Chapter 9
Morphometric Analysis in Stingless Bee (*Apidae meliponini*) Diversity

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ABSTRACT

Insects occur in large numbers. Therefore, it is important to have a system to identify the different species of insects. Traditional morphological identification of insects requires an experienced entomologist while molecular techniques require laboratory expertise and involve substantial costs. Due to that, there has been a dramatic increase of studies using morphometric analysis in understanding the systematics, taxonomy, and diversity of stingless bees. Morphometric analysis is a powerful tool as it is effective with minimum technical experience. It is a simple technique because of the current availability of cheap computer technology equipped with software, and at the same time, this method preserves the physical integrity of the shape measured. Morphometric analysis makes it credible to recognise morphological disparity and lead ways to explore the causes, both within and between, the stingless bee populations.

INTRODUCTION

Insect pollinators are important in improving crop productivity and helping achieve optimum pollination during flowering. The evolution of self and maintenance of mixed mating systems is theoretically affected by pollination ecology (Brunet & Sweet, 2006). The stability, diversity, and function of natural and agricultural plant

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communities are influenced by insect pollinators (Saunders, 2018). The quality and quantity of crop yields in the agricultural system are influenced by insect pollinators that provide the ecosystem service. In contrast, the natural system is influenced by plant reproduction and community (Saunders, 2018). The majority of the pollinating insects are from the order Hymenoptera.

In insect nomenclature, Hymenoptera is the third largest insect order and probably the most beneficial to humans of all insect orders. Like other hymenopterans, stingless bees are members of the class Insecta under the family Apidae and live in colonies (groups). The order of Hymenoptera is called "Hymen," which comes from the Greek word meaning god of marriage because the forewing and hind wings are joined together with small hooks (hamuli). There are two pairs of membranous wings (Plate 1) and three pairs of legs located at the thorax, divided into coxa, trochanter, femur, tibia, and metatarsus sections and claws (Plate 2). Most stingless bee workers have a modified hind legs structure and a corbicular (pollen basket) for collecting and transporting pollen and other materials. After a foraging activity, these pollen baskets are stuffed full of bright yellow or orange pollen.

Figure 1. The forewing of a stingless bee.

MORPHOMETRIC ANALYSIS IN STINGLESS BEE DIVERSITY

The world is facing climatic changes, which have altered certain insects' distribution and phenology (Batista et al., 2011). According to Lancaster et al. (2016), insects vary their morphological traits across climatic gradients. The variation in insect morphological traits may have benefits such as survival and enable it to colonize wide environmental tolerances (Bai et al., 2016). Different survival patterns have taken place in distinguishing insect species' resilience from different morph frequencies

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