



Taxonomic revision of the *Odontophrynus cultripes* species group, with description of a new related species (Anura, Cycloramphidae)

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Abstract

The revision of the *O. cultripes* species group is presented, through the definition and characterization of *O. cultripes*, the redescription of *O. carvalhoi* based on recently collected specimens, and the description of a new species. *Odontophrynus monachus* **sp. nov.** is described from the headwaters of the São Francisco River, in the Parque Nacional da Serra da Canastra (20°10'S, 46°30'W, 1350 m above sea level), Municipality of São Roque de Minas, State of Minas Gerais, Brazil. The geographic distributions of the referred species are described and mapped.

Key words: Amphibia, geographic distribution, *Odontophrynus carvalhoi*, *Odontophrynus cultripes*, *Odontophrynus monachus* **sp. nov.**, taxonomy

Resumo

A revisão das espécies do grupo de *O. cultripes* é apresentada, com definição e caracterização de *O. cultripes*, redescrição de *O. carvalhoi* com base em exemplares recentemente obtidos e descrição de uma nova espécie. *Odontophrynus monachus* **sp. nov.** é descrita das cabeceiras do Rio São Francisco, no Parque Nacional da Serra da Canastra (20°10'S, 46°30'W, 1350 m acima do nível do mar), Município de São Roque de Minas, Estado de Minas Gerais, Brasil. As distribuições geográficas das espécies são atualizadas e mapeadas.

Introduction

The genus *Odontophrynus* Reinhardt & Lütken, 1862 was included in the family Cycloramphidae and considered a monophyletic group by Frost *et al.* (2006). The monophyletism of *Odontophrynus* was also stated by Pyron and Wiens (2011), but this genus plus *Macrogenioglottus* Carvalho and *Proceratophrys* Miranda-Ribeiro were included in a family named Odontophrynidae. In this paper we followed the well established catalogue of Frost (2011) and maintained the genus *Odontophrynus* in the family Cycloramphidae.

Currently, the genus *Odontophrynus* comprises ten species and, although not assessed by a modern phylogenetic analysis, these species have been combined into three morphological groups based on overall similarities inferred from Savage and Cei (1965), Cei *et al.* (1982), Di Tada *et al.* (1984), Cei (1985, 1987), Martino and Sinsch (2002), Rosset *et al.* (2006, 2007), and Rosset (2008). The previously recognized *O. moratoi* species group, as defined by Jim and Caramaschi (1980) and Caramaschi (1996), including *O. moratoi* Jim and Caramaschi and *O. salvatori* Caramaschi, was removed from the genus by Amaro *et al.* (2009) by transferring *O. moratoi* to the genus *Proceratophrys*, under the combination *Proceratophrys moratoi*, based on molecular analyses of three genes (16S,

cyt *b*, and Rag-1). Although Amaro *et al.* (2009) suggested that *O. salvatori* should be included in the genus *Proceratophrys*, we think that the transfer of one genus to another must be done by means of modern phylogenetic analysis. Therefore, *O. salvatori* is herein maintained in the genus *Odontophrynus*, but not associated to any species group.

The *O. americanus* species group, comprising diploid and tetraploid species ($2n = 22$ and $2n = 44$ chromosomes; Beçak & Beçak 1974), is characterized by the absence of large dorsal tibial and forearm glands, and no distinctly developed postorbital, temporal, and parotoid glands, although glandular ridges may be present on postorbital and parotoid regions and on posterolateral surface of forearm (Savage & Cei 1965). Species included in this group are *O. americanus* (Duméril and Bibron), *O. lavillai* Cei, *O. cordobae* Martino and Sinsch, and *O. maisuma* Rosset.

The *O. occidentalis* species group, comprising only diploid species ($2n = 22$ chromosomes; Beçak & Beçak, 1974), is defined by having enlarged postorbital and temporal glands, several moderate sized parotoid glands, numerous enlarged glands scattered over back and sides, upper eyelids with few greatly enlarged and several small warts, anterior surfaces of forearms and tibiae with scattered small glands, and a glandular fold on posterolateral surface of forearm (Savage & Cei 1965). Species included in this group are *O. occidentalis* (Berg), *O. barrioi* Cei, Ruiz and Beçak, and *O. achalensis* Di Tada, Barla, Martoni and Cei.

The *O. cultripes* species group, containing only diploid species ($2n = 22$ chromosomes; Beçak & Beçak, 1974), is characterized by the presence of a single, greatly developed, smooth, elongated or kidney-shaped parotoid gland, no enlarged glands on back and sides, except by well-developed postorbital and temporal glands, presence of a glandular fold on the posterior surface of forearm, and presence or absence of a tibial gland (Savage & Cei 1965). According to Savage and Cei (1965), *O. carvalhoi* should be included in the *O. americanus* species group by the absence of tibial glands and temporal glands. However, the postorbital, temporal, and parotoid glands are present in *O. carvalhoi*, and the species is herein associated to the *O. cultripes* species group. Species included in this group are *O. cultripes* Reinhardt and Lütken and *O. carvalhoi* Savage and Cei.

The present paper deals with the taxonomic revision of the *Odontophrynus cultripes* species group and provides the definition and characterization of *O. cultripes*, the redescription of *O. carvalhoi* based on recently collected specimens, and the description of a new related species.

Material and methods

Examined specimens and data were obtained from the following Brazilian collections: Museu Nacional, Rio de Janeiro, Rio de Janeiro (MNRJ); Museu de Zoologia, Universidade Federal da Bahia, Salvador, Bahia (UFBA); Museu de Ciências Naturais, Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Minas Gerais (MCNAM); Museu de Zoologia, Universidade Federal de Viçosa, Minas Gerais (MZUFV); Museu de Zoologia, Universidade de São Paulo, São Paulo (MZUSP); Museu de Zoologia, Universidade Estadual de Feira de Santana, Bahia (MZUEFS); Museu de História Natural, Universidade Estadual de Campinas, São Paulo (ZUEC); Departamento de Zoologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro (ZUF RJ); Coleção Herpetológica da Universidade de Brasília, Federal District (CHUNB), and Célio F.B. Haddad Collection, Universidade Estadual Paulista—Campus de Rio Claro, São Paulo (CFBH). Examined specimens are listed in the Appendix 1. Localities from literature are: *Odontophrynus carvalhoi*: BRAZIL: ALAGOAS: Iateguara, Mata do Engenho Coimbra (Lisboa *et al.* 2010). BAHIA: Vitória da Conquista (Beçak & Beçak 1974). PERNAMBUCO: Parque Nacional do Catimbau, in the municipalities of Buíque, Ibimirim, and Tupanatinga; Floresta and Ingá, Reserva Ecológica de Serra Negra; Igarassú, Usina São José; Serra Talhada, Fazenda Saco; Triunfo (Moura *et al.* 2011). PIAUÍ: Planalto da Ibiapaba, including municipalities of Carnaubal, Croatá, Guaraciaba do Norte, Ibiapina, Ipú, São Benedito, Tanguá, Ubajara, and Viçosa do Ceará (Loebmann & Haddad 2010); Uruçui (Skuk *et al.* 2004). *Odontophrynus cultripes*: GOIÁS: Luziânia, Córrego do Mesquita (Brandão & Batista 2000). MINAS GERAIS: Catas Altas, Serra do Caraça (Canelas & Bertoluci 2007); Uberlândia (Giaretta *et al.* 2008).

Measurements followed Napoli (2005) and are in millimeters (mm): SVL (snout-vent length); HL (head length); HW (head width); IND (internarial distance); END (eye to nostril distance); ED (eye diameter); UEW (upper eyelid width); IOD (interorbital distance); HAL (hand length); THL (thigh length); TL (tibia length); FL (foot length). Snout profile terminology and webbing formula notation followed Heyer *et al.* (1990).

The advertisement call of the new species of *Odontophrynus* described herein was obtained on 12 December 1980, 20:00h, by Adão J. Cardoso during a survey of anurans at Parque Nacional da Serra da Canastra, Municipality of São Roque de Minas, Minas Gerais State, Brazil, between the national park entrance and a stream. Frog vocalizations were recorded in the field with an Uher 4000 IC tape recorder and an Uher M538 microphone. Advertisement calls of *O. carvalhoi* from the municipalities of Maracás (16–20 January 2004; voucher specimen UFBA 2911) and Serra do Ramalho (12 December 2007; voucher specimen UFBA 7691), State of Bahia, Brazil, were recorded by Marcelo F. Napoli, with a Marantz Portable Cassette Recorder PMD222 with a Sennheiser ME66 directional microphone. L.F. Toledo kindly provided the advertisement call of *O. cultripes*, recorded with uninformed equipment at the Municipality of São Tomé das Letras, State of Minas Gerais, Brazil. Calls were digitized at a sampling rate of 4 kHz, and analyzed with Avisoft SAS—Lab Light for Windows (version 3.74) and Sound Ruler Acoustic Analysis (version 0.9.6.0). Audiospectrograms were made with Fast Fourier Transform length (FFT) of 256, overlap 87.5%, frame 100%, window Flat Top, and frequency resolution of 58 Hz. Ten call parameters were measured: number of notes, call duration (s), note duration (s), inter-note duration (s), inter-call duration (s), note rate (notes/s), number of pulses, pulse rate (pulses/s), call dominant frequency (kHz), and frequency amplitude (kHz). Pulse rate was calculated for each note as pulse number/note duration; note rate as note number/call duration. The terminology used for the description of advertisement calls followed Duellman and Trueb (1994).

Taxonomic account

Odontophrynus cultripes Reinhardt and Lütken, 1862

Figure 1

Odontophrynus cultripes Reinhardt and Lütken, 1862

Pyxicephalus cultripes—Cope, 1863

Ceratophrys cultripes—Boulenger, 1882

Syntypes. Zoologisk Museum, University of Copenhagen, Denmark (ZMUC) and [on exchange from ZMUC] Naturhistorische Museum, Wien, Austria (NHMW 16522), according to Häupl and Tiedemann (1978) and Frost (2011).

Type locality. “Reinhardt har taget de 2 foreliggende Exemplarer ved Tamburil, en Landeiendom ikke langt fra Lagoa Santa, og ved Taboleiro Grande, en lille Flaekke beliggende en 12 Mill N. V. for nysnaevnte By” (Reinhardt & Lütken 1862) [“Reinhardt has taken the 2 available specimens at Tamburil, a ranch not far from Lagoa Santa, and at Taboleiro Grande, a small township lying about 12 miles north west of the same city.”; translated by A. Schmidt-Nielsen]. Both localities referred by Reinhardt and Lütken (1862), Tamburil and Taboleiro Grande (currently Derrubadas, according to Bokermann 1966), are located in the Municipality of Lagoa Santa (19°38’S, 43°54’W, ca. 740 m a.s.l.), State of Minas Gerais, Brazil.

Diagnosis. A species belonging to the *Odontophrynus cultripes* group and associated with the Cerrado environments of Central and Southeastern Brazil, is characterized by the following combination of traits: (1) size large (SVL 50–60 mm in males, 45–70 mm in females); (2) snout vertical in profile; (3) parotoid glands large, ovoid; (4) glands on forearms and tibiae present; (5) dorsum without or with few scattered glands; (6) elongated gland on the ventrolateral surface of forearm present; (7) elongated gland along the external border of the tarsus/metatarsus present; (8) foot webbing formula I 1½–2⁺ II 1½–3⁺ III 2⅔–3 IV vestigial V.

Comparisons with other species. *Odontophrynus cultripes* is distinguished from *O. carvalhoi* and *O. monachus* **sp. nov.** by the ovoid parotoid glands (elongated to elliptical in *O. carvalhoi*; globose, pearl-shaped in *O. monachus* **sp. nov.**), presence of a differentiated, large gland on the forearm (absent in *O. carvalhoi* and *O. monachus* **sp. nov.**), presence of a conspicuous, globose gland on the tibiae (poorly developed in *O. carvalhoi* and *O. monachus* **sp. nov.**), and presence of an elongated gland along the external border of the tarsus/metatarsus (poorly developed in *O. carvalhoi* and *O. monachus* **sp. nov.**) Additionally, *O. cultripes* is separated from *O. carvalhoi* by the total absence or presence of few scattered glands on dorsum (presence of shallow glands scattered on dorsum of *O. carvalhoi*), and from *O. monachus* **sp. nov.** by the vertical snout in profile (obtuse in *O. monachus* **sp. nov.**), and

foot webbing less developed (foot webbing formula in *O. cultripes*, I 1½–2⁺ II 1½–3⁺ III 2⅔–3 IV vestigial V; in *O. monachus* **sp. nov.**, I 1–2 II 1–2 III 1–3⁺ IV 3–1 V).



FIGURE 1. Living specimen of *Odontophrynus cultripes*, MZUFV 6669, SVL 62,6 mm, adult male, from the Serra do Brigadeiro, Municipality of Araponga, State of Minas Gerais, Brazil (Photo by Renato N. Feio: December 2005).

Description. The species was well characterized by Cochran (1955), Savage and Cei (1965), and Cei (1980), which makes unnecessary a redescription.

Color in life. The following description was based on color photographs of an adult male from Araponga, State of Minas Gerais, Brazil (MZUFV 6669), and another from Viçosa, State of Minas Gerais, Brazil (not collected). Dorsal ground color grayish green. A weak thin dorsal black to blackish brown Y-shaped mark is discernible from each upper eyelid to near the posterior edges of parotoid glands, bordered and defined on outside by broad reddish cream bands of similar width and extension. A reddish cream mid-dorsal pin stripe is visible over the sacrum. Parotoid, temporal, and postorbital glands reddish brown, each one delimited by a black edge; other minor glands and enlarged warts orange to greenish brown with or without black edgings. Flank marked by a broad reddish cream dorsolateral stripe from the parotoid gland to near the groin. Head highlighted by the anterior border of the dorsal Y-shaped mark, which outlines a V-shaped interocular reddish cream bar with dark brown edges. Snout marked by the presence of two blackish brown stripes from upper lip to nostrils, and posteriorly until reaching the anterior corner of eyes, delimiting a cross-shaped mask filled with dorsal background color. Three to four other blackish brown perpendicular stripes were present on the upper lip, a pale one placed in the midpoint between nostril and anterior corner of eye, and the remaining three from anterior to posterior corners of eye, on a cream to somewhat orange background. Arms and legs with irregular light to dark brown crossbars, which become less distinct proximally. Tibial gland reddish brown. Forearms with a well developed orange longitudinal glandular stripe. Belly grayish white; throat greenish brown. Sole of foot and tarsus dark gray, with light gray tubercles. Superior and inferior surfaces of iris white, marbled with thin black reticulations; anterior and posterior surfaces black; a thin vertical black stripe divides the eye, the lower half larger than the upper half, which may be absent.

Color in preservative. Dorsum of head, body, and limbs brownish or olive-brown; a cream interorbital bar; sides of head light brown with two dark brown blotches, one below and the other in front of the eye; two distinct cream stripes on the body sides, running obliquely downward from the tympanic area nearly to groin; a short mid-dorsal whitish-cream line on the sacrum; arms and legs with irregular light and dark brown crossbars, becoming

less distinct proximally; glands and enlarged warts brown with some black edging. Undersurfaces uniformly cream; throat of males grey to dark brown.

Advertisement call. The following description is based on the advertisement calls of two males from the Municipality of São Tomé das Letras, State of Minas Gerais, Brazil. The call (fig. 2 A–D) is composed by one multi-pulsed note. Four main energetic bandwidths (sidebands) are distinguishable in the audiospectrogram (fig. 2 A, D), due to the pulsatile nature of the call. Pulses with the highest energy peaks arise in the first half of note (fig. 2 C, D). Detailed descriptive statistics are given in Table 1. For comparisons with other species of the *O. cultripes* group, see the *O. monachus* **sp. nov.** advertisement call description below.

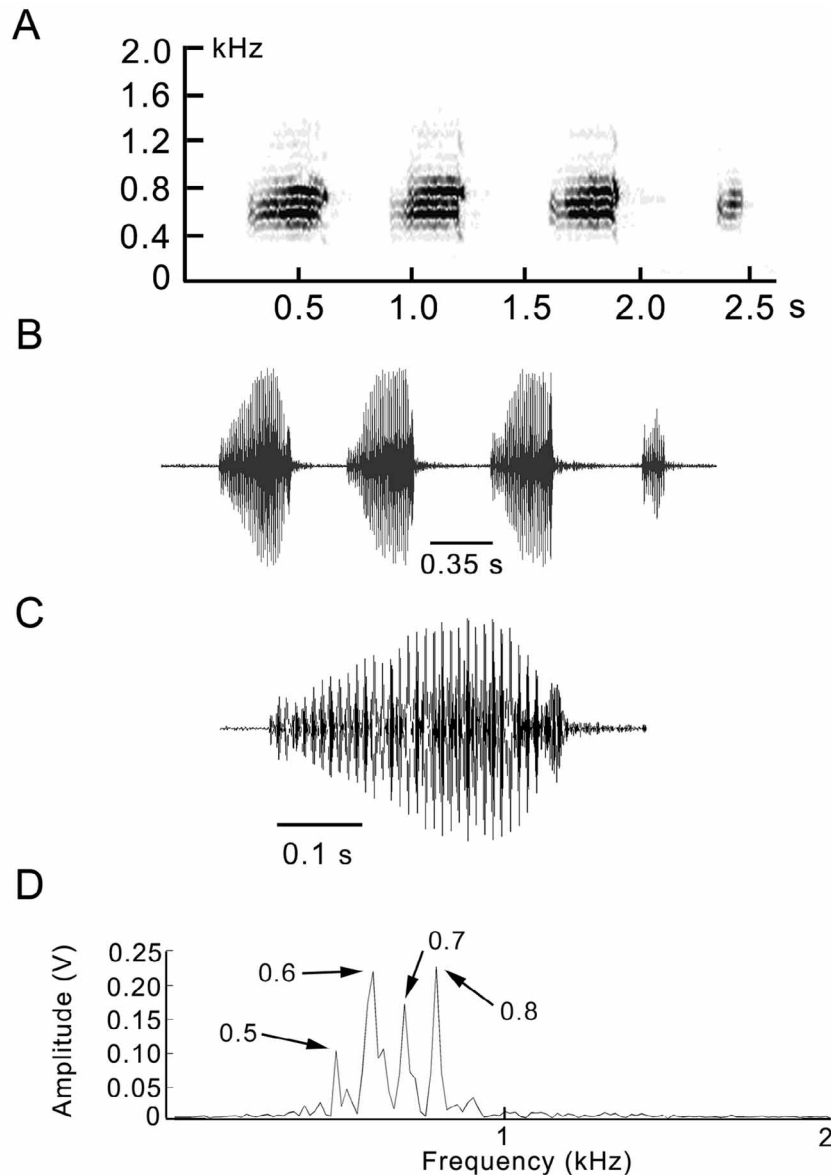


FIGURE 2. (A) audiospectrogram, (B) oscillogram, (C) oscillogram of the first note, and (D) power spectrum of the advertisement call of *Odontophrynus cultripes* from the Municipality of São Tomé das Letras, State of Minas Gerais, Brazil. Air temperature 14°C.

Tadpole. The tadpole was described and figured by Savage and Cei (1965) and Cei (1980).

Karyotype. The karyotype was described and figured by Beçak *et al.* (1967, 1971), Beçak and Beçak (1974), Ruiz and Beçak (1976), and Ruiz *et al.* (1981).

Geographic distribution and ecological remarks. The geographical distribution of *O. cultripes* is mapped in fig. 3. *Odontophrynus cultripes* mainly inhabits environments of altitudes higher than 800 m a.s.l. (800–999 m: 61.4% of the total number of localities, $n = 67$; >1000 m: 19.3%; 600–799 m: 15.8%; 500–599 m: 3.5%). The southern limit of the species distribution is defined by the southern sector of the Serra da Mantiqueira mountain

range; the eastern limit is defined by the Serra do Espinhaço mountain range, except by three samples located in the northern sector of the Serra da Mantiqueira mountain range. From its southernmost to northernmost distribution limits (Central Brazilian Plateau), *O. cultripes* is distributed through a series of plateaus and mountain chains in the states of Minas Gerais and Goiás (Serra da Canastra, Planalto Central Brasileiro, Planalto Centro Sul de Minas, and Patamares and Serras do Rio São Francisco; see Alvarenga *et al.* 1997 for definition of Brazilian relief units). Most known populations of *O. cultripes* are under a Cwa type of Köppen's climate classification (humid and sub-humid mesothermic climate) and less frequently under a Cwb or Cfa types. The north-westernmost known population samples of the species are located in the Cerrado biome (see Rizzini 1979 for definition of "Cerrado"), whereas southernmost samples are in the Tropical Atlantic Forest biome, inhabiting seasonal semi-deciduous forests (known as interior forests; see Silva & Casteleti 2005 for distribution and characterization of the Tropical Atlantic Forest sub-regions). We do not have ecological data from all geographic samples, but *O. cultripes* may be associated with semideciduous or deciduous forest borders within the Cerrado biome, as occurs to *O. carvalhoi* within the Caatinga biome (see below).

TABLE 1. Acoustic properties of the advertisement call of *Odontophrynus carvalhoi* (Maracás and Serra do Ramalho, State of Bahia, Brazil), *O. cultripes* (São Tomé das Letras, State of Minas Gerais, Brazil), and *O. monachus* (holotype, Parque Nacional da Serra da Canastra, State of Minas Gerais, Brazil). Values are: mean \pm standard deviation (range; sample size). *n*, number of specimens analyzed. Temporal parameters of the call in seconds. Frequencies in kilohertz (kHz). Values in bold indicate main differences among species.

	<i>O. carvalhoi</i>		<i>O. cultripes</i> (<i>n</i> = 2)	<i>O. monachus</i> (<i>n</i> = 1)
	Maracás (<i>n</i> = 1)	Serra do Ramalho (<i>n</i> = 2)		
Call duration	0.31 \pm 0.01 (0.24–0.35; 96)	0.39 \pm 0.09 (0.26–0.50; 22)	0.34 \pm 0.04 (0.27–0.40; 30)	0.62 \pm 0.18 (0.28–0.98; 54)
Interval between calls	1.35 \pm 0.38 (0.75–2.51; 96)	2.36 \pm 1.05 (1.27–4.51; 22)	2.68 \pm 0.88 (1.62–4.90; 24)	1.49 \pm 0.60 (0.72–3.91; 36)
Number of notes	1	1	1	1–3 (mode 2)
Note duration (overall)	0.31 \pm 0.01 (0.24–0.35; 96)	0.39 \pm 0.09 (0.26–0.50; 22)	0.34 \pm 0.04 (0.27–0.40; 30)	0.31 \pm 0.03 (0.23–0.39; 54)
Note 1 duration	0.31 \pm 0.01 (0.24–0.35; 96)	0.39 \pm 0.09 (0.26–0.50; 22)	0.34 \pm 0.04 (0.27–0.40; 30)	0.33 \pm 0.02 (0.28–0.39; 54)
Note 2 duration	—	—	—	0.28 \pm 0.01 (0.23–0.34; 54)
Note 3 duration	—	—	—	0.27 \pm 0.01 (0.28; 2)
Inter-note duration	1.35 \pm 0.38 (0.75–2.51; 96)	2.36 \pm 1.05 (1.27–4.51; 22)	2.68 \pm 0.88 (1.62–4.90; 24)	0.08 \pm 0.02 (0.06–0.18; 54)
Note rate (notes/s)	3.19 \pm 0.20 (2.79–4.06; 96)	2.72 \pm 0.70 (1.98–3.84; 22)	3.18 \pm 0.18 (3.04–3.72; 30)	2.88 \pm 0.18 (2.50–3.52; 54)
Number of pulses	29.41 \pm 1.86 (23–34; 96)	42.90 \pm 10.06 (30–54; 22)	23.21 \pm 2.19 (19–28; 29)	25.33 \pm 2.70 (20–32; 54)
Note pulse rate (pulses/s)	93.56 \pm 1.79 (89.7–96.3; 96)	110.17 \pm 2.39 (104.9–115.3; 22)	69.26 \pm 2.41 (62.2–71.7; 29)	80.91 \pm 4.20 (73.3–92.7; 54)
Frequency amplitude	0.42–0.71	0.40–0.78	0.42–0.78	0.42–0.81
Call dominant frequency	0.50 \pm 0.19 (0.48–0.59; 96)	0.58 \pm 0.03 (0.47–0.60; 22)	0.66 \pm 0.00 (0.66, 30)	0.63 \pm 0.05 (0.54–0.72; 54)

Remarks. The specimens referred by Cochran (1955) as *Odontophrynus cultripes* to “Rio de Janeiro: Alto Itatiaia, AMNH 17060” and “São Paulo: Butantan, USNM 121326 and IB 3.,” not examined by us, are probably *Odontophrynus americanus*, or the localities are in error; the specimens referred to “Rio Grande do Sul: Passo Fundo, IB 87–8 and USNM 121327”, not examined by us, are probably *Odontophrynus maisuma*, or the locality is in error.

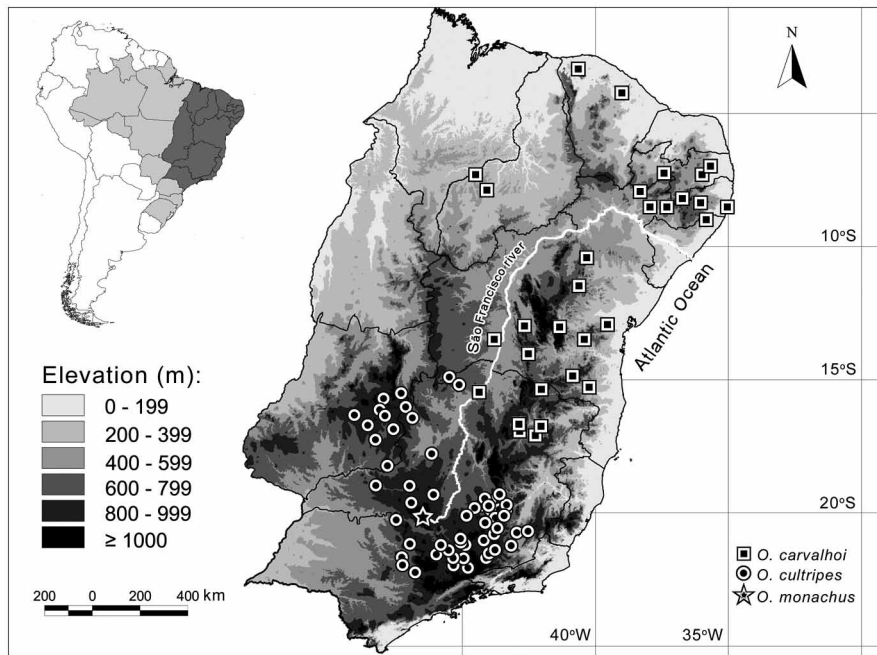


FIGURE 3. Geographic distribution of the species of the *Odontophrynus cultripes* group on topographic map.

Odontophrynus carvalhoi Savage and Cei, 1965

Figures 4–6

Odontophrynus americanus—Miranda-Ribeiro, 1937.

Odontophrynus carvalhoi Savage & Cei, 1965.

Holotype. MNRJ 0313 (fig. 4), adult female, collected by Antenor Leitão de Carvalho, in 1936.

Type locality. Municipality of Poção (08°11'S, 36°42'W, ca. 1035 m a.s.l.), State of Pernambuco, Northeastern Brazil.

Diagnosis. A species belonging to the *Odontophrynus cultripes* group and associated with the “caatinga” and “dry forest” environments (deciduous and semi-deciduous forests) of northeastern Brazil, is characterized by the following combination of traits: (1) size large (SVL 51.6–69.4 mm in males, 53.3–76.5 mm in females); (2) snout vertical in profile; (3) parotoid glands large, elongated to elliptical; (4) glands on forearms and tibiae absent; (5) dorsum with scattered, shallow glands; (6) elongated gland on the ventrolateral surface of forearm poorly developed; (7) elongated gland along the external border of the tarsus/metatarsus poorly developed; (8) foot webbing formula I 1½–2⁺ II 1½–3⁺ III 2⅔–3 IV vestigial V.

Comparisons with other species. *Odontophrynus carvalhoi* is distinguished from *O. cultripes* by the elongated to elliptical parotoid glands (ovoid in *O. cultripes*), presence of shallow glands scattered on dorsum (absent or few in *O. cultripes*), absence of a differentiated, large gland on the forearm (present in *O. cultripes*), elongated gland on the ventrolateral surface of the forearm poorly developed (absent in *O. cultripes*), absence of a conspicuous globose gland on the tibiae (present in *O. cultripes*), and elongated gland along the external border of the tarsus/metatarsus poorly developed (conspicuous in *O. cultripes*). From *O. monachus* **sp. nov.**, *O. carvalhoi* is separated by the snout vertical in profile (obtusely in *O. monachus* **sp. nov.**), parotoid glands elongated to elliptical (globose, pearl-shaped in *O. monachus* **sp. nov.**), presence of shallow glands scattered on dorsum (absent in *O. monachus* **sp. nov.**), and foot webbing less developed (webbing formula in *O. cultripes*, I 1½–2⁺ II 1½–3⁺ III 2⅔–3 IV vestigial V; in *O. monachus* **sp. nov.**, I 1–2 II 1–2 III 1–3⁺ IV 3–1 V).



FIGURE 4. *Odontophrynus carvalhoi*, holotype, MNRJ 0313, adult female, SVL 63.3 mm, from the Municipality of Poção, State of Pernambuco, Brazil.

Description. Body stout (fig. 5); head wider than long, HL about 74% of HW, HL about 32% of SVL, HW about 43% of SVL. Snout short, semi-circular viewed from above (fig. 5 A), vertical in profile (fig. 5 C); canthus rostralis distinct, rounded; loreal region oblique, slightly concave. Nostrils closer to tip of snout than to eyes; internarial distance slightly smaller than eye to nostril distance and much smaller than eye diameter. Eyes prominent, lateral, slightly directed ahead; eye to nostril distance much smaller than eye diameter, upper eyelid width, and interorbital distance. Upper eyelid width smaller than interorbital distance. Tympanum concealed. Upper eyelid, head, dorsal skin, and dorsal surface of thighs rugose, with small tubercles uniformly distributed; shallow glands scattered on dorsum, without forming defined pattern. Postorbital glands evident, small, approximately rounded; temporal glands present, about the same size as postorbitals, sometimes masqueraded by color pattern; parotoid glands large, elongated to elliptical; forearm and tibial glands absent. Flanks and ventral skin barely rugose; lateral skin adhered to the middle of the arm; belly disk fold indistinct; a granular seat patch under thighs. Vocal sac developed, subgular. Vocal slits present, amply opened along the sides of tongue; vomerine teeth in two small transverse series, almost contacting medially, laying between the relatively large choanae; tongue large, approximately circular, largely notched behind. Hand (fig. 5 E) with fingers slender, not webbed nor ridged, tips rounded, not expanded; fingers lengths $IV < II < I < III$, first finger slightly longer than second; subarticular tubercles large, rounded, the proximals more developed than distals; numerous rounded supernumerary tubercles present; outer metacarpal tubercle large, longitudinally divided, the outer part about two to three times the inner part; inner metacarpal tubercle elliptical, about half of outer; nuptial pads on thumbs and prepollex absent; a weak, elongated gland on the ven-

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trolateral surface of the forearm; skin on forearm, hands, and fingers smooth. Legs short, tibia length smaller than thigh length; sum of tibia and thigh lengths approximately 75% of SVL. Foot large (fig. 5 D), foot length larger than tibia and thigh lengths, about 60% of SVL. Toes slender, not fringed; toes lengths $I < II < V < III < IV$; toe tips rounded; webbing formula $I \ 1\frac{1}{2}-2^+ \ II \ 1\frac{1}{2}-3^+ \ III \ 2\frac{2}{3}-3 \ IV \ \text{vestigial} \ V$; subarticular tubercles large, rounded; sole of foot with distinct, approximately aligned, supernumerary tubercles; outer metatarsal tubercle very small, rounded; inner metatarsal tubercle very large, shovel-like, with the free external border keratinized; inner tarsal fold distinct, approximately the length of the tarsus; a weak, elongated gland along the external border of the tarsus/metatarsus; skin on feet and toes smooth.



FIGURE 5. *Odontophrynus carvalhoi*, MNRJ 50203, adult male, SVL 57.4 mm, from the Municipality of Maracás, State of Bahia, Brazil. Dorsal (A) and ventral (B) views; head profile (C); ventral views of foot (D) and hand (E).



FIGURE 6. Living specimen of *Odontophrynus carvalhoi*, UFBA 7350, adult male, SVL 61.8 mm, from the Parque Estadual das Sete Passagens, Serra de Jacobina mountain (a regional designation of the Serra do Espinhaço mountain range), Municipality of Miguel Calmon, State of Bahia, Northeastern Brazil (Photos by Rafael O. Abreu: 19 February 2007).

Measurements of holotype (mm). SVL 63.3; HL 22.9; HW 29.6; IND 5.4; END 5.3; ED 7.5; UEW 6.0; IOD 6.7; HAL 17.5; THL 26.6; TL 23.3; FL 38.8.

Color in life. The following description was based on two adult males and one adult female from Maracás, State of Bahia, Brazil (fig. 6, specimens not identified, but currently housed in UFBA collection). Dorsal ground color grayish green. Dorsum with a blackish to grayish green Y-shaped mark, from each upper eyelid to near the sacral region, bordered and defined on outside by grayish white bands of similar width and extension, clearly to poorly evident, which may be continuous with a grayish thin to wide mid-dorsal stripe over the sacrum. Parotoid, temporal, and postorbital glands dark brown, each one delimited by a black edge; other minor glands and enlarged warts cream to dark brown with or without black edgings. Flank marked by a broad grayish white dorsolateral stripe from the parotoid gland to near the groin. Head highlighted by the anterior border of the dorsal Y-shaped mark, which outlines a V-shaped inter-ocular grayish white bar with black edges. Snout marked by the presence of two blackish brown stripes from upper lip to nostrils, continuing until reaching the anterior corner of eyes, delimiting a cross-shaped mask filled with dorsal background color. An additional three to four blackish brown perpendicular stripes present on the upper lip, a pale one placed in the midpoint between nostril and anterior corner of eye and the remaining three from anterior to posterior corners of eye, over a cream to somewhat orange background

color. Arms and legs with irregular light to dark brown crossbars, which become less distinct proximally. Upper arms and forearms sometimes with thin orange longitudinal glandular stripes. Belly grayish white. Sole of foot and tarsus dark gray, with light gray tubercles. Superior and inferior surfaces of iris white; anterior and posterior surfaces blackish brown; a thin vertical black stripe divides the eye, the lower half larger than the upper half.

A male from the Parque Estadual das Sete Passagens, Municipality of Miguel Calmon, State of Bahia, Brazil (UFBA 7350) varied in color pattern, as follows: the grayish green background color observed in the Maracás specimens only was noted on surfaces of arms, legs, and flanks; light dorsal markings cream (instead of grayish white); and background color of dorsum brown (instead of grayish green). A longitudinal brown stripe on outer surfaces of forearm and tibia was present. Additional color data obtained from specimen UFBA 7350: chest and throat greenish brown; ventral surfaces of arms, hands, thighs, tibia, tarsus, and foot dark purple, with tubercles and skin glands white.

Color in preservative. Follows the color in life, but with faded dorsal background color, which becomes light brown (grayish brown in live specimens). The ventral surfaces of arms, legs, feet, and hands become light brown; tubercles and ventral surfaces of fingers and toes become cream.

Variation. Other examined specimens are congruent respecting the morphological characters and color. Sexual dimorphism is indicated by the presence of vocal sac in males and size slightly larger in females. Descriptive statistics of measurement data of males and females are in Table 2.

TABLE 2. Descriptive statistics of the measurements (mm) of adult males and females of *Odontophrynus carvalhoi*. n, number of specimens; SD, standard deviation. Other abbreviations are defined in the text.

Characters	Males (n = 20)			Females (n = 6)		
	Range	Mean	SD	Range	Mean	SD
SVL	51.6–69.4	61.8	4.41	53.3–76.5	67.9	9.01
HL	17.0–20.6	19.0	9.92	19.9–23.2	22.1	1.17
HW	22.9–28.1	25.7	1.51	25.4–32.8	29.2	2.62
IND	4.2–6.0	5.1	0.52	4.9–6.1	5.5	0.42
END	4.3–6.1	5.4	0.39	4.8–6.7	5.7	0.78
ED	6.4–8.2	7.0	0.41	7.0–8.1	7.5	0.36
UEW	5.1–6.8	6.2	0.50	5.9–7.3	6.5	0.53
IOD	5.4–6.7	6.0	0.32	6.2–7.1	6.6	0.31
HAL	15.2–20.0	18.2	1.45	16.4–21.9	19.6	2.21
THL	20.7–28.4	25.1	1.73	22.0–30.3	27.5	3.03
TL	18.1–23.8	21.8	1.48	19.8–26.3	23.7	2.42
FL	31.2–39.2	36.0	2.56	33.2–45.4	40.1	4.31

Advertisement call. The following description was based on the advertisement call of a male from the Municipality of Maracás and a male from Serra do Ramalho, both in the State of Bahia, Brazil. The call (fig. 7 A–D) is composed by one multi-pulsed note. Pulses with highest peak intensities always localized around the middle of a note (fig. 7 B, C). Three main energetic bandwidths (sidebands) are distinguishable in the audiospectrogram (fig. 7 A, D), and possibly are due to the pulsatile nature of the call. Note with frequency modulation, rising to higher frequencies up to the first half of note, and then decreasing till the end of note. Detailed descriptive statistics is given in Table 1. For comparisons with other species of the *O. cultripes* group, see the *O. monachus* **sp. nov.** advertisement call description below.

Tadpole. The tadpole was described and figured by Caramaschi (1979).

Karyotype. The karyotype was described and figured by Beçak and Beçak (1970, 1974).

Geographic distribution and ecological remarks. *Odontophrynus carvalhoi* inhabits environments ca. 500 m above sea level (fig. 3), mainly found in altitudes above 600 m (70%). The species is geographically distributed between the Serra do Espinhaço mountain range (on west) and the Atlantic Ocean coastline (on east), from the Jequitinhonha river valley (on the south), in the State of Minas Gerais, up to State of Paraíba (on the north). The species occurs in the Caatinga biome (40% of geographic samples), in the Atlantic Forest biome (40%), and in the

Cerrado biome (20%; see Rizzini 1979 for definitions of “Caatinga” and “Cerrado”). The Caatinga biome is characterized by a semi-arid to arid tropical or subtropical climate, covered by a super-xerophyte caatinga. This ecological scenario leads to a fallacious conclusion that *O. carvalhoi* is a caatinga plant cover inhabitant. The species is often associated with deciduous or semideciduous forests (see Silva & Casteleti 2005 for distribution and characterization of the Tropical Atlantic Forest sub-regions: interior forests, São Francisco, Chapada Diamantina, Brejos Nordestinos, and west of the Espinhaço Mountain Range, within the São Francisco basin, along the margins of the São Francisco river). Only two samples were obtained within areas of sub-xerophyte caatinga, and another from an area of cerrado, but always adjacent to deciduous or semideciduous forest areas. Geographic samples of *O. carvalhoi* are in three types of Köppen’s climate classification: Cwa (humid and sub-humid mesothermic climate; southern Bahia and northeastern Minas Gerais), megathermic humid and sub-humid climates (Aw, São Francisco river valley and Pernambuco State), and Am (Chapada Diamantina and adjacent areas). *Odontophrynus carvalhoi* can be considered a dry forest border inhabitant of northeastern Brazil.

Remarks. The holotype of *Odontophrynus carvalhoi* is well preserved, only slightly fade. External characters, measurements, and body proportions have not changed from those given in the original description.

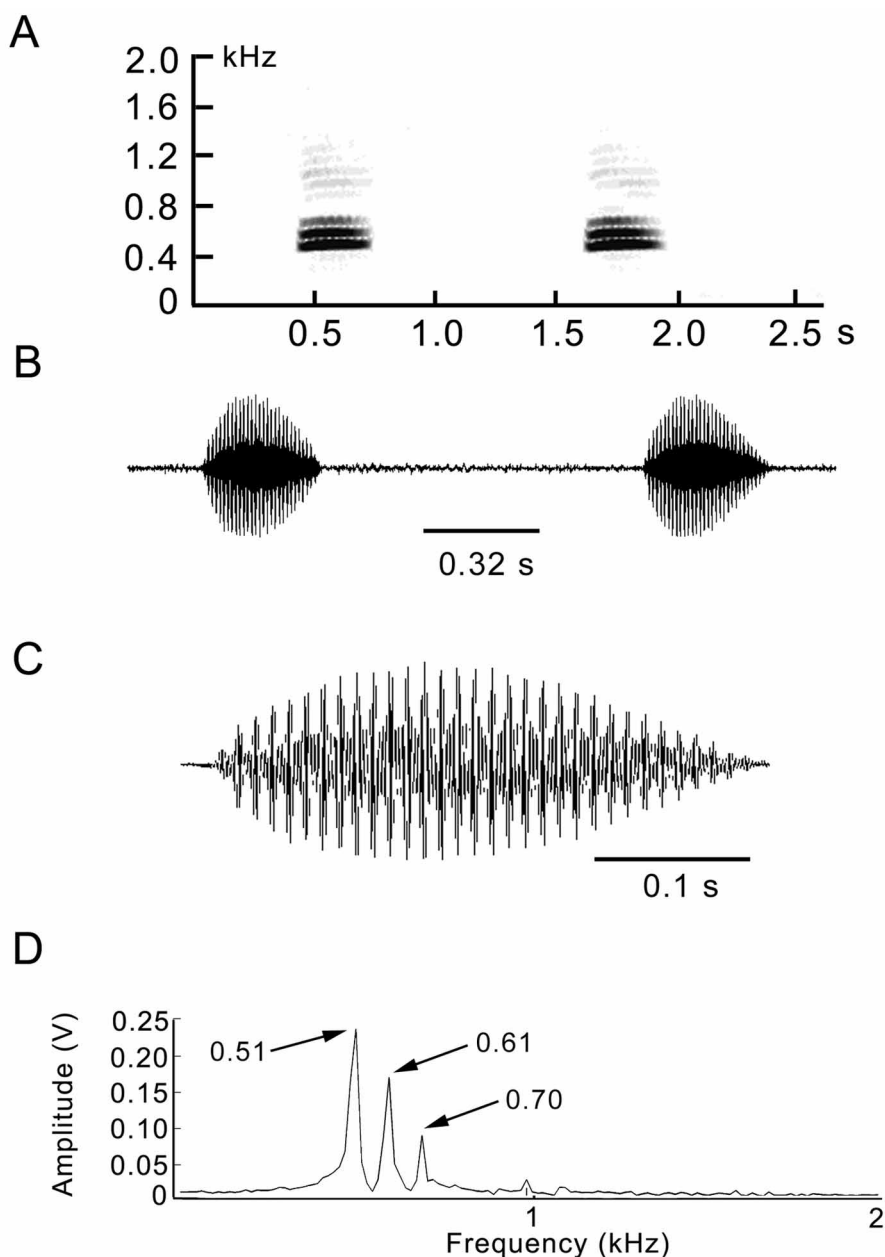


FIGURE 7. (A) audiospectrogram, (B) oscillogram, (C) oscillogram of the first note, and (D) power spectrum of the advertisement call of *Odontophrynus carvalhoi* (UFBA 2911) from the Municipality of Maracás, State of Bahia, Brazil. Air temperature not recorded.

Odontophrynus monachus sp. nov.

Figures 8–9

Odontophrynus cf. *carvalhoi*—Haddad, Andrade and Cardoso, 1988.

Holotype: ZUEC 4440 (fig. 8), adult male, collected at Parque Nacional da Serra da Canastra (20°10'S, 46°30'W, ca. 1350 m a.s.l.), headwaters of the São Francisco River, Municipality of São Roque de Minas, State of Minas Gerais, Southeastern Brazil, on 13 October 1981, by A.J. Cardoso, G.V. Andrade and C.F.B. Haddad.

Paratypes. MZUSP 132973–132974, males, MZUSP 132972, female, collected at the type locality in December 2004, by C. Nogueira.

Diagnosis. A species belonging to the *Odontophrynus cultripes* group by having a single, greatly developed, smooth, parotoid gland, no enlarged glands on back and sides, except by well-developed postorbital and temporal glands, and presence of a glandular fold on the posterior surface of forearm; it is characterized by the following combination of traits: (1) size small (SVL 40.6–54.1 mm in males, 55.5 mm in female); (2) snout obtuse in profile; (3) parotoid glands globose, pearl-shaped; (4) glands on forearms and tibiae absent; (5) dorsum granulose, without scattered glands; (6) elongated gland on the ventrolateral surface of forearm poorly developed; (7) elongated gland along the external border of the tarsus/metatarsus poorly developed; (8) webbing formula, I 1–2 II 1–2 III 1–3⁺ IV 3–1 V.

Comparisons with other species. *Odontophrynus monachus* sp. nov. is distinguished from *O. carvalhoi* and *O. cultripes* by the larger head (HL 33% of SVL, HW 44.3% of SVL in *O. monachus* sp. nov.; HL 31% of SVL, HW 42% of SVL in *O. carvalhoi*; HL 30% of SVL, HW 40.5% of SVL in *O. cultripes*), snout profile obtuse (vertical in *O. carvalhoi* and *O. cultripes*), and foot webbing more extensive (webbing formula, I 1–2 II 1–2 III 1–3⁺ IV 3–1 V in *O. monachus* sp. nov.; I 1½–2⁺ II 1½–3⁺ III 2½–3 IV vestigial V in *O. carvalhoi*; I 1½–2⁺ II 1½–3⁺ III 2½–3 IV vestigial V in *O. cultripes*). Additionally, *O. monachus* sp. nov. is separated from *O. carvalhoi* by the globose, pearl-shaped parotoid glands (elongated to elliptical in *O. carvalhoi*), and by the absence of scattered glands on dorsum (present in *O. carvalhoi*); from *O. cultripes*, the new species is distinguished by the absence of developed glands on forearms and tibiae, and by the poorly developed elongated glands on the ventrolateral surface of forearm and along the external border of the tarsus/metatarsus (conspicuous in *O. cultripes*).

Description of holotype. Body stout (fig. 8); head wider than long, HL 74.4% of HW, HL 33% of SVL, HW 44.3% of SVL. Snout short, semi-circular viewed from above (fig. 9 A), obtuse in profile (fig. 9 B); canthus rostralis distinct, canthal crest present; loreal region oblique, slightly concave. Nostrils approximately at the same distance from tip of snout as from eyes; internarial distance slightly larger than eye to nostril distance and much smaller than eye diameter. Eyes large, prominent, lateral, slightly directed ahead; eye to nostril distance much smaller than eye diameter and upper eyelid width, and slightly larger than interorbital distance. Upper eyelid width larger than interorbital distance. Tympanum concealed. Upper eyelid, head, dorsal skin, and dorsal surface of thighs rugose, with small tubercles uniformly distributed. Postorbital gland large, approximately pearl-shaped; temporal gland large, slightly smaller than postorbital; parotoid gland large, globose, pearl-shaped; forearm and tibial glands absent. Flanks and ventral skin barely rugose; lateral skin adhered to the middle of the arm; belly disk fold indistinct; a granular seat patch under thighs. Vocal sac developed, subgular. Vocal slits present, amply opened along the sides of tongue; vomerine teeth in two small transverse series, almost contacting medially, laying between the relatively large choanae; tongue large, approximately circular, notched behind. Hand (fig. 9 C) with fingers slender, not webbed nor ridged, tips rounded, not expanded; fingers lengths IV < II < I < III, first finger longer than second; subarticular tubercles large, rounded, the proximals more developed than distals; several rounded supernumerary tubercles present; outer metacarpal tubercle large, longitudinally divided, the outer part about three times the inner part; inner metacarpal tubercle large, rounded, slightly smaller than outer; nuptial pads on thumbs and prepollex absent; a weak, elongated gland on the ventrolateral surface of the forearm; skin on forearm, hands, and fingers smooth. Legs short, tibia length smaller than thigh length; sum of tibia and thigh lengths 73.2% of SVL. Foot large (fig. 9 D), foot length larger than tibia and thigh lengths, 59.6% of SVL. Toes slender, fringed; toes lengths I < II < V < III < IV; toe tips rounded; webbing formula, I 1–2 II 1–2 III 1–3⁺ IV 3–1 V; subarticular tubercles large, rounded; sole of foot with distinct, approximately aligned, small supernumerary tubercles; outer metatarsal tubercle absent; inner metatarsal tubercle very large, shovel-like, with the free external border keratinized; inner tarsal fold distinct, approximately the length of the tarsus; a weak, elongated gland along the external border of the tarsus/metatarsus; skin on feet and toes smooth.

Measurements of holotype. See Table 3.

TABLE 3. Measurements (mm) of adult males and female from the type-series of *Odontophrynus monachus* sp. nov. Abbreviations are defined in the text.

Characters	ZUEC 4440	MZUSP 132974	MZUSP 132973	MZUSP 132972
	Holotype	Paratype	Paratype	Paratype
	Males			Female
SVL	40.6	48.8	54.1	55.5
HL	13.4	15.5	17.6	16.3
HW	18.0	20.1	24.1	24.0
IND	3.5	4.8	4.8	5.2
END	3.4	5.2	5.3	4.9
ED	5.8	5.9	6.4	6.1
UEW	5.0	5.0	6.1	5.3
IOD	3.3	4.9	4.9	6.4
HAL	11.0	13.9	15.8	14.4
THL	15.5	19.9	22.9	20.3
TL	14.2	17.8	20.6	20.0
FL	24.2	31.7	34.5	34.4

Color in preservative. Dorsum of head, body, and limbs brown or olive-brown; a cream interorbital bar; sides of head light brown with two dark brown blotches, one below and the other in front of the eye; two distinct cream stripes on the body sides, running obliquely downward from the tympanic area nearly to groin; a short mid-dorsal whitish-cream line on the sacrum; arms and legs with irregular light and dark brown crossbars, becoming less distinct proximally; glands and enlarged warts brown with some black edging. Undersurfaces uniformly clear-cream; throat of males grey to dark brown.

Variation. Examined specimens not vary from the above descriptions. Sexual dimorphism is indicated by the presence of vocal sac in males and slightly larger size in females. Measurements of paratypes are in Table 3.

Advertisement call. The following description is based on 54 advertisement calls of the holotype from the Parque Nacional da Serra da Canastra, Municipality of São Roque de Minas, State of Minas Gerais, Brazil. The call (fig. 10 A–D) is composed by 1 (14 calls, 25.9%), 2 (38 calls, 70.4%), or 3 (2 calls, 3.7%) multi-pulsed notes. Three main energetic bandwidths (sidebands) are distinguishable in the audiospectrogram (fig. 10 A, D), due to the pulsatile nature of the call. Pulses with the highest energy peaks occur at the end of the note (fig. 10 B, C). Modest frequency modulation occurs at the end of notes, rising to higher frequencies. Detailed descriptive statistics are given in Table 1.

The advertisement calls of *O. carvalhoi* and *O. cultripes* are readily diagnosed from those of *O. monachus* by having a single note (1–3 notes in the latter, but each call often contains 1–2 notes). Inter-note duration in the call of *O. monachus* is very short (0.06–0.18 s), much longer in *O. carvalhoi* (0.75–4.51 s) and *O. cultripes* (0.28–0.61 s). The note pulse rate in *O. cultripes* (62.2–71.7 pulses/s) is less than that of *O. carvalhoi* and *O. monachus* (combined note pulse rate 73.3–115.3 pulses/s). In addition, the waveform structure of a note of *O. monachus* clearly differs from *O. carvalhoi* and *O. cultripes* by presenting pulses with the highest energy peaks at the end of the note, while in the other two species the highest energy peaks are around the middle of the note.

Tadpole. Unknown.

Karyotype. Unknown.

Etymology. The specific epithet, “*monachus*”, is a Latin masculine substantive used in apposition, meaning “monk”, in allusion to the followers of Saint Francis of Assis, the Franciscan monks. Saint Francis was born on 26 September 1181 in Assis, Italy, and died on 03 October 1226, also in Assis. He was canonized in 1228 and currently Saint Francis of Assis is known as patron of the animals and of the environment. The name is given for the type locality, in the headwaters of the São Francisco River.

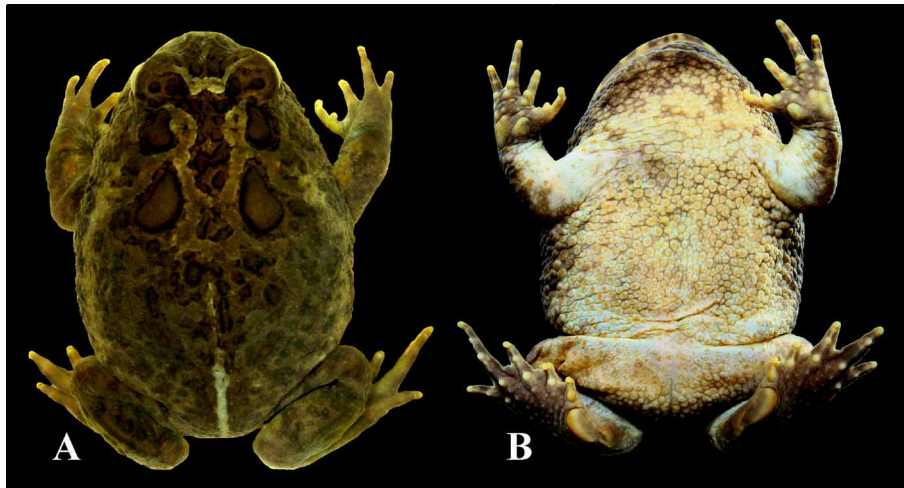


FIGURE 8. *Odontophrynus monachus* sp. nov., holotype, ZUEC 4440, adult male, SVL 40.6 mm, from the Parque Nacional da Serra da Canastra, Municipality of São Roque de Minas, State of Minas Gerais, Brazil. Dorsal (A) and ventral (B) views.



FIGURE 9. *Odontophrynus monachus* sp. nov., holotype, ZUEC 4440, adult male, SVL 40.6 mm, from the Parque Nacional da Serra da Canastra, Municipality of São Roque de Minas, State of Minas Gerais, Brazil. Dorsal (A) and lateral (B) views of head; ventral views of hand (C) and foot (D).

Geographic distribution and ecological remarks. Known only from the type locality (fig. 3), in the Parque Nacional da Serra da Canastra, southwestern State of Minas Gerais, southeastern Brazil.

According to IBAMA (1997), the Parque Nacional da Serra da Canastra was established on 03 April 1972, comprising areas of the municipalities of São Roque de Minas, Sacramento, and Delfinópolis, in southwestern State of Minas Gerais, Brazil. The regional climate is classified as tropical, humid heat, with four or five dry months (normally May to September). The annual average temperature ranges between 18–20°C, with absolute maximum of 34–36°C and absolute minimum of -4–0°C. The annual rainfall is between 1500 and 1750 mm a year. In the predominantly rolling relief of the National Park are the main headwaters of two important rivers, the São Francisco and the Araguari Rivers.

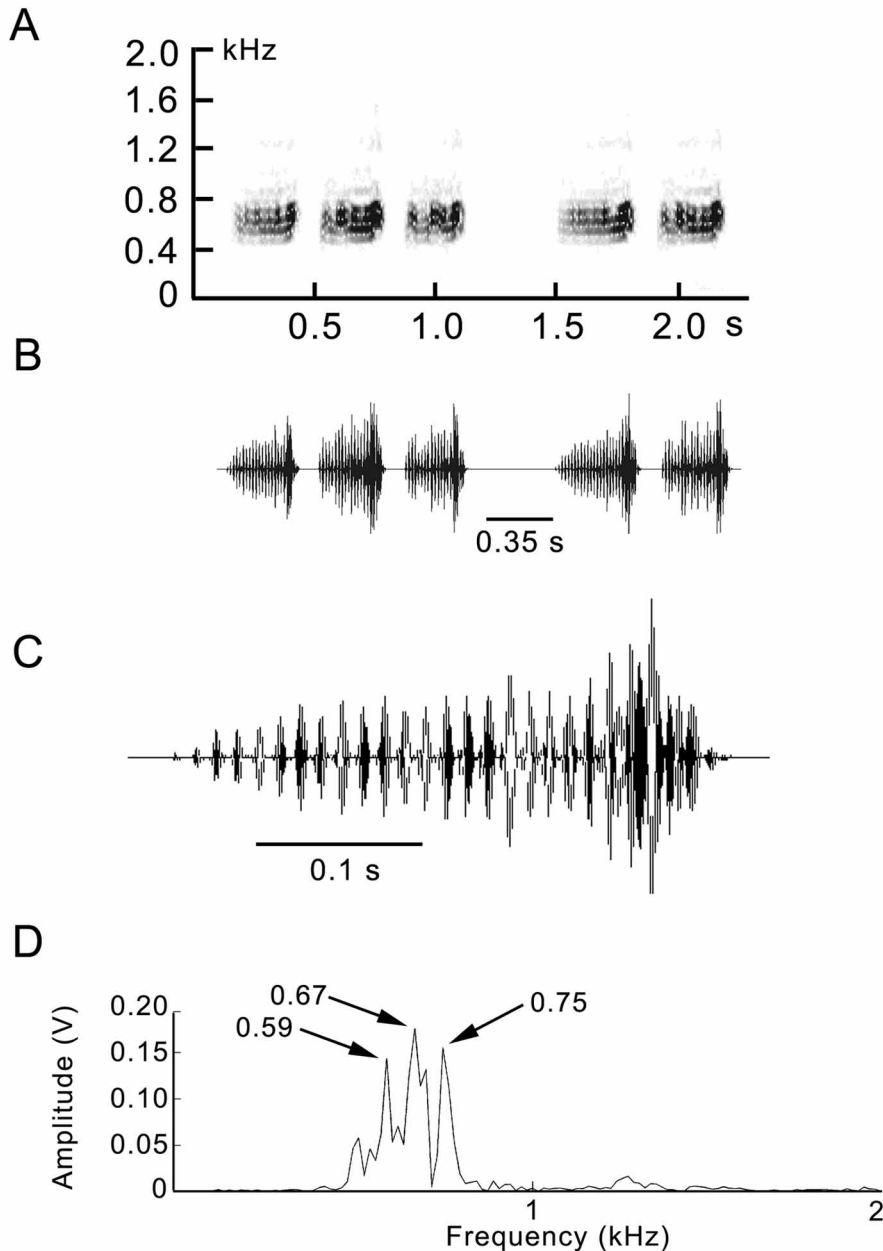


FIGURE 10. (A) audiospectrogram, (B) oscillogram, (C) oscillogram of the first note of the second call, and (D) power spectrum of the advertisement call of *Odontophrynus monachus* sp. nov., holotype, ZUEC 4440, from the Parque Nacional da Serra da Canastra, Municipality of São Roque de Minas, State of Minas Gerais, Brazil. Air temperature 18°C; water temperature 19°C. Interval between calls is abbreviated in the figure.

Haddad *et al.* (1988) stated that the specimen ZUEC 4440, here the holotype of *O. monachus* sp. nov., was collected in the area around the two main riverheads of the São Francisco River, above the landmark of these riverheads, at approximately 1350 m a.s.l. The area had many swamps covered by grasses on dark, clayish soil, with small, slow rivulets and pools formed in its beds. Specimens of *O. monachus* sp. nov. were observed near shallow

temporary pools or on the border of pools formed in the rain drainage beds. In these sites, males start calling at dusk. In the same area a putative also new species was collected and treated as “*Odontophrynus* sp. (aff. *moratoi* Jim & Caramaschi, 1980)”. Other anuran species obtained in the same area were *Bufo rufus* Garman [currently *Rhinella rubescens* (A. Lutz)], *Hyla albopunctata* Spix (= *Hypsiboas albopunctatus*), *H. canastrensis* Cardoso & Haddad (= *Scinax canastrensis*), *H. cipoensis* B. Lutz (= *Hypsiboas cipoensis*), *H. ibitiguara* Cardoso (= *Bokermannohyla ibitiguara*), *H. machadoi* Bokermann & Sazima (= *Scinax machadoi*), *H. maracaya* Cardoso & Sazima (= *Scinax maracaya*), *H. minuta* Peters (= *Dendropsophus minutus*), and *H. squalirostris* A. Lutz (= *Scinax squalirostris*), *Crossodactylus* cf. *trachystomus* (Reinhardt & Lütken), *Leptodactylus cunicularius* Sazima & Bokermann, *L. furnarius* Sazima & Bokermann, *L. jolyi* Sazima & Bokermann (currently *L. sertanejo* Giaretta & Costa), *L. labyrinthicus* (Spix), *Physalaemus cuvieri* Fitzinger, and *Pseudopaludicola saltica* (Cope).

Remarks. The distinctiveness of *Odontophrynus monachus* **sp. nov.** was first observed by Haddad *et al.* (1988), by indicating that the collected specimen (the holotype) showed characters that ally it to *O. carvalhoi*, but pronounced differences were also noted, mainly relating to total length and dorsal glands distribution. However, they refrained to from further taxonomic action pending the acquisition of additional data on different populations of *O. carvalhoi*.

Discussion

The species groups in the genus *Odontophrynus* usually are largely allopatric with respect to each other, with small superposition of distributions at their geographic distribution limits. The *O. occidentalis* species group is associated with arid and semiarid environments in western and central Argentina. The three species involved are *O. occidentalis*, widely distributed in those regions, *O. achalensis*, occurring in the highlands of the Pampa de Achala and in the Sierra de Comechingones, and *O. barrioi*, known from the provinces of Catamarca, La Rioja, and San Juan (Cei *et al.* 1982; Di Tada *et al.* 1984; Rosset *et al.* 2007). In its turn, the *O. americanus* species group is currently composed by four species: the widely distributed *O. americanus* occurs in central and northern Argentina, south-eastern and southern Brazil, Paraguay, and Uruguay, in a complex distribution pattern of diploid and tetraploid populations, which may represent different species (Rosset *et al.* 2006); *O. lavillai* is associated with the Chaco biome and marginal Yungas from northern Argentina, Bolivia, and Paraguay (Rosset *et al.* 2006; Rosset 2008); *O. cordobae* is known from localities in northwestern Province of Cordoba to Ojo de Agua, in the Province of Santiago del Estero, Argentina (Martino & Sinsch 2002; Rosset *et al.* 2006); and *O. maisuma* occurs in the coastal regions of the State of Rio Grande do Sul, Brazil, and of Uruguay (Rosset 2008). The species of the *O. cultripes* group are allopatric to all other species groups of the genus, and are distributed in southeastern, central, and northeastern Brazil. *Odontophrynus cultripes* may be associated with semideciduous or deciduous forest borders within the Cerrado biome, distributed through a series of plateaus and mountain chains in the states of Goiás and Minas Gerais and in the Federal District; *O. carvalhoi* is a dry forest border inhabitant of northeastern Brazil, mainly associated to the deciduous and semideciduous forests of the Caatinga, Cerrado, and Atlantic Forest biomes; and *O. monachus*, contrarily to the other widely distributed species of the group, is known only from the type locality, in the southwestern portion of the State of Minas Gerais, Brazil.

The species currently included in the *O. cultripes* group, mainly *O. cultripes* and *O. carvalhoi*, follow a general pattern observed in the distribution of other species of reptiles (e.g. Rodrigues 1987; Silva 2000; Silva and Rodrigues 2008) and anurans (e.g. Caramaschi 2006, for the hylid species of the *Phyllomedusa hypochondrialis* group, and Narvaes & Rodrigues 2009 for the bufonid species of the *Rhinella granulosa* group) according the great diagonal belt of open formations in South America (Ab’Sáber 1974; Vanzolini 1974) including the Caatinga, Cerrado, and Chaco Domains or Biomes. As pointed out by Narvaes and Rodrigues (2009), further elucidative taxonomic studies of complex groups of anurans inhabiting open formations may bring to light new patterns of distribution. Apparently, there are species of anurans limited to specific Brazilian biomes, as well as widely distributed species that occur in several biomes. The identification of characteristic faunal assemblages may prove to be important for definition of species conservation and protection.

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APPENDIX 1. Specimens examined.

- Odontophrynus carvalhoi*—BRAZIL: CEARÁ: Guaramiranga, Trilha do Remanso (MNRJ 55772). PARAÍBA: Areia, Estação Ecológica do Pau Ferro (ZUF RJ 9099, 9101); Maturéia, Engenho Bom Conselho (MNRJ 54455–54456). PERNAMBUCO: Poção (MNRJ 0313, holotype). BAHIA: Caetité (MNRJ 32988, UFBA 8586–8587); Campo Formoso (MZUSP 38808); Elísio Medrado, Serra da Jibóia (MZUEFS 080); Itapetinga (MZUSP 85686–85687); Macaúbas (MNRJ 59715); Maracás (MNRJ 3981, 15356–15357, 35183–35184, 50201–50208, MZUSP 96324–96332, 96548–96562, 96575–96611, 98159–98193, 108955, UFBA 2346–2352, 2358–2359, 2544–2547, 2551–2554, 2911); Miguel Calmon, Parque Estadual das Sete Passagens (UFBA 7350, 7896); Mucugê (UFBA 7899); Serra do Ramalho (MZUEFS 3687–3688, UFBA 7691). MINAS GERAIS: Cristália (MNRJ 50199–50200, MZUFV 532); Grão Mogol (CFBH 10202–10204); Grão Mogol, UHE Irapé (MCNAM 3847, 5399–5400, 6872–6873, 6707–6708); Januária, Peruaçu (MZUFV 5127); Jenipapo de Minas (MZUFV 6102); São João do Paraíso (MCNAM 9711).
- Odontophrynus cultripes*—BRAZIL: DISTRITO FEDERAL: Brasília, Lagoa Bonita (MNRJ 17426); Brasília (CHUNB 14293, 35962–35964, 38867, 49659). GOIÁS: Alexânia, Fazenda Cafundó (CHUNB 39060, 39747–39749, 39755–39757); Campo Limpo de Goiás (CFBH 8176–8178, 11589); Catalão (CHUNB 50354–50356); Luziânia, UHE Corumbá 4 (CHUNB 42289–42290, 40665–40668); Mineiros (CHUNB 36545); Novo Gama (CHUNB 14292, 14294–14298); Pedregal (MNRJ 34314, MZUSP 77990–77994); Petrolina de Goiás (MZUSP 126667–126670); Pires do Rio (MZUFV 6549); São João da Aliança (CHUNB 38726); Silvânia (CFBH 4189); Três Ranchos, LT Serra da Mesa (CHUNB 44735). MINAS GERAIS: Alfenas, Parque Municipal Manoel Pedro Rodrigues (MZUSP 132740–132742); Antonio Carlos (MZUSP 22923–22924); Apiaí (MZUFV 4756); Araçuaí (MCNAM 7524); Araçuaí, Serra do Brigadeiro (MZUFV 1628–1630, 6669); Araxá (MNRJ 51052, MZUFV 2193); Baependi (MCNAM 2061–2062); Barro Alto, Rio São Francisco (MZUSP 26293); Belo Horizonte (MNRJ 51045, 51051, MCNAM 2251, MZUSP 76373, 85642–85643, 108947, 108979–108981); Belo Horizonte, Parque das Mangabeiras (MNRJ 51049–51050, MZUFV 1754, MCNAM 647, 2992, 4302, 5430, 5498); Bonfim (MCNAM 8602); Caeté (MCNAM 837, 873); Capim Branco (MCNAM 9480–9481); Catas Altas (MZUFV 4631); Conselheiro Lafaiete (MCNAM 1843); Conselheiro Lafaiete e Congonhas (MCNAM 9491–9492); Cordisburgo, Gruta do Salitre (MNRJ 51048); Divinópolis, Parque Ecológico Gafanhoto (MCNAM 9544–9545); Embaúbas, near Belo Horizonte (MNRJ 51038–51044); Esmeraldas (MCNAM 1990); Ibertioga (MCNAM 9205); Itabira, Usina São José (MNRJ 25639–25640); Ituiutaba (MZUSP 10383); Itumirim (MCNAM 3558); João Pinheiro, Fazenda Rio Verde (MNRJ 42092); Lambari, Parque Estadual Nova Baden (MZUSP 132743); Lavras (MCNAM 6235); Monte Santo de Minas (MZUSP 110717–110738, 130212–130213); Nova Lima (MCNAM 4051); Nova Lima, Mata do Jambreiro (MCNAM 1699, 2045); Ouro Branco, Serra do Ouro Branco (MZUFV 7035, 7087, 7098, 7507); Ouro Preto, Parque Estadual do Tripuí (MNRJ 30599); Ouro Preto (MZUSP 22639); Palmital, UHE Queimado (MCNAM 5839); Pará de Minas (MCNAM 9133); Patrocínio (MCNAM 2692); Perdões (MCNAM 3566); Poços de Caldas (MZUSP 132439–132441); Pomba (MNRJ 51037); Rio Acima, Canto das Águas (MCNAM 2026–2027, 2995); Santana do Garambéu (MCNAM 2307–2308); São Gonçalo do Rio Abaixo, Peti (MNRJ 21401, 34498); São Gotardo, LT Itumbiara–Bom Despacho (CHUNB 49396–49397); São Tomé das Letras (CFBH 7415); Serra do Cipó (MNRJ 51046–51047, MZUSP 108080–108081); Tiradentes (MCNAM 1588, 4492); Três Pontes (MZUSP 13468); UHE Queimado (MCNAM 3450, 3977, 3981, 3982, 8844, 8921–8925); Unaí (MZUFV 471); Varginha (MCNAM 5700); Vespasiano (MZUSP 4978, 108957–108958); Vicente Carvalhais (MZUSP 13469); Viçosa (MZUFV 7, 8, 52, 205, 787, 7404). SÃO PAULO: Faveiro (MZUSP 26292); Nova Louzã (MZUSP 13470); Pedregulho (CFBH 13980–13983); Santa Silvéria (MZUSP 13467).