

**DIVERSITY OF MANTIS
(INSECTA: MANTODEA) IN SABAH,
MALAYSIA**



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UMS
UNIVERSITI MALAYSIA SABAH

**INSTITUTE FOR TROPICAL BIOLOGY AND
CONSERVATION
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2011**

**DIVERSITY OF MANTIS
(INSECTA: MANTODEA) IN SABAH,
MALAYSIA**

LING KAI LIN



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(INSECTA: MANTODEA) DI SABAH,
MALAYSIA**

LING KAI LIN



**TESIS YANG DIKEMUKAKAN UNTUK
MEMENUHI SYARAT MEMPEROLEHI IJAZAH
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ABSTRACT

DIVERSITY OF MANTIS (INSECTA: MANTODEA) IN SABAH, MALAYSIA

This study was carried out to investigate diversity and provide current species checklist of mantis in Sabah. To date, this is the first study of mantis in Sabah that is conducted on a long-term basis. This study was carried out in Lower Kinabatangan where two study sites were used which was Sukau Village (SV) and Gomantong Virgin Jungle Reserve (G.VJR); and Danum Valley Conservation Area (DVCA). Six samplings have been conducted (August 2008-June 2009) which consisted of 20 days sampling respectively at each study site. Mantises were sampled using light-trap and manual collection techniques. Additional method, baited trap was carried out for one week in DVCA to test the effectiveness of the method to sample mantises. In this study, a total of 40 species (824 individuals) belonging to seven families were collected. This result represented approximately 39% out of 102 species of mantises that were recorded in Borneo. The dominant family was Mantidae. A total of four families representing 11 species with 75 individuals were recorded from SV (disturbed area, D/R); this followed by 15 species with 143 individuals belonging to five families in G.VJR (Class VI protected area, P-VI) and seven families which included 35 species with 606 individuals were recorded from DVCA (Class I protected area, P-I). These sampling sites shared three species (8%) with 288 individuals (28%). *Gildella suavis* was sampled only using baited trap. Most of the mantises were sampled during night time (809 individuals, 98%) and using light-trap (700 individuals, 85%). The most dominant species was *Hierodula* sp. 1 making up 17% (139 individuals) of total mantises collected and eight singletons were sampled. There were two unidentified species and indicated as sp. 1 and sp. 2. A total of 21 species from six families were new records for Sabah. The Shannon-Wiener diversity index, H' was higher in P-I compared to the two other study sites ($D/R=1.91$, $P-VI=2.1$, $P-I=2.72$). Similarly result for Margalef's diversity index, D_{Mg} and Simpson's index, $1/D$. The diversity indices were compared between sampling sites using 95% bootstrap confidence limits and showed the same result for H' , D_{Mg} and $1/D$. Pairwise comparisons using randomization tests for H' , D_{Mg} and $1/D$ showed that there were significant different ($p<0.05$) in species diversity between D/R & P-I and P-VI & P-I; not significant different ($p>0.05$) between D/R & P-VI. Overall, light-trap was the most effective method compared to manual collection and baited trap. Apart from gathering information on diversity, data collection on life history, behaviour and ecology were also included in this study. For life history, different stages of mantis were observed. For mantis's behaviour, defensive strategy and mating activity of *Amantis reticulata* were observed. For their ecology, oothecae attacked by ants and fungus infection were observed. Specimen identification was the major problem of this study due to lack of literature on key for identification of mantises.

ABSTRAK

*Kajian ini telah dijalankan untuk menyelidik kepelbagaian dan menyediakan senarai semak spesies terkini bagi mentadak di Sabah. Sehingga kini, kajian ini merupakan yang pertama dijalankan dalam jangka masa yang panjang di Sabah. Kajian ini telah dijalankan di Ulu Kinabatangan di mana dua kawasan digunakan sebagai tempat kajian, iaitu Kampung Sukau (Kg.S) dan Hutan Simpan Gomantong (HSG); dan Hutan Simpan Lembah Danum (HSLD). Enam persampelan telah dikendalikan (Ogos 2008-Jun 2009), di mana melibatkan 20 hari persampelan di setiap kawasan kajian. Mentadak disampel menggunakan teknik perangkap cahaya dan persampelan secara manual. Kaedah tambahan iaitu perangkap berumpan telah digunakan di HSLD selama satu minggu untuk menguji keberkesanan kaedah ini untuk persampelan mentadak. Dalam kajian ini, 40 spesies (824 individu) yang dimiliki oleh tujuh famili telah disampel. Ini mewakili kira-kira 39% dari jumlah 102 spesies mentadak yang direkodkan di Borneo. Famili yang dominan adalah Mantidae. Sebelas spesies dengan 75 individu dari empat famili telah direkodkan dari Kg.S (kawasan terganggu, KT), 15 spesies dengan 143 individu dari lima famili dari HSG (Kelas VI, K-VI), dan 606 individu dari tujuh famili di HSLD (Kelas I, K-I). Ketiga-tiga kawasan ini berkongsi tiga spesies (8%) dengan 288 individu (28%). *Gildella suavis* telah disampel hanya dengan menggunakan perangkap berumpan. Kebanyakan mentadak disampel pada waktu malam (809 individu, 98%) dan dengan menggunakan perangkap cahaya (700 individu, 85%). *Hierodula* sp. 1 merupakan spesies yang paling dominan dalam kajian ini dengan 17% (139 individu) dan lapan singleton telah disampel. Terdapat dua spesies yang tidak dapat dikenalpasti dan dinamakan sp. 1 dan sp. 2. Sejumlah 21 spesies dari enam famili merupakan rekod baru di Sabah. Nilai indeks kepelbagaian Shannon-Wiener adalah tinggi di K-I berbanding dengan dua kawasan yang lain (KT=1.91, K-VI=2.1, K-I=2.72). Hasil yang sama bagi indeks kepelbagaian Margalef's, D_{Mg} dan indeks songsangan Simpson, $1/D$. Indeks kepelbagaian ini dibandingkan di antara kawasan persampelan dengan menggunakan 95% bootstrap confidence limits dan hasil yang sama ditunjukkan bagi H' , D_{Mg} and $1/D$. Perbandingan Pairwise menggunakan ujian kerawakan (randomization test) bagi H' , D_{Mg} dan $1/D$ menunjukkan terdapat perbezaan signifikan ($p < 0.05$) untuk kepelbagaian spesies di antara KT & K-I dan K-VI & K-I; tiada perbezaan signifikasi ($p > 0.05$) di antara KT & K-VI. Secara keseluruhan, perangkap cahaya merupakan kaedah yang paling berkesan berbanding dengan pengumpulan secara manual dan perangkap berumpan. Selain mengumpulkan maklumat tentang kepelbagaian, pengumpulan data tentang kitar hidup, kelakuan dan ekologi juga termasuk dalam kajian ini. Untuk kitar hidup, beberapa peringkat dalam kitar hidup diperhatikan. Dari segi kelakuan mentadak, strategi pertahanan dan aktiviti mengawan oleh *Amantis reticulata* diperhatikan. Dari segi ekologi, serangan 'oothecae' oleh semut dan jangkitan kulat diperhatikan. Identifikasi spesimen merupakan masalah utama dalam kajian ini disebabkan oleh kekurangan literatur untuk kekunci identifikasi mentadak.*

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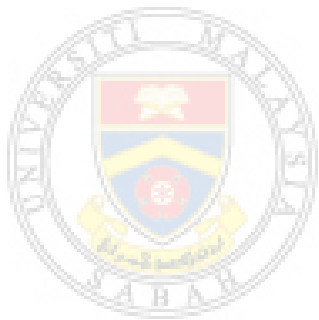
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LIST OF ABBREVIATIONS

UK	means	United Kingdom
Kg. S	means	Kampung Sukau
HSG	means	Hutan Simpan Gomantong
HSLD	means	Hutan Simpan Lembah Danum
LK	means	Lower Kinabatangan
SV	means	Sukau Village
G.VJR	means	Gomantong Virgin Jungle Reserve
DVCA	means	Danum Valley Conservation Area
P-I	means	Class I protected area
P-VI	means	Class VI protected area
D/R	means	Disturbed or residential area
H'	means	Shannon-Wiener's Diversity Index
1/D	means	Simpson's Reciprocal Index
D_{Mg}	means	Margalef's Diversity Index
CI	means	Confidence intervals
a.m.	means	ante meridiem (before midday)
p.m.	means	post meridiem (after midday)
ITBC	means	Institute for Tropical Biology and Conservation
UMS	means	Universiti Malaysia Sabah
IUCN	means	Red List of threatened species
FR	means	Forest Reserve
KWS	means	Kinabatangan Wildlife Sanctuary
WWF	means	World Wide Fund for Nature
N	means	North

E	means	East
no.	means	number
sp.	means	species
spp.	means	more than one species
<i>et al.</i>	means	and others



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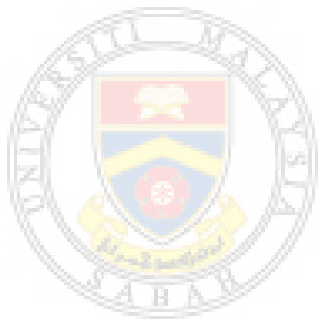
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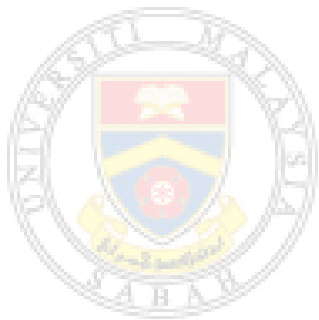
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LIST OF SYMBOLS

&	means	And
%	means	Per cent
/	means	Or
*	means	New record of Mantis for Sabah
**	means	Family of new record species
•	means	Uncertain species
✕	means	Species not taken into count for data analysis



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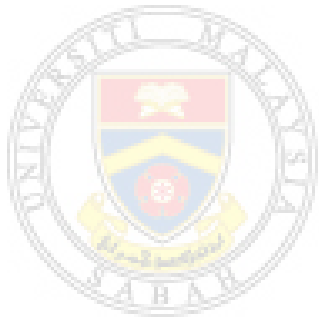
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LIST OF UNITS

km²	means	Kilometer square
cm	means	Centimeter
mm	means	Millimeter
Ha	means	Hectare
°	means	Degree (coordinate)
'	means	Minute (coordinate)
"	means	Second (coordinate)
°C	means	Degree Celsius



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CHAPTER 1

INTRODUCTION

1.1 Mantis Introduction

Mantises are fairly large insects, ranging in length from 1-17 cm. They have several local names in Malaysia, which are 'Mentadak', 'Sesembah', 'Belalang Berparang' or 'Buoyon' and in Indonesia, it is called 'Binatang Penyembah'.

The mantis derives its name from Greek language, 'mantis' meaning diviner or prophet (Feldman, 1999). Mantis also known as praying mantis. The name has also become interchangeable with 'preying', due to its fierce predatory behaviour. They also have known informally as 'soothsayers', 'devil's horses', 'mule killers' and 'camel crickets' since their saliva was erroneously thought to poison farm livestock (Feldman, 1999).

The mantis has long been a popular figure in many different cultures, and the subject of rich mythology. In France people believed a mantis would point a lost child's home (Feldman, 1999). In Arab and Turkish cultures, a mantis was thought to point toward Mecca, a site of considerable religious interest. In Africa they were thought to bring good luck to whomever they landed on, and could ever restore life into dead. In the United State they were thought to blind men and kill horses. Europeans believed they were highly reverent to God since they always seemed to be praying. In China, nothing cured bedwetting better than roasted mantis eggs (Feldman, 1999).

Mantises are found only on land in rainforests, dry forests, undisturbed and second-growth forests, or forests that grow naturally after cutting or a fire, grasslands, and deserts. Species living in grassland and meadows are usually pale yellowish brown or light green. Mantises found on leaf litter tend to be dark brown, while those found on or near flowers are yellow, white, pink, or light green. They can blend so well with surroundings like flowers, trees and leaves. This special

characteristic is called colouring camouflage to protect them from predators that hunt them for food (Balderson, 1991). Sexual cannibalism of the male by the female is another special characteristic of mantis. Adult female sometimes kill the male if she is hungry while or after mating.

1.2 The Importance of Mantis Research

Many people like to rear mantises as pets and commercial purposes, but not much basic information is available about this unique creature. For example, the information of taxonomy, diversity and ecology are poorly known, especially in Sabah. To date, the dichotomous keys used for species identification are not fully developed in some families.

Mantis is unique because it is carnivorous insect, superlative hunter, and also well known as tyrannosaurus in the gardens as it is at the top of tropic level in the Class Insecta. It eats any small animals that it can grab such as aphids, fruit flies, gnats, mosquitoes, beetles, grasshoppers, caterpillars, moths and including other mantises when no food is available. On rare occasion, they will attack other animals such as small mice, lizards, frogs, and birds. Predators of mantis are frogs, monkeys, spiders, larger birds and snakes (Feldman, 1999).

Rainforest destruction is mainly caused by human activities. Forest disturbance could lead to the reduction in structural diversity of the forest. One of the principal causes of disturbance to the rainforest of South East Asia is commercial timber utilization. Selective logging have been implemented to reduce or to minimize the effects of logging activities to it surrounding, which select and cut only large trees. Unfortunately, these trees may be widely spaced and are often situated deep in the forest. Therefore, although only a small proportion of the trees may be cut, the heavy machinery used for felling and transporting is estimated to damage a further 60-70% (Magintan, 2000).

No doubt, mantises are morphologically highly camouflage with forest characteristics such as bark, flower, grass, and trees. Therefore, they are highly

depending on forest for their survival. Without research on mantis, a lot of mantises' diversity information will lose.

1.3 Previous Study of Mantis

Previous studies regarding mantis' morphology and taxonomy (Roy,1999), ecology (Hurd, 1999), mating behaviour (Maxwell, 1999), hearing (Yager, 1999), vision (Kral, 1999), motor behaviour (Brackenbury, 1999; Prete *et al.*, 1999; Liske *et al.*, 1999), defensive behaviour (Liske *et al.*, 1999; Edmunds *et al.*, 1999) do exist but not focused on the diversity.

Currently, there is very little literature on mantises from Borneo. Bragg (2008; 2010) published records of the genus *Citharomantis* Rehn, 1909 from Borneo and a review of the family Liturgusidae. Helmkampf *et al.* (2007) published the first look at the biodiversity of mantis in Sabah and Shelford (1903) published descriptive notes on some mantises from Sarawak. So far, 102 species out of 47 genera have been recorded to occur in Borneo (Ehrmann, 2002).

In Malaysia, there was lack information for further science references. Through this study, information on diversity, life history, behaviour, and ecology of mantis based on long-term study could be gathered.