

The Diversity, Distribution, and Habitat Preference of Rodents in Five Contrasting Habitats in the Tropical Rainforest of Malaysian Borneo

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ABSTRACT. – Rapid land-use changes may alter rodent assemblages in Malaysian Borneo. Understanding the diversity, distribution, and habitat preference of rodents from contrasting habitats may aid in pest control and conservation plan for rare species as well as species that important for conservation in Sarawak. In view of this, rodents were surveyed using cage and Sherman's traps along several habitat gradients (primary forest, secondary forest, oil palm plantation, rural and urban areas) in Sarawak. This reveals that the highest species diversity was in the primary forest ($H'=2.03$) followed by the secondary forest ($H'=1.16$), which decreased along the habitat gradient. *Maxomys whiteheadi* appeared as the indicator species in the primary forest ($IndVal=0.894$, $p=0.033$). *Rattus tanezumi* ($n=155$) appeared as the generalist followed by *Sundamys muelleri* ($n=63$) ($PDI=0.61$ and $PDI=0.75$, respectively). Meanwhile, three habitat specialists were detected ($PDI=1.00$), namely *Leopoldamys sabanus*, *Maxomys surifer*, and *Niviventer rapit* in the primary forest. Habitat preference analysis shows that most forest species were avoiding disturbed habitats and few species were recorded in disturbed habitats. This survey may provide information to aid various stakeholders in understanding rodent ecology for conservation purposes and pest control mitigation plans in Sarawak.

KEYWORDS: Muridae, *Rattus tanezumi*, distribution, habitats gradient, Sarawak.

INTRODUCTION

Rodents are the largest family among mammals, as they cover over 40% of all mammalian species worldwide (Gorbunova et al., 2008; Delaney et al., 2018) and approximately 27% of the terrestrial mammalian diversity in Borneo (Phillipps and Phillipps, 2018). Being considered primary consumers, rodents are the main prey species for predators as well as important dispersers for both seeds and herbage (Krebs, 2001; Mulungu et al., 2008). Due to their extensive ability to live and adapt to a wide range of environmental conditions as well as sharing human food resources, they are recognised as pests and important spreaders of zoonotic diseases (Dossou et al., 2020; White and Razgour, 2020). Rodents cause damage to equipment and structures, spoil crops and livestock production, and also cause food contamination resulting in approximately millions of dollars of economic losses annually (Rahdar et al., 2016).

Rodents show habitat preferences by corresponding to vegetation heterogeneity throughout their life strategies where their diversity can be influenced by habitat variability and resources (Cramer and Willig, 2002; Fitzherbert et al., 2007). Their distribution and abundance are influenced by environmental factors such as vegetation density, climatic conditions, predators, disease and human interference (Johnson and Horn, 2008). In this study, we refer to the Muridae as an ideal family since they are highly explorative,

quick response to environmental changes, and able to live in a wide range of habitats (Dammhahn et al., 2020).

Habitat destruction and alteration have been the biggest threats to most mammals in the tropical rainforest to this date (Azlan, 2006). Sarawak covers 37.5% of land in Malaysia with a major portion of the area being occupied by tropical rainforest (Sa'adi et al., 2017; Jaafar et al., 2020). These areas experience a high forest reduction annually due to urbanisation and agricultural purposes (Kamlun et al., 2012). Agricultural sectors in Sarawak were dominated by oil palm plantation with massive expansion over the years and has reached over 1.5 million hectares of land area (Mohd Azlan et al., 2019; Jaafar et al., 2020). This massive land-use intensification may have influenced the habitat preference, diversity, distribution and population of rodents (Zhang et al., 2016; Morand et al., 2019; Palmeirim et al., 2020).

The loss of several rodent native species and others that were able to survive in disturbed forests have been documented years ago by Wells et al. (2007a), Rickart et al. (2011), and Wells et al. (2014). Accelerated tropical forest fragmentation could result in the total extinction of native species (Gibson et al., 2013). Despite the various studies on rodents that have been conducted in Sarawak (Nakagawa et al., 2006; Ng et al., 2017; Pui et al., 2017; Blasdell et al., 2019), it is highly unpredictable to verify which species will endure the intense urbanisation and the landscape conversion of the natural environment (Chung and Corlett, 2006). To this date, the rodent relationship