# ADVERTISEMENT CALL OF THE INDIAN BRONZED FROG, *RANA TEMPORALIS* (GUNTHER, 1864)

GIRISH G. KADADEVARU[1], RAVISHANKAR D. KANAMADI[1,3] AND HANS SCHNEIDER[2]
[1]*Department of Zoology, Karnatak University Dharwad- 585003 India. E-mail: karuni@bgl.vsnl.net.in*
[2]*Zoologisches Institut, University of Bonn, Germany*
[3]author for correspondence

ACOUSTIC signals play a very important role in the breeding activity of frogs and toads and are regarded as one of the key characters responsible for reproductive isolation and specification events in the animal group (Wells, 1977). Male anurans use vocalization to advertise their species identity, sex and location to females for the purpose of breeding. The Western Ghats of India have been identified as one of the hot spots of biodiversity in the world. It harbors more than 100 species of anurans (Daniels, 1997a,b). However, bioacoustic studies on Indian anurans are limited to only a few species (Kanamadi,1996). The Indian Bronzed Frog *Rana temporalis* is widely distributed in Western Ghats of India (Daniels, 1997), and also found in Sri Lanka (Dutta, 1992, 1997). Except for the distribution records (Inger & Dutta, 1989) there are practically no other reports on this species. In the present study we describe the advertisement call of *R. temporalis* for the first time.

Field studies were carried out from 1996-1999 in different parts of the Western Ghats. Calling sites were marked based on the vocalization around Sagar (16° 37' N 76° 51' E), Jog (14° 45' N 74° 53' E), Shimoga (13° 56' N 75° 38' E), Sringeri (13° 25' N 75° 15' E) and Kollur (13° 53' N 74° 53' E). A few calling frogs were collected for taxonomic studies. The frogs were identified in the laboratory by using available taxonomic keys (Boulenger, 1890., Daniel & Sekar,1989). Later they were confirmed by the Zoological Survey of India, Southern Regional Station, and Dr. M.S. Swaminathan Research Foundation, Chennai. Advertisement calls were recorded on SONY, Super FE cassette tapes using AKAI AJ 490 FS tape recorder (4.8cm/s speed) and AKG, D707, C/190 directional microphones. Microphones were held at a distance of 4-6 cm away from the frogs. Sound pressure level was measured from a distance of 1m by using a LUTRON SPL meter. Air temperature and relative humidity of the calling sites were also recorded. Calls of 10 frogs were analysed at the Zoological Institute, University of Bonn, Germany by using the computer program MOSIP (R) Spectro analysis V6 8, 41 /89, MEDAV GmbH. The statistical analysis was carried out with Statagraphics Program STSC Inc., Knoxville, USA.

| Parameter | Sample size | Mean ± s $\bar{x}$ | Range |
|---|---|---|---|
| Call duration (ms) | 120 | 62.8 ± 0.8 | 47 - 88 |
| Call interval (s) | 102 | 1.41 ± 0.09 | 0.54 - 5.68 |
| Call period (s) | 101 | 1.46 ± 0.09 | 0.60 - 5.80 |

**Table 1.** Acoustic features of advertisement call of *R. temporalis* (calls of 10 randomly selected individuals were used for statistical analysis)

*Rana temporalis* is a medium sized frog (male SVL$\bar{x}$=55.3mm, n=10). Vocalization began after 2 to 3 heavy monsoon showers (June/July) and the maximum activity was observed in the early phase of monsoon (June-August). Males possess single subgular vocal sacs and emit advertisement calls by sitting on the floating vegetation or under the submerged grass. Daily calling activity began when it grew dark and continued late into the night. Calls were given in series with a long call interval (Fig. 1A). Each call consisted of a single pulse group, and the pulses within each pulse

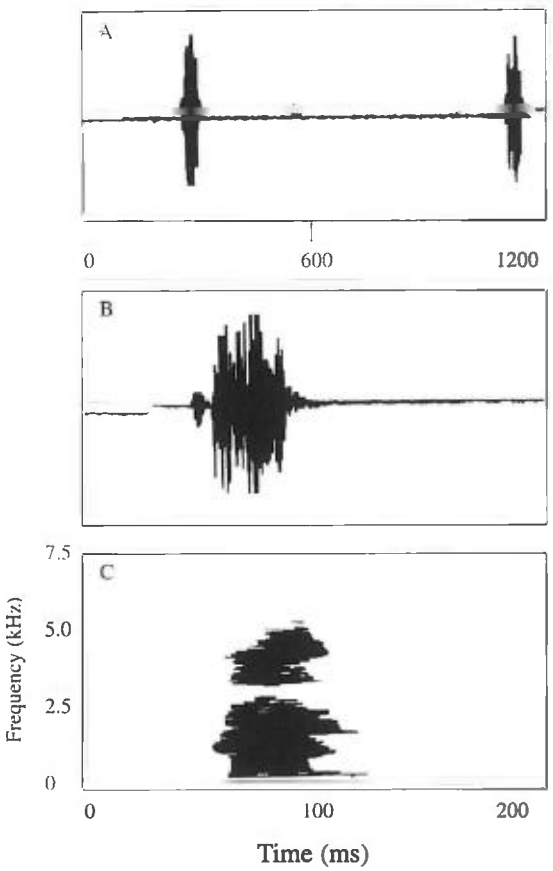


**Fig. 1** (A) Oscillogram of two advertisement calls showing long call interval, (B) oscillogram and (C) sonogram of expanded single advertisement call of *Rana temporalis* recorded at Agumbe (air temperature 20°C).

group overlap. The first 3-4 pulses are separated from the remaining pulses by a negligible interval. Acoustical features of the advertisement call are summarized in Table 1. The amplitude of the pulses in the beginning was low and later it gradually increased to maximum in the middle of the call, thereafter gradually decreasing (Fig. 1B). The sound energy was concentrated between 37 to 7200 Hz, with a dominant frequency between 2300 and 3000 Hz. The energy spectra consist of indistinct harmonics (Fig. 1C), and the sound pressure level of the call varied from 67-75 dB. Air temperature and the relative humidity at the recording site varied from 19-22° C and 87- 91% respectively.

Advertisement calls of the Indian ranids, *Rana crassa* (Kanamadi, Hiremath & Schneider, 1992), *R. limnocharis* ( Kanamadi et al., 1995) and *Tomopterna rufescens* (Kadadevaru, Kanamadi & Schneider, 2000) consist of a series of pulse groups, whereas in *R. tigrina, T. breviceps* (Kanamadi et al., 1994), and *Indirana beddomii* (Kadadevaru et al., 2000) the call consists of a single pulse group. Similarly, in *Rana temporalis* also the call consists of a single pulse group. The call interval of *R. temporalis* (ranging between 0.54s and 3.5s) is high compared to *R. tigrina* and *T. breviceps*, but it is low when compared with *I. beddomii,* where the call interval extends upto 35.12s. Amongst the Indian ranids described so far the frequency spectra of *R. tigrina* and *I. beddomii* consist of two energy bands. In *R. temporalis* also the frequency spectra consists of two bands of energy. The energy spectra of *R. temporalis,* extending between 37 and 7200 Hz, is comparable with that of *I. beddomii* (37 to 6820 Hz). In both the frogs the spectra consists of indistinct harmonics. Variations in the spectral and temporal features in the advertisement call and absence of sympatric species isolate *R. temporalis* from other frogs and helps in species recognition.

## ACKNOWLEDGEMENTS

The study was supported by a grant from DST (No. SP/SO/C-23/93) awarded to R.D.K. and partly by the SAP-II UGC grant, New Delhi. We thank University Grans Commission, New Delhi, India and German Academic Exchange Service, Bonn, Germany, for selecting the second author for study visit (1997). We also thank Dr. M.S. Ravichandran of Zoological Survey of India, Southern Regional Station, Chennai and Dr. Ranjit Daniels of Dr. M.S. Swaminathan Research Foundation, Chennai, for confirming the identifications of the frogs.

## REFERENCES

Boulenger, G.A. (1890). *Fauna of British India including Ceylon and Burma: Reptilia and Batrachia.* London: Taylor and Francis.

Daniels, R.J.R. (1997a). A field guide to the frogs and toads of the Western Ghats: India. *Cobra* **27**, 1-25.

Daniels, R.J.R. (1997b). A field guide to the frogs and toads of the Western Ghats: India. *Cobra* **28**, 1-24.

Daniel, J. C. & Sekar, A.G. (1989). Field guide to amphibians of Western India. *J. Bombay nat. Hist. Soc.* **86**, 506-522.

Dutta, S.K. (1992). Amphibians of India: Updated species list with distribution record. *Hamadryad* **17**, 1-13.

Dutta, S.K. (1997). *Amphibians of India and Sri Lanka* (check list and bibliography). Bhubaneshwar, Orissa: Odyssey

Kanamadi, R. D. (1996). Acoustic communication in some Indian anurans: A review. *Zoos' print.* **XI (8)**, 26-35.

Kanamadi, R. D., Hiremath, C. R. & Schneider, H. (1992). Vocalization and breeding period inthe South Indian tropical frog, *Rana crassa* (Jerdon). *Zool. Anz.* **28**, 26-31.

Kanamadi, R. D., Hiremath, C. R. & Schneider, H. (1994). Advertisement call of two anuran amphibians, *Rana tigrina* and *Tomopterna breviceps. J. Bio.Sci* **19**, 75-80.

Kanamadi, R. D., Hiremath, C. R. & Schneider, H. (1995). Vocalization and territoriality of the Indian frog, *Rana limnocharis. Proc. natn. Sci. Acad.* **B59**, 489- 500.

Kadadevaru, G. G., Kanamadi, R. D.& Schneider, H. (2000). Advertisement call of two Indian ranids, *Indirana beddomii* and *Tomopterna rufescens. Amphibia-Reptilia* **21**, 242-246.

Wells, K.D.(1977). The courtship of frogs. In *The Reproductive biology of Amphibians*, pp. 233-255. Taylor, D. H. & Guttman, G. I. (Eds). New York: Plenum Press.