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Notes on Geographic Distribution

First records of *Tropidurus callathelys* and *T. chromatops* (Reptilia: Squamata: Tropiduridae) in Brazil

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Abstract: We present the first records of *Tropidurus callathelys* and *T. chromatops* in Brazil, at Parque Estadual Serra Ricardo Franco, Mato Grosso. The two species are largely syntopic and associated with rock outcrops on the plateaus of the Serranía de Huanchaca, Bolivia and Brazil. *Tropidurus callathelys* is more abundant, more heliophilous and uses vertical surfaces more often than *T. chromatops*. In Brazil, they are apparently restricted to Serra de Ricardo Franco, a protected area threatened by cattle raising, logging and agriculture, still in need of demarcation and a management plan.

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Lizards of the genus *Tropidurus* Wied-Neuwied, 1825 occupy a wide range of open environments along the dry diagonal of South American biomes (Werneck 2011), but also in the Atlantic Forest and in Amazonian savannas (Rodrigues 1987, 1988; Carvalho 2013). Recent works revealed undescribed species and a still unknown diversity within *Tropidurus* (Passos *et al.* 2011; Kunz and Borges-Martins 2013). These lizards are diurnal and heliophilous (Rocha and Bergallo 1990; Vitt 1993; Vitt *et al.* 1996; Gandolfi and Rocha 1998; Kiefer *et al.* 2005, 2007; Ribeiro *et al.* 2008), sit-and-wait foragers that feed predominantly on ants (Colli *et al.* 1992; Bergallo and Rocha 1994; Faria and Araujo 2004; Van Sluys *et al.* 2004; Carvalho *et al.* 2007; Ribeiro and Freire 2011), and reproduce primarily during the wet season (Vitt and Goldberg 1983; Van Sluys 1993, 1998, 2000; Van Sluys *et al.* 2002; Wiederhecker *et al.* 2002; Wiederhecker *et al.* 2003).

During 2–3 March 2013 and from 20 January to 20 February 2014, we conducted field expeditions to survey the herpetofauna of Parque Estadual Serra Ricardo Franco, a protected area in the municipality of Vila Bela da Santíssima Trindade (15°0′18.65″S, 59°57′3.89″ W), Mato Grosso, Brazil. We collected 32 individuals of *Tropidurus callathelys* Harvey & Gutberlet, 1998 and 6 individuals of *T. chromatops* Harvey & Gutberlet, 1998, representing the first records of these two species in Brazil (Figure 1). *Tropidurus callathelys* was previously known only from rock outcrops on the northern portion of Serranía de Huanchaca, between 500 and 600 m, near Lago Caimán, Provincia Velasco, Departamento Santa Cruz, Bolivia (Harvey and Gutberlet 1998), whereas *T. chromatops* was previously collected in Serranía de Huanchaca and on granitic inselbergs in the Bajo Paragua Forest Reserve, Departamento Santa Cruz, Bolivia (Harvey and Gutberlet 1998; Dirksen and De La Riva 1999).

The Serranía de Huanchaca is a vast (*ca.* 6,800 km^2) tableland in eastern Bolivia and western Brazil; approximately 5,300 km^2 lie in Bolivia and the remainder is in Brazil, where it is called Serra de Ricardo Franco (Litherland and Power 1989). The Brazilian portion is elongated, approximately 150 km long and 50 km wide, with a

Figure 1. (A) *Tropidurus callathelys* (CHUNB 74538, SVL = 87 mm) and (B) *T. chromatops* (CHUNB 74553, SVL = 75 mm) at Parque Estadual Serra Ricardo Franco, Vila Bela da Santíssima Trindade, Mato Grosso, Brazil.

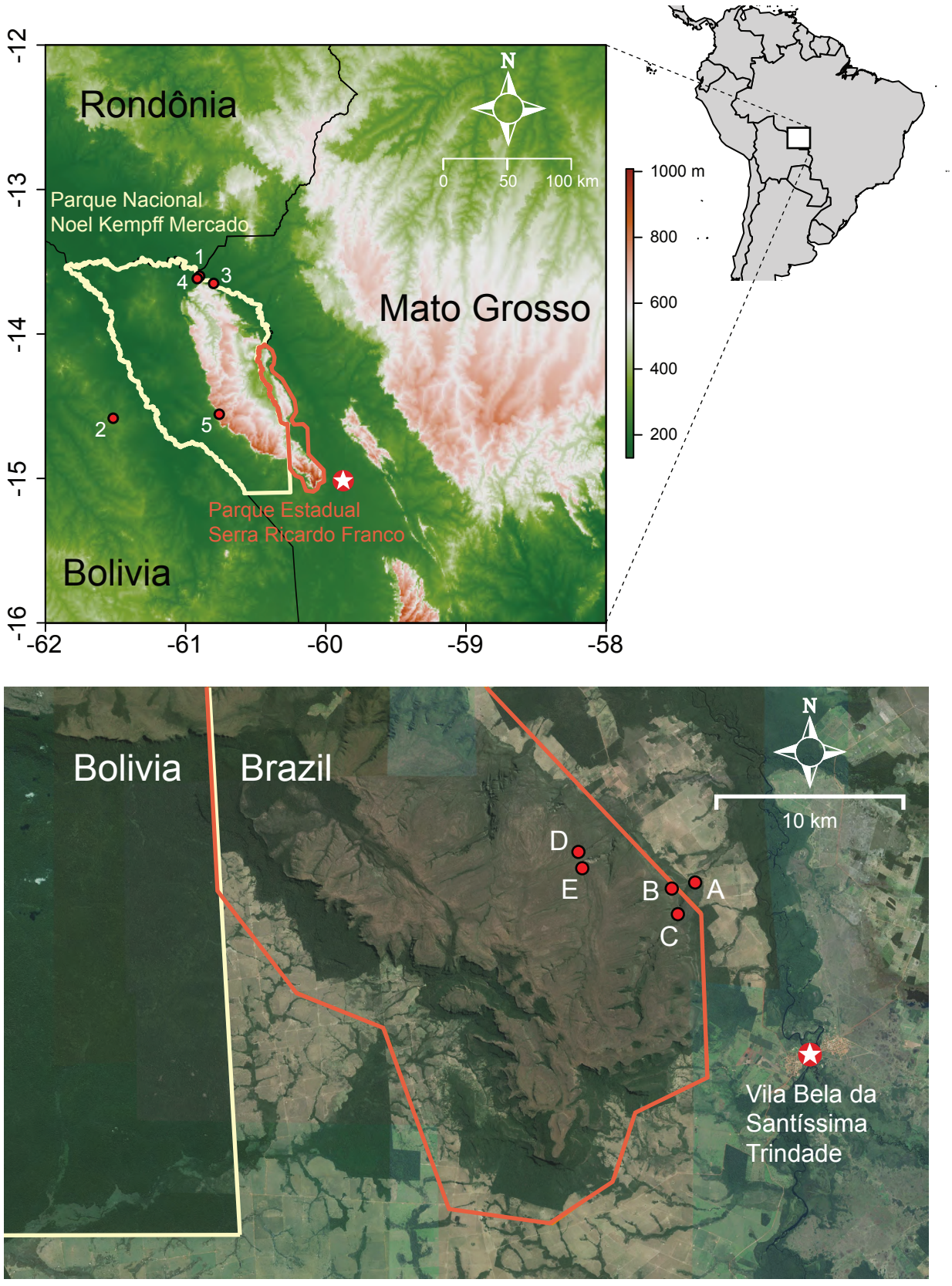

Figure 2. Top: previous records of *Tropidurus callathelys* and *T. chromatops* in Bolivia; *T. callathelys*: (1) Santa Cruz: northern slope of the Serranía de Huanchaca 13°36′ S, 60°54′ W, 500–600 m elevation (Harvey and Gutberlet 1998); *Tropidurus chromatops*: (2) Santa Cruz: inselberg, granite outcrops of the Bajo Paragua Forest Reserve 14°35′ S, 61°31′ W (Dirksen and De La Riva 1999); (3) Santa Cruz: campamento Las Torres (13°39′ S, 60°48′ W), 10 km E of Florida on the road to Los Fierros (Dirksen and De La Riva 1999); (4) northern slope of the Serranía de Huanchaca 13°37′ S, 60°55′ W, 400-600 m elevation (Harvey and Gutberlet 1998); (5) Serranía de Huanchaca, 7 km S of Los Fierros 14°33′21″ S, 60°45′36″ W, altitude 700 m (Harvey and Gutberlet 1998). Bottom: study sites at Parque Estadual Serra Ricardo Franco; (A) park headquarters, (B) Cachoeira Paraíso, (C) Cachoeira dos Namorados, (D) Cachoeira dos Macacos, (E) Cachoeira do Jatobá. Star indicates the city of Vila Bela da Santíssima Trindade, Mato Grosso, Brazil.

NW–SE orientation along the major axis (Litherland and Power 1989). The area sits at the transition between the Amazon Forest (Prance and Lovejoy 1985), the Cerrado savannas (Oliveira and Marquis 2002), the Chiquitano dry forests (Killeen *et al.* 2006) and the Pantanal wetlands (Junk *et al.* 2011). Savanna-like formations predominate on the plateau, dry forests occupy the slopes and foothills, and forests and wetlands occur in lowest elevation areas, especially around river courses (Killeen and Schulenberg 1998; Killeen *et al.* 2003). Two protected areas exist in the region (Figure 2): the Parque Nacional Noel Kempff Mercado (PNNKM) in Bolivia, with 1,523,000 ha (Killeen and Schulenberg 1998), and Parque Estadual Serra Ricardo Franco (PESRF) in Brazil, with 158,620.85 ha (created by Mato Grosso State decree 1,796 from 4 November 1997, available at http://www.sema.mt.gov.br).

Tropidurus callathelys is a member of the *T. spinulosus* group, which also includes *T. guarani* Alvarez, Cei & Scolaro, 1994, *T. melanopleurus* Boulenger, 1902, *T. spinulosus* (Cope, 1862), and *T. xanthochilus* Harvey & Gutberlet, 1998. The group is diagnosed by thigh marks yellow or white, antegular fold conspicuous, postmental scales poorly defined, circumorbital scales often arranged in two rows, and a middorsal scale row (Harvey and Gutberlet 1998; Frost *et al.* 2001). *Tropidurus callathelys* is uniquely characterized by the following combination of characters: vertebral crest strong and serrate in adult males (weak and not serrate in females); ventrolateral mite pockets deep and medial to antegular fold; preauricular fringe with granular scales and a lower cluster of 2–5 spines; ear canal deep in adults; tufts of neck spines low; preocular not contacting canthals; tail cylindrical, not heavily mucronate, longer than snout-vent length (SVL); and reverse sexual dichromatism, with females having brightly colored red heads (Harvey and Gutberlet 1998).

Tropidurus chromatops is a member of the *T. torquatus* group (Rodrigues 1987), which also includes *T. cocorobensis* Rodrigues, 1987, *T. erythrocephalus* Rodrigues, 1987, *T. etheridgei* Cei, 1982, *T. hispidus* (Spix, 1825), *T. hygomi* Reinhardt & Lütken, 1861, *T. insulanus* Rodrigues, 1987, *T. itambere* Rodrigues, 1987, *T. montanus* Rodrigues, 1987, *T. mucujensis* Rodrigues, 1987, *T. oreadicus* Rodrigues, 1987, *T. psammonastes* Rodrigues, Kasahara & Yonenaga-Yassuda, 1988, and *T. torquatus* (Wied-Neuwied, 1820). This group is characterized by lacking an enlarged middorsal scale row and by not being extremely flattened (Frost *et al.* 2001). *Tropidurus chromatops* is uniquely characterized by the following combination of characters: vertebral crest and tufts of neck spines absent; preauricular fringe complete, consisting of a row of seven spines; ear canal deep in adults; tail longer than SVL, cylindrical, not heavily mucronate; two mite pockets on each side of the neck, medial to oblique neck folds, subequal, deep; patch of granular scales in axilla not forming mite pockets; inguinal scales not differentiated into granules or mite pocket; scales on sides of neck much smaller than dorsals; fourth toe subdigital lamellae 25–29; complex facial color pattern in males; dorsum lacking large yellow blotches; males with midventral black patches (Harvey and Gutberlet 1998).

We captured lizards by hand and with the aid of nooses or shotguns loaded with dust shot, under "Licença de Pesquisa Científica em Unidade de Conservação Estadual 010/2013" from SEMA-MT and "Licença Permanente para Coleta de Material Zoológico 13324-1" from SISBIO, both issued to GRC. Lizards were euthanized with lethal doses of sodium thiopental, fixed in 10% formaldehyde, preserved in 70% ethanol, and deposited in Coleção Herpetológica da Universidade de Brasília – CHUNB, Brazil (*Tropidurus callathelys*: CHUNB 74521-74552; *T. chromatops*: CHUNB 74553-74558). At the time of capture of each lizard, we recorded the activity at first sight (immobile, slow pace or running), microhabitat (grass, open ground, tree trunks, or rocks), time of capture, and exposure in relation to sunlight (direct sunlight, shade, filtered sunlight). We immediately took cloacal, substrate, air 5 cm above substrate, and air at chest height temperatures with a Miller & Weber quick-reading thermometer (0.2°C precision). Prior to fixation, we took morphometric measurements of specimens using Mitutoyo® digital calipers (0.01 mm precision) and Pesola® spring dynamometers (0.1 g precision). We collected tissue (liver) samples, now stored at –80°C at CHUNB.

We captured all lizards at the top of the Serra de Ricardo Franco, dominated by a Cerrado vegetation with scattered rock outcrops, or in its steep slopes; we found no *Tropidurus* in the valley below the plateau. Searches took place from 10:00 h to 14:00 h and lizards were found throughout this time interval. Waterfalls are the most important landmarks at PESRF and most hiking tracks in the park lead to them. We captured lizards during surveys along tracks leading to the following waterfalls (Figure 2): (1) top of "Cachoeira dos Macacos" (14°54′44.09″ S, 60°4′23.24″ W, 638 m) and "Cachoeira do Jatobá" (14°54′58.51″ S, 60°4′24.66″ W, 660 m), (2) top of "Cachoeira dos Namorados" (14°56′20.24″ S, 60°1′32.24″ W), and (3) bottom of "Cachoeira Paraíso" (14°55′52.09″ S, 60°1′31.90″ W). We collected *T. callathelys* in all sites, but found *T. chromatops* exclusively along the track from "Cachoeira dos Macacos" to "Cachoeira do Jatobá". At "Cachoeira Paraíso", lizards were collected on rocky cliffs, close to the top of the plateau. *Tropidurus callathelys* clearly preferred vertical rocky surfaces, whereas *T. chromatops* was primarily found on the ground (Figure 3a). Most *T. callathelys* were immobile at first sight, whereas most *T. chromatops* were running (Figure 3b). Individuals of both species were generally exposed to direct sunlight when first sighted (Figure 3c). Body, substrate and air temperatures were similar for the two species (Table 1) and did not differ significantly (*t*-tests, all $P > 0.05$). None of the body measurements differed significantly between the two species (*t*-tests, all $P > 0.05$). Our specimens fall within the known range of SVL for *T. chromatops*, but we recorded three specimens of *T. callathelys* larger than the previous records (89.9 mm SVL, Harvey and Gutberlet 1998), the largest having 98.0 mm SVL (CHUNB 74523). *Tropidurus callathelys* and *T. chromatops* are largely sympatric, saxicolous and heliophilous, in agreement with previous observations (Harvey and Gutberlet 1998). However, *T. callathelys* apparently occurs in higher densities, prefers more direct sunlight and vertical surfaces, and is less active than *T. chromatops*.

Our records broaden the known distribution of *T. callathelys* and *T. chromatops* southeastwards, and represent their first record in the Brazilian Cerrado. They also extend the distribution of *T. callathelys* 176 km in a straight line from

the closest previous record, and 89 km for *T. chromatops*. Nineteen species of *Tropidurus* are known from Brazil (Carvalho 2013; Kunz and Borges-Martins 2013), eleven of which occur in the Cerrado. Five species of *Tropidurus* are Cerrado endemics: *T. callathelys, T. chromatops, T. insulanus, T. itambere,* and *T. montanus* (Nogueira et al. 2011). Given their habitat specialization and isolation of the plateau where they occur, the distribution of *T. callathelys* and *T. chromatops* in Brazil appears to be restricted to PESRF. Because PNNKM is relatively remote from large human settlements, *T. chromatops* was classified as Least Concern by IUCN (Embert and Dirksen 2010), whereas *T. callathelys* has not been evaluated (IUCN 2013). The surroundings of PESRF in Brazil are heavily exploited by agriculture and logging (Figure 2), most of the land still belongs to farmers and PESRF has not been effectively demarcated and lacks a management plan. Our records highlight the importance of PESRF in protecting two Cerrado endemics, with a very restricted distribution in a highly threatened region of Brazil.

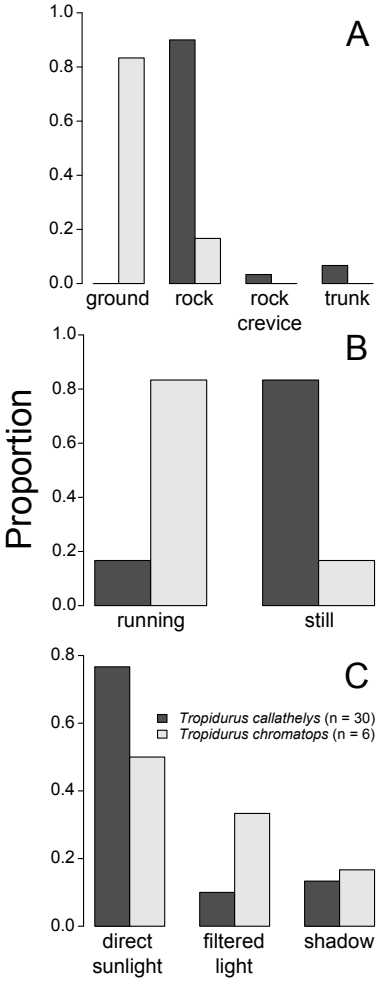

Figure 3. Microhabitats (A), activity (B), and exposure to sunlight (C) in individuals of *Tropidurus callathelys* and *T. chromatops* when first sighted, at Parque Estadual Serra Ricado Franco, Vila Bela da Santíssima Trindade, Mato Grosso state, Brazil.

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Table 1. Body mass (g), body measurements (mm) and body and environmental temperatures (°C) of *Tropidurus callathelys* and *Tropidurus chromatops* from Parque Estadual Serra Ricardo Franco, Vila Bela da Santíssima Trindade, Mato Grosso, Brazil. Details: n: sample size, sd: standard deviation, min: minimum, max: maximum.

Variables	*Tropidurus callathelys*					*Tropidurus chromatops*				
	n	mean	sd	min	max	n	mean	sd	min	max
Body mass	31	13.86	7.05	4.80	29.00	6	12.18	3.27	8.20	16.00
Snout-vent length	31	74.10	11.40	52.00	98.00	6	72.83	5.19	66.00	79.00
Tail length	21	109.19	17.13	81.00	146.00	4	96.75	12.53	84.00	108.00
Body width	32	18.97	3.64	11.63	27.34	6	17.06	2.70	13.35	20.27
Body height	32	11.65	2.64	7.60	16.83	6	12.00	2.87	8.36	15.76
Head width	31	14.98	2.88	9.83	20.97	6	14.35	1.29	12.97	16.51
Head height	31	9.07	1.71	6.38	12.90	6	8.91	0.97	7.27	9.85
Head length	31	17.55	2.85	12.70	23.20	6	17.16	1.62	14.62	18.36
Forelimb length	31	33.57	4.95	24.38	43.00	6	31.30	1.88	29.25	34.21
Hindlimb length	32	48.36	7.69	35.50	61.67	6	49.29	3.14	44.78	53.35
Body temperature	30	34.20	2.62	28.40	39.20	6	31.47	4.50	24.80	36.00
Substrate temperature	29	31.90	2.99	28.00	39.70	6	29.47	3.77	24.20	34.00
Air temperature (at 5 cm from substrate)	29	29.80	2.51	26.00	36.00	6	29.40	2.72	25.80	32.20
Air temperature (at chest height)	31	28.71	2.01	25.00	33.40	6	28.43	2.33	25.20	31.00

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