

**THE DIVERSITY OF MACRO-MOTH IN GOMANTONG VIRGIN JUNGLE
RESERVE AND KLIAS PEAT SWAMP FOREST RESERVE**

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IJAZAH: SARJANA MUDA DENGAN KEFUJIAN (BIOLOGI PEMULIHARAAN)

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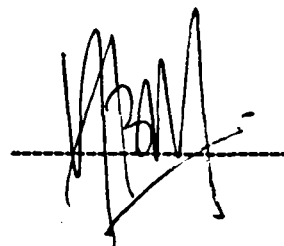


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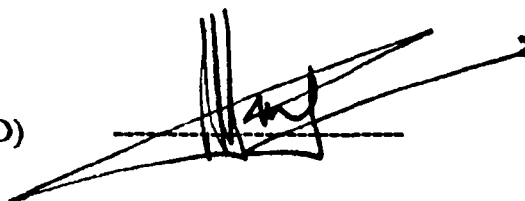
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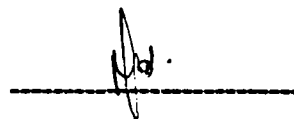
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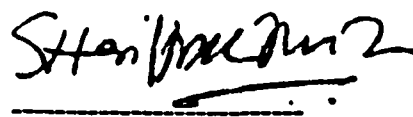
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ABSTRAK

Satu kajian kepelbagaian rama – rama makro telah dijalankan di Hutan Simpan Dara Gomantong dan Hutan Simpan Paya Gambut Klias dengan menggunakan kaedah perangkap cahaya. Persampelan telah dijalankan sebanyak dua kali di setiap kawasan persampelan di mana setiap sesi dijalankan selama 48 jam (12 jam x 4 malam). Objektif kajian ini adalah (1) menghasilkan senarai semak rama – rama makro di Hutan Simpan Dara Gomantong dan Hutan Simpan Paya Gambut Klias. (2) melihat kepelbagaian yang ada di kedua – dua kawasan persampelan. Daripada kajian ini, sebanyak 244 individu rama – rama makro, yang terdiri daripada 120 spesies telah berjaya direkodkan di Hutan Simpan Dara Gomantong manakala di Hutan Simpan Paya Gambut Klias, 105 individu rama – rama makro yang terdiri dari 54 spesies telah berjaya diperoleh. Hasil menunjukkan bahawa diversiti rama – rama makro adalah lebih tinggi di Hutan Simpan Dara Gomantong ($H'=3.705$) berbanding Hutan Simpan Paya Gambut Klias ($H'=1.630$). Ini kerana, Hutan Simpan Dara Gomantong menyediakan habitat hutan yang merupakan tempat tinggal rama – rama makro, yang lebih baik berbanding Hutan Simpan Paya Gambut Klias. Oleh itu, kajian ini mencadangkan habitat rama – rama perlu diberi perhatian sewajarnya daripada aspek konservasi supaya populasi rama – rama di kedua – dua kawasan kajian ini dapat dikekalkan.



ABSTRACT

A study of diversity of macro – moth has been carried in Gomantong Virgin Jungle Reserve and Klias Peat Swamp Forest Reserve. Sampling was done by using light trap twice at both sampling areas where each session comprises of 48 hours sampling (12 hours x 4 nights). The study aims on (1) producing a checklist of macro – moth at Gomantong Virgin Jungle Reserve and Klias Peat Swamp Forest Reserve. (2) to assessed the diversity of macro – moth at both sampling areas. From this study, a total of 244 macro – moth individuals comprises of 120 species were collected at Gomantong Virgin Jungle Reserve, whereas in Klias Peat Swamp Forest Reserve, 105 macro – moth individuals from 54 species were recorded. Results show that the diversity of macro – moth is higher at Gomantong Virgin Jungle Reserve ($H' = 3.705$) compared to Klias Peat Swamp Forest Reserve ($H' = 1.630$). There is a possibility that the diversity of macro – moth at Gomantong Virgin Jungle Reserve is higher compared to Klias Peat Swamp Forest Reserve because of the present of higher diversity of host plant for macro – moth at Gomantong Virgin Jungle Reserve. Since this is a preliminary study, we hoped that this effort will be continue by other researcher, in order to maintain the diversity of macro – moth.



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LIST OF SYMBOLS

$^{\circ}\text{C}$	=	Degree Celsius
m	=	Meter
mm	=	Millimeter
km^2	=	Square kilometer
H'	=	Shannon Index value
p_i	=	proportion of individuals found in the i th species.
D	=	Simpson's Index value
n_i	=	the number of individuals in the i th species
N	=	the total number of individuals



CHAPTER 1

INTRODUCTION

1.1 Introduction

A moth is an insect closely related to the butterfly. Both came from order Lepidoptera. The division of Lepidopterans into moths and butterflies is a popular taxonomy, not a scientific one. Many efforts have been made to subdivide the Lepidopterans into groups such as the Microlepidoptera and Macrolepidoptera, Frenatae and Jugatae, or Monotrysia and Ditrysia. Most moth species are nocturnal, but there are some that is crepuscular and diurnal species. Night-blooming flowers usually depend on moths (or bats) for pollination, and artificial lighting can draw moths away from the flowers, affecting the plant's ability to reproduce. A hard skeleton composed of chitin with soft parts of body inside usually present among adult moth. This chitinous exoskeleton burden certain limits on the development of group together with spiracular system of respiration. An adult moth usually has all the basic structure of moth. These basic structure consist of head, eyes, antennae, wings, and legs. There are slight differences



between moth and butterflies as they came from same group. The wings of moth will folded into a roof like shape as they were in rest. They do not close their wings like butterflies do.

1.2 Structure

1.2.1 Antenna

The antennae of moth often scaled and segmented. These antennae carry by the head of the moth itself. The antennae of moth can be various. They may be simple (filiform), unipectinate, bipectinate, doubly bipectinate, ciliate, setose-ciliate, lamellate, fasciculate or they can be the combination of these. The antennae of female moth are simpler than the antennae of male moth which is more complicated. Thus, the antennae can be used to distinguish the sexes.

The antennae are diverse compared to butterflies. The antennae of moth can be threadlike, feathery, tiny spoon shaped attachment, or spurred. Male moth often has complex antennae compared to male moth that have simpler antennae.



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The antennae are diverse compared to butterflies. The antennae of moth can be threadlike, feathery, tiny spoon shaped attachment, or spurred. Male moth often has complex antennae compared to male moth that have simpler antennae.



1.2.2 Eyes

At the base of the antennae are the compound eyes. They usually seen as prominent black globules. Those compound eyes may be hairy, smooth or lashed. Although it is difficult to see these hairs or lashes in old or worn set specimens, these distinctions are considerable importance.

1.2.3 Mouth

The mouthparts of adult moth primarily consist of proboscis, which consist of two high modified maxillae, together they held by a series of hooks and spikes to form a tube. This tube used to sucked liquid food. The proboscis of moth are varies. It can be atrophied or short. Sometimes it is totally absent in certain species. Some of it may be longer than the body of moth itself and it is fitted for sucking nectar of long trumpet-shaped flowers which is at the base of it.

1.2.4 Thorax

The thorax of moth consists of three parts, prothorax, mesothorax and metathorax. A pair of leg carried by each parts. The mesothorax hold the front wings while smaller metathorax hold the hind wings.



1.2.5 Legs

A pairs of legs carried by each part of these thoraxes. The wings of moth usually covered with scales on both upper and underside and they are membranous. In classifying Lepidoptera, venation of the wings is a subject of considerable important. The legs of moth divided into five segments. One of the important features in classification are the different number of legs.

1.2.6 Wings

The wings of the moth have a bristle and catch arrangement that linked the fore and hind wings. This enable the wings to move in unison. Moth also fold their wings into roof like shape when they were in rest. The wings of moth usually covered with scales and membranous on both upper and lower sides.



1.3 Objectives

This study aims:

- 1.3.1 To assess the diversity of moth at Klias Peat Swamp Forest Reserve and Gomantong Virgin Jungle Reserve.
- 1.3.2 To produce the checklist of moth at Klias Peat Swamp Forest Reserve and Gomantong Virgin Jungle Reserve.
- 1.3.3 To compare the diversity of moth between Klias Peat Swamp Forest Reserve and Gomantong Virgin Jungle Reserve.

1.4 Scope and Limitation of the study

This study is focused on macro moths that attracted to the light trap during sampling session between 6pm till 6am and the areas were limited to accessible areas of each forest reserve.

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CHAPTER 2

LITERATURE REVIEW

2.1 Rainforest

In the world's forest, a fairly continuous canopy formed by the growing of tall trees that grows closely enough over a broad region. Rainforest are the forest that is essentially oxygen neutral with little or no net oxygen production. Rainfalls are the main characteristic used to characterize this forest. The minimum or normal rainfall of the rainforest falls between 1750 mm and 2000 mm (Starr, 1994).

Tropical forests are characterized by the greatest diversity of species. They occur near the equator, within the area bounded by latitudes 23.5 degrees N and 23.5 degrees S. Tropical forests distinct seasonality where winter is absent. Only two seasons are present at the tropical rainforest which are rainy season and dry season. The length of daylight at this forest is 12 hours and varies little. Tropical rainforests exist in the Amazon Basin, in Nicaragua, in much of southeastern Asia from Myanmar to Indonesia and Papua New Guinea, northern and eastern Australia and in the Hawaiian Islands (Minkoff,1996).



The temperature of the tropical rainforest is on average 20-25° C and it varies little throughout the year (Minkoff,1996).

Precipitation is evenly occurring throughout the year in the tropical rainforest, with annual rainfall exceeding 2000 mm (Minkoff,1996).

Decomposition in the tropical rainforest is rapid and soils are subject to heavy leaching. Because of this, soil of tropical rainforest is nutrient-poor and acidic (Minkoff,1996).

Layers of tropical forests are multilayered and continuous. There are five layers that is emergent layers, canopy layers, understory layers, shrub layers, and forest layers. Multilayered and continuous layers of tropical rainforest allowing little light penetration (Minkoff,1996).

Flora of tropical rainforest is highly diverse. The trees are 25-35 m tall, with buttressed trunks and shallow roots, mostly evergreen, with large dark green leaves. Plants such as orchids, bromeliads, vines (lianas), ferns, mosses, and palms are common in tropical rainforest (Minkoff,1996).

Fauna of tropical rainforest are varies. They include numerous birds, bats, small mammals, and insects (Minkoff,1996).



Tropical rainforest can be divided into a few subdivisions that is evergreen rainforest, seasonal rainforest, semievergreen forest and moist or dry deciduous forest (Minkoff,1996).

2.2 Temperate rainforest

Temperate forests have well-defined seasons with a distinct winter. This type of forest occurs in eastern North America, northeastern Asia, and western and central Europe. Moderate climate and a growing season of 140-200 days during 4-6 frost-free months distinguish temperate forests (Smith,1999).

The temperature of temperate forest varies from -30°C to 30°C (Goodall, 1994).

Precipitation is occurring evenly throughout the year in the temperate forest with annual rainfall 75-150cm (Goodall, 1994).

Soil of temperate forest is fertile where they were enriched with decaying litter (Goodall, 1994).

Layers of temperate forests are also multilayered and continuous. There are five layers that are emergent layers, canopy layers, understorey layers, shrub layers, and forest layers. The canopy of temperate forest is moderately dense and this allows light to penetrate. This events resulting in well-developed and richly diversified understory vegetation and stratification of animals (Goodall, 1994).



Trees of temperate forest are distinguished by broad leaves that are lost annually. The flora of temperate forest includes species such as oak, hickory, beech, hemlock, maple, basswood, cottonwood, elm, willow, and spring-flowering herbs (Goodall, 1994).

The fauna of temperate forest is diverse and squirrels, rabbits, skunks, birds, deer, mountain lion, bobcat, timber wolf, fox, and black bear are common (Goodall, 1994).

2.3 Deforestation of rainforest

Rainforest had been deforested at alarming rate nowadays. Tropical rainforest had disappear at rate of 150,000 square kilometers per year (150,000 km² /day) and now it is estimated that 40 percent of the world's rainforest had been destroyed (Minkoff, 1996).

There are a few factors contributing deforestation. The growth of human population is the major factor (Minkoff, 1996). The increase of human population will also increase the need of food, medicine and space to live. In order to fulfill these needs, humans will deforest forest and this get worse from day to day.

2.4 Wildfire and burning of rainforest

The major reason for burning forest is for agriculture needs. Farmers burn the forest to release the nutrients the trees have stored back to the earth. The trees in



small area cut and burned. This will thereby release their stored nutrients back to soil and the land will be fertile for few years (Feri, 1996).

2.5 The diversity of Gomantong Virgin Jungle Reserve

Gomantong Virgin Jungle Reserve situated in the eastern lowlands of Sabah, in the district of Sandakan. Gomantong has humid tropical climate with an average annual rainfall of about 2600mm and mean diurnal temperatures ranging from 22°C to 32°C (Scott, 1989).

The landscape of Gomantong Virgin Jungle Reserve was made up from soft sandstones and mudstones. This forest reserve was logged from early 1950s. Most of their lowland rainforest has being replaced by cocoa and oil palm plantations.

This study conducted at this area for a reason that is to study the moth diversity at the logged forest and compare them to the other type of forest.

2.6 The diversity of Klias Peat Swamp Forest Reserve

Klias Peat Swamp Forest Reserve situated at South West of Sabah. It is located in the Beaufort District district. Klias Peat Swamp Forest Reserve is surrounded by more than 20 villages.



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