

Herpetofauna in a highly endangered area: the Triângulo Mineiro region, in Minas Gerais State, Brazil

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Abstract

The Brazilian Cerrado and Atlantic Forest shelter an especially rich herpetofauna and experience strong anthropogenic disturbances, which is also true for the western portion of Minas Gerais State. Herein, we present a list of the herpetofauna from the Triângulo Mineiro region in Minas Gerais State, southeastern Brazil. From 2012 to 2016, we sampled 28 localities along 23 municipalities in the region, using three sampling methods: active search, pitfall traps, and opportunistic records. We recorded 79 species, 44 amphibians and 35 reptiles. Three species (*Bokermannohyla szazimai*, *Oloolygon canastrensis*, and *Pithecopus azureus*) are classified as “data deficient” (DD) according to the IUCN. One species (*Proceratophrys moratoi*) is classified as “critically endangered” (CR) according to the IUCN Red List, and “endangered” (EN) according to the national red list. However, we suggest listing *P. moratoi* in the “least concern” category. We also present the first record of *Dendropsophus elianeae* in Minas Gerais State, and distribution map of the species. Furthermore, we elucidate the composition of the herpetofauna in the Triângulo Mineiro region and contribute to future conservation plans for the region and the species.

Key Words

amphibians, Atlantic Forest, Cerrado, checklist, new records, reptiles

Introduction

Brazil harbors the most diverse herpetofauna in the world (Costa and Bérnils 2015; Segalla et al. 2016). Such notable species richness is found throughout the different

Brazilian morphoclimatic domains, with each domain supporting a singular evolutionary history of its herpetofauna (e.g. Nogueira et al. 2011; Valdujo et al. 2012; Haddad et al. 2013). The Atlantic Forest and Cerrado domains are considered some of the most species rich and

most threatened ecoregions on our planet, experiencing strong anthropic influence, which makes them priority areas for developing effective biodiversity conservation policies (Mittermeier et al. 2004).

The transition zones between such domains lead to a wide overlap in geographic distribution of amphibians and reptiles, with phytophysiognomies ranging from savanna formations (e.g. Cerrado *stricto sensu*) to forest environments (e.g. gallery forest) (Oliveira-Filho and Ratter 2002; Sano et al. 2010) and formations of ombrophylous forests to altitude fields (Veloso et al. 1991) in the Atlantic Forest. Such phytophysiognomies contribute to the high heterogeneity of the landscape and deeply influence the amphibian diversity in these domains (Nogueira et al. 2011; Valdujo et al. 2012; Haddad et al. 2013). Nevertheless, most of the natural habitats in this region were lost due to agriculture, mining, and urbanization (Scolforo 2006).

This situation is the same in the Triângulo Mineiro region (TM hereafter) in western Minas Gerais State. The TM is characterized by the Atlantic Forest and Cerrado, which are the main physiognomies of the landscape. However, less than 25% of the TM remains undisturbed (Sano et al. 2010) and the high anthropogenic pressure, associated with the poorly known TM herpetofauna, highlights the need for intense sampling efforts in the region (e.g. Giaretta et al. 2008; Conté et al. 2013; Costa et al. 2014).

Some studies surveying the local herpetofauna in the TM region present amphibians (Giaretta et al. 2008; Conté et al. 2013) and snakes (Costa et al. 2014) separately. Herein, we present a list of amphibians and reptiles from the Grande River and Paranaíba River interfluvium in the TM region of Minas Gerais State. Additionally, we briefly address the taxonomy and natural history of some recorded species.

Material and methods

Study site

The TM region is located in the western portion of Minas Gerais state, encompasses 66 municipalities, and covers nearly 90,000 km² (Fig. 1). The region is delimited by the Grande River in the north and by the Paranaíba River in the south, with the confluence in the extreme West of Minas Gerais state, where the headwaters of the Paraná River are located. The region has great economic importance, mainly related to cultivation of sugar cane and its derivatives (Michelotto 2008). Despite the high degree of anthropic disturbance, patches of natural environments, including native cover, ponds, and swamps, remain.

Data collection

Between 2012 and 2016, we sampled from 28 localities in 23 municipalities in the TM region (Fig. 1; Table 1). Each site was sampled twice a year, in the wet (October

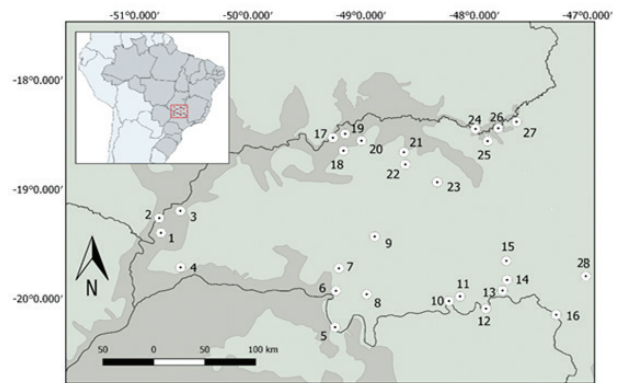


Figure 1. Sampling areas distributed in the TM region, Minas Gerais State. Sampling points: (1) Rural Reserve, (2) Ferry of the Paranaíba River, (3) Middle São Domingos River, (4) Santa Rita Farm, (5) Cisco Stream, (6) Low São Mateus Riverside, (7) High São Mateus Riverside, (8) Middle Frutal Riverside, (9) Cocal Riverside, (10) Giral Powerplant Region, (11) Grande River Bank, (12) Mata Farm, (13) Delta Region, (14) Aroeiras Farm, (15) Grovão Farm, (16) Estreito Powerplant, (17) Low Piedade River, (18) High Barreirinho Stream, (19) Paranaíba's Lake, (20) Garcias Region, (21) Cruz Riverside, (22) Samambaia Riverside, (23) Óleo Riverside, (24) Powerplant Region, (25) Paraiso Ranch, (26) Grupiara Dam, (27) Confins Region, and (28) D'Anta Stream. Dark gray: Atlantic Forest; Light gray: Cerrado.

to February) and dry (June to August) seasons. We associated the following categories of habitat and microhabitats to each species recorded. Habitats: Open Formation (*i.e.* Cerrado *sensu stricto*), Riparian Forest, Fragment Forest (transitional formation between Cerrado and Atlantic Forest morpho domain), Dam (damming of streams), Lakes (natural lakes formed along the Grande and Paranaíba River banks), Ponds (formed during rains), Stream, Swamp, and Urban Zone. Microhabitats: arboreal, shrub, leaf litter, bare soil, fallen trunks, and over water.

Due to logistical issues, sampling efforts were not systematically undertaken. The herpetofauna was sampled using the following methods: *i*) active search (AS), *ii*) pitfall traps (PT), and *iii*) opportunistic records (OR). The AS method consisted of random search for specimens (from 16:00 to 22:00hs) in fallen trunks, rocky crevices, bromeliads, and marginal vegetation of water bodies (Heyer et al. 1994). The PT were installed near water bodies using guide fences (e.g. Cechin and Martins 2000) in 12 localities (Table 1). At each location, five lines of traps were installed, each of the tracks had four 60 l buckets, connected by 12 m of fence (50 cm tall), totaling 240 buckets. Data collection using PT was performed during five consecutive days at each locality, except for the Delta region where data was collected for 10 days (Table 1). We obtained the OR on the trails between sampling sites or by collection from third parties.

We collected the individuals and killed them by immersion in water with benzocaine hydrochloride 250 mg/l or intraperitoneal injection of liquid lidocaine (CFBio N° 148/2012). We fixed the specimens in 10% formalin, and

Table 1. Sampling areas distributed in the TM region, Minas Gerais State, Southeast Brazil with their respective municipalities, coordinates, and sampling efforts of active search (h) and pitfalls (days of sampling).

	Locality	Municipality	Coordinates	Sampling efforts (h)	Pitfall (days of sampling)
1	Rural Reserve	Limeira do Oeste	19°23'59.90"S, 50°46'1.17"W	24	–
2	Ferry of the Paranaíba River	Limeira do Oeste	19°15'51.82"S, 50°46'54.93"W	72	–
3	Meddle São Domingos River	Santa Vitória	19°11'55.72"S, 50°35'45.82"W	24	–
4	Santa Rita Farm	Carneirinho	19°42'56.52"S, 50°35'38.91"W	12	–
5	Cisco Stream	Fronteira	20°15'47.00"S, 49°13'45.00"W	54	5
6	Low São Mateus Riverside	Itapagipe	19°55'49.73"S, 49°13'18.99"W	54	5
7	High São Mateus Riverside	Comendador Gomes	19°43'29.00"S, 49°11'44.00"W	54	5
8	Meddle Frutal Riverside	Frutal	19°57'43.73"S, 48°57'2.09"W	54	5
9	Cocal Riverside	Prata	19°26'1.69"S, 48°52'46.69"W	12	–
10	Giral Powerplant Region	Conceição das Alagoas	20°01'26"S, 48°13'24"W	10	–
11	Grande River Bank	Água Comprida	19°58'52"S, 48°07'32"W	36	–
12	Mata Farm	Uberaba	20°5'36.58"S, 47°53'50.39"W	54	5
13	Delta Region	Delta	19°55'41.02"S, 47°45'1.09"W	72	10
14	Aroeiras Farm	Uberaba	19°49'50.78"S, 47°42'37.75"W	30	5
15	Grotão Farm	Uberaba	19°39'22.04"S, 47°43'1.28"W	30	–
16	Estreito Powerplant	Sacramento	20°08'58"S, 47°16'37"W	56	–
17	Low Piedade River	Araporã	18°31'46.58"S, 49°14'54.37"W	36	5
18	High Barreirinho Stream	Centralina	18°38'53.60"S, 49°9'17.88"W	36	5
19	Paranaíba's Lake	Centralina	18°29'39.13"S, 49°8'27.05"W	36	5
20	Garcias Region	Monte Alegre de Minas	18°33'23.56"S, 48°59'47.57"W	36	5
21	Cruz Riverside	Tupaciguara	18°39'44.50"S, 48°37'18.43"W	36	–
22	Samambaia Riverside	Tupaciguara	18°46'26.00"S, 48°36'33.00"W	12	–
23	Óleo Riverside	Uberlândia	18°56'10.75"S, 48°19'39.39"W	24	–
24	Powerplant Region	Araguari	18°26'56"S, 47°59'21"W	10	–
25	Paraíso Ranch	Cascalho Rico	18°33'39"S, 47°52'57"W	12	–
26	Grupiara Dam	Grupiara	18°26'33"S, 47°47'20"W	30	–
27	Confins Region	Douradoquara	18°23'03"S, 47°37'39"W	20	–
28	D'Anta Stream	Campos Altos	19°40'6.72"S, 45°57'13.36"W	40	5

stored them permanently in 70% alcohol. We deposited the vouchers in Coleção Herpetológica do Museu de Zoologia João Moojen da Universidade Federal de Viçosa (MZUFV), Coleção Herpetológica da Universidade Federal de Juiz de Fora (CHUFJF - Répteis) and Coleção Zoológica da Universidade Federal de Mato Grosso do Sul (ZUFMS) (collection permit SISBIO/IBAMA number 54493-3) (Appendix I).

The conservation status of each taxon was verified using the list of endangered fauna species for Minas Gerais State (Drummond et al. 2009), the list of endangered Brazilian fauna species (ICMBio 2017) and the Red List of Threatened Species from the International Union for Conservation of Nature (IUCN 2017).

Results

We recorded a total of 79 species: 44 amphibians (Fig. 2; Table 2) and 35 reptiles (Fig. 3; Table 3). Among the amphibians, the families Hylidae and Leptodactylidae were the most species rich, with 19 (~43%) and 15 (~34%) species sampled, respectively. Among the reptiles, the squamates were the richest group sampled, with 33 species distributed within 13 families. Dipsadidae (11 spp., ~33%) and Colubridae (4 spp., ~12%) were the richest families among the squamates. In addition, one species

of Alligatoridae (*Paleosuchus palpebrosus*) and Chelidae (*Phrynops geoffroanus*) were also recorded.

Among the habitats, open areas were the richest, with 35% of the amphibian and 25% of reptile species recorded. This habitat type was followed by dam and swamp for amphibians (26% both); and by fragment forest (22%) and riparian forest (13%) for reptiles. We also found some amphibians (e.g. *Rhinella schneideri*, *Leptodactylus labyrinthicus*, and *Odontophrynus cultripes*) and reptiles (e.g. *Amphisbaena alba*, *Hemidactylus mabouia*, *Ameiva ameiva*, and *Tropidurus torquatus*) in urban areas. For microhabitats, we recorded most amphibian richness in shrub (16%), bare soil (16%), and leaf litter (15%). The dominant reptile richness was found in leaf litter (30%).

Regarding the methods used, we captured specimens from all amphibian species using AS, while the PT registered 18% of amphibian species, and OR only 9%. Among the reptiles, AS was also the most efficient method, recovering 77% of the species, followed by OR (46%) and PT (11%). We registered 17 reptile species by the AS alone, seven by OR, and *Typhlops brongersmianus* was only registered by PT.

We found five populations of *Dendropsophus elianae* throughout the TM region. Currently, this species is only known in the states of Mato Grosso, Mato Grosso do Sul, and São Paulo. Herein, we present the first record and a distribution map of *D. elianae* in Minas Gerais State (Fig. 4).



Figure 2. Anuran species recorded from sampling areas in the TM region of Minas Gerais State. Family Brachycephalidae: (a) *Ischnocnema* sp. (gr. *guentheri*); Family Bufonidae: (b) *Rhinella mirandaribeiroi*; Family Hylidae: (c) *Boana lundii*, (d) *Dendropsophus elianeae*, (e) *Oloolygon canastrensis*, (f) *Pseudis bolbodactyla*, (g) *Pseudis platensis*, and (h) *Scinax squalirostris*; Family Leptodactylidae: (i) *Physalaemus marmoratus*, and (j) *Pseudopaludicola falcipes*; Family Microhylidae: (k) *Chiasmocleis albopunctata*; Family Odontophrynidae: (l) *Proceratophrys moratoi*.

Table 2. List of anuran species recorded in the TM region, Minas Gerais State. Methods: (AS) Active Search, (OR) Opportunistic Records, and (PT) Pitfall Traps. Sampling points where specimens were found see Table 1. Habitats: Open Formation (OF), Riparian Forest (RF), Fragment Forest (FF), Dam (DA), Lakes (LK), Ponds (PO), Stream (ST), Swamp (SW), and Urban Zone (UR). Microhabitats: arboreal (ar), shrub (sh), leaf litter (ll), bare soil (bs), fallen trunks (ft), and over water (ow).

Order/Family/Species	Sampling	Sampling Points	Habitats (Microhabitats)
Anura			
Brachycephalidae			
<i>Ischnocnema</i> sp. (gr. <i>guentheri</i>)	AS	28	FF(ar)
Bufo			
<i>Rhinella schneideri</i> (Werner, 1894)	AS, OR	1–3, 5–7, 9–12, 16–21, 25, 27	OF, RF, DA, PO, UR (ll, bs)
<i>Rhinella mirandaribeiroi</i> (Gallardo, 1965)	AS	7, 14, 21	PO, SW (bs)
Hylidae			
<i>Boana albopunctata</i> (Spix, 1824)	AS	1–6, 8–15, 17–23, 25	RF, DA, LK, PO, SW (sh, bs)
<i>Boana faber</i> (Wied-Neuwied, 1821)	AS, OR	13, 28	FF, DA, LK (ar, ow)
<i>Boana lundii</i> (Burmeister, 1856)	AS	2, 3, 7–9, 12, 13, 15, 17, 18, 20–22, 28	RF, FF, SW (ar)
<i>Boana raniceps</i> Cope, 1862	AS	1–3, 5, 6, 10, 17–19, 25	OF, LK, SW (sh)
<i>Bokermannohyla sazimai</i> (Cardoso & Andrade, 1983)	AS	15	OF, ST (ar)
<i>Dendropsophus cruzi</i> (Pombal & Bastos, 1998)	AS	1–3, 7, 17–20, 22, 23	OF, DA, LK, SW (sh)
<i>Dendropsophus elianae</i> (Napoli & Caramaschi, 2000)	AS	1, 2, 13, 16, 18	OF, DA, LK, SW (sh)
<i>Dendropsophus jimi</i> (Napoli & Caramaschi, 1999)	AS	11, 13–15, 19, 20, 23	OF, DA, LK, SW (sh)
<i>Dendropsophus melanargyreus</i> (Cope, 1887)	AS	7, 19, 21	OF, FF, PO (ar, sh)
<i>Dendropsophus minutus</i> (Peters, 1872)	AS	1, 3, 5, 7, 8, 10, 12–23, 28	OF, RF, FF, DA, LK, PO, SW (ar, sh)
<i>Dendropsophus nanus</i> (Boulenger, 1889)	AS	2, 5–7, 10, 12, 17, 1–21, 25	OF, DA, LK, SW (sh)
<i>Oloolygon canastrensis</i> (Cardoso & Haddad, 1982)	AS	28	OF, DA (sh)
<i>Pseudis bolbodactyla</i> Lutz, 1925	AS	1, 19	LK (ow)
<i>Pseudis platensis</i> (Linnaeus, 1758)	AS	5	LK (ow)
<i>Scinax constrictus</i> Lima, Bastos & Giaretta, 2005	AS	2	OF, DA (sh)
<i>Scinax fuscomarginatus</i> (Lutz, 1925)	AS	3, 5–7, 17–23	OF, DA, LK (sh)
<i>Scinax fuscovarius</i> (Lutz, 1925)	AS	1, 2, 5–9, 14, 17–23, 28	OF, RF, DA, PO, SW (sh, bs)
<i>Scinax squalirostris</i> (A. Lutz, 1925)	AS	15	OF, SW (sh)
<i>Trachycephalus typhonius</i> (Linnaeus, 1758)	AS	1, 2, 6, 9, 10, 13	OF, RF, DA, PO, ST (ar)
Leptodactylidae			
<i>Leptodactylus chaquensis</i> (Cei, 1950)	AS	1, 2, 6, 11–15, 25	OF, DA, LK, ST, SW (sh)
<i>Leptodactylus fuscus</i> (Schneider, 1799)	AS	1–22, 25	OF, FF, DA, LK, PO, SW (sh)
<i>Leptodactylus labyrinthicus</i> (Spix, 1824)	AS	1–3, 5–9, 11, 12, 14–21, 23, 25	OF, DA, PO, ST, SW, UR (ll, bs)
<i>Leptodactylus latrans</i> (Steffen, 1815)	AS	6, 12, 19	OF, DA, LK, PO, ST, SW (ll, bs)
<i>Leptodactylus mystaceus</i> (Spix, 1824)	AS, PT	6, 7, 12, 13, 17	RF, FF (ll)
<i>Leptodactylus mystacinus</i> (Burmeister, 1861)	AS, PT	6, 12, 15, 18, 21, 25	OF, RF, DA, SW (ll, bs)
<i>Leptodactylus podicipinus</i> (Cope, 1862)	AS	2, 5, 6, 8–10, 12–14, 16–22, 24	OF, RF, DA, LK, PO, SW (ll, bs, ow)
<i>Leptodactylus syphax</i> Bokermann, 1969	AS	7, 9	OF (ll)
<i>Physalaemus centralis</i> Bokermann, 1962	AS, PT	1, 5, 6, 8, 10, 13, 15, 17, 18, 20, 21	OF, RF, DA, LK, PO, SW (ll, bs, ow)
<i>Physalaemus cuvieri</i> Fitzinger, 1826	AS, PT	2, 3, 5–8, 10–15, 17–23, 25	OF, RF, DA, LK, PO, SW (ll, bs, ow)
<i>Physalaemus marmoratus</i> (Reinhardt & Lütken, 1862)	AS	9, 20	OF (bs)
<i>Physalaemus nattereri</i> (Steindachner, 1863)	AS, PT, OR	1, 2, 5–9, 11, 12, 15, 17–22	OF, FF, DA, PO, SW (ll, bs, ow)
<i>Pseudopaludicola facureae</i> Andrade & Carvalho, 2013	AS	1, 2–4, 18–22	OF, DA, LK, SW (bs, ow)
<i>Pseudopaludicola falcipes</i> (Hensel, 1867)	AS	7, 9	OF, DA, LK, ST, SW (bs, ow)
<i>Pseudopaludicola saltica</i> (Cope, 1887)	AS	8, 10, 11, 15, 19, 22	OF, DA, LK, SW (bs, ow)
Microhylidae			
<i>Chiasmocleis albopunctata</i> (Boettger, 1885)	AS, PT	12–14, 17, 19	OF, RF, PO (ll, ow)
<i>Dermatonotus muelleri</i> (Boettger, 1885)	AS, PT	12, 14, 15, 17–20	OF, RF, FF, PO (ll, ow)
<i>Elachistocleis cesarii</i> (Miranda-Ribeiro, 1920)	AS	1, 2, 12, 14, 18–21	OF, RF, DA, PO, ST, SW (bs)
Odontophrynidae			
<i>Proceratophrys moratoi</i> (Jim & Caramaschi 1980)	AS	5, 7, 14, 19, 21	OF, FF, ST, SW (ll)
<i>Odontophrynus cultripes</i> Reinhardt & Lutken, 1862	AS, OR	5, 23, 28	OF, UR (ll)
Phyllomedusidae			
<i>Phitecopus azureus</i> Cope, 1862	AS	7, 15, 18, 21, 23	OF, RF, DA, ST, SW (ar, sh)
Strabomantidae			
<i>Barycholos ternetzi</i> (Miranda-Ribeiro, 1937)	AS, PT	5–9, 11–15, 17–21	OF, RF, FF (ll)

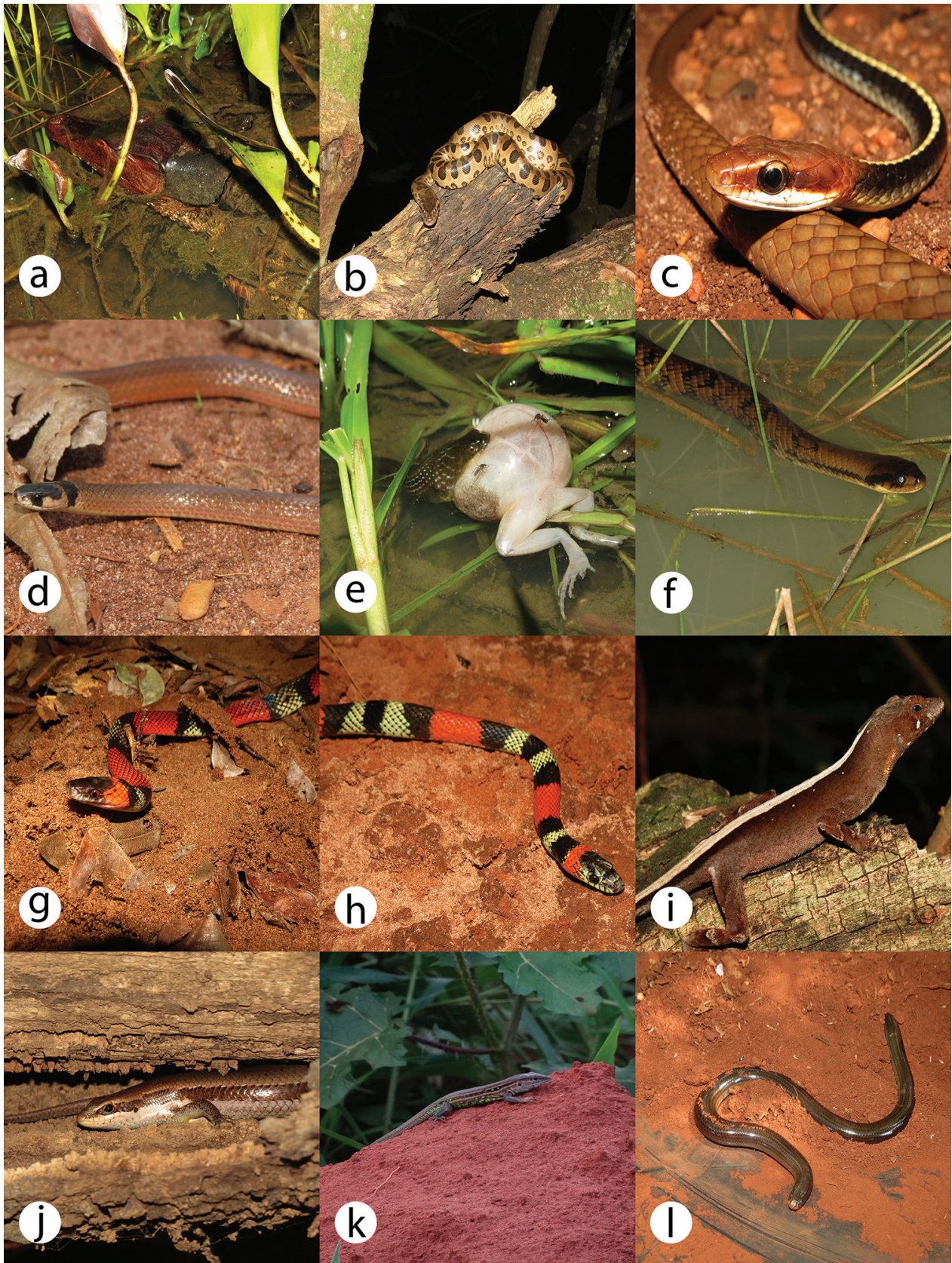


Figure 3. Reptile species recorded from sampling areas in the TM region of Minas Gerais State. Family Alligatoridae: (a) *Pa-leosuchus palpebrosus*; Family Boidae: (b) *Eunectes murinus*; Family Colubridae: (c) *Chironius flavolineatus* and (d) *Tantilla melanocephala*; Family Dipsadidae: (e) *Helicops modestus*, (f) *Hydrodynastes gigas*, (g) *Oxyrhopus guibei*, and (h) *Oxyrhopus trigeminus*; Family Dactyloidae: (i) *Norops brasiliensis*; Family Mabuyidae: (j) *Copeoglossum nigropunctatum*; Family Teiidae: (k) *Cnemidophorus* sp. (aff. *ocellifer*); Family Typhlopidae: (l) *Typhlops brongersmianus*.

Table 3. List of reptile species recorded in the TM region, Minas Gerais State. Methods: (AS) Active Search, (OR) Opportunistic records, and (PT) Pitfall Traps; sampling sites where specimens were found are given in Table 1. Habitats: Open Formation (OF), Riparian Forest (RF), Fragment Forest (FF), Dam (DA), Lakes (LK), Ponds (PO), Stream (ST), Swamp (SW), and Urban Zone (UR). Microhabitats: arboreal (ar), shrub (sh), leaf litter (ll), bare soil (bs), fallen trunks (ft), and over water (ow). * specimen found crossing the highway.

Order/Family/Species	Sampling	Sampling Points	Habitats (Microhabitats)
Crocodylia			
Alligatoridae			
<i>Paleosuchus palpebrosus</i> (Cuvier, 1807)	AS	2, 3, 5, 10	OF, DA, LK, ST (ow)
Squamata			
Amphisbaenidae			
<i>Amphisbaena alba</i> Linnaeus, 1758	AS, OR	17, 19, 23	OF, FF, UR (ll)
<i>Amphisbaena mertensi</i> Strauch, 1881	AS	13	FF (ll)
Anguillidae			
<i>Ophiodes</i> sp. (cf. <i>striatus</i>) (Spix, 1825)	OR	1, 2, 22	OF, FF (ll)
Boidae			
<i>Boa constrictor</i> Linnaeus, 1758	AS, OR	5, 6, 8, 10–12, 16, 23–25	OF, RF, FF, DA, LK, SW (ll)
<i>Epicrates crassus</i> Cope, 1862	OR	7	*
<i>Eunectes murinus</i> (Linnaeus, 1758)	AS	2, 5, 6, 8, 11, 12, 16, 25, 27	OF, RF, ST, SW (ar, ll, ow)
Colubridae			
<i>Chironius flavolineatus</i> (Jan, 1863)	AS	13, 20	OF, FF (ar, ll)
<i>Drymarchon corais</i> (Boie, 1827)	AS	1	RF (ll)
<i>Spilotes pullatus</i> (Linnaeus, 1758)	AS	14, 15, 21, 24, 25	OF, FF (ll)
<i>Tantilla melanocephala</i> (Linnaeus, 1758)	AS	18, 21	FF (ll)
Dipsadidae			
<i>Erythrolamprus poecilogyrus</i> (Wied-Neuwied, 1825)	OR	1, 12, 15	FF (ll)
<i>Helicops modestus</i> Günther, 1861	AS	19, 22	OF, LK (ow)
<i>Hydrodynastes gigas</i> (Duméril, Bibron & Duméril, 1854)	AS, OR	5, 6	OF, RF, LK (ll, ow)
<i>Leptodeira annulata</i> (Linnaeus, 1758)	OR	28	OF (ll)
<i>Oxyrhopus guibei</i> Hoge & Romano, 1978	AS, OR	2, 9, 11, 13–15	OF, FF (ll)
<i>Oxyrhopus trigeminus</i> Duméril, Bibron & Duméril, 1854	AS	2, 6, 7, 22	OF, FF (ll)
<i>Philodryas olfersii</i> (Liechtenstein, 1823)	OR	21	FF (ll)
<i>Philodryas patagoniensis</i> (Girard, 1858)	AS	3	FF (ll)
<i>Sibynomorphus mikanii</i> (Schlegel, 1837)	AS	6, 13, 22	OF, SW (ll)
<i>Xenodon merremii</i> (Wagler, 1824)	OR	1, 2, 3, 4	OF, FF (ll)
<i>Xenopholis undulatus</i> (Jensen, 1900)	OR	7	OF (ll)
Dactyloidae			
<i>Norops brasiliensis</i> (Vanzolini & Williams, 1970)	AS	4, 6, 13, 17, 18	RF, FF (ar, ll)
Gekkonidae			
<i>Hemidactylus mabouia</i> (Moreau de Jonnés, 1818)	AS	2, 6, 8, 12, 25	OF, UR
Gymnophthalmidae			
<i>Colobosaura modesta</i> (Reinhardt & Lütken, 1862)	AS	28	FF (ll)
Mabuyidae			
<i>Copeoglossum nigropunctatum</i> (Spix, 1825)	AS	6, 8, 9, 19, 20	OF, RF (ll, ft)
<i>Notomabuya frenata</i> (Cope, 1862)	AS, PT	1, 11, 13, 14, 17, 18	OF, RF (ll, ft)
Teiidae			
<i>Ameiva ameiva</i> (Linnaeus, 1758)	AS, PT, OR	2, 3, 5–8, 10–13, 17–21	OF, RF, FF, UR (ll, bs)
<i>Cnemidophorus</i> sp. (aff. <i>ocellifer</i>)	AS	2–4, 17, 18, 20, 21	OF, FF (ll, ft)
<i>Salvator merianae</i> (Duméril & Bibron, 1839)	AS, OR	1, 2, 5, 6, 8, 10–13, 16–22, 25–27	OF, RF, FF (ll)
Typhlopidae			
<i>Typhlops brongersmianus</i> Vanzolini, 1976	PT	7, 17, 18	FF (ll)
Tropiduridae			
<i>Tropidurus torquatus</i> (Wied-Neuwied, 1820)	AS, PT, OR	1, 2, 9, 11, 17–20, 22, 25	OF, RF, FF, UR (ll)
Viperidae			
<i>Bothrops moojeni</i> (Hoge, 1966)	AS, OR	1–3, 5, 6, 8, 11–15, 17–20, 22	OF, RF, FF (ll, bs, ft)
<i>Crotalus durissus</i> Linnaeus, 1758	AS, OR	1–3, 5–8, 11, 12, 15–19, 21, 25, 27	OF, RF, FF (ll, bs)
Testudinae			
Chelidae			
<i>Phrynops geoffroanus</i> (Schweigger, 1812)	AS	3, 11, 16, 25	OF, RF, DA, ST

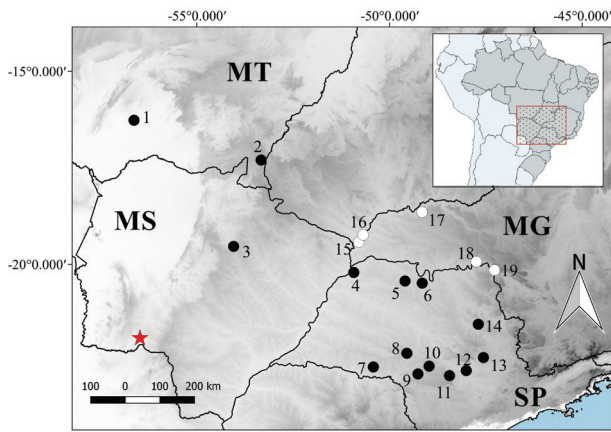


Figure 4. Geographical distribution of *Dendropsophus elianeae*. Literature records (black circle): Mato Grosso State in (1) Poconé (Moura 2015) and (2) Alto Araguaia (Mendes-Pinto and Miranda 2011); Mato Grosso do Sul State in (3) Camapuã (Sugai et al. 2014); São Paulo State in (4) Santa Fé do Sul (Santos et al. 2007), (5) Palestina (Oliveira 2008), (6) Icém (Silva and Rossa-Feres 2007), (7) Estação Ecológica de Assis (Araújo and Almeida-Santos 2011), (8) Gália and Alvilândia (Brassaloti et al. 2010), (9) Estação Ecológica de Santa Bárbara (Araújo et al. 2013), (10) Borebi (Maffei et al. 2011b), (11) Botucatu (Melo et al. 2007), (12) Anhembi (Costa et al. 2013), (13) Rio Claro (Zina et al. 2007), and (14) Luiz Antônio (Prado et al. 2009). New records of *D. elianeae* in Minas Gerais state: (15) Rural Reserve, (16) Ferry of the Paranaíba River, (17) High Barreirinho Stream, (18) Delta Region and (19) Estreito Powerplant. Type locality (red star): Bela Vista municipality (Napoli and Caramaschi 2000). MT: Mato Grosso state; MS: Mato Grosso do Sul State; MG: Minas Gerais State; and SP: São Paulo State.

Discussion

Despite the high degree of anthropogenic disturbance in the study area (Michelotto 2008), we found a notable herpetofaunal diversity. The first amphibian inventory for the TM region, Giaretta et al. (2008) found 32 species throughout the Araguaia, Perdizes, and Uberlândia municipalities. Five years later, Conté et al. (2013) recorded 40 amphibian species along the Tijuco River, in the Monte Alegre de Minas and Ituitaba municipalities. From all the amphibian species detected in the previous inventories, we did not find *Ischnocnema penaxavantino*, *Rhinella granulosa*, *Ameerega flavopicta*, *Dendropsophus rubicundulus*, *Boana paranaíba*, *Leptodactylus cunicularius*, *Leptodactylus sertanejo*, *Elachistocleis bicolor* and *Proceratophrys goyana* (Giaretta et al. 2008; Conté et al. 2013). Costa et al. (2014) presented the first snake checklist in the TM region, reporting 43 species at the Nova Ponte Hydroelectric Power Plant, Nova Ponte municipality; we were only able to detect 13 of these species.

Our study is the first to consider all reptiles (lizards, snakes, caimans, and freshwater turtles) in the TM region (Costa et al. 2014 only covered the snakes). Other species, besides those recorded in faunistic surveys, have been described in the TM region: Uberlândia municipal-

ity is the type locality of the *Ischnocnema penaxavantino*, *Leptodactylus sertanejo*, *Pseudopaludicola facureae* and *Apostolepis tertuliano-beui* (Lema 2004; Giaretta and Costa 2007; Giaretta et al. 2007; Andrade and Carvalho 2013); *Boana paranaíba* is described in the Araguaia municipality (Carvalho et al. 2010); *Drymoluber brazili* described in Uberaba (Gomes 1918); and *Bokermannohyla napolii* in Perdizes, at the border with Serra da Canastra (Carvalho et al. 2012).

In fact, we found 35 additional species in the region compared to the previous survey. Therefore, we suggest that the checklist of the herpetofauna in the TM region is currently composed of 122 species (Suppl. material 1: Table S1), with 57 amphibian species and 65 reptile species. This increase in the number of species known from this region highlights the need for continuous sampling efforts to describe the true diversity of the region, especially in endangered areas.

During our field work, we made novel records of *Dendropsophus elianeae* (Fig. 2d) from five different localities in the TM region. *D. elianeae* was described from the municipality of Bela Vista, Mato Grosso do Sul state (Napoli and Caramaschi 2000) and is distributed in Mato Grosso do Sul and São Paulo States, with some reports from Paraguay (Brusquetti and Lavilla 2006). Here, we present the first records of *D. elianeae* in Minas Gerais State, and expand its distribution ~ 180 km northeast (as the crow flies) of its known distribution (Fig. 4).

The genus *Ophiodes* Wagler (1828) has a Neotropical distribution and problematic taxonomic history, mainly due to its highly cryptic diversity (e.g. Montechiaro et al. 2011; Cacciali and Scott 2012, 2015; Costa and Bérnills 2015; de Oliveira et al. 2016). In fact, one study points out that populations of *Ophiodes* found in Southwestern/Midwestern Brazilian regions could represent an undescribed species (Borges-Martins 1998). Another genus of lizards, *Cnemidophorus*, also has a complex taxonomy, suggesting that *C. ocellifer* may be a species complex (Rodrigues 1987; Rocha et al. 1997), and likely reflecting the need to review this group in detail. Meanwhile, undescribed taxa may remain hidden under the name *C. ocellifer* (Dias et al. 2002; Rodrigues 2003).

Bokermannohyla sazimai, *Ololygon canastrensis*, and *Pithecopus azureus* are classified as “data deficient” (DD) by IUCN (2017). *Paleosuchus palpebrosus* is evaluated as “data deficient” (DD) on the list of endangered species of Minas Gerais (Drummond et al. 2009). *Proceratophrys morato* (Fig. 2l) is listed as “critically endangered” (CR) by the IUCN Red List Categories and Criteria because its occurrence is less than 100 km² and area of occupancy is less than 10 km² – criteria B1ab(iii,v)+2ab(iii,v) – (IUCN 2001). *P. morato* is also classified as “endangered” (EN) by the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio 2017) and “vulnerable” by the red list of São Paulo state (Garcia et al. 2009). *P. morato* was considered endemic, with only a few populations, all of which were in the central region of the São Paulo State (Rolim et al. 2010; Maffei et al. 2011a). However, Mar-

tins and Giaretta (2012) expanded the species distribution, including four new records in the TM region.

Herein, we recorded five other populations of *P. moratoi* in the interfluvium of the Paranaíba River and Grande River, demonstrating the wide distribution of *P. moratoi* in Minas Gerais State. The specimens were found in forest patches that were altered by pasture and plantations, which indicates the resistance of *P. moratoi* to these type of habitat alterations; similar information was reported in other studies (e.g. Carvalho Jr. et al. 2010; Martins and Giaretta 2012). In addition, some populations of *P. moratoi* have already been recorded in conservation areas of São Paulo and Minas Gerais (Martins and Giaretta 2012) States. Brasileiro et al. (2008) and Martins and Giaretta (2012) classified *P. moratoi* as “data deficient”; however, in the light of these new distribution areas we suggest listing the species in the “least concern” category, following the evaluation criteria of IUCN (2001).

Finally, we elucidate the composition of the TM region’s herpetofauna, which is needed to understand local biodiversity and conservation strategies (Haddad 1998; Biek et al. 2002). Future studies should help to overcome the data deficiency for some of the species in this study, especially species that are taxonomically complicated (i.e. genus *Ophiodes* and *C. ocellifer*). Furthermore, this study provides insight into conservation of the TM region and threatened species.

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Appendix I

Specimens of anurans and reptiles collected at the Triângulo Mineiro region, State of Minas Gerais, Brazil: *Ischnocnema* sp. (gr. *guentheri*) (ZUFMS-AMP09762-63), *Rhinella schneideri* (MZUFV 14473), *R. mirandaribeiroi* (ZUFMS-AMP07922), *Boana albopunctata* (MZUFV 14474, 14476, 15066-67), *B. lundii* (MZUFV 15065), *B. raniceps* (MZUFV 14482-83, 15068), *Dendropsophus cruzi* (MZUFV 14499, 14502), *D. elianae* (ZUFMS-AMP07918, 07919), *D. jimi* (MZUFV 14495, 14498), *D. melanargyreus* (MZUFV 15599), *D. minutus* (MZUFV 14491, 15071-72, 15323), *D. nanus* (MZUFV 14492, 14494), *Oloolygon canastrensis* (ZUFMS-AMP09764-74), *Pseudis bolbodactyla* (ZUFMS-AMP07909, 07920, 07921), *P. platensis* (ZUFMS-AMP07933), *S. constrictus* (MZUFV 15324), *S. fuscomarginatus* (MZUFV 14486-87), *S. fuscovarius* (ZUFMS-AMP09775, MZUFV 15069), *Trachycephalus typhonius* (ZUFMS-AMP07941), *Leptodactylus fuscus* (MZUFV 14485), *L. labyrinthicus* (MZUFV 15070), *L. latrans* (MZUFV 14471-72), *L. mystaceus* (MZUFV 15838-89), *L. mystacinus* (MZUFV 15320), *L. podicipinus* (MZUFV 14479, 14481, 15074-75), *L. siphax* (MZUFV 15597, 15594), *Physalaemus centralis* (MZUFV 15077), *P. cuvieri* (MZUFV 14484, 15073), *P. marmoratus* (MZUFV 15595), *P. nattareri* (MZUFV 14489-90, 15319), *Pseudopaludicola facureae* (MZUFV 15587-89), *P. falcipes* (ZUFMS-AMP07923-29), *P. saltica* (MZUFV 15596), *Chiasmocleis albopunctata* (MZUFV 14488), *Dermatonotus muelleri* (MZUFV 14468, 14470), *Proceratophrys moratoi* (MZUFV 15317-18), *Phitecopus azureus* (MZUFV 15837), *Barycholos ternetzi* (MZUFV 15076, 15321-22), *Amphisbaena alba* (CAUFJF 1116), *A. mertensi* (ZUFMS-REP02703), *Ophiodes* sp. (cf. *striatus*) (ZUFMS-REP02697), *Eunectes murinus* (CHUFJF

0996), *Chironius flavolineatus* (ZUFMS-REP02710), *Tantilla melanocephala* (ZUFMS-REP02712), *Helicops modestus* (ZUFMS-REP02713), *Hydrodynastes gigas* (ZUFMS-REP-2389), *Leptodeira annulata* (ZUFMS-REP02800), *Oxyrhopus guibei* (ZUFMS-REP02701), *O. trigeminus* (ZUFMS-REP02700), *Sibynomorphus mikanii* (ZUFMS-REP02709), *Xenopholis undulatus* (MZUFV 2251), *Norops brasiliensis* (MZUFV 1251), *Copeoglossum nigropunctatum* (ZUFMS-REP02798-99), *Cnemidophorus* sp. (aff. *ocellifer*) (MZUFV 1253), *Typhlops brongersmianus* (MZUFV 2252), *Tropidurus torquatus* (MZUFV 1252), *Bothrops moojeni* (CHUFJF 1117), *Crotalus durissus* (ZUFMS-REP02702).

Supplementary material 1

Table S1. Amphibian and reptile species recorded in the TM region, State of Minas Gerais, Brazil

Authors: Matheus de Oliveira Neves, André Yves, Elvis Almeida Pereira, Leandro Alves, Jacqueline Bonfim Vasques, Joaquim Fernandes Teixeira Coelho, Patrícia Santos Silva

Data type: occurrence

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