Acoustic variation in Alarm sound and chuckle sound of Squirrels (*Funambulus pennantii*) in Chitrakoot

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Abstract- Animals use many types of signals to communicate with each other; acoustic signals have been used to study the behaviour of Squirrels. The present study focuses on acoustic variations of squirrels (*Funambulus pennantii*). This study has been conducted in Chitrakoot during the summer and winter season between September to December. Multiple behaviour were observed in Squirrels, with data from two acoustic variation analysed. Two types of behaviour have been studied in squirrels, Alarm sound and Chuckle sound. PRAAT software has been used to study their behavior, through which sound has been analyzed through computer using PRAAT software.

Key words – Acoustic variation, Communication, Behaviour, Alarm sound, Chuckle sound.

Introduction

Acoustic signals provide root of various information about animal behavior, ecological and physiological status. Animal's use many type of communication signals to interact with each other: tactile, visual, chemical, electric and acoustic.

The International Journal of Animal Sound and its Recording discussed that Bioacoustics is cross-disciplinary science that combines Biology and Acoustics. Usually it refers to the investigation of sound production, dispersion and reception in animals (including humans). The use of Bioacoustic as a material from which to infer ecological information enables acoustics to investigate the ecology of populations, communities and landscapes. Bioacoustics is closely related to eco acoustics, but differs markedly in that eco-acoustics considers sound to be a component and an indicator of ecological processes, whereas bioacoustics is an animal behavior discipline that studies mainly sound as a signal that transfers information between individuals (Fletcher 2007).

Squirrels are present in all biogeographic zones except Australia, Madagascar, Antarctica, and other oceanic islands and deserts (Yousefi *et al.* 2013). Squirrels (*Funambulus pennantii*) it is found in the India, Nepal,

Bangladesh, Pakistan and Iran. Squirrels are very agile, which makes it difficult to study their behaviour. Squirrels are a mammalian animal which is found in the environment around us. Northern palm squirrel (*Funambulus pennantii*) also called the Five- striped northern palm squirrel is a species of rodent in the family Sciuridae (IUCN Red List Category – Least concern). To understand the different types of behaviour of squirrels, their biological sounds were studied. We can find out about Squirrels behaviour from his voice.

Methodology

Study area - Present Research work will be conduct in Chitrakoot area. The site lies approximately between the north latitude 25° 18' to 25° 20' and east longitude 80° 85' to 80° 87'. Surveys were conducted from September 2024 to December 2024 in Chitrakoot area, India. In which data collection and survey was done by observing the sounds of squirrels.

Study site selection - Chitrakoot is an important pilgrimage site or place in India. The forest type of Chitrakoot dominantly consists of tropical dry deciduous types. Three major landscapes were selected for the study of squirrels (*Funambulus pennantii*) with the aim to understand the different types of behaviour of squirrels from the sound they produce. Three sites Chitrakoot were selected such as 1. Kalikadevi mandir, 2. Biharichauk and 3. Second mukharbind and different behavior of morning and evening squirrels were observed.

Sampling Method - Some data was collected for the study of sound analysis of squirrels, in which a survey was conducted for four to six hours in morning and evening for recording the sound of squirrels. Focal animal sampling is a method commonly used in the study of animal behavior (Altman, 1974).

Required apparatus - Different types of equipment are used for acoustic analysis of squirrels like sound recorder, Mic, sound level meter, PRATT application and Acoustic software platform.

Result

This study was focused on acoustic variation analysis of wild animals in various squirrels (*Funambulus pennantii*) sound which is helpful to highest lowest frequency and amplitude in different condition or situation of their living.

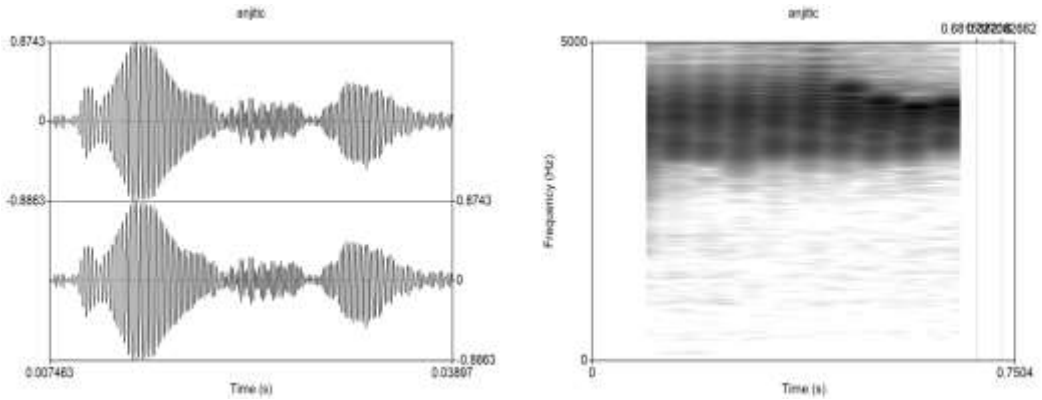
In this Research work, Two types of vocalization of Squirrels have been studied:

1. **Alarm sound** **2. Chuckle sound**

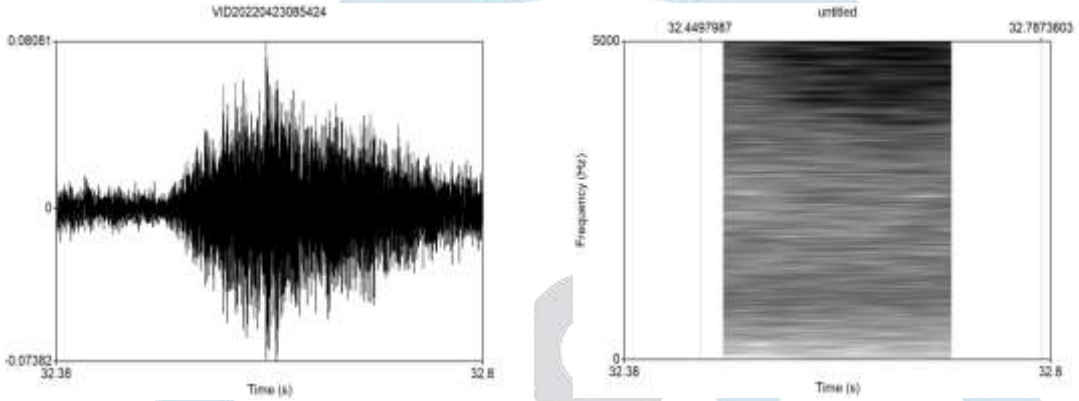
Fig. 1- Behavioral activities of *Funambulus pennantii*

Acoustic Variation of *Funambulus pennantii*

- **Alarm Sound -** The sound was recorded during morning. Squirrels use vocal communication to talk to each other and in the morning most of the Squirrels (*Funambulus pennantii*) are seen playing with each other and their mean pitch and intensity is quite high.
    - **Duration -** 2.774 seconds
    - **Intensity –** 78.361dB
    - **Mean pitch –** 435.939 (±138.86) Hz



- **Chuckle Sound -** The sound was recorded during evening time. Squirrels look very happy after eating nuts and they were running happily on the branches of trees.
    - **Duration -** 1.199 seconds
    - **Intensity –** 52.162 dB
    - **Mean pitch –** 249.722 (±23.34) Hz



Discussions

Acoustic analysis of the vocal communication of Northern Palm Squirrel (*Funambulus pennantii*), can provide valuable insights into their behaviour, communication, and ecological interactions. In the process of comparison among acoustic properties of their calls, pattern, and functions were used. Characteristics of acoustic variation were analyzed in relation to their functions such as same species communication, territory defence, alarm behaviour and foraging behaviour. The study found evidence supporting the hypothesis that *Funambulus pennantii* utilize their distinct vocal repertoire to convey information about their different acoustic variation status and individual identity.

The present study indicates that five- striped palm squirrels *Funambulus pennantii* display different activities during morning and evening and two types of behaviours acoustic variation were observed in *Funambulus pennantii* (Alarm sound and Chuckle sound), Which the pitch and intensity of the Alarm sound is the highest. Through the acoustics variation of squirrels, we observed when they were most happy and when they were protecting themselves from other animals. All these activities help in understanding their behaviour.

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