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**USING GENETICS AND MORPHOLOGY TO EXAMINE
SPECIES DIVERSITY OF OLD WORLD BATS:
REPORT OF A RECENT COLLECTION FROM MALAYSIA**



Field party at cafeteria of Bako National Park, Sarawak, Malaysian Borneo. Sitting: Faynella Saing Laman, Faisal Ali Anwarali Khan, Vicki J. Swier, Charlie J. Laman, Huzal Irwan Husin. Standing, first row: Besar Ketol, Flora Williams, Laila Ibrahim, Ida Nivina Pathe, Fredonia Bajik Laman. Standing, second row: Wahap Marni, Mohammad Tajuddin Abdullah, Robert J. Baker, Peter A. Larsen, Sergio Solari. Photo by Charlie J. Laman.



Field party at entrance of Kubah National Park, Sarawak, Malaysian Borneo. Sitting: Faisal Ali Anwarali Khan, Huzal Irwan Husin. Standing, first row: Ahmad Mashur Julaihi, Besar Ketol, Mohidin Rajuli (Park Warden), Vicki J. Swier, Fong Pooi Har, Jayaraj Vijayakumaran, Sergio Solari, Andy Kho Han Guan, Nurhaliza Hassan. Standing, second row: Wahap Marni, Robert J. Baker, Peter A. Larsen. Photo by Peter A. Larsen.

Front cover: Top left: *Macroglossus sobrinus* (TTU 108207); top right: *Hipposideros coxi* (TTU 108272); bottom left: *Megaderma spasma* (TTU 108347); bottom right: *Saccolaimus saccolaimus* (TTU 108286). Photos by Robert J. Baker.

USING GENETICS AND MORPHOLOGY TO EXAMINE SPECIES DIVERSITY OF OLD WORLD BATS: REPORT OF A RECENT COLLECTION FROM MALAYSIA

FAISAL ALI ANWARALI KHAN, VICKI J. SWIER, SERGIO SOLARI, PETER A. LARSEN, BESAR KETOL, WAHAP MARNI, SIVANATHAN ELLAGUPILLAY, MAKLARIN LAKIM, MOHAMMAD TAJUDDIN ABDULLAH, AND ROBERT J. BAKER

ABSTRACT

A three-week field survey was conducted to sample bat species diversity in Malaysia. The survey sampled five localities during August 2006, including one in Peninsular Malaysia and four in Borneo. A total of 259 specimens representing at least 50 species were recorded. Three sampling nights were spent at each locality; four harp traps and 15 mist nets were set most nights. The highest species diversity was recorded in Mount Penrisen (Borneo) with 27 species, whereas the lowest diversity was at Monggis Sub Station and Bako National Park (Borneo) with 13 species each. We added four new geographic records for Sarawak, Malaysian Borneo: *Arielulus cuprosus*, *Hesperoptenus tomesi*, *Kerivoula lenis*, and *Myotis adversus*; and the second record of *Hipposideros doriae* in Sarawak. Other findings included a colony of earwigs collected from an *Eonycteris major* and the documentation of highly developed facial glands on male *Hipposideros ater* and *H. galeritus*. Species were identified using traditional skin and skull characteristics as well as mitochondrial cytochrome-*b* gene sequences that were compared to existing GenBank records. This multifaceted approach, using genetic and morphological identifications, has provided greater resolution to species identification as well as a better understanding of the diversification of Old World Bats from Malaysia. Although in most cases genetic data validated the present taxonomy, there were still a number of cases of cryptic species suggesting an underestimation of the actual biodiversity. This study has demonstrated the value of genetic data in providing an independent test for species boundaries among the 50 species of bats collected (about 40% of the known Malaysian bat fauna).

Key words: Borneo, Chiroptera, cytochrome-*b*, diversification, Peninsular Malaysia

INTRODUCTION

The first faunal list of bats from Malaysia (including Peninsular Malaysia, Sabah, and Sarawak) was published by Chasen (1940) and contained 84 species. Several subsequent compilations listing the Malaysian chiropteran fauna were published, each with alternative numbers of bat species (80 spp. in Malaysia and Singapore, Medway 1969; 92 spp. in Borneo, Payne et al. 1985; 307 spp. within the Indomalayan range, Corbet and Hill 1992). The most recent taxonomic synthesis identified 125 species with Malaysian distributions (Simmons 2005).

Comparing the number of species compiled within these faunal lists provides insight into the advance-

ment of capture techniques (e.g., harp traps; Francis 1989), and the resolving power (to delimit species) of methodologies and species concepts for species recognition (e.g., DNA sequencing: Avise and Walker 1999; Bradley and Baker 2001; Baker and Bradley 2006). Given this, it is clear that an integrated approach using morphology and genetics has the potential to provide better resolution of species and species boundaries (e.g., Francis et al. 2007; Mayer et al. 2007). It is effective to incorporate these methods into field surveys aimed at describing species diversity.

We assigned species level names to our specimens through comparison of morphology to published spe-