COMPARISON OF ARTHROPOD RICHNESS AND ABUNDANCE BETWEEN THREE DIFFERENT AGRICULTURAL HABITATS

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COMPARISON OF ARTHROPOD RICHNESS AND ABUNDANCE BETWEEN THREE DIFFERENT AGRICULTURAL HABITATS

By

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DEDICATION

Thanks and praise to Allah S.W.T. for giving me better life and these chances.

Dedicated this thesis to:

For my beloved family:

Kamaruzzaman Bin Mokhtar, Rosmiha Binti Mohamed Nor

and also, my siblings.

For my respected supervisor,

Dr. Badrul Azhar Bin Md. Sharif

Who has encouraged me, helped and give so much support during conducting this research and in my study.

For my supportive friends,

Afifah, Ruby, Mohsin, Mizan, Lijan, Syafiq, Iffah

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

ABSTRACT

The conversion of natural forests into agricultural landscapes in Southeast Asia has been caused by the high global demand for rubber and oil palm. This results in a negative impact on overall biodiversity. The study aimed to examine the arthropods abundance between three different habitat types, namely fruit orchards, monoculture rubber plantations and oil palm plantations. This study was conducted at Kampung Ulu Sepri, Kampung Empang Batu and Kampung Batang Sepri located in Pedas, Negeri Sembilan. Arthropod sampling was carried out using pitfall trap at 90 sampling points with 100 meters distance between points in each habitat. Overall, a total of 12,942 arthropods made up of 14 different orders were recorded. Fruit orchards recorded the highest number of individuals (5011 individuals), followed by rubber plantation (4546 individuals) and oil palm plantations (3385 individuals). The fruit orchards were characterised by greater habitat heterogeneity. A variety of plant species provide food sources and habitats for arthropods. Fruit orchards can maintain greater arthropod diversity than monoculture habitats. Management of agricultural habitats is crucial for arthropod community and conservation.

ABSTRAK

Penukaran hutan semula jadi ke landskap pertanian di Asia Tenggara adalah disebabkan oleh permintaan global yang tinggi untuk getah dan kelapa sawit. Hal ini demikian, menghasilkan kesan negatif ke atas keseluruhan kepelbagaian biodiversiti. Kajian ini bertujuan untuk mengkaji kelimpahan arthropod antara tiga jenis habitat yang berbeza, iaitu dusun buah, ladang getah monokultur dan ladang kelapa sawit. Kajian ini dijalankan di Kampung Ulu Sepri, Kampung Empang Batu dan Kampung Batang Sepri yang terletak di Pedas, Negeri Sembilan. Pensampelan arthropoda dilakukan menggunakan lubang perangkap di 90 titik pensampelan yang mempunyai jarak 100 meter antara titik di setiap kawasan perladangan. Secara keseluruhannya, sejumlah 12942 individu Arthropoda yang terdiri daripada 14 order yang berbeza telah direkodkan. Bagi kajian ini, dusun buah-buahan mencatatkan bilangan individu Arthropoda yang tertinggi (5011 individu), diikuti dengan perladangan getah (4546 individu) dan ladang kelapa sawit (3385 individu). Oleh itu, dusun buah dicirikan oleh heterogeniti habitat yang lebih besar. Pelbagai spesies tumbuhan menyediakan sumber makanan dan habitat untuk arthropoda. Dusun buah-buahan dapat mengekalkan kepelbagaian arthropoda yang lebih besar daripada habitat monokultur. Pengurusan habitat pertanian adalah penting untuk komuniti dan pemuliharaan arthropoda.

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APPROVAL SHEET

I certify that this research project report entitled “Comparison of Arthropod Richness and Abundance between Three Different Agricultural Habitats” by Intan Farha Shamim Binti Kamaruzzaman 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, Universiti Putra Malaysia.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
FAO	Food and Agriculture Organization of the United Nations
HSD	Honestly Significant Difference
IUCN	International Union for Conservation of Nature

CHAPTER 1

INTRODUCTION

1.0 Background of Study

The Global Forest Resources Assessment (2015) stated that deforestation has decreased and afforestation has expanded in 1990-2015 (Sloan & Sayer, 2015). Nonetheless, forest lost at a global scale reach 13 million hectares anually (FAO, 2010a) with 200 km^2 each day (IUCN, 2015). The major cause of tropical deforestation is mainly due to forest conversion into agriculture land. In Malaysia, agriculture was divided into two categories which are food crops (vegetables, fruit and grain crops) and industrial crops (oil palm, rubber, tea) (Ng, 2016).

In major oil palm producing countries forest conversion is estimated to cover 270000 ha from 2000-2011 (Vijay et al., 2016). Conversion of oil palm is one of the major factors causing biodiversity declining. However, agricultural management and practices can be improved to ensure biodiversity conservation. For example, the forested habitats in tropical landscapes represents coffee agroforestry shaded by a diversity of natural or planted trees. Diversity of trees supports a high variety of birds, including species that depend on closed canopies and endangered migratory birds by shaded of coffee, which can be found in coffee plantations in higher densities than in natural forest (Tscharntke et al., 2005).

Earlier studies have shown that the local biodiversity decreases due to intensification of agricultural management as seen in monoculture systems (Bengtsson et al., 2005). The post war transformation of traditional to modern causes main biodiversity losses and then, declining of biodiversity may affect ecosystem functioning and yield (Russell 1989; Daily 1997). The intensification of agricultural practices and simplification of agroecosystem may affect significant ecological services via the loss of biodiversity (Tscharntke et al., 2005). This can be seen by crop production, pest control, pollination and decomposition processes (Daily 1997; Altieri 1999; Schläpfer et al. 1999; Tilman et al. 2002; Wilby & Thomas 2002). The potential for disservices from agriculture also affect management practices, including loss of habitat for preserving biodiversity, nutrient runoff, sedimentation of waterways, and pesticide poisoning of humans and non-target species (Zhang et al. 2007). In effort to accomplish environmentally sustainable, ecological intensification has been promoted to buildup ecosystem functions that regulate and support production (Pywell et al., 2015). The ecosystem functioning was influenced by the functional characteristics of species such as their traits directly by mediating changes in biotic controls and indirectly through responses to changes in local environment (Wood et al., 2015).

Tropical forest is well known for its diverse insect colonies. Insects dominate the food web of these forests from terrestrial to aquatic ecosystem. The threat to tropical ecosystem is well expressed because of forest degradation and land conversion to agriculture lead to population decline of tropical insects (Lowe et

al., 2005). Insects consist of the most diverse and successful group of multicellular organisms on the planet, and they commit significantly to vital ecological functions such as pollination, pest control, decomposition, and maintenance of wildlife species (Losey & Vaughan, 2006).

In agricultural land, habitat heterogeneity is lower compared to forest area, but agricultural land still supports few insect communities for food resources and pollination. Arthropods can become a crucial ecological indicator to measure biodiversity friendly practices in agricultural landscapes such as ants and bee (Hymenoptera), beetles (Coleoptera), spiders (Araneae) and true bugs (Heteroptera) species (Hendrickx et al., 2007). The ecological processes on local environment influence local species diversity and also affect with land-use intensity (Tscharntke et al., 2005).

1.1 Problem Statement

Natural forest area has been converted into agricultural lands which lead to arthropod biodiversity loss (Ewers et al., 2009). Arthropods provide ecosystem services such as pollination, natural predator and decomposer. Deforestation and unsustainable agriculture negatively affect ecosystem services provisioned by arthropods. Assessment effort to investigate the effect of land used changes on arthropod biodiversity is still lacking. Arthropods community can become a significant ecological indicator to promote agricultural management and practices that can support biodiversity conservation.

1.2 Justification

Arthropods represent an ideal model organism to determine agricultural system that is biodiversity-friendly. Complex habitats such as polyculture system such as fruit orchard, may have more niches and diverse environmental resources compared to monoculture system (Bazzaz, 1975). Thus, this can increase species diversity and habitat heterogeneity in polyculture system due to complex vegetation structure. However, different monoculture plantations such as rubber and oil palm plantations may support different arthropod communities. This study will provide more information about arthropod community between monoculture and polyculture systems.

1.3 Research Objectives

This study set out to determine arthropod abundance at three different agriculture habitats. The specific objective was to compare the number of arthropod orders between monoculture (oil palm and rubber plantations) and polyculture (fruit orchard) systems.

1.4 Research Questions

The present study asks the following questions; (i) Is there any differences in abundance of arthropod between monoculture crop plantations and agroforestry farms (ii) Is there any differences in vegetation structure between monoculture crop plantations and agroforestry farms.

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