



ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

COMBAT AND ACOUSTICS OF THE ENDANGERED LITTLE TREE FROG (AMPHIBIA: RHACOPHORIDAE: *RHACOPHORUS LATERALIS*) FROM THE WESTERN GHATS, INDIA

Sunil Sachi¹ & K.P. Dinesh²

OPEN ACCESS

¹ Mudsosi Estate, Makonahalli post, Mudigere (TQ), Chikmagalur, Karnataka 577132, India

² IMPU, Near Beranjihalla, Aldur, Chikmagalur, Karnataka 560111, India

¹ disturbedfred666@gmail.com, ² kpdinesh11@gmail.com (corresponding author)

Abstract: *Rhacophorus lateralis* is a endangered tree frog found distributed in the hill ranges of Wayanad, Coorg and Chikmagalur, and is well known for its unique leaf nesting behavior. Here we present male-male combat and acoustics for *R. lateralis*.

Keywords: Leaf nesting, Little Tree Frog, male-male combat, Western Ghats.

Rhacophorus lateralis Boulenger, 1883 is categorized as an ‘Endangered’ (Biju et al. 2004) species of rhacophorid tree frog known for its novel single leaf foam nesting behavior from the Western Ghats (Biju 2009; Goel & Goel 2010). Although this species was described by Boulenger in the year 1883, it was known poorly until its report by Bennet et al. (2000) and Das (2000) from Coorg and Biju (2000) from Wyanad. Subsequently, its distribution records were compiled and reported by Dinesh et al. (2010), Goel & Goel (2010), Molur & Molur (2010) and Biju et al. (2013).

Among the members of the genus in the Western Ghats natural history studies on the nest formation for laying eggs were well studied for the species *Rhacophorus calcadensis*, *R. pseudomalabaricus*, *R. malabaricus* and *R. lateralis* (Biju 2009; Biju et al. 2013), but not much information is available for the male-male combat and acoustics in these species, specifically for *R. lateralis*.

During one of our searches in May 2013 for *Rhacophorus lateralis* at Makonahalli, Mudigere (13.155972N & 75.691778E, 1000m), Karnataka between 20:00–23:00 hr we encountered a congregation of *R. lateralis* next to an irrigation well surrounded by a coffee plantation. The advertisement call sounds like “tip.. tip...”, bubble burst feeble call, which could be heard only at close proximity (about a meter). Other species of frogs calling at that time were *Rhacophorus malabaricus* and *Raorchestes luteolus* at a distance. The day had a good pre-monsoon shower at around 1600hr and drizzle



NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENDANGERED	EXTINCT IN THE WILD	EXTINCT
NE	DD	LC	NT	VU	EN	CR	EW	EX

Rhacophorus lateralis
Little Tree Frog



DOI: <http://dx.doi.org/10.11609/JoTT.o4225.7282-6> | ZooBank: urn:lsid:zoobank.org:pub:2A270252-BC51-4376-9BF0-7DACA0893806

Editor: Sanjay Molur, ZOO/WILD, Coimbatore, India.

Date of publication: 26 May 2015 (online & print)

Manuscript details: Ms # o4225 | Received 04 February 2015 | Finally accepted 30 April 2015

Citation: Sachi, S. & K.P. Dinesh (2015). Combat and acoustics of the endangered Little Tree Frog (Amphibia: Rhacophoridae: *Rhacophorus lateralis*) from the Western Ghats, India. *Journal of Threatened Taxa* 7(6): 7282–7286; <http://dx.doi.org/10.11609/JoTT.o4225.7282-6>

Copyright: © Sachi & Dinesh 2015. Creative Commons Attribution 4.0 International License. JoTT allows unrestricted use of this article in any medium, reproduction and distribution by providing adequate credit to the authors and the source of publication.

Funding: None.

Competing interests: The authors declare no competing interests.

Acknowledgements: We are grateful to Dr. K.V. Gururaja for his assistance in the call pattern analysis. We also thank the anonymous referee for critical comments on an earlier version of the manuscript.

till late evening. At around 2100hr we noticed that a few of the *R. lateralis* were hopping on one another on the bushes below the coffee plantation and it seemed to be a male-male combat. We herein report the male-male combat sequence in two pairs of *R. lateralis* and call pattern analysis.

MATERIALS AND METHODS

For male-male combat studies one of the authors (SS) sat next to *R. lateralis* at the breeding site. Video clips, photographs and call recording were made using Nikon D7100DSLR camera. Field notes on behavior, time and duration were noted. Calls were recorded 10–20 cm away from three calling male individuals. Relative humidity 93.75 ± 3.3 % (range: 90–98 %) and air temperature 21.76 ± 1.45 °C (range: 20–23.6 °C) were measured using a TFA digitalThermo-Hygrometer. A total of six calls were analyzed using SIGVIEW32 Ver.2.6.1. Call terminology was based on Giacomo & Castellano (2001).

OBSERVATIONS AND RESULTS

Male-male combat: In one sequence, a male individual of *R. lateralis* (male-A) was calling from a bush about 1m above the ground level (Video 1). Slowly

another male (male-B) sitting and calling from the next bush of similar height jumped on to the branch where male-A was sitting (Image 1.1) and resumed calling. After a few minutes male-B started mounting the back of male-A from behind (Image 1.2). While being mounted, male-A continued calling at regular intervals while male-B started moving towards the head region from behind (Image 1.3) and started pressing down on the head (Image 1.4) to stop male-A from calling. During this process both males fell down from the branch to another branch and male-A started kicking male-B with his hind legs to escape from the clasp.

In another sequence a calling male-A was approached and mounted by male-B (Image 2.1) and started calling while pressing down the head of male-A with his forelimbs (Image 2.2) preventing male-A from calling. Subsequently, male-A dislodged himself from the clutches of male-B and mounted male-B replaying the same steps (Image 2.3) followed by kicking male-B with his hind limbs (Image 2.4).

Male-C joined male-A and male-B during the combat (Image 3). Once male-C joined, the combat intensified and all the three males fell down from the bush and occupied different positions and resumed calling.



Image 1. Male-male combat in *Rhacophorus lateralis* by pressing the head and vocal sac.



Image 2. Male-male combat in *Rhacophorus lateralis* by pressing and kicking.

Table 1. Advertisement Call characteristics of *Rhacophorus lateralis*. Values are Mean \pm SE and the range is given in parenthesis.

Call Type	N	Duration (sec)	Dominant Frequency (Hz)	Pulse rate (#pulse/Sec)
Type 1 (Single note)	3	0.0104	2347.33 \pm 86.09 (2250–2519)	-
Type 2 (4 note)	3	0.215 \pm 0.013 (0.191–0.236)	2418 \pm 212.36 (2094–2818)	18.78 \pm 1.17 (16.94–20.94)

Call pattern analysis: Two types of calls were recorded in *R. lateralis*, Type I and Type II calls. Type I calls are single notes with the time lag ranging from 0.45 sec to 4.0 sec. The dominant frequency of this call is 2347.33 \pm 86.09 Hz. The duration and dominant frequency of the calls are given in Table 1. Type II calls comprise four notes and are generally made in chorus. The call duration ranges from 0.19–0.24 sec with a pulse rate of 18.78 \pm 1.17, and the dominant frequency ranges from 2094–2818 Hz. Type II call frequency, spectrogram and bandwidth are given in Fig. 1.

DISCUSSION

Aggressive combat behaviour preceding territorial calls have been studied in anurans since Wells (1977).



Image 3. Male-male combat in *Rhacophorus lateralis* in group.

Interspecific interactions ranging from vocal signals to aggressive encounters are reported by Schwartz & Wells (1984). Among inter-specific interactions, territorial combat with primitive amplexus and venter-to-venter grappling is reported in centrolenid frogs (Bolivar et al. 1999). Behavioural characteristics are useful in phylogenetic systematics (de Queiroz & Wimberg 1993), specifically in placing anurans in different generic levels

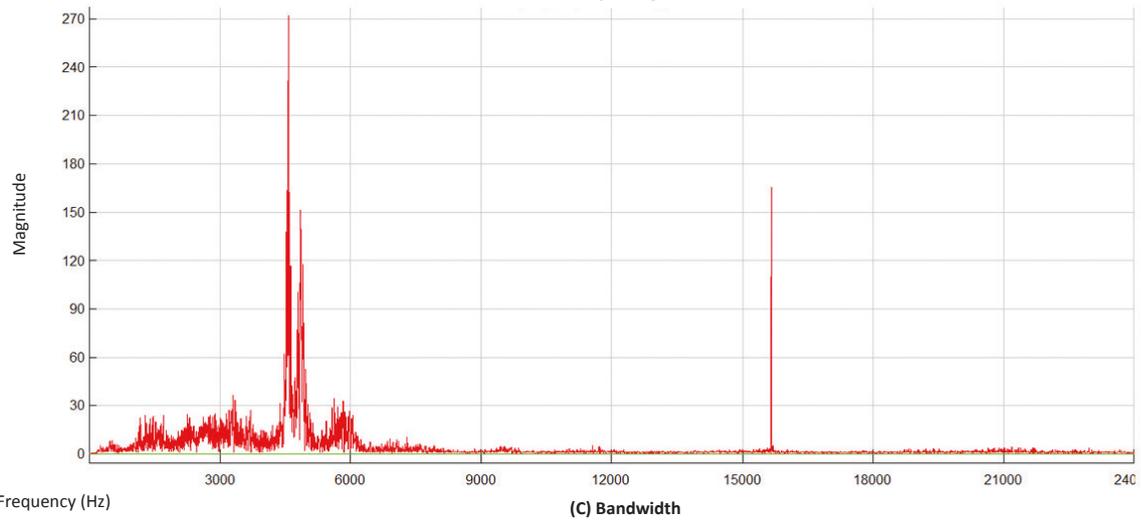
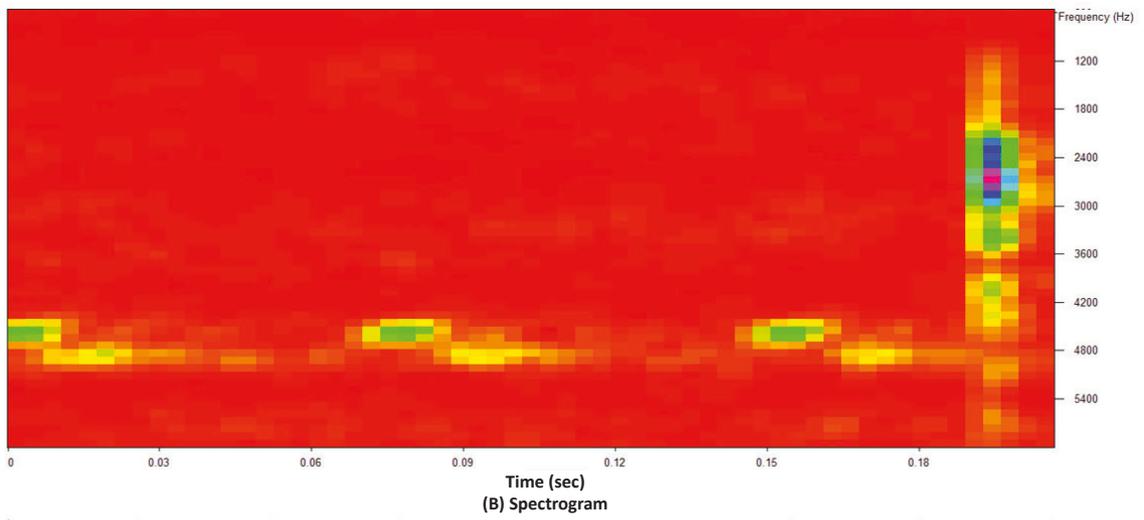
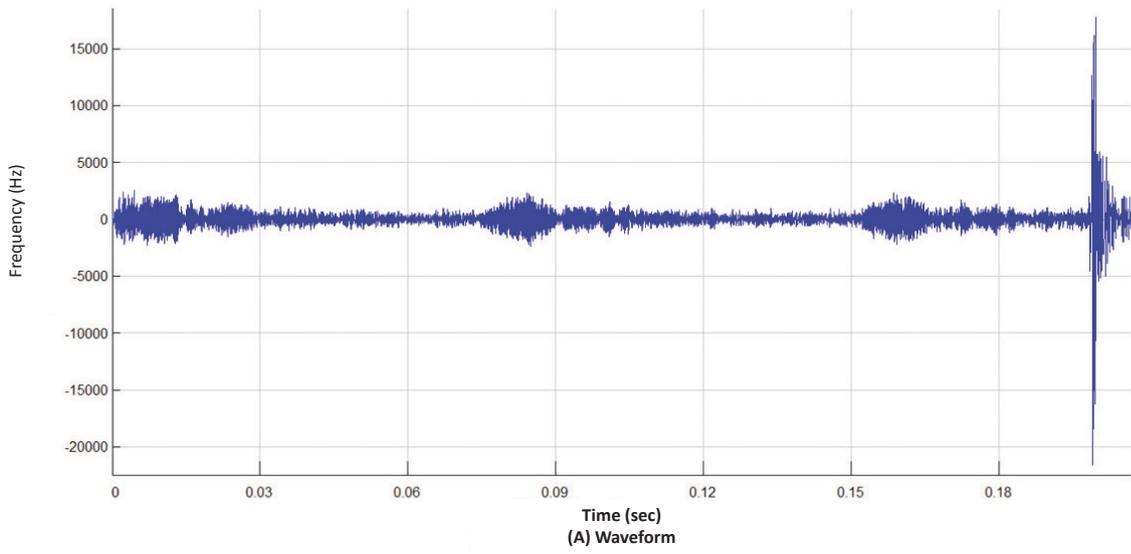


Figure 1. Type II advertisement call in *R. lateralis*. A - Waveform, B - Spectrogram and C - Band width.

(Bolívar et al. 1999).

From Indian amphibian research context, in the family Rhacophoridae male-male combat is reported in *Raorchestes bombayensis* (*Philautus variabilis*) by Kadadevaru & Kanamadi (2001), *Raorchestes annandalii* by Sarkar & Deuti (2007) and for *R. chromasynchysi*, *R. luteolus* and *Pseudophilautus amboli* by Dinesh et al. (2011). This is the first report on male-male combat and acoustics in *Rhacophorus lateralis* and more efforts are warranted to understand the complete breeding behaviour in this species.

REFERENCES

- Bennet, D., K. Hampson, K. Sanders & M. Anderson (2000). Frogs of Coorg, Karnataka, India. Final Report of the Aberdeen University Western Ghats Project, 1998.
- Biju, S.D. (2000). Two frogs and 100 years. Occasional Publication of the Indian Society for Conservation Biology (ISCB), Tropical Botanic Garden and Research Institute, Thiruvananthapuram, India, 14pp.
- Biju, S.D. (2009). A novel nesting behaviour of a Treefrog, *Rhacophorus lateralis* in the Western Ghats, India. *Current Science* 97(3): 433–437.
- Biju, S.D., S.K. Dutta, K. Vasudevan, C. Srinivasulu & S.P. Vijayakumar (2004). *Rhacophorus lateralis*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. <www.iucnredlist.org>. Downloaded on 21 October 2013.
- Biju, S.D., R.G. Kamei, S. Mahony, A. Thomas, S. Garg, G. Sircar & S. Robin (2013). Taxonomic review of the tree frog genus *Rhacophorus* (Anura: Rhacophoridae), from the Western Ghats, India, with description of ontogenetic colour changes and reproductive behavior. *Zootaxa* 3636 (2): 257–289; <http://dx.doi.org/10.11646/zootaxa.3636.2.3>
- Bolívar, G., W.T. Grant & L.A. Osorio (1999). Combat behavior in *Centrolene buckleyi* and other centrolenid frogs. *Alytes* 16: 3–4.
- Boulenger, G.A. (1883). Description of new species of reptiles and batrachians in the British Museum. *Annals and Magazine of Natural History* 5(12): 161–167.
- de Queiroz, A. & P.H. Wimberger (1993). The usefulness of behavior for phylogeny estimation: levels of homoplasy in behavioural and morphological characters. *Evolution* 47: 46–60.
- Das, I. (2000). Nomenclatural history and rediscovery of *Rhacophorus lateralis* Boulenger, 1883 (Amphibia: Rhacophoridae). *Current Herpetology* 19(1): 35–40.
- Dinesh, K.P., C. Radhakrishnan, K.V. Gururaja & A. Zacharia (2010). New locality records of *Rhacophorus lateralis* Boulenger, 1883 (Amphibia: Anura: Rhacophoridae), in Western Ghats, India. *Journal of Threatened Taxa* 2(6): 986–989; <http://dx.doi.org/10.11609/JoTT.o2209.986-9>
- Dinesh, K.P., N.U. Kulkarni, K.V. Gururaja & C. Radhakrishnan (2011). Male territorial combat in bush frogs of Western Ghats. *Frog leg* 17: 16–19.
- Giacomo, C. & S. Castellano (2001). Advertisement call variation and speciation in the *Bufoviridis* complex, pp. 205–219. In: Ryan, M.J. (ed). *Anuran Communication*. Smithsonian University Press, Washington.
- Goel, A. & M. Goel (2010). Observations on *Rhacophorus lateralis* and *R. malabaricus* in northern Coorg. *Frog leg* 14: 8–10.
- Kadadevaru, G.G. & R.D. Kanamadi (2001). Vocal interactions, territoriality and fighting behaviour of the rhacophorid frog, *Philautus variabilis* (Gunther, 1858). *Current Science* 80(12): 1486–1488.
- Molur, S. & P. Molur (2010). *Rhacophorus lateralis* in Madikeri, Kodagu, Karnataka. *Frog leg* 14: 6–7.
- Sarkar, A. & K. Deuti (2007). Wrestling for territorial defense in *Philautus annandalli*. *Hamadryad* 35(2): 367–368.
- Schwartz, J.J. & K.D. Wells (1984). Interspecific acoustic interactions of the Neotropical Treefrog *Hyla ebracata*. *Behaviour Ecology and Sociobiology* 14(3): 211–224.
- Wells, K.D. (1977). The social behaviour of anuran amphibians. *Animal Behaviour* 25: 666–693.

