MONITORING DIPTERA DIVERSITY USING STICKY TRAP BETWEEN DIFFERENT VEGETATION STRUCTURE

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Monitoring Diptera Diversity Using Sticky Trap Between Different Vegetation Structure

By

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A Project Report Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry Universiti Putra Malaysia

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DEDICATION

This thesis is dedicated to:

The sake of Allah, my Creator and my Master,

My great teacher and messenger, Muhammad (May Allah bless and grant him), who taught us the purpose of life,

My great parents, who never stop giving of themselves in countless ways,

To all my family, the symbol of love and giving,

My friends who encourage and support me,

All the people in my life who touch my heart,

I dedicate this research.

Thank you for everything. May Allah Bless All of us.

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ABSTRACT

Tropical forests are facing massive land use changes for agricultural expansion. This has become a major concern for overall biodiversity decline and require improved effort for biodiversity conservation especially in agricultural landscape. The current study aimed to investigate Diptera abundance and family richness between monoculture and polyculture systems. Three agricultural landscapes of orchard, rubber and oil palm plantations were selected and compared to understand the impacts of different agricultural systems on Diptera assemblages. The study was carried out in Kampung Sungai Lalah, Pedas, Negeri Sembilan. Diptera communities were sampled using sticky traps at 45 sampling points at all agricultural landscapes. From the results, a total of 1585 individuals belonging to 7 families of Diptera were recorded. Monoculture rubber plantations recorded the greatest abundance and family richness of Diptera followed by orchard and monoculture oil palm plantations. Diptera abundance and diversity in monoculture rubber plantations is explained by their important functions as pollinators for rubber trees. While, polyculture orchard showed greater Diptera abundance compared to monoculture oil palm plantations due to its diverse plant community that provide more shelter and food resources. Overall, polyculture and monoculture showed different habitat heterogeneity, however, the impacts of different agricultural systems on Diptera communities is difficult to measure. Thus, further research is required by including suitable insects as ecological indicators to highlight the impacts of agricultural systems on insects biodiversity.

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ABSTRAK

Hutan tropika menghadapi perubahan penggunaan tanah secara besar-besaran untuk pengembangan pertanian. Ini telah menjadi kebimbangan utama penurunan keseluruhan biodiversiti dan memerlukan usaha yang lebih baik untuk pemuliharaan biodiversity terutamanya di kawasan pertanian. Kajian ini mengkaji kelimpahan Diptera dan kekayaan famili antara sistem monokultur dan polikultur. Tiga landskap pertanian iaitu; dusun buah, getah dan kelapa sawit telah dipilih dan dibandingkan untuk memahami system pertanian yang berbeza terhadap perkumpulan Diptera. Kajian ini dijalankan di Kampung Sungai Lalah, Pedas, Negeri Sembilan. Komuniti Diptera ditangkap menggunakan perangkap melekat berwarna kuning pada 45 titik pensampelan di semua landskap pertanian selama 28 hari. Hasilnya, sebanyak 1585 individu yang terdiri daripada 7 famili Diptera telah direkodkan. Getah monokultur mencatatkan kelimpahan terbesar dan kekayaan famili Diptera diikuti ladang kelapa sawit. Kelimpahan dan kepelbagaian Diptera di ladang getah monokultur dijelaskan oleh fungsi penting mereka sebagai pendebunga untuk pokok-pokok getah. Sementara, dusun buah polikultur memperlihatkan kelimpahan Diptera yang lebih besar berbanding ladang kelapa sawit monokultur kerana komuniti tanaman yang pelbagai yang menyediakan lebih banyak sumber perlindungan dan makanan. Secara keseluruhannya, polikultur dan monokultur menunjukkan heterogeniti habitat yang berbeza, bagaimanapun, impak sistem pertanian yang berbeza pada Diptera adalah sukar untuk diukur. Oleh itu, penyelidikan selanjutnya diperlukan dengan memasukkan serangga yang sesuai sebagai penunjuk ekologi untuk menunjukkan kesan sistem pertanian terhadap biodiversiti serangga.

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APPROVAL SHEET

I certify that this research project report entitled “Monitoring Diptera Diversity Using Sticky Trap Between Different Vegetation Structure” by Azyyati Binti Hasan has been examined and approved as a partial fulfillment of the requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry, Univeristi Putra Malaysia.

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CHAPTER 1

INTRODUCTION

1.1 General Background

Agriculture has become one of the major economic sector worldwide to ensure food security. In Malaysia, agricultural sector has contributed 8.9% of the total national output. Agricultural sector is essential for economic growth as agricultural products not only provide raw materials for many industries, but also food production. Kuznets (1973) summarizes four main channels through which agriculture contributes to economic growth; a forward linkage result (agriculture providing food and raw materials to non-agricultural production), a backward linkage result (agriculture overwhelming industrial merchandise like insect powder or tractors), inter-sectoral transfers (agriculture contributes taxes and low cost labour to alternative sectors), and exchange (through agricultural exports). Oil palm has become one of the most dominant industrial crop in Malaysia due to its high demand for edible oil (MPOC, 2008). This has triggered a rapid expansion of oil palm plantations and Malaysia has now become the second largest producer after Indonesia for palm oil production (USDA, 2007). However, the rapid expansion of agricultural land especially oil palm plantations from natural forests areas is a major concern for biodiversity losses (Sodhi et al., 2010).

Forest degradation has been a major threat to tropical biotas worldwide (Dirzo & Raven, 2003). Forest conversion into agricultural lands involves forest clearance that lead to the loss of overall biodiversity (Wilcove & Koh,

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2010). Some animal species may persist under agricultural landscapes especially insectsthrough conservation management such as riparian forest buffers that provide refuge for forest-specialist species (Koh & Wilcove, 2008). Different agricultural systems can have different impact on biodiversity conservation (Ghazali et al., 2016). Agricultural systems such as monoculture and polyculture may have different impacts on insect communities due to variation in habitat complexity. Monoculture is represented by the production of a single crop within an agricultural landscape. While, polyculture is represented in agricultural practices that interplant more than one crop species.

Agricultural expansion caused decline in the diversity and abundance of insects (Jones et al., 2003). Insect such as flies (Insecta: Diptera) plays a major role in ecosystem functioning providing diverse ecological functions (Keiper, et al., 2002). Diptera are closely associated with human as they are commonly found in urban environment and often considered as crop pest and vector of serious diseases. However, some species do play an important role under natural environment by maintaining ecosystem through decomposition and pollination. For instance, the feeding habits of flies have profound impacts on natural decomposition as their larvae can be herbivores, scavengers and decomposers for decaying organic matter within an environment. In additon, most Diptera larvae are scavengers that contribute to the decomposition of organic material, which in turn, provides nutrients for plants and support a better ecosystems. Besides that, flies also served as an effective pollinators for various flowering plants and fungi (Sutherland et al.,

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2001). Some Diptera species are also an effective predator and an important food resource for other animals such as birds and amphibians. Due to this, Diptera can become a useful bioindicator to assess environmental disturbance (Khairiyah et al., 2013).

1.2 Problem Statement and Justification of Study

Different agricultural management between monoculture and polyculture practice can have different impact on insect biodiversity (Cunha & Juen, 2017). Agricultural landscapes such as orchard, oil palm and rubber plantations may harbour different insect community due to different habitat complexity. However, most studies have focused mainly on insect groups such as butterfly (Benedick et al., 2007) and ants (Bruhl et al., 2010) in agricultural landscapes. Diptera contribute significantly to the overall biodiversity as they play an important role for decomposition and pollination. Despite this fact, studies to assess the impacts of different agricultural systems on Diptera communities are still lacking.

The diversity and abundance of Diptera can be related to vegetation structure and microclimatic conditions in different agricultural landscapes. Diptera has shown successful adaptation to changes in environmental conditions. However, studies looking at the impacts of forest conversion into agriculture lands on Diptera communities are largely overlooked. Biodiversity conservation in agricultural lands requires an assessment of diverse insect communities as each insect group plays an important ecological functions

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within an ecosystems. Thus, the present study will provide information regarding the effects of agricultural intensification on Diptera diversity and abundance for conservation management.

1.3 Objective

The study aimed to determine Diptera diversity and abundance in three different agricultural landscapes between monoculture and polyculture systems. The specific objectives of the study were (i) to assess Diptera number of family and abundance using sticky trap under different agricultural management and (ii) to investigate the effects of microclimatic conditions and vegetation structure on Diptera distribution and assemblages. The study test the prediction that habitat heterogeneity within an agricultural landscape can provide more resource availability to sustain insect populations such as Diptera.

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