

# ACOUSTIC CALL STUDIES OF ANURANS IN DIFFERENT HABITATS OF CENTRAL WESTERN GHATS

M.P. Krishna\*

\*Department of Zoology, Field Marshal K. M. Cariappa  
Mangalore University College, Madikeri 571201, Karnataka, India.

## Abstract

Anuran vocalization surveys are widely used as a technique for monitoring the occurrence of populations of amphibians. The comparison of advertisement calls of different populations has played a major role in the detection of cryptic species worldwide. Acoustic studies of anurans were carried out during rainy seasons (June-October) in the year 2016 in plantation habitats of central Western Ghats (coffee, cardamom and mixed plantations). The call recordings and analysis of calls were made by standard methods. Acoustic call features of three anuran species were analyzed in the present study. They include *Duttaphrynus melanostictus*, *Fejaryarya caperata*, and *Hylarana temporalis*. The call of each species is distinctive and is a good guide for field identification.

**Keywords:** acoustic, breeding, habitat, plantation, vocalization

## Introduction

Acoustic calling activity is intense during May to August and decreases noticeably during September to October. Calling begins after sunset at 18.30 – 19.0 h and continues till late night. The call at the breeding season is one of the principal means of guidance for individuals of a species to gather at suitable breeding sites. Among vertebrates, advertisement calls by males are widespread in mammals, birds and amphibians (Schneider and Haxhiu, 1994; Welch *et al.*, 1998; Doutrelant *et al.*, 2000). In anurans, It is well known that the mating call is an important behavioral isolating mechanism and no two species have been found to have the similar call (Blair, 1958; Gerhardt, 1994; Ryan and Rand, 1993). The preferential response of females to the mating calls of conspecific males often maintain reproductive isolation among population. Anuran activity patterns are dynamic and are affected by changes in the climatic conditions (Ossen and Wassersug, 2002). The call of each species is distinctive and is a good guide for field identification.

In anurans advertisement calling play a vital role not only in territorial maintenance but also in female attraction (Bunnell, 1973; Wells, 1977; Narins and Capranica, 1978). Female mate choice is often based largely or exclusively on advertisement call characteristics (Ryan and Rand, 1990; Lopez and Narins, 1991; Gerhardt, 1994). There are only few reports on acoustic behaviour of anurans in Kodagu district are available

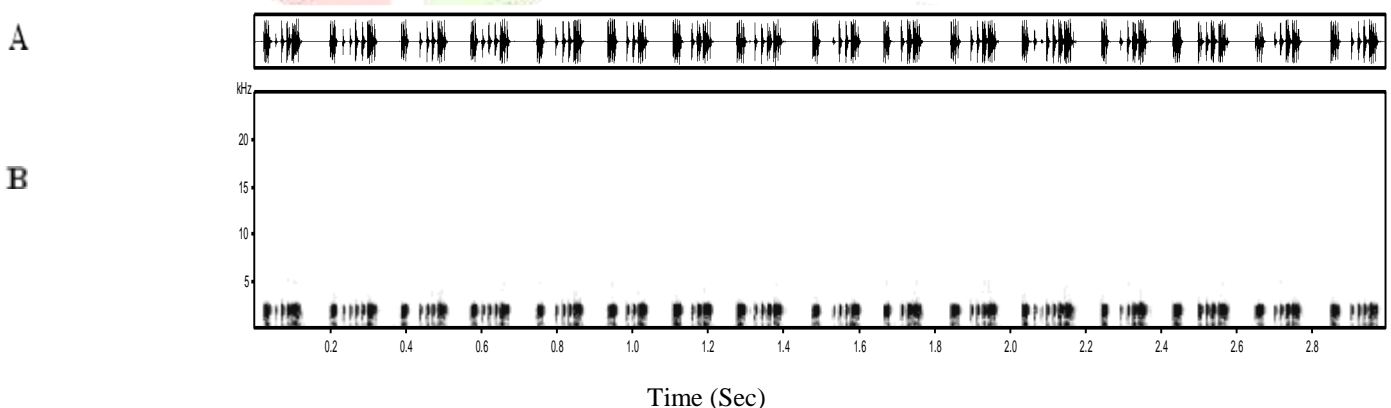
(Kuramoto and Joshy, 2001; Hampson and Bennet, 2002; Krishna and Sreepada, 2010). Hence acoustic call structures of three species of anurans that are distributed in the different plantation habitats of Western Ghats, Kodagu district are carried out in the present study.

## Materials and Methods

Acoustic studies of anurans were carried out during rainy seasons (June-October) in the year 2016 in plantation habitats of central Western Ghats (coffee, cardamom and mixed plantations). Air and water temperature were measured at the time of call recording using a digital thermometer and atmospheric humidity was recorded using hygrometer. The call recordings were made with a Sony WMD6C (walkman) TCD5 PRO cassette tape recorders and Sennheiser ME88 microphones. Call classification and call components terminology are based on (Duelman and Trueb, 1994); (Cocroft and Ryan, 1995) and (Littlejohn, 2001). Six important call properties were analysed (Call duration, Pulse rate(s), pulse length(s) number of pulses per call, Fundamental and Dominant frequency). Oscillogram and audiospectrogram of advertisement calls were studied for call analysis using the software Avisoft-SAS Lab Pro®, Version 4.40 (Avisoft Bioacoustics, Germany).

## Results and Discussion

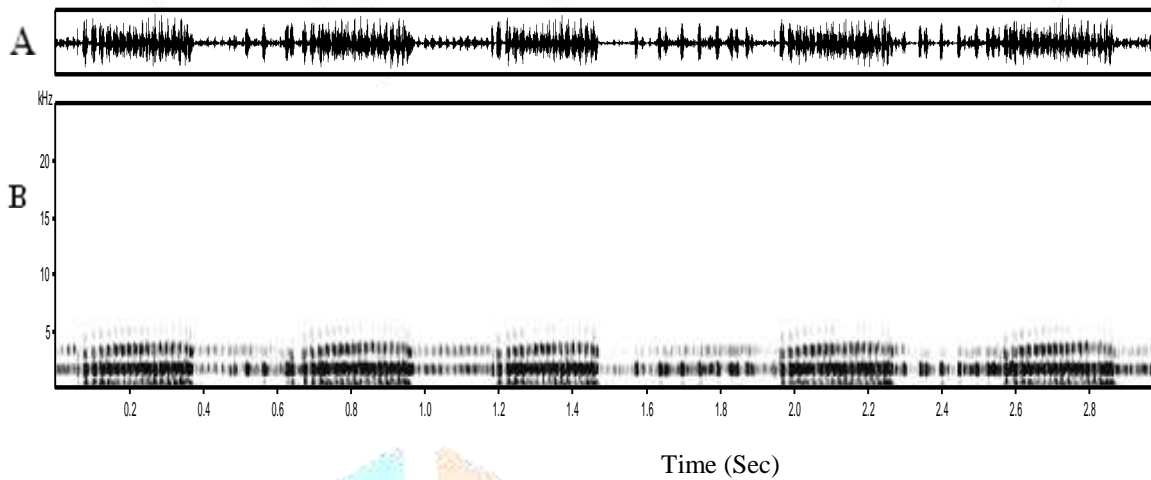
Acoustic call features of three anuran species were analyzed in the present study. They include *Duttaphrynus melanostictus*, in the family Bufonidae, *Fejarvaryia caperata*, in the family Dicroglossidae and *Hylarana temporalis*, in the family Ranidae. Average numbers for each acoustic property were calculated for each anuran species. Oscillogram and audio spectrogram of advertisement calls of three species of anurans in Central Western Ghats of Kodagu are given in Figs. 1- 3



**Fig.1.** *Duttaphrynus melanostictus* : A . Oscillogram B . Audio spectrogram

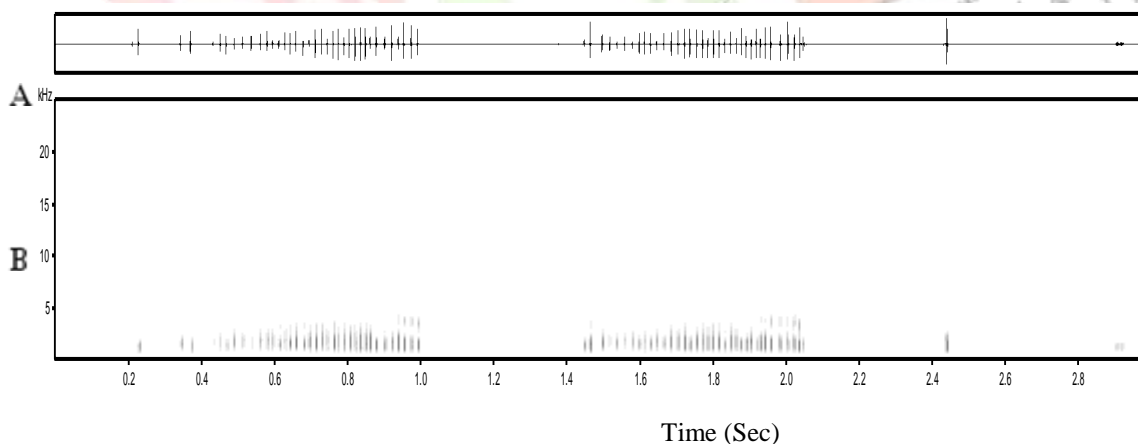
*Duttaphrynus melanostictus* (Schneider, 1799): The advertisement calls of this species was recorded near slow flowing streams in a mixed plantation at an air temperature of 24°C, water temperature of 22.5°C and humidity 75%. The duration of call was nearly 40 seconds with 42 pulses per seconds, 0.02 seconds of pulse

length. Each call constitutes 18 pulses having fundamental frequency of 0.95 kHz and dominant frequency of 2.23 kHz. Hampson and Bennet (2002) have analyzed earlier the calls of *Bufo melanostictus* and reported the fundamental frequency of 0.55 kHz and dominant frequency of 1.59 kHz.



**Fig. 2.** *Fejervarya caperata* : A . Oscillogram B . Audio spectrogram

*Fejervarya caperata* (Kuramoto, Joshy, Kurabayashi and Sumida, 2007): Advertisement calls of this species was recorded near slow flowing streams cardamom plantation at air temperature 20°C, water temperature 18.5°C and humidity 88%. Call duration were 0.07 seconds with 38 pulses per seconds, 0.004 seconds of pulse length, pulses per calls about 13, fundamental frequency 1.09 kHz and dominant frequency 2.18 kHz. Kuramoto *et al.*, (2007) have analyzed earlier the calls of *Fejervarya caperata* and reported that the call fundamental frequency 1.8 kHz and dominant frequency is 3.6 kHz.



**Fig. 3.** *Hylarana temporalis* : A . Oscillogram B . Audio spectrogram

*Hylarana temporalis* (Gunther, 1864): Calls were recorded in the banks of ponds near Coffee plantation at an air temperature of 20.5°C, water temperature of 19°C and humidity 86%. Call duration was 0.1 seconds with 35 pulses per seconds, 0.005 seconds of pulse length, each call constitutes 4 pulses, fundamental frequency of 0.99 kHz and dominant frequency of 2.31kHz. Kuramoto and Joshy (2001) have reported

advertisement call studies of this species from two different regions of Western Ghats. Dominant frequency differed significantly between populations of Kudremukh and Madikeri that is 2.73 and 2.83 kHz respectively. These variations may be due to the differences in breeding urge and body size of males. Signals are found to vary between and within individuals and between geographically separated populations of a single species (Cocroft and Ryan, 1995). Anurans use these differences in call characteristics to identify individuals of the same or different species and to signal intent. Frost and Platz (1983) have proposed that these interspecific and intraspecific differences in fundamental call characteristics such as pulse rate, duration of call, dominant frequency, or a combination of these parameters permits females to reduce the likelihood of error in mate choice. Anurans recognize individuals of the same and different species by their dominant frequencies. Duellman and Pyles (1983) have discovered that smaller frogs tend to call at higher frequencies and have a reduced auditory sensitivity compared with larger frogs.

### References

- Blair, W.F. 1958. Mating call in the speciation of anuran amphibians. *American Naturalist* 92:27-51.
- Bunnell, P. 1973. Vocalizations in the territorial behavior of the frog *Dendrobates pumilio*. *Copeia* 1973: 277-284.
- Cocroft, R.B and Ryan, M.J. 1995. Patterns of advertisement call evolution in toads and chorus frogs. *Animal behavior* 49: 283-303.
- Doutrelant, C., Blandell, J., Perret, P and Lambrechts, M.M. 2000. Blue tit song repertoire size, male quality and interspecific competition. *J. Avian Biol.* 31 : 360-366.
- Duellman, W.E and Pyles, R.A. 1983. Acoustic resource partitioning in anuran communities. *Copeia* 1983: 639-649.
- Duellman, W.E and Trueb, L. 1994. Biology of Amphibians. New York: *McGraw-Hill Book company*. pp 670.
- Frost, J.S and Platz, J.E. 1983. Comparative assessment of modes of reproductive isolation among four species of leopard frogs (*Rana pipiens* complex). *Evolution* 37: 66-78.
- Gerhardt, H.C. 1994. The evolution of vocalization in frogs and toads. *Annual reviews of ecology systems*. 25: 293-324.
- Hampson, K., and Bennet, D. 2002. Advertisement calls of amphibians at Lackunda estate, Coorg, Karnataka. In: *Frogs of Coorg, Karnataka, India*. (Bennet,D eds), Glossop Viper press. pp 121-135.
- Krishna, M. P. and Sreepada, K. S.2010. Breeding Calls of Few Frogs in Pushpagiri Wildlife Sanctuary, Central Western Ghats, Karnataka, India. *J. Theoretical and Experimental Biology* 7: 57-63.
- Kuramoto, M., and Joshy, S.H. 2001. Advertisement call structures of frogs from South Western India, with some ecological and taxonomic notes. *Current Herpetology* 20: 85-95.

- Kuramoto, M., Joshy, S.H., Kurabayashi, A. and Sumida, M. 2007. The Genus *Fejervarya* (Anura: Ranidae) in Central Western Ghats, India, with Descriptions of Four New Cryptic Species. *Current Herpetology* 26: 81-105.
- Littlejohn, M.J. 2001. Patterns of differentiation in temporal properties of acoustic signals of anurans In: *Anuran communication*. (Ryan, M.J.(eds), Washington: Smithsonian Institution Press. pp. 102-120.
- Lopez, P.T. and Narins, P.M. 1991. Mate choice in the neotropical frog, *Eleutherodactylus coqui*. *Animal Behavior* 41: 757-772.
- Narins, P.M. and Capranica, R.R. 1978. Communicative significance of the two-note call of the tree frog *Eleutherodactylus coqui*. *J. Comp. Physiol.* 127: 1-9.
- Ossen, K.L. and Wassersug, R.J. 2002. Environmental factors influencing calling in sympatric anurans *Oecologia* 133: 616-625.
- Ryan, M.J. and Rand, A.S. 1990. The sensory basis of sexual selection for complex calls in the tungara frog. *Physalaemus pustulosus* (sexual selection for sensory exploitation). *Evolution* 44:305-314.
- Ryan, M.J. and Rand, A.S. 1993. Species recognition and sexual selection as a unitary problem in animal communication. *Evolution* 47: 647-657.
- Schneider, H and Haxhiu, I. 1994. Mating call analysis and taxonomy of the water frogs in Albania (Anura: Ranidae). *Oecologia* (Berlin) 14: 99-110.
- Welch, A.M., Semlitsch, R.D and Gerhardt, H.C. 1998. Call duration as an indicator of genetic quality in male tree frogs. *Science* 280: 1928-1930.
- Wells, K.D. 1977. The social behavior of anuran amphibians. *Animal behavior*. 25: 666-693.