filadelfia (MHNP.5161*); 15.6 km S from Filadelfia (MHNP.10029*); 12.3 km S from Filadelfia (MHNP.10099*); 7 km S from Filadelfia (MHNP.10574*); Caaguazú, 5 km N from Coronel Oviedo (MHNP w.n.*). *Chaco:* Faro 60 km N from Tenente Montanía (MACN.31975*). *Presidente Hayes:* Ruta 9, km 100.2 (MHNP.10715*).