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ADVERTISEMENT CALL OF THE CYCLORAMPHID TOAD *PROCERATOPHRYS MELANOPOGON* (MIRANDA-RIBEIRO, 1926)

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Abstract. *Proceratophrys melanopogon* is always observed at high altitudes, having never been diagnosed in altered areas. The advertisement call of this species is described from Serra do Brigadeiro, state of Minas Gerais, southeastern Brazil. The call consists of a multipulsed (12-41 pulses) note with a mean duration of 0.39 s, emitted sporadically, and a dominant frequency around 1179 Hz. By comparing the call of *P. melanopogon* with other species of the genus it is possible to establish similarities and differences among the analyzed parameters.

Keywords. Anura, vocalization, anuran communication, *Proceratophrys,* acoustic parameters.

Introduction

The genus *Proceratophrys* Miranda-Ribeiro, 1920 currently comprises 21 species occurring in Brazil, Argentina, and Paraguay (Frost, 2010; Prado and Pombal, 2008). Based on morphological similarities, some species have been lumped together into species complexes and groups (the monophyletism of which has not been tested), whereas others, due to the presence of peculiar characteristics, do not belong to any group (Prado and Pombal, 2008). The species *Proceratophrys melanopogon* was placed in the *P. appendiculata* complex, which is characterized by the presence of eyelid and snout appendages (Prado and Pombal, 2008) (Figure 1). This complex contains seven species: *P. appendiculata* (Günther, 1873); *P. laticeps* Izecksohn and Peixoto, 1981; *P. melanopogon* (Miranda-Ribeiro, 1926); *P. moehringi* Weygoldt and Peixoto, 1985; *P. phyllostomus* Izecksohn, Cruz and Peixoto, 1998; *P. subguttata* Izecksohn, Cruz and Peixoto, 1998 and *P. tupinamba* Prado and Pombal, 2008.

Proceratophrys melanopogon was described from Paranapiacaba, São Paulo state, Brazil, and occurs in the Atlantic Rainforest of southeastern Brazil. The species is ecologically restricted to high altitude areas on the south, central, and northern portions of Rio de Janeiro state, east of São Paulo state and south and southeast of Minas Gerais state. In Minas Gerais its distribution includes the mountain ranges of Serra do Brigadeiro (northernmost and one of the westernmost distribution records) and Ibitipoca (Feio *et al.* 2003; Prado and Pombal, 2008) (Figure 2). Heyer *et al.* (1990) found *P. melanopogon* inside forested areas of Boracéia, São Paulo state, on trails and leaf litter, usually at daytime, from September to May. However, he did not hear the advertisement call during that time period. The ecology and natural history of *Proceratophrys melanopogon* are poorly known (Prado and Pombal, 2008) and the advertisement call has not been described.

Anuran advertisement calls are species-specific (Gerhardt and Davis, 1988), and the acoustic analysis of the advertisement calls is an important character for taxonomy and, therefore, useful in the distinction of the species (Duellman and Trueb, 1986). In this study, we describe the advertisement call of *Proceratophrys melanopogon* recorded from individuals at Serra do Brigadeiro, municipality of Ervália, northern portion of the Mantiqueira Moutain Range, State of Minas Gerais, and compare the results with calls described for other species of the genus.

Material and Methods

On 21 October 2009, several males of *Proceratophrys melanopogon* were recorded in Parque Estadual da Serra do Brigadeiro, at a permanent stream (20°88'808"S e 42°52'887"W) located in the district of Careço, municipality of Ervália, Minas Gerais state, southeastern Brazil. Calls of two males were recorded at 21:00 h, at an air temperature of 19.8°C, totaling 39 calls, using a

Panasonic RR-US450® digital recorder with an internal microphone and sampling frequency of 16.000 Hz and 16-bit resolution. Calls were analyzed with AVISOFT-SASLab Light for Windows (v. 3.74) and SoundRuler (V. 0.9.4.1). Audiospectrograms were produced with the following parameters: *FFT (fastr fourier transformation)* = 256, *Frame* = 100, *Overlap* = 75, and flat top filter. The sonogram, oscillogram, and power spectrum were performed in SoundRuler (V. 0.9.4.1). Terminology of calls follows Duellman and Trueb (1986) and Tárano (2001).

FIGURE 1. *Proceratophrys melanopogon* photographed in Parque Estadual da Serra do Brigadeiro (individual not collected). (Photo by S. Mângia)

Comparative data for other species were obtained from the available literature (Weygoldt and Peixoto , 1985 – *P. moehringi;* Heyer *et al.,* 1990 – *P. boiei;* Eterovick and Sazima, 1998 – *P. cururu;* Kwet and Faivovich, 2001 – *P. bigibbosa* – *P. brauni;* Kwet and Baldo, 2003 and Lima, 2007 – *P. avelinoi;* Nunes and Juncá, 2006 – *P. cristiceps;* Brasileiro *et al.,* 2008 – *P. moratoi;* Santana *et al.,* 2010 – *P. concavitympanum*); if the call of a species had been reported multiple times, we consider each call to represent a different population. Voucher specimens are deposited in the *Museu de Zoologia João Moojen, Universidade Federal de Viçosa* (MZUFV), Viçosa, state of Minas Gerais, Brazil, under the labels MZUFV 10.043 and 10.044.

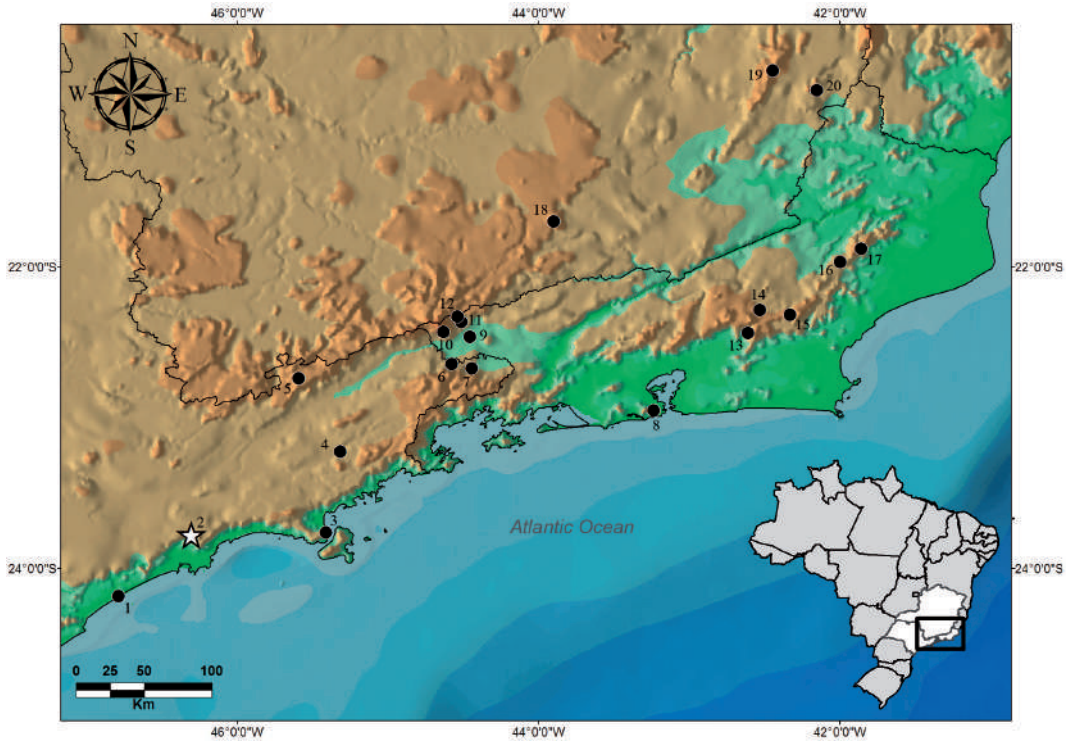

FIGURE 2. Geographic distribution of *Proceratophrys melanopogon.* São Paulo State: 1 = Itanhaém; 2 = Paranapiacaba (type locality); 3 = Água Branca, São Sebastião, Parque Estadual da Serra do Mar; 4 = São Luiz do Paraitinga; 5 = Campos dos Jordão; 6 = São José do Barreiro; 7 = Arapei, Serra da Bocaina. Rio de Janeiro State: 8 = Barão Homem de Mello; 9 = Resende; 10 = Itatiaia; 11 = APA da Mantiqueira; 12 = Visconde de Mauá; 13 = Macaé de Cima; 14 = Nova Friburgo; 15 = Serra de Macaé; 16 = Santa Maria Madalena; 17 = Parque Estadual do Desengano. Minas Gerais State: 18 = Parque Estadual do Ibitipoca; 19 = Parque Estadual da Serra do Brigadeiro; 20 = Pedra Dourada.

Results

Juveniles and adults of *P. melanopogon* were found at Serra do Brigadeiro, state of Minas Gerias, Brazil, on trails in the forest or amidst the leaf litter, just as was observed in Boracéia by Heyer *et al.* (1990). However, the males whose calls we recorded were observed calling at the margins of a little permanent stream, of sandy and stony bed, inside the forest, where the water current was weaker or absent. The ventral surface of the body was submerged. Calling began at sunset and remained until *ca.* 22:00 h. At that time, several males were still calling; some of them close to each other (*ca.* 0.5-2.0 m).

The advertisement call of *P. melanopogon* (Figures 3 and 4) consists of a multipulsed note with duration of 170-480 ms ($\overline{X}$ = 390 ± 60 ms, n = 39 calls from to males), emitted sporadically with 12-41 pulses ($\overline{X}$ = 28.9 ± 4.6) and the pulse rate ranges from 68-96 pulses/s ($\overline{X}$ = 73.36 ± 4.13 pulses/s). The dominant frequency is between 999.12-1274.1 Hz ($\overline{X}$ = 1179 ± 64 Hz) (Table 1).

Discussion

At Serra do Brigadeiro, Feio *et al.* (2008) observed specimens of *P. melanopogon* only at the banks of slow water streams, inside pristine forests at high

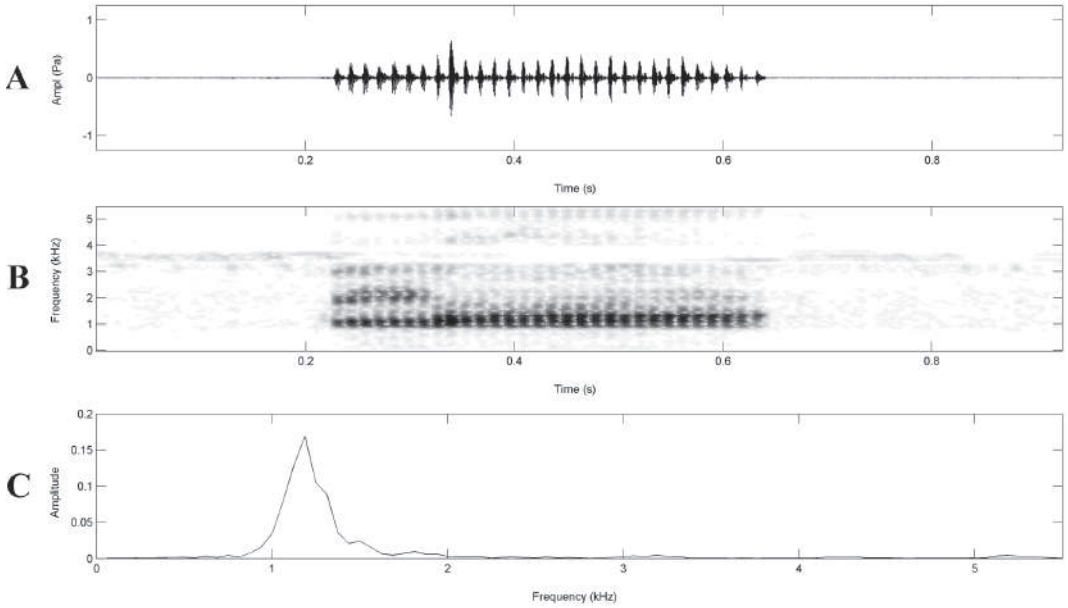

Figure 3. *Proceratophrys melanopogon,* advertisement call: (A) oscillogram, (B) audiospectrogram, and (C) power spectrum of a single call (air temperature = 19.8°C).

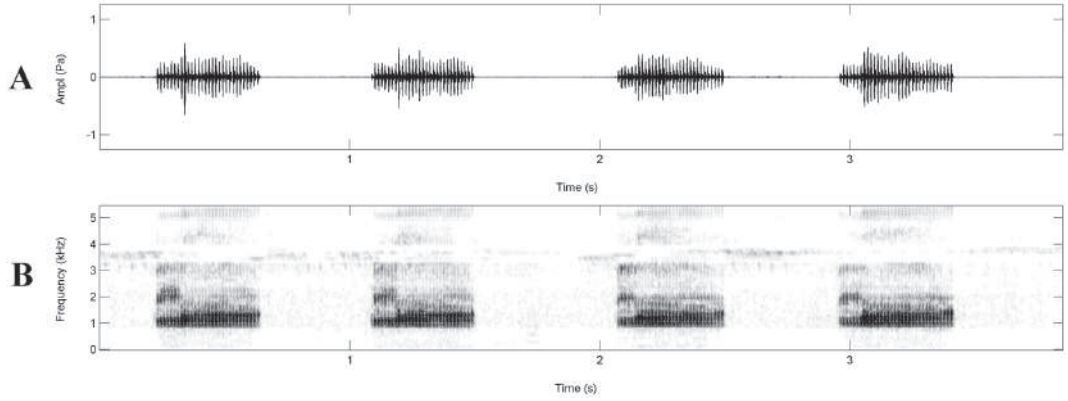

Figure 4. *Proceratophrys melanopogon,* advertisement call: (A) oscillogram and (B) audiospectrogram of a session of four notes (air temperature = 19.8°C).

Table 1. Advertisement calls described for the genus *Proceratophrys*. Modified table from Santana *et al.* (2010) with data added from the present study. Values are presented as mean ± SD (range), SD = standard deviation.

Taxa	Duration call	Pulses/s	Pulses/call	Dominant Frequency (Hz)	Reference
P. avelinoi	544.0 ± 1194 (200 – 754)	68.7 ± 1.8 (64 – 72)	37.5 ± 9.4 (23 – 70)	1600 (1050 – 2300)	Kwet and Baldo, 2003
P. avelinoi	868 – 1184	*	*	*	De Lima, 2007
P. bigibbosa	1600 – 1900	23 – 27	40 – 45	1050 (500 – 1400)	Kwet and Faivovich, 2001
P. boiei	700 – 800	45	30 – 35	600 (350 – 1350)	Heyer *et al.,* 1990
P. brauni	700 – 900	35 – 40	24 – 28	1350 (800 – 1800)	Kwet and Faivovich, 2001
P. concavitympanum	367 ± 58 (230 – 500)	14.7 ± 4.5 (5.29 – 25.40)	38.7 ± 7.4 (23 – 51)	948 ± 67 (851 – 1186)	Santana *et al.,* 2010
P. concavitympanum	278 ± 40 (178 – 326)	110.95 ± 5.24 100.67 – 119.72	30.85 ± 4.81 (19 – 37)	819.18 ± 62.20 (754.63 – 874.51)	Santana *et al.,* 2010
P. cristiceps	660 ± 50 (520 – 790)	89.54 ± 1.20 (87.43 – 91.85)	57.46 ± 6.02 (46 – 69)	940 ± 20 (900 – 990)	Nunes and Juncá, 2006
P. cururu	600 – 1000	45	40	900 (600 – 1000)	Eterovick and Sazima, 1998
P. melanopogon	390 ± 60 (0.17 – 0.48)	73.36 ± 4.13 (68 – 96)	28.9 ± 4.6 (12 – 41)	1179 ± 64 (999 – 1274)	Present work
P. moehringi	3500 – 4000	33 – 40	140	450 (200 – 700)	Weygoldt and Peixoto, 1985
P. moratoi	206.8 ± 17.6 (146 – 238)	—	17.5 ± 1.5 (12 – 20)	1348.7 ± 86.6 (1153 – 1420)	Brasileiro *et al.,* 2008
P. moratoi	245.4 ± 28.7 (185 – 307)	—	20.5 ± 2.5 (15 – 26)	1342 ± 73.7 (1174 – 1444)	Brasileiro *et al.,* 2008

* The author mentioned that there were no differences between with the parameters described in Kwet and Baldo (2003)

altitudes. In the present study, we corroborate those observations. All males observed were found only in this habitat, at 1240 m asl. Heavy rains characterized the day we made recordings, and several males were calling. At Serra do Brigadeiro, *P. melanopogon* may display opportunistic behavior, reproducing only in days of strong rainfall, at the warmest and most humid period of the year (Feio *et al.,* 2008).

From the 21 known *Proceratophrys* species, the advertisement call of only nine has been described. Comparing the call of *P. melanopogon* within this genus, it is possible to establish similarities and differences among the analyzed parameters. However, it does not make the advertisement call a character of little importance to the taxonomy of the genus, due to the absence of identical calls or overlaps. The advertisement call of *P. melanopogon* differs from the calls of the other *Proceratophrys* species. The average call duration of *P. melanopogon* is shorter than *P. avelinoi, P. bigibbosa, P. boiei, P. brauni, P. cristiceps, P. cururu* and *P. moehringi* and greater than *P. concavitympanum* and *P. moratoi.* The pulse rate (pulse/s) in *P. melanopogon* is shorter than *P. cristiceps* and *P. concavitympanum* (for the population from Rondônia) and greater than *P. avelinoi, P. boiei, P. brauni, P. concavitympanum* (for the population from Mato Grosso), *P. cururu, P. moehringi* and *P. bigibbosa* (this parameter is not described for *P. moratoi*). The number of pulses per call in *P. melanopogon* is shorter than in *P. avelinoi, P. bigibbosa, P. boiei, P. concavitympanum, P. cristiceps, P. cururu* and *P. moehringi;* similar to the call of *P. cristiceps* and greater than the pulses in *P. moratoi.* The dominant frequency (Hz) of *P. melanopogon* is higher than that emitted by *P. boiei, P. concavitympanum, P. moehringi, P. cristiceps* and *P. cururu,* and lower than that emitted by *P. avelinoi, P. bigibbosa, P. brauni* and *P. moratoi.*

Amaro *et al.* (2009), when allocating *Odontophrynus moratoi* in *Proceratophrys,* provided a phylogenetic hypothesis for the species of *Proceratoprhys,* showing two trees obtained with different methods (Parsimony and Bayesian). Both trees have no clear subdivisions that substantiate the currently recognized groups, and present *P. melanopogon* as a species closely related to *P. appendiculata,* as has also been indicated by Izecksohn *et al.* (2005). However, the advertisement call of *P. appendiculata* is not described

in this paper, hampering any taxonomic comparisons or systematic implications. Furthermore, as observed herein, call parameters of *P. melanopogon* are intermediate in value compared to the other calls described for the genus, not presenting similarities to any species. Thus, for better comparisons, the description of calls of other species is warranted.

Resumo

Proceratophrys melanopogon sempre é encontrada em altitudes elevadas, nunca tendo sido diagnosticada em áreas alteradas. O canto de anúncio desta espécie é descrito para a Serra do Brigadeiro, Minas Gerais, sudeste do Brasil. O canto consiste de uma nota multipulsionada com duração média de 0.39 s, emitidas esporadicamente, com 12 a 41 pulsos e a freqüência dominante possui um valor médio de 1179.41 Hz. Comparando o canto de anúncio de *P. melanopogon* com os cantos descritos de outras espécies do gênero é possível estabelecer semelhanças e diferenças entre os parâmetros analisados.

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Literature Cited

Brasileiro, C. A., I. A. Martins, and J. Jim. 2008. Amphibia, Anura, Cycloramphidae, *Odontophrynus moratoi:* Distribution extension and advertisement call. Check List, 4(4): 382-385.

Duellman, W. E. and L. Trueb. 1986. Biology of Amphibians. The Johns Hopkins University Press. 670 pp.

Eterovick, P. C. and I. Sazima. 1998. New species of *Proceratophrys* (Anura: Leptodactylidae) from southeastern Brazil. Copeia, (1): 159-164.

Feio, R. N., C. A. G. Cruz, and E. Izecksohn. 2003. *Proceratophrys melanopogon.* Geographical Distribution. Herpetological Review. 32(2): 125.

Feio, R. N., P. S. Santos, C. S. Cassini, J. S. Dayrell, and E. F. Oliveira. 2008. Anfibios da Serra do Brigadeiro, MG. MG.Biota. v. 1, n. 1.

Frost, D. R. 2010. Amphibian Species of the World: an Online Reference. Version 5.4 (8 April, 2010). Electronic Database Accessible at http://research.amnh.org/herpetology/amphibia/ American. Museum of Natural History, New York, USA.

Gerhardt, H. C. and M. S. Davis. 1988. Variation in the coding of species identify in the advertisement calls of *Litoria verreauxi* (Anura: Hylidae). Evolution, 42: 556-563.

Heyer, W. R., A. S. Rand, C. A. G. Cruz, O. L. Peixoto, and C. E. Nelson. 1990. Frogs of Boraceia. Arq. Zool. Sao Paulo, 31: 231-410.

Kwet, A. and J. Faivovich. 2001. *Proceratophrys* bigibbosa species group (Anura: Leptodactylidae), with description of a new species. Copeia, 2001(1): 203-215.

Lima, A. M. X. 2007. *Proceratophrys avelinoi* Advertisement call. Herpetological Review, 38(2): 191.

Nunes, I. and F. A. Juncá. 2006. Advertisement calls of three Leptodactylid frogs in the state of Bahia, northeastern Brazil (Amphibia, Anura, Leptodactylidae), with considerations on their taxonomic status. Arquivos do Museu Nacional, 64(2): 151-157.

Prado, G. M. and J. P. Pombal-Jr. 2008. Espécies de *Proceratophrys* Miranda-Ribeiro, 1920 com apêndices palpebrais (Anura; Cycloramphidae). Arquivos de Zoologia, 39(1): 1-85.

Santana, D. J., V. A. São Pedro, P. S. Bernarde, and R. N. Feio. 2010. Descrição do canto de anúncio e dimorfismo sexual em *Proceratophrys concavitympanum* Giaretta, Bernarde, and Kokubum, 2000. Papéis Avulsos de Zoologia, 50(11): 167-174.

Tárano, Z. 2001. Variation in male advertisement calls in the Neotropical frog *Physalaemus enesefae.* Copeia, 4: 1064-1072.

Weygoldt, P. and O. L. Peixoto. 1985. A new species of horned toad (*Proceratophrys*) from Espírito Santo, Brazil (Amphibia: Salientia: Leptodactylidae). Senckenbergiana Biologica, 66(1/3): 1-8.

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