



## A new species of *Pseudopaludicola* Miranda-Ribeiro (Leiuperinae: Leptodactylidae: Anura) from the Cerrado of southeastern Brazil

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### Abstract

A new species of *Pseudopaludicola* is described from the Cerrado of southeastern Brazil. *Pseudopaludicola facureae* sp. nov. is diagnosed from the *P. pusilla* species group by the absence of either T-shaped terminal phalanges or toe tips expanded, and distinguished from almost all recognized taxa currently assigned to *Pseudopaludicola* (except *P. canga*, *P. giarettai*, and *P. hyleaustralis*) by possessing a non-pulsed advertisement call. However, the advertisement call of the new species consists of the emission of well-defined call series, whereas the advertisement call of *P. giarettai* is long (117–187 ms) and with an isolated emission pattern; respecting to *P. canga*, the new species emits very long notes series (up to 53 notes/advertisement call), compared to the short call series of *P. canga* (up to 9 notes/advertisement call); considering *P. hyleaustralis*, the new species has a shorter note duration (15–35 ms), higher note rate per minute (480–1860), and higher dominant frequency (4076–5108).

**Key words:** Amphibia, *Pseudopaludicola facureae* sp. nov., Advertisement call, State of Minas Gerais, taxonomy

### Introduction

The genus *Pseudopaludicola* Miranda-Ribeiro comprises 15 species (Frost 2011; Carvalho 2012; Pansonato *et al.* 2012) that occur throughout South America (Lynch 1989; Toledo 2010). *Pseudopaludicola* is treated as a monophyletic grouping, supported by distinctive morphological features: hypertrophied antibrachial tubercle (Lynch 1989) and osteological features (Lobo 1995). Lynch (1989) recognized two groups in the genus: the *P. falcipes* and *P. pusilla* species groups. Lobo (1995) recovered only the latter (*P. pusilla* group) as a monophyletic grouping, which included four taxa: *P. boliviana* Parker, *P. ceratophyes* Rivero and Serna, 1984, *P. llanera* Lynch, 1989, and *P. pusilla* (Ruthven, 1916), all sharing the presence of T-shaped terminal phalanges. *Pseudopaludicola canga* Giaretta and Kokubum, 2003 was assigned to the *P. pusilla* group in the original description, based on the presence of T-shaped terminal phalanges. However, Cardozo and Suárez (2012) stated that this character is in fact absent in *P. canga*, assessed by an osteological study of the species. The genus encompasses eleven species additionally to the four species of the *P. pusilla* group currently unassigned to any recognized monophyletic grouping, assembled by the absence of T-shaped terminal phalanges and any other distinctive shared characters: *P. canga*, *P. falcipes* (Hensel, 1867), *P. giarettai* Carvalho, 2012, *P. hyleaustralis* Pansonato, Morais, Ávila, Kawashita-Ribeiro, Strüssmann and Marrtins, 2012, *P. mineira* Lobo, 1994, *P. murundu* Toledo, Siqueira, Duarte, Veiga-Menoncello, Recco-Pimentel and Haddad, 2010, *P. mystacalis* (Cope, 1887), *P. riopiedadensis* (Mercadal de Barrio and Barrio, 1994), *P. saltica* (Cope, 1887), *P. serrana* Toledo, 2010, and *P. ternetzi* Miranda-Ribeiro, having no distinctive shared derivations, and considered paraphyletic (Lynch, 1989; Lobo, 1995).

A *Pseudopaludicola* species referred to as *Pseudopaludicola* aff. *canga* from the Municipality of Uberlândia (Giaretta & Facure 2009; Duarte *et al.* 2010) was evaluated based on morphological and bioacoustic approaches in

order to assess its taxonomic status. Herein we recognize the specimens of *Pseudopaludicola* aff. *canga* from the Municipality of Uberlândia (State of Minas Gerais), Cerrado of southeastern Brazil, as belonging to an undescribed species. The new species is not assigned to any species group. Future studies based on a phylogenetic approach will assess its phylogenetic position and interrelationships in the genus *Pseudopaludicola*.

## Material and methods

Specimens were recorded and collected at the Clube de Caça e Pesca Itororó de Uberlândia (18°58'30.46"S, 48°17'26.23"W; 790 m above sea level) and in the Jardim Karaíba neighborhood (18°56'37.38"S 48°16'00.18"W; approximately 860 m above sea level), Municipality of Uberlândia, State of Minas Gerais, Brazil. The distance between both study sites is approximately 5 km in a straight line. Type specimens are deposited in the Collection of frogs of the Universidade Federal de Uberlândia (AAG-UFU), Municipality of Uberlândia, State of Minas Gerais, and at the Museu de História Natural da Universidade Estadual de Campinas (ZUEC), Campinas, State of São Paulo, Brazil.

Morphometric characters of 13 adult males and 10 adult females were measured under a stereomicroscope coupled to an ocular micrometer. Eight measurements follow Duellman (1970): snout-vent length (SVL), head length (HL), head width (HW), internarial distance (IND), eye-nostril distance (END) (= snout length), eye diameter (ED), shank length (SL) (= tibia length), and foot length (FL); two measurements follow Heyer *et al.* (1990): hand length (HAL), and thigh length (TL). Three morphometric characters (SVL, HL, HW) were measured with calipers to the nearest 0.1 mm under a stereomicroscope. Toe tips were dissected from two male paratopotypes (AAG-UFU 1164 and ZUEC 13652) in order to verify the shape (simple / T-shaped) of terminal phalanges (*sensu* Lynch 1971, 1989). Systematic classification follows Pyron and Wiens (2011). See Appendix I in Carvalho (2012) for a list of additional examined specimens.

Vocalizations were recorded using digital recorders M-audio Microtrack II (coupled to directional microphone K6/ME66), Boss 864, Marantz PMD 670, and Marantz PMD 671 coupled to Sennheiser ME67/K6 microphones set at 44.1–48.0 kHz sample rate and 16 bits resolution. Bioacoustic variables were analyzed with Audacity software version 1.3.13 Beta (Audacity Team 2011); sound graphs were obtained with Seewave (version 1.6.4) (Sueur *et al.* 2008), R (version 2.15.1) package (R Development Core Team 2012); Seewave settings were Hanning window, 85% overlap, and 512 points resolution (FFT). Call terminology generally followed Duellman and Trueb (1994). Total mean values of bioacoustic variables from all ten recorded males were obtained from individual means, since we have different call samples among the analyzed males, an effort to reduce any bias due to the variable sample number according to each analyzed male. In addition, we point out that no expressive differences in the advertisement call of the analyzed males were observed. Voucher specimens for call recordings: *Pseudopaludicola facureae* **sp. nov.**: AAG-UFU 0853–0855, AAG-UFU 2622, and ZUEC 13650.

Figures 2–3 were slightly edited in order to remove flash shadows caused by camera.

## Species account

### *Pseudopaludicola facureae*, new species

(Figures 2–3)

**Holotype:** AAG-UFU 0853, adult male, collected at the Clube Caça e Pesca Itororó de Uberlândia (18°58'30.46"S, 48°17'26.23"W; 790 m above sea level), Municipality of Uberlândia, State of Minas Gerais, southeastern Brazil, in October 2011 by A.A. Giaretta.

**Paratypes:** Two adult male specimens collected at the Clube Caça e Pesca Itoror Uberlândia, Municipality of Uberlândia, State of Minas Gerais, Brazil: AAG-UFU 0854–0855, collected by A.A. Giaretta in October 2011. Twenty adult specimens in the Jardim Karaíba neighborhood, Municipality of Uberlândia, State of Minas Gerais, Brazil: ten males: ZUEC 13650 collected by A.P. Rodrigues and A.A. Giaretta in March 2006; ZUEC 13651 collected by A.A. Giaretta on 24 February 2001; ZUEC 13652 collected by A.A. Giaretta on 25 November 2000; AAG-UFU 2281 collected by A.A. Giaretta on 28 February 2001; AAG-UFU 2277–2278 collected by A.A.

Giaretta on 09 February 2001; AAG-UFU 2528 collected by A.A. Giaretta and K.G. Facure on 09 October 2003; AAG-UFU 2622 collected by A.A. Giaretta on 06 March 2004; AAG-UFU 3586 collected by A.A. Giaretta on 25 November 2000; AAG-UFU 3588 collected by A.A. Giaretta and K.G. Facure on 29 October 2000. Females: ZUEC 13653 collected by A.A. Giaretta on 27 September 2001; ZUEC 13654, AAG-UFU 3587 collected by A.A. Giaretta on 24 February 2001; AAG-UFU 1160 collected by A.A. Giaretta and F.S. Andrade on 01 June 2012; AAG-UFU 2279 collected by A.A. Giaretta on 09 February 2001; AAG-UFU 2282 collected by A.A. Giaretta on 28 February 2001; AAG-UFU 3585 collected by A.A. Giaretta on 25 November 2000; AAG-UFU 3589 collected by A.A. Giaretta in June 2000; AAG-UFU 3591 collected by A.P. Rodrigues and D.R. Silva on 07 May 2006; AAG-UFU 4731 collected by A.A. Giaretta, M.N.C. Kokubum, M. Menin, and R. Alvarenga on 31 October 2000. Juvenile specimens: AAG-UFU 1157–1159, and AAG-UFU 1161–1164 collected by A.A. Giaretta and F.S. Andrade on 01 June 2012.

**Referred specimens:** *Pseudopaludicola* aff. *canga*—Brazil, Minas Gerais, Uberlândia: AAG-UFU 2608–2609 (Giaretta & Facure 2009); ZUEC 14181, 14185–14187, 14209, 14212, 14214, 14216–14217, 14222–14223 (Duarte *et al.* 2010). *Pseudopaludicola* sp.—Brazil, Minas Gerais, Uberlândia: AAG-UFU 4728–4732 (Carvalho 2012).

**Diagnosis.** *Pseudopaludicola facureae* **sp. nov.** is assigned to the genus by possessing hypertrophied antibrachial tubercle. The new taxon is diagnosed by the following combination of characters: (1) small size (SVL 12.1–15.1 mm in adult males); (2) absence of either T-shaped terminal phalanges or expanded toe tips (disks or pads); (3) absence of enlarged palpebral tubercles; (4) short hindlimbs (tibiotarsal articulation reaching the eye); (5) advertisement call composed of series of non-pulsed notes, emitted in well-defined sequences.

**Comparisons with other species.** *Pseudopaludicola facureae* **sp. nov.** is promptly diagnosed from the *P. pusilla* species group by the absence of either T-shaped terminal phalanges or expanded toe tips (disks or pads). The new species can also be distinguished from *P. boliviana*, *P. ceratophyes*, and *P. llanera* by the absence of enlarged palpebral tubercle (Lynch 1989).

*Pseudopaludicola facureae* **sp. nov.** (12.1–15.1 mm in adult males) is diagnosed from *P. giarettai*, *P. riopiedadensis*, *P. saltica*, *P. serrana*, and *P. ternetzi* (combined adult male SVL 15.0–19.7 mm) (see Table 2 in Carvalho 2012) by its smaller snout-vent length. Morphological/morphometric comparisons with *P. riopiedadensis* were very limited due to the lack of data on the species in the original description (see Mercadal de Barrio & Barrio 1994). *Pseudopaludicola facureae* **sp. nov.** is distinguished from *P. murundu*, *P. saltica*, and *P. serrana* by having short hindlimbs (tibiotarsal articulation reaching the eye), whereas all three abovementioned species have long hindlimbs (tibiotarsal articulation extending beyond the tip of snout).

*Pseudopaludicola facureae* **sp. nov.** is diagnosed from almost all congeners by possessing the advertisement call (fig. 4) composed of series of non-pulsed notes in comparison with that of congeners [pulsed advertisement calls: *P. boliviana* (Duré *et al.* 2004), *P. saltica* and *P. falcipes* (Haddad & Cardoso 1987), *P. mystacalis* (A. Pansonato unpubl. data), *P. murundu* (Toledo *et al.* 2010), *P. serrana* (Toledo 2010), *P. mineira* (Pereira & Nascimento 2004), *P. riopiedadensis* (L.D. Vizotto pers. comm.; A. Pansonato unpubl. data), and *P. ternetzi* (A. Pansonato unpubl. data)]. From *P. canga*, *P. giarettai*, and *P. hyleaustralis*, all three possessing non-pulsed advertisement calls, the new species is diagnosed by the emission of the advertisement call in note series, note duration, note rate per minute, and dominant frequency. The advertisement call of *P. facureae* **sp. nov.** (fig. 4) is composed of 3–5 notes/call, whereas topotypic *P. canga* releases series of up to nine notes (Giaretta & Kokubum 2003); and non-topotypic populations releases series of up to 19 notes (Pansonato *et al.* 2012). *P. giarettai* releases isolated long (117–187 ms) notes (Carvalho 2012), whereas the new species releases short (15–35 ms) notes in series. Note duration of *P. hyleaustralis* ranges from 25–50 ms, emitted at a rate of 504–623 notes/minute, and dominant frequency from 3605–4164 Hz (Pansonato *et al.* 2012), whereas *P. facureae* **sp. nov.** has a shorter note duration (15–35 ms), a higher emission rate (480–1860 notes/minute), and a higher dominant frequency (4076–5108 Hz).

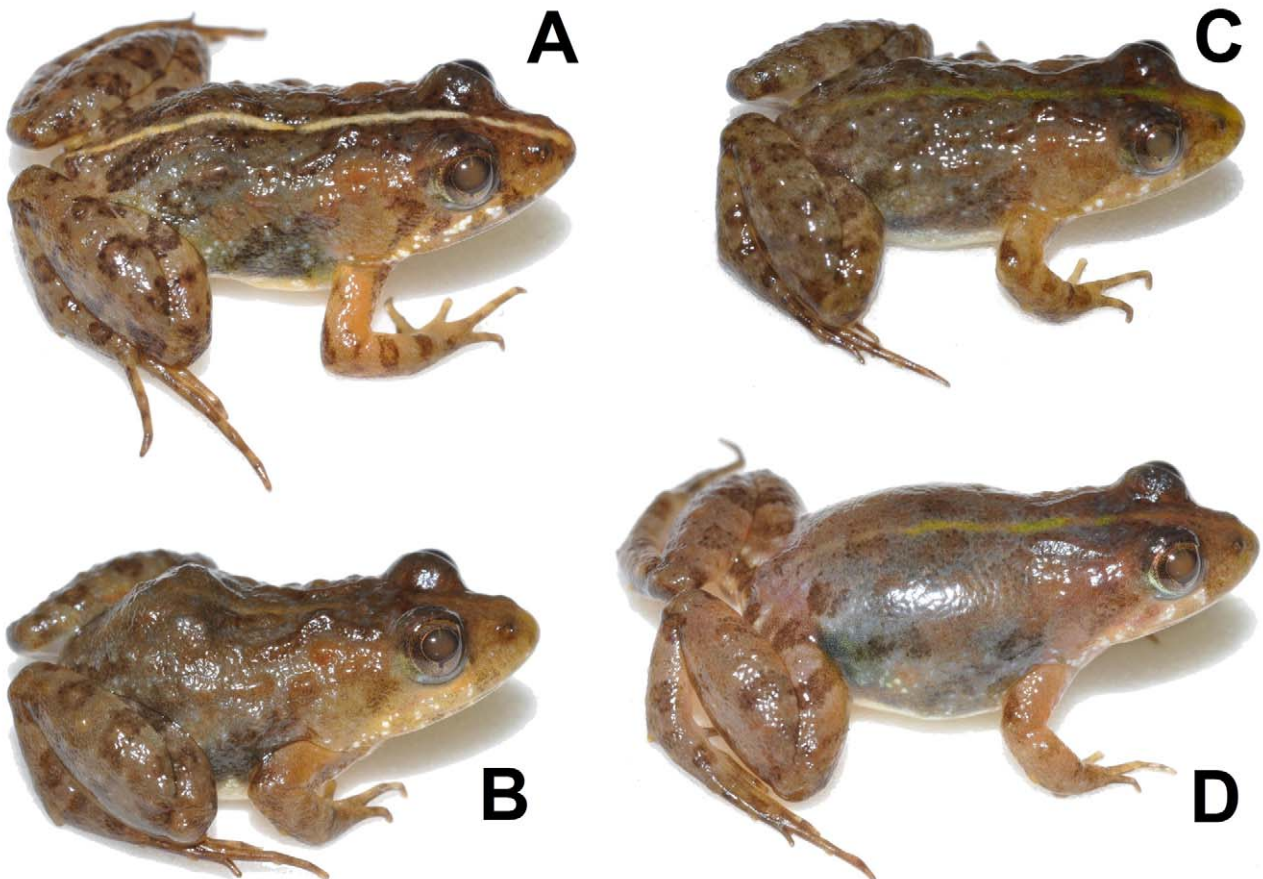
*Pseudopaludicola facureae* **sp. nov.** (2n = 18 chromosomes; see *P. aff. canga* from Uberlândia in Duarte *et al.* 2010) is also diagnosed from *P. mystacalis* (2n = 16), *P. falcipes*, *P. mineira*, *P. murundu*, and *P. saltica* (2n = 22), and *P. ternetzi* (2n = 20), by a distinctive chromosome number (Duarte *et al.* 2010; Toledo 2010; Fávero *et al.* 2011).

**Description of holotype.** Snout subovoid from above, rounded in lateral view (*sensu* Heyer *et al.* 1990) (figs. 3A–B). Nostrils closer to the snout tip than to the eyes; pupil rounded; upper eyelids. Canthus rostralis rounded,

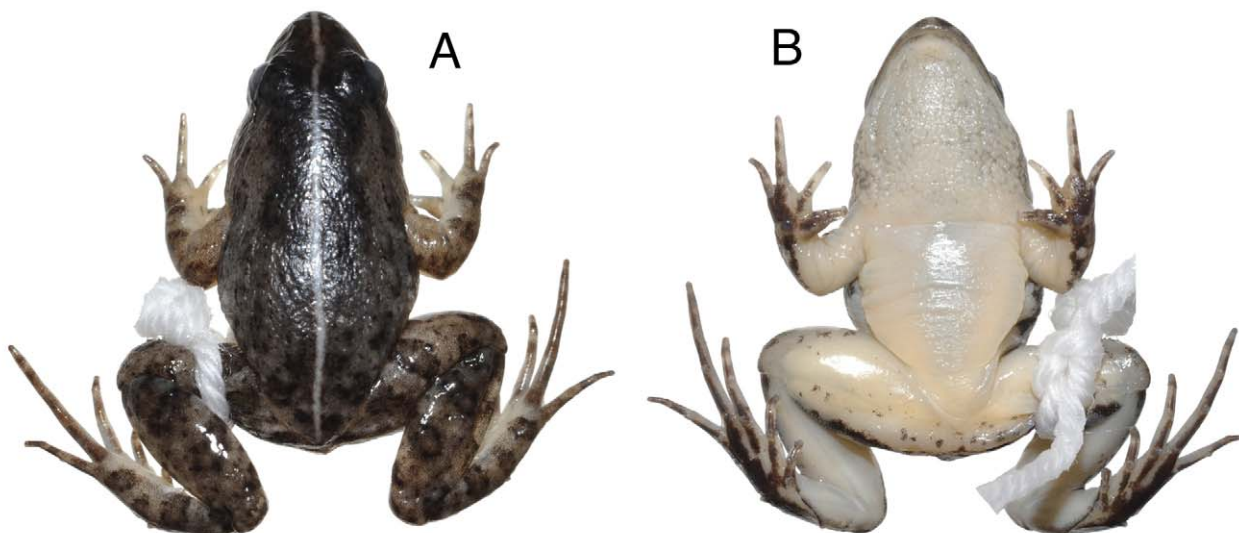
smooth; single subgular vocal sac; choanae well-separated from each other; vocal slits present. Vomerine teeth absent; tongue ovoid, free posteriorly; no pigmentation on the base of tongue. Tympanic ring undefined; lateral of head and flanks with discrete granules (superior surface of limbs). One ovoid antebrachial tubercle present in the first quarter of the forearm; outer metacarpal tubercle round; inner metacarpal tubercle elongated; subarticular tubercles rounded, supernumerary tubercles indistinct; fingers extensively fringed; outer ridge from the outer metacarpal tubercle to almost the tip of finger IV (fig. 3C); relative length of fingers  $I < II \sim IV < III$ ; inner metatarsal tubercle oval; outer metatarsal tubercle round, 1/3 of the size of the inner metatarsal tubercle; outer metatarsal tubercle conical (fig. 3D); relative length of toes  $I < II < III \sim V < IV$ ; finger and toe tips not expanded laterally; a dermal ridge from the inner metatarsal tubercle to 1/2 of the length of tarsus ending in a discrete, enlarged tubercle; outer fringe of toe V extending to almost the outer metatarsal tubercle; discrete fine nuptial asperity present on the base of thumbs; toes webbed basally and extensively fringed to almost their tips; outer edge of tarsus and forearm, and heel, smooth. Cloacal region smooth. Belly and ventral limb surfaces smooth. A well-defined vertebral stripe from the snout tip to vent; transverse stripes on thighs (2–3), shanks (3–4), feet (3–4), and forearms (2–3). Dorsal surfaces smooth, with some scattered enlarged granules on shanks; a broad discontinuous stripe on the posterior surface of thighs, passing below vent.

**Measurements of holotype (mm).** SVL 13.6, HL 3.5, HW 4.6, IND 1.1, END 1.2, ED 1.6, HAL 4.0, TL 7.2, SL 7.3, FL 7.8.

**Color of holotype in preservative.** In preservative (fig. 2), grayish brown surfaces in dorsal view, with darker brown blotches and a white vertebral stripe. Belly unpigmented (whitish); ventral surface of hands and feet dark gray, mottled. Vocal sac with a few dark brown mottled; posterior surface of thighs with brown blotches and with a cream stripe.



**FIGURE 1.** Paratopotypes of *Pseudopaludicola facureae* sp. nov. in life. A—adult female (AAG-UFU 1157; SVL = 16.1 mm); B—juvenile female (AAG-UFU 1158; SVL = 13.4 mm); C—juvenile male (AAG-UFU 1164; SVL = 14.8 mm); D—adult female (AAG-UFU 1160; SVL = 15.3 mm). Specimens from the Municipality of Uberlândia, State of Minas Gerais, Brazil.



**FIGURE 2.** *Pseudopaludicola facureae* sp. nov., adult male, holotype (AAG-UFU 0853). (A) Dorsal and (B) ventral views. SVL = 13.6 mm.

**TABLE 1.** Morphometric characters (in millimeters) of the *Pseudopaludicola facureae* sp. nov. type series adult specimens (including the holotype) from the Municipality of Uberlândia, State of Minas Gerais, Brazil. Mean $\pm$ SD (minimum–maximum). N = number of specimens analyzed.

Characters	Males N = 13	Females N = 10
SVL	13.2 $\pm$ 0.9 (12.1–15.1)	16.1 $\pm$ 1.1 (14.7–18.3)
HL	3.3 $\pm$ 0.2 (3.0–3.8)	4.4 $\pm$ 0.5 (3.9–5.3)
HW	4.7 $\pm$ 0.3 (4.2–5.3)	5.6 $\pm$ 0.4 (4.8–6.2)
ED	1.5 $\pm$ 0.1 (0.9–1.4)	1.8 $\pm$ 0.2 (1.6–2.0)
END	1.1 $\pm$ 0.1 (0.9–1.4)	1.3 $\pm$ 0.2 (1.2–1.8)
IND	1.1 $\pm$ 0.1 (0.9–1.3)	1.4 $\pm$ 0.2 (1.1–1.7)
HAL	3.9 $\pm$ 0.3 (3.4–4.5)	4.5 $\pm$ 0.3 (4.2–5.3)
TL	6.6 $\pm$ 0.6 (5.6–7.6)	7.5 $\pm$ 0.3 (7.0–7.8)
SL	7.0 $\pm$ 0.6 (6.1–8.0)	8.3 $\pm$ 0.3 (7.8–8.7)
FL	7.7 $\pm$ 0.5 (7.0–9.0)	9.2 $\pm$ 0.4 (8.7–9.8)

**Color in life.** Dorsum dark gray or brown; flanks pale gray or brown; belly cream; pale cream blotches on a whitish background on chin; pale cream blotches on the lateral of head; a cream stripe on the posterior surface of thighs. Some specimens have a mottled vocal sac.

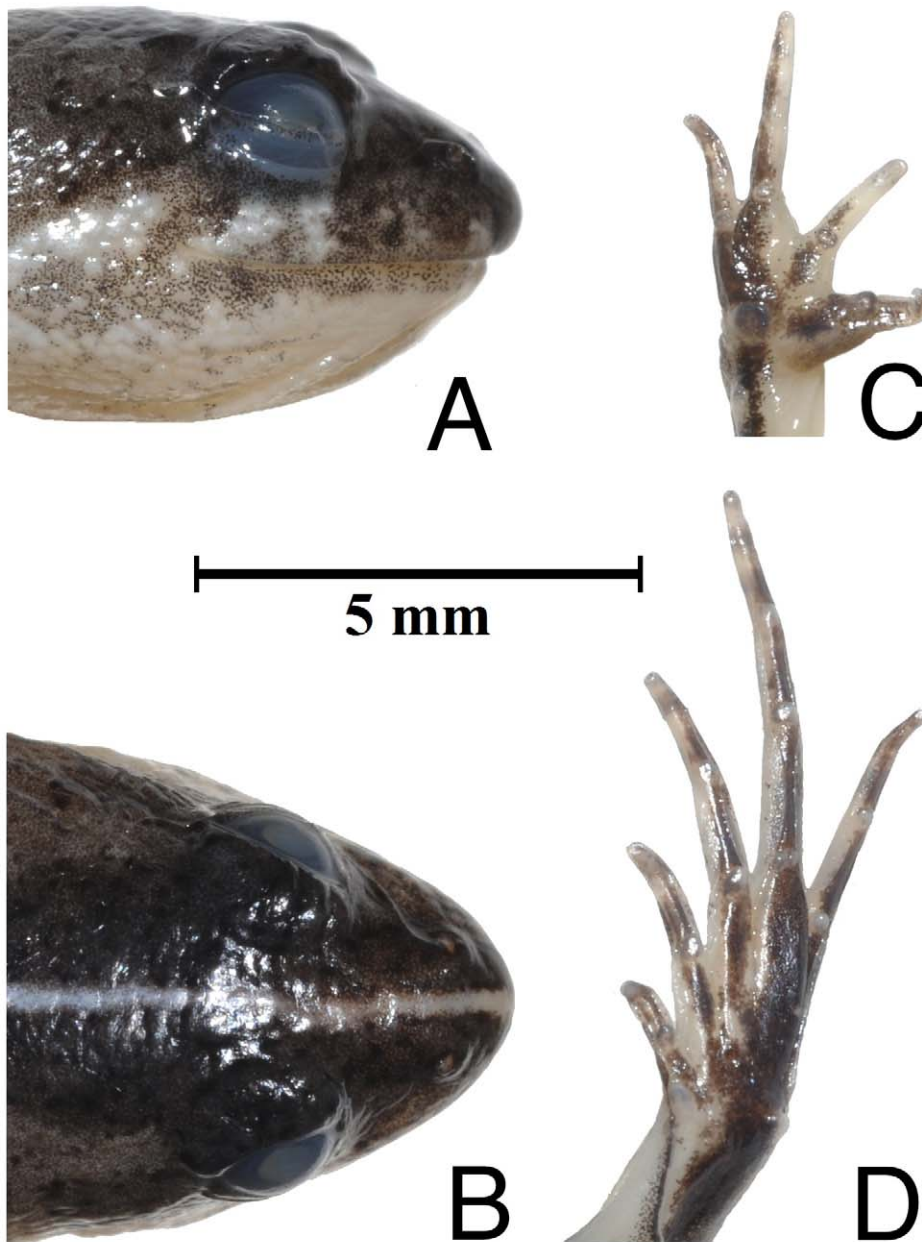
**Variation.** The specimens AAG-UFU 0854–0855, 2528, 2277, 3586, and ZUEC 13650, 13652 have a discrete tympanic ridge from behind the eyes to the proximal portion of the arms. The specimens AAG-UFU, 3585, 3589, ZUEC 13650–13652, 13654 have paravertebral chevron-shaped dermal ridges from behind the eyes to the scapular region. The specimens AAG-UFU 1159, 2277–2279, 2281–2282, 2528, 2622, 3585–3588, 4731, and ZUEC 13650–13652 have dorsum and dorsal surfaces of limbs with some degree of discoloration in preservative. The specimens AAG-UFU 2277–2278, 2281, 2622, 3586, 3588, and ZUEC 13650–13652 have the ventral surface of hands and feet dark brown, mottled. The specimens AAG-UFU 1158, 1164, 0854–0855, 2281–2282, 2528, 3586–3588, 3591, and ZUEC 13652–13653 have no vertebral stripe. The specimen AAG-UFU 1164 had a green vertebral stripe in life. The specimens AAG-UFU 2528, and ZUEC 13651–13652 have the vocal sac with many warts. The females have a more robust body, nuptial pads absent.

**Natural history.** A detailed description of *P. facureae* sp. nov. natural history aspects, including call activity,

reproductive ecology, and tadpole description is found in Giaretta and Facure 2009 (referred to as *Pseudopaludicola* aff. *canga*).

**Distribution.** *Pseudopaludicola facureae* sp. nov. is known from the type locality (Municipality of Uberlândia), as well as in the Municipality of Limeira do Oeste (vocalizations; L.B. Martins), State of Minas Gerais, approximately 250 km in a straight line westward from the type locality.

**Etymology.** The name is a noun in the genitive case honoring Kátia G. Facure, the first researcher who called attention to the occurrence of this species in the study region in October 2000.



**FIGURE 3.** *Pseudopaludicola facureae* sp. nov., adult male, holotype (AAG-UFU 0853). (A) Dorsal and (B) lateral views of head; (C) ventral views of hand and (D) foot. Scale bar = 5 mm.

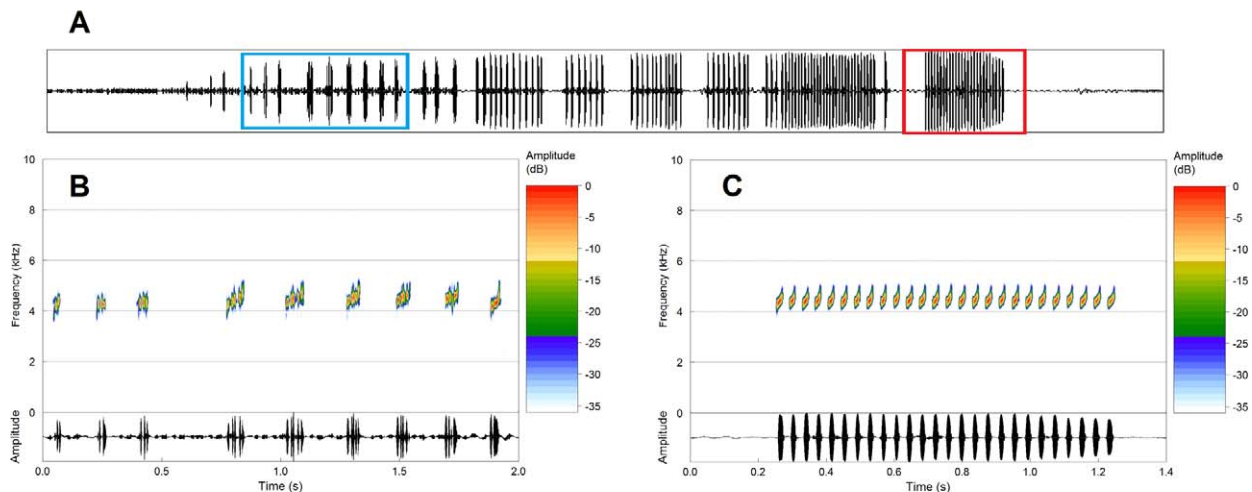
**Advertisement call.** Ten males recorded ( $N = 88$  advertisement calls). Quantitative variables are summarized in Table 2. Advertisement call (fig. 4) consists of series of 3–53 non-pulsed notes/call (mean 16.0;  $SD = 3.5$ ), emitted in sequences of 3–26 advertisement calls/sequence (mean 9.2;  $SD = 4.8$ ); sequence duration was 3–22 seconds (mean 9.8;  $SD = 6.3$ ). Advertisement call sequence was emitted at a rate of 1–2 sequences/minute (mean 1.2;  $SD = 0.4$ ). Advertisement call duration was 21–3013 ms (mean 658.5;  $SD = 194.2$ ), and intercall duration was

204–931 ms (mean 462.2; SD = 108.8). Advertisement call was emitted at a rate of 1–2 calls/second (mean 1.1; SD = 0.2). Note duration was 15–35 ms (mean 23.1; SD = 3.7), and internote duration was 12–104 ms (mean 27.0; SD = 9.8), with a rate of 8–31 notes/second (mean 17.0; SD = 2.5), and a rate of 480–1860 notes/minute (mean 1020.6; SD = 147.6). Dominant frequency was 4076–5108 Hz (mean 4500; SD = 263).

**TABLE 2.** Bioacoustic variables of *Pseudopaludicola facureae* **sp. nov.** from the Municipality of Uberlândia, State of Minas Gerais, Brazil. Mean $\pm$ SD (minimum–maximum). N = number of specimens recorded (number of analyzed advertisement calls).

Variables	<i>Pseudopaludicola facureae</i> <b>sp. nov.</b> N=10 (88)
Advertisement call duration (ms)	658.5 $\pm$ 194.2 (21–3013)
Intercall interval (ms)	462.2 $\pm$ 108.8 (204–931)
Notes/advertisement call	16.0 $\pm$ 3.5 (3–53)
Note duration (ms)	23.1 $\pm$ 3.7 (15–35)
Internote duration (ms)	27.0 $\pm$ 9.8 (12–104)
Advertisement call sequence (s)	9.8 $\pm$ 6.3 (3–22)
Advertisement calls/sequence	9.2 $\pm$ 4.8 (3–26)
Advertisement calls sequence/minute	1.2 $\pm$ 0.4 (1–2)
Advertisement calls/second	1.1 $\pm$ 0.2 (1–2)
Notes/second	17.0 $\pm$ 2.5 (8–31)
Notes/minute	1020.6 $\pm$ 147.6 (480–1860)
Dominant frequency (Hz)	4500 $\pm$ 263 (4076–5108)

Before the emission of the advertisement call sequences, isolated notes with irregular structure, duration, and interval are emitted, herein referred to as introductory notes (fig. 4). Duration of introductory note sequence was 0.5–2.5 seconds (mean 1.7; SD = 0.5), with 4–15 notes/sequence (mean 10.4; SD = 2.7). Interval between introductory note sequences and advertisement call sequences was 74–317 ms (mean 165.1; SD = 75.1).



**FIGURE 4.** A—Oscillogram (14 seconds) of 15 introductory notes followed by an entire advertisement call sequence (6 advertisement calls) of *Pseudopaludicola facureae* **sp. nov.** from the Municipality of Uberlândia, Minas Gerais, Brazil. B—Audiospectrogram (above) and corresponding oscillogram (below) detailing 9 introductory notes outlined by a blue rectangle. C—Audiospectrogram (above) and corresponding oscillogram (below) detailing the last advertisement call (26 notes) of the entire sequence outlined by a red rectangle. Sound file: Pseudop\_facureaeUberlândiaMG9aAAGm671; approximately 17:30h, 28 October 2011; air 27°C, water 25°C. Vouchered recording.

**Remarks.** Three populations from southeastern and northeastern Brazil were assigned to *Pseudopaludicola* aff. *canga* (Giaretta & Facure 2009; Duarte *et al.* 2010) on the basis of common chromosome number ( $2n = 18$ ) and putative morphological relatedness. The population from Uberlândia, State of Minas Gerais, actually represents *P. facureae*, easily diagnosed from *P. canga* by a bioacoustic approach. These species are separated by a vertical distance of about 1500 km from each other considering their respective type localities. The population assigned to *P. aff. canga* from Icém (State of São Paulo), southeastern Brazil, occurs about 185 km southward from *P. facureae* type locality, and currently represents an additional undescribed species with distinctive morphological and bioacoustic evidence in comparison with both *P. canga* and *P. facureae* (Pansonato pers. comm.). The third population assigned to *P. aff. canga* from Barreirinhas (State of Maranhão), northeastern Brazil, was reassessed in Pansonato *et al.* (2012) and currently represents a new distributional record of *P. canga* instead.

## Acknowledgements

Grants by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) (TRC) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) (FSA). Financial support to our laboratory came from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG). Special thanks go to Ariovaldo A. Giaretta, coordinator of our lab, and Lucas B. Martins for providing bioacoustic data on the newly described species; André Pansonato and Luiz Dino Vizotto for making available essential data on *Pseudopaludicola*, Vanessa Suzuki Kataguirí for providing laboratory facilities, and Isabelle Aquemi Haga for helping at laboratory.

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