ABSTRACT

Doctoral Dissertation

Three genera *Murina*, *Harpiocephalus* and *Harpola* of tube-nosed bats (Murininae) and two genera *Kerivoula* and *Phoniscus* of woolly bats (Kerivoulinae) are currently recognized. The members of these groups are small to medium-sized or slightly large bats of the vespertilionid bats with a distribution throughout Asia, from northeastern Pakistan, eastwards to Siberia, Korea and Japan, southwards to northeastern Australia, except for Kerivoulinae, which have a wider range to Africa.

Recent studies indicated that the species number of *Murina* rapidly increased with thirty-five recorded species from Southeast Asia. The subfamily Kerivoulinae is currently contains twenty-six species. However, the taxonomic status of both subfamilies remains problematic by appear the complex species, particularly the intraspecific variation of possible cryptic species, *Kerivoula hardwikii* as well as the generic status of *Kerivoula* and *Phoniscus*.

Recent studies on the species diversity and taxonomy of afore-mentioned groups were also based on diagnostic characters (e.g., fur color, forearm length, and skull characters) to identify the species. Nevertheless, comprehensive skull morphometric analyses based on sufficient number of specimens and species have never been carried out for these subfamilies.

In this study of Doctoral Thesis, field surveys were conducted from 2001 to 2014 in forty-three sites of twenty-eight provinces of Vietnam and a collection of 424 specimens of tube-nosed and woolly bats was examined for morphological characteristics. Based on morphometric variation among and within species, I intended to identify and evaluate the interspecific and intraspecific variation in skull size and shape. In additional I discussed the taxonomy, distribution, habitat use and the morphological diversification of tube-nosed and woolly bats in Vietnam. Principal
component analysis (PCA) and Canonical variate analysis (CVA) were used for multivariate analysis of craniodental measurements, skull size and shape of all species. Moreover, karyological data of seven species were also provided. Principal findings of the study are arranged as follows:

1) The genus *Murina*: Morphological diversification were found among sympatric species pairs and between sexes of *Murina* in Vietnam. The diversification of sexual dimorphism in genus *Murina*, which *M. harrisoni* showed that the differences in skull size and shape might be due to the functional limitations and compensation of the skull. Further investigation suggests that morphological variability also exists in the nasal capsule or braincase and this is possibly in relation to echolocation function, that echolocation may have strongly affected for the complicated morphological and species diversity.

2) The subfamily Kerivoulinae: *Phoniscus* clearly separated from *Kerivoula* based on measurements of the braincase height, interorbital width, and the shape of anterior part of the palatal bones. Statistic analysis also revealed the morphological variation in the skull shape of *Kerivoula hardwickii* in Vietnam. This suggests a possible separation of three morphotypes, representing cryptic species supported by statistic differences variation in skull size/shape and teeth.

3) In this study, detail morphology, distribution, and taxonomic note of the subfamily Murininae were provided. Vietnam harbors the highest species diversity of Murininae with fifteen recorded species. Five of them are common species, found in more than ten localities and six species have limited distribution ranges of which four are rare species. Kon Tum Province in the Central Highlands of Vietnam has the highest number of bat species with ten recorded species. The results also indicated that the forearm length and the skull length are significantly different among sympatric species pairs and between sexes. It is assumed that the skull size and shape are affected by food habits and echolocation function, while the forearm and external morphology is more related to fly behavior and aerial niche use of the Murininae species.

4) The study first provided the largest karyotype results of seven species in Vietnam, of which, five are newly recorded for the bat fauna from Vietnam. Species of *Murina* and *Harpiola* shared similar karyotypes, while *Harpiocephalus* differs from both afore-mentioned genera by having one more pair of chromosome and it is suggested that to have evolved by the inversion of the acrocentric pair in the *Murina* karyotype during the evolution of the genus *Harpiocephalus*. Except for *Harpiocephalus*, conservative trends in chromosome re-arrangement in the subfamily Murininae were confirmed in this study.
Photos

Skull specimens used in this study and publication

*Harpiocephalus harpia*  
*Harpiola isodon*

*Murina beelzebub*  
*Murina chrysochaetes*