

Description of the advertisement call of *Hyla ehrhardti* MÜLLER, 1924 and new distribution records (Anura: Hylidae)

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Abstract. The advertisement call of the South Brazilian hylid *Hyla ehrhardti* is described for the first time. It consists of a long series of single notes with high repetition rates ranging from 204-264 notes/min. The dominant frequency lies between 2.6 and 2.9 kHz. New records for *Hyla ehrhardti* significantly extend the distribution of this little known species, which was restricted to the State of Santa Catarina, northward, through Paraná State up to São Paulo State.

Key words. Santa Catarina; Paraná; São Paulo.

Introduction

Hyla ehrhardti MÜLLER, 1924 (Fig. 1) is a little known treefrog from southern Brazil, which was described from a single male collected in Humboldt (now municipality of Corupá), State of Santa Catarina (MÜLLER 1924). Up to now, we have had next to no knowledge of the biology of this species. The known distribution of *H. ehrhardti* has increased slightly due to the synonymisation of *Hyla arianae* CRUZ & PEIXOTO, 1985, which was also described from Santa Catarina, with *H. ehrhardti* by FAIVOVICH *et al.* (2002). The



Fig. 1. *Hyla ehrhardti*; (a) adult male from São José dos Pinhais, State of Paraná (EI 10899). Photo: J. RICETTI. (b) Recently metamorphosed specimen from Santo Amaro da Imperatriz, State of Santa Catarina (MCP 8120). (c) Tadpole from a small stream at Santo Amaro da Imperatriz possibly belonging to this species; note red eyes. Photos: A. KWET.



Fig. 2. Known geographic range of *Hyla ehrhardti*, including the new records: 1- Ribeirão Grande; 2- São José dos Pinhais; 3- Guaratuba; 4- Corupá; 5- São Bento do Sul; 6- Rio dos Cedros; 7- Santo Amaro da Imperatriz; 8- Lauro Müller.

type locality of *H. arianae* is Rio dos Cedros and the paratypes are from Novo Horizonte and São Bento do Sul (CRUZ & PEIXOTO 1985). It is important to clarify here that the locality Novo Horizonte, where one paratype was collected in 1970, is not synonymous with the Municipality of Novo Horizonte in northwestern Santa Catarina, which was founded in 1992 only. Actually, Novo Horizonte is a small town in southeastern Santa Catarina belonging to the Municipality of Lauro Müller. However, in both cases the known distribution of *H. ehrhardti* is restricted to the state of Santa Catarina.

In this paper we describe the advertisement call of *H. ehrhardti* from Paraná and São Paulo for the first time and present three new records from north of the known localities in Santa Catarina which significantly extend the distribution of the species. Two records are from the adjacent State of Paraná and one record is from the south of São Paulo State. In addition, we present a new locality from southern Santa Catarina. All specimens were identified by comparing collected individuals with the descriptions provided by CRUZ & PEIXOTO (1985) and FAIVOVICH et al. (2002).

Results

One of our records is based on two males collected in Serro e Gemido, Municipality of São José dos Pinhais ($25^{\circ}41'15''\text{S}$, $49^{\circ}03'35''\text{W}$, about 980 m elevation), Paraná, by C.E. CONTE. One of these specimens (Fig. 1a), collected on 19 January 2003 and deposited at Eugênio Izecksohn Collection, Rio de Janeiro (EI 10899), was vocalizing 2 m from a stream, perching on leaves at 2.5 m above ground. The other individual, collected on 10 February 2003 by C.E. CONTE and deposited at Coleção científica da UNESP/São José do Rio Preto (DZSJRP 6229), was calling 6 m beside a stream at 3 m above ground. Both specimens were observed inside forest habitat, in a transitional region between Araucaria Forest and Atlantic Rain Forest. The second new record is based on a male, collected in Alto da Serra, Municipality of Guaratuba ($25^{\circ}52'27''\text{S}$, $48^{\circ}54'08''\text{W}$, about 558 m elevation), Paraná, on 3 January 2004 by R. LINGNAU. This individual was calling in bushes in the Atlantic Rain Forest, 1.6 m above ground, and was deposited at Museu Nacional Rio de Janeiro (MNRJ 35105). The third record is based on a male, collected in Sumidouro, Municipality of Ribeirão Grande ($22^{\circ}48'30''\text{S}$, $45^{\circ}27'42''\text{W}$, about 724 m elevation), State of São Paulo, on 2 November 2003 by C.E. CONTE and A. URBEN FILHO. This individual, deposited at Eugênio Izecksohn Collection (EI 10900), was vocalizing 3 m from a stream on a leaf at 2.5 m above ground. Our most recent record is of a juvenile, collected in Caldas da Imperatriz, Parque Estadual da Serra do Tabuleiro, Municipality of Santo Amaro da Imperatriz ($27^{\circ}43'\text{S}$, $48^{\circ}49'\text{W}$, about 450 m elevation), State of Santa Catarina, on 15 December 2004 by A. KWET, A.F. CORDEIRO and M. DI-BERNARDO. It is a freshly metamorphosed specimen, which was perched on a tree at 1.5 m above ground, next to a small stream inside the Atlantic Rain Forest (Fig. 1b). This specimen is housed in the Museu de Ciências e Tecnologia da PUCRS, Porto Alegre (MCP 8120). Addi-

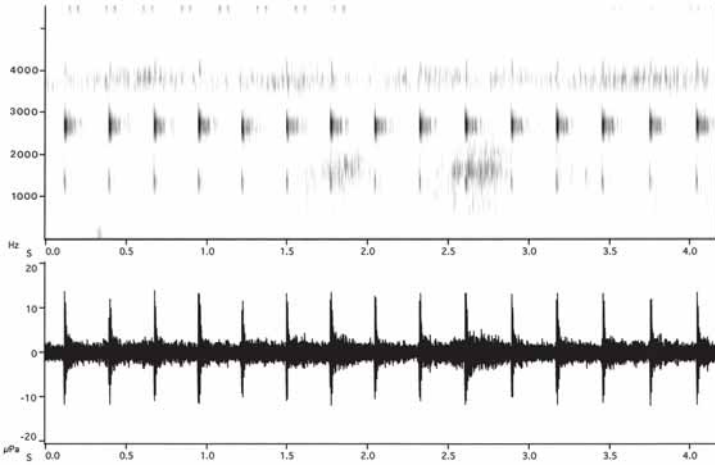


Fig. 3. Audiospectrogram (above) and oscillogram (below) of nine advertisement calls of *Hyla ehrhardti*, from Guaratuba, State of Paraná (19.5 °C, without voucher specimen).

tionally, we observed tadpoles with conspicuous red eyes apparently belonging to *H. ehrhardti* (Fig. 1c).

All in all, our observations extend the known distribution of *H. ehrhardti* up to 300 km north of previous records and fill a gap left between the southernmost record from Lauro Müller and the records from northern Santa Catarina. Hence, *H. ehrhardti* seems to be a species restricted to the Atlantic Rain Forest domain of southern and southeastern Brazil, ranging from south of Santa Catarina State across Paraná northward to São Paulo State (Fig. 2).

Advertisement calls of *H. ehrhardti* were recorded on 11 November 2003 (22:20 h) at municipality of Guaratuba, State of Paraná (19.5 °C air temperature), and on 26 November 2003 (22:00 h) at municipality of Ribeirão Grande, State of São Paulo (air temperature unknown). We did not collect voucher specimens for these recordings but were able to assign them to *H. ehrhardti* by observing calling males on other occasions. Call recordings were made using a Sony WM-D6C tape recorder, a Sennheiser directional microphone system K6 with ME 66 module and metal tapes Sony Metal XR-90 (at Guaratuba) and a MD Sony MZ-R30 tape recorder with Sennheiser microphone (at Ribeirão

Grande). Advertisement calls (a series of 40 notes from one individual at each locality) were analysed with the Macintosh-based sig-

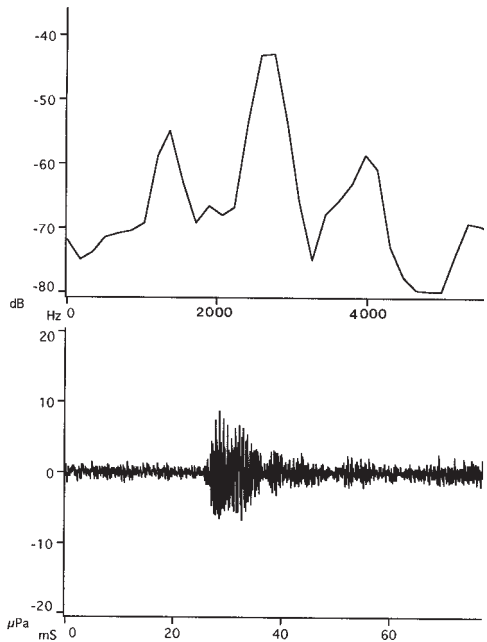


Fig. 4. Power spectrum (above) and oscillogram (below) of one advertisement call of *Hyla ehrhardti*, from Guaratuba, State of Paraná (19.5 °C, without voucher specimen).

	(a): 11 November 2003	(b): 26 November 2003
Air temperature (°C)	19.5	–
Note duration (ms)	10.66 ± 1.02 (8.7 - 12.6)	9.52 ± 0.91 (8.1 - 11.0)
Note interval (ms)	295.1 ± 20.9 (269 - 348)	245.6 ± 37.0 (206 - 337)
Note repetition rate (notes/min)	204 - 210	240 - 264
Dominant frequency (Hz)	2680 (2600 - 2800)	2640 (2600 - 2900)
Fundamental frequency (Hz)	1300 - 1500	1300 - 1500
Third harmonic (Hz)	3900 - 4100	3900 - 4100

Tab. 1. Acoustic parameters for two males of *Hyla ehrhardti* from Guaratuba, State of Paraná (a) and Ribeirão Grande, State of São Paulo (b). In temporal parameters, the mean is followed by the standard deviation and the ranges in parentheses.

nal analysis software Canary 1.2 (Cornell University) at a sampling frequency of 44.4 kHz, 16 bit amplitude resolution and 700 Hz filter bandwidth.

Temporal and spectral parameters are listed in Table 1. Figures 3 and 4 depict audio-spectrogram, oscillogram and power spectrum of the advertisement call of *H. ehrhardti*. Each advertisement call is composed of a single note. Males emit long series of these notes, separated by regular time intervals (Fig. 3). An individual can call for several minutes without stopping and without notable variation in note repetition rate (notes per minute). Call parameters were almost identical in both localities, presenting a note duration of 9 to 13 ms and note intervals between 200 and 350 ms. The note repetition rate at Ribeirão Grande (240-264 notes per minute) was on average higher than at Guaratuba (204-210 notes per minute), which may be due to temperature effects. Single notes consisted of 2-4 poorly developed pulses (Fig. 4). The dominant frequency ranged between 2600 and 2900 Hz presenting a peak at 2680 Hz. Weak harmonic frequency bands were found between 1300 and 1500 Hz (fundamental frequency) and between 3900 and 4100 Hz (third harmonic).

Discussion

Hyla ehrhardti, a member of the *Hyla albomarginata* SPIX, 1824 group of COCHRAN (1955), was associated to the *Hyla albofrenata* LUTZ, 1924 complex by CRUZ & PEIXOTO

(1985, as *Hyla arianae*). CARVALHO-E-SILVA & CARVALHO-E-SILVA (2005) considered the *albomarginata* group to be composed of three species complexes. Regarding the *albofrenata* complex, advertisement calls of three species have been described: *Hyla albofrenata* (BOKERMANN 1967), *Hyla arildae* CRUZ & PEIXOTO, 1987 (HEYER et al. 1990) and *Hyla eugenioi* CARVALHO-E-SILVA & CARVALHO-E-SILVA, 2005 (HARTMANN et al. 2004, as *Hyla* sp. aff. *ehrharti*). The advertisement call of *H. ehrhardti* differs considerably from the calls of these three species by its much higher note repetition rate (200-260 notes per minute in *H. ehrhardti* versus 40 notes/minute in *H. albofrenata*, 42-102 notes/minute in *H. arildae* and 22 notes/minute in *H. eugenioi*). The dominant frequency of the call of *H. ehrhardti* is similar to that of *H. arildae* (2200-2800 Hz in *H. arildae*). BOKERMANN (1967) did not give values for the frequency of the advertisement call of *H. albofrenata*, but comparing with the audiospectrogram depicted in this publication, the dominant frequency appears to be similar to that of *H. ehrhardti*. The advertisement call of *H. eugenioi* is composed of one note with three harmonics, and all these harmonics have higher values in *H. ehrhardti*.

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References

- BOKERMANN, W.C.A. (1967): Notas sobre cantos nupciais de anfíbios brasileiros. – An. Acad. Brasil. Ci. **39**: 441-443
- CARVALHO-E-SILVA, A.M.P.T. & S.P. CARVALHO-E-SILVA (2005): New species of the *Hyla albofrenata* group, from the states of Rio de Janeiro and São Paulo, Brazil (Anura, Hylidae). – J. Herpetol. **39**: 73-81.
- COCHRAN, D.M. (1955): Frogs of Southeastern Brazil. – United States Nat. Mus. Bull. **206**: 1-411.
- CRUZ, C.A.G. & O.L. PEIXOTO (1985): Espécies verdes de *Hyla*: o complexo “*albofrenata*” (Amphibia, Anura, Hylidae). – Arq. Univ. Fed. Rur. Rio de J. **8**: 59-70.
- FAIVOVICH, J., C.A.G. CRUZ & O.L. PEIXOTO (2002): The identity of *Hyla ehrhardti* MÜLLER, 1924 (Anura, Hylidae). – J. Herpetol. **36**: 325-327.
- FAIVOVICH, J., C.F.B. HADDAD, P.C.A. GARCIA, D.R. FROST, J.A. CAMPBELL & W.C. WHEELER (2005): A review of the systematics of the frog family Hylidae, with special reference to the Hylinae: a phylogenetic analysis and taxonomic revision. – Bulletin of the American Museum of Natural History, **294**: 1-240.
- HARTMANN, M.T., P.A. HARTMANN & C.F.B. HADDAD (2004): Visual signaling and reproductive biology in a nocturnal treefrog, genus *Hyla* (Anura, Hylidae). – Amphibia Reptilia **25**: 395-406.
- HEYER, W.R., A.S. RAND, C.A.G. CRUZ, O.L. PEIXOTO & C.E. NELSON (1990): Frogs of Boracéia. – Arq. Zool. **31**: 231-410.
- MÜLLER, L. (1924): Neue Laubfrösche aus dem Staate Santa Catharina, S.O. Brasilien. – Zool. Anz. **59**: 233-238.

Note added in proof: A recently published work by FAIVOVICH et al. (2005) reviewed the Hylinae and suggested to use *Aplastodiscus ehrhardti* instead of *Hyla ehrhardti*.

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