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UNIVERSITI MALAYSIA SABAH PERPUSTAKAAN UTAMA

SALTICID DIVERSITY IN FRAGMENTED AND UNFRAGMENTED LOWLAND FORESTS, SUKAU KINABATANGAN AND DANUM VALLEY

SUHAN A/L SUKUMARAN

THIS THESIS IS SUBMITTED AS A PARTIAL REQUIREMENT TO OBTAIN THE BACHELOR OF SCIENCE DEGREE IN CONSERVATION BIOLOGY

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I hereby declare that, no part of this thesis has been previously submitted for a degree for this or any other university. All works are of my own, except where indicated.

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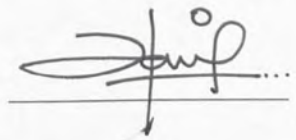

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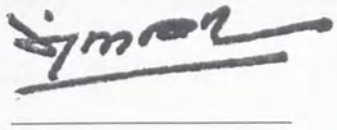

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ABSTRACT

The study concerns the biodiversity of spiders from the family Salticidae or commonly known as the jumping spiders in two areas, which are fragmented and unfragmented lowland forests. The objectives of this study include, determining whether salticids can be used as diversity indicators. This study is also to start a collection of specimens for the Borneensis collection and to provide some species identification material (type specimens) since there has been no previous research on spiders. There were a total of 29 different species collected in Danum and 18 different species in Sukau. There were a number of new records. There was no standard method followed when this study was conducted because there has yet to be any stated or made for sampling spiders. Among the methods used to collect spiders included manual collecting, aspirators and also the use of an umbrella. Samples were preserved in 70% alcohol. Identifying was done using a binocular microscope. The t-Test and Shannon-Weiner diversity index was used to determine the diversity statistically, besides computing the diversity ordering and species accumulation graphs.

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* All photographs are courtesy of Dr.Peter Koomen unless stated otherwise

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

This research is on the diversity of a family of spiders, the salticids or commonly known as the jumping spiders, in fragmented and unfragmented lowland forests, which are Danum Valley and the Lower Kinabatangan Wildlife Sanctuary. This research is to determine the variability among the Salticids in both areas to see if there is a difference in species diversity in fragmented and unfragmented habitats. It is also to start a collection of specimens for the Borneensis collection and to obtain material for species identification on salticids in Sabah. Besides this, this research is also to determine whether Salticids can be used as diversity indicators.

Both areas are suitable for research because of their ecosystems. Danum Valley is an undisturbed forest whereas Sukau is a forest, which has gone through a certain degree of disturbance. So it is clear why these places are suitable for research. Moreover, both areas are easily accessible. These areas also have adequate amenities for research.

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This is also a follow-up research of research done by other arachnologists (scientists whose research are on arachnids). There has been no significant amount of research on salticids or for that matter on other spiders here in Borneo. Among arachnologists who have done research here are Peter Koomen, Christa Deeleman, on Salticids and Frances and John Murphy who did their research about all the families of spiders in general, writing an identification manual on the spiders of South East Asia.

Among the problems faced, is the lack of literature concerning species identification and also concerning the biology of these spiders. Most articles concerning species identification of salticids here in Borneo are in foreign languages, for instance in Dutch (research papers by Christa Deeleman). Moreover, books that have been written have only discussed the biology of these spiders briefly.

Christa Deeleman still has a number of specimens from Danum, which are yet to be identified and also specimens found by Peter Koomen who has also been continuously doing research on Salticids here.

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1.2 OBJECTIVES

The objectives of this study are :

1. To determine the correlation between the diversity of the Salticids and the degree of fragmentation of the selected areas.

2. To start a collection of specimens for the Borneensis collection.

3. To have some material on species identification (reference specimens) for the Salticids of Borneo.

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CHAPTER 2

LITERATURE REVIEW

2.1 LOWER KINABATANGAN WILDLIFE SANCTUARY

Habitat fragmentation includes two processes, a reduction in total habitat area and creation of separate isolated patches from a larger continuous distribution (Frankham *et al.*, 2002). Habitat fragmentation leads to overall reductions in population size for most if not all species. Among the primary causes of biodiversity loss are human-induced, habitat loss and fragmentation, through land clearing, forestry and damming rivers.

Fragmented forests are secondary or tertiary forests, which have gone through little disturbance or severe disturbance. Large parts of the rain forests today are going through severe fragmentation. The rain forests today, only covers 6% of the world.

The Lower Kinabatangan Wildlife Sanctuary has gone through some disturbance. The natural vegetation on flood-free land throughout the Lower Kinabatangan was originally lowland evergreen dipterocarp forest. This forest is characterized by high diversity of trees, but with the family Dipterocarpaceae dominant in terms of emergent trees, basal area and woody biomass (Davison,2000). The tree

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canopy typically reaches to 60 metres, with scattered emergents of up to 80 metres. Woody climbing plants and palms are abundant.

This forest type remained essentially undisturbed until the 1950s, since when it has been replaced almost entirely by oil palm plantations (Davison,2000). Small patches of such forest remain within forest reserves, totaling about 11,000 ha in the Lower Kinabatangan Wildlife Sanctuary, but much of this has been adversely affected by logging, illegal activities, and fire during a rare long dry period in 1982–83. Few big trees remain.

The Kinabatangan River flows for 560 km eastwards to the Sulu Sea. The catchment area is 16,800 km2, and the lower part of the catchment covers about 395,000 ha, of which 330,000 ha are flood-free and 65,000 ha are potentially flooded at some time. Of the flood-prone 65,000 ha, at least 20,000 ha have been converted to agriculture, mainly oil palm (Davison,2000). The Kinabatangan floodplain is a rainforest wetland, among the most productive types of wetland and one of the most significant in Sabah (Davison,2000).

Because of their unique richness, the remaining forests of the Lower Kinabatangan are now in the process of being gazetted as a Wildlife Sanctuary (Lackman,2001). This forested corridor along the lower Kinabatangan River is bordered by many human activities, both by local communities and by extensive palm oil plantations (Lackman,2001). In addition, former habitat reduction and fragmentation have resulted in an increased rate of wildlife-human conflicts. Most likely the

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management of the future wildlife sanctuary will have to face high pressures from the growing human activities outside-and possibly inside its boundaries.

The low altitude and flood regime may be among the factors responsible for the high biological diversity of the Lower Kinabatangan. The forest types represented include lowland dipterocarp forest, forest over limestone, seasonal swamp forest, permanent freshwater swamps, floating aquatic vegetation, tidal swamp forest and mangroves (Davison,2000). The lower (seaward) end of the Lower Kinabatangan region consists of extensive mangrove forests and nipah palm stands.

The Kinabatangan Wildlife Sanctuary has been established on the advice of the Sabah Wildlife Department, acting on behalf of the Sabah State Government. It contains a mosaic of many different vegetation types, mediated by topography, soil type and hydrological conditions (Davison,2000). The sanctuary is important to Sabah as a key tourism destination, and therefore a source of revenue. It is also economically important for flood mitigation, fisheries, water supply, and reduction of sediment in run-off. At 27,000 ha, the Kinabatangan Wildlife Sanctuary is part of an important network of conservation areas in the lowlands of eastern Sabah. Together with existing Forest Reserves, a natural corridor of natural vegetation links the lower tidal reaches of the river.

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2.2 DANUM VALLEY

A primary forest, might have gone through some or at times severe disturbance but still remain unfragmented. A good example of one would be Danum Valley.

Danum Valley Conservation Area (DVCA) was designated in 1981 and is located in the Ulu Segama Forest Reserve in eastern Sabah, near the town of Lahad Datu. Danum Valley Forest Reserve is a 438 sq km tract of undisturbed, predominantly lowland rain forest located near Lahad Datu (Sabah Forestry Department,2003). It is the most valuable example of lowland dipterocarp rainforest remaining in Sabah. Formerly DVCA was part of the Yayasan Sabah Concession. The DVCA was declared a Class I (Protection) Forest Reserve in May 1995. Although it is officially known as the Danum Valley Forest Reserve, it is still commonly known as the DVCA (Sabah Forestry Department,2003). DVCA boasts an amazing diversity of animal life including the highly endangered Sumatran rhino, elephant, tembadau (banteng), sun bear, orang utan and clouded leopard. Some 275 species of birds have also been recorded, including all eight species of Bornean hornbill. The flora is no less diverse with tree species numbering over 200 per hectare. A special feature is the 'Nenga Gajah', a small arecoid palm, found in only three locations in the world. Most of the Ulu Segama region is lowland, evergreen dipterocarp forest. Taking a conventional altitudinal limit of lowland forest of 760 m asl, 91% of the DVCA can be considered lowland forest and the balance 'lower montane'. The dipterocarps make up 88% of the total volume of large trees in DVCA. At higher elevations, the vegetation is quite different, the forest canopy does not exceed 25 m, and is dominated by smaller-crowned trees, among which are the Dacrydium species and other gymnosperms.

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Figure 2.1 Location of the Danum Valley Conservation Area

The Segama River forms the eastern and southern boundary to the DVCA for more than half its length, while the left bank catchment divide the Danum River defines the northern boundary along an intermittent ridge known as the Brassy Range. Approximately 9.6% of the area lies above 760 m asl and another 36% is at lower elevation but on slopes exceeding 25 degrees. Three major summits are Mount Nicola (917 m) on the northern perimeter, the more isolated Mount Danum in the centre, and Mount Tribulation (861 m) in the upper Segama highlands to the southwest (Sabah Forestry Department,2003).

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Table 2.1 : A brief history of the process of gazetting Danum valley as conservation area and the opening of the Danum Valley field research centre

1889	Gold-prospecting expedition led by Mr. R.D.Beeston reached the upper Segama River. Hardships revealed in names of such features as Gunung Tribulation and Dismal Gorge
1942-45	Dusun farmers temporarily cultivate in Ulu Segama to avoid Japanese authority further downstream.
1970	Ulu Segama recognized as having outstanding wildlife value in Land Capability Study.
1975	World Wide Fund for Nature-Malaysia expedition to Danum Valley recommended National Park status.
1981	438 sq. km. designated as Danum Valley Conservation Area within Yayasan Sabah Forest Concession.
1984	Construction of road to site of proposed Field Centre and suspension bridge on Segama River.
Memorandum of Understanding signed among Yayasan Sabah, the Sabah Forestry Department, and Universiti Kebangsaan Malaysia - Sabah Campus to initiate Danum Valley Rain Forest Research and Training Programme. Supplementary agreement also signed with the Royal Society London, as a collaborative partner in the Programme.	
Aug 29, 1986	Field Centre officially opened by former Sabah Chief Minister, YAB Datuk Joseph Pairin Kitingan.
Nov 27, 1991	Official opening of third phase development

(Source: www.infosabah.com.my)

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2.3 GENERAL CHARACTERISTICS OF A SPIDER

Spiders belong to the class Arachnida, and the order Araneida, they are among the most successful groups of animals. Their success is based on their venom, used for defense and attack, and on the many uses of silk. The number of known species in the world is about 35,000 (Hilliyard, 1999). The correct estimate of the spider species should be 36,446 (Platnick, 2003). The classification of a spider is as follows:

Kingdom	Animalia
Phylum	Arthropoda
Sub-Phylum	Chelicerae
Class	Arachnida
Order	Araneida

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2.3.1 Anatomy

A spider is an arthropod, which means that the legs are jointed and the body has a rigid outer skeleton (Hilliyard,1999). They have eight legs and two body parts. The spiders' body consists of a cephalothorax, covered by a carapace, and an abdomen (Levi & Levi,1996).

The front of the cephalothorax is called the head, and here the eyes and chelicerae are found. At the end of the chelicerae are the movable fangs (Murphy & Murphy,2000). The cephalothorax contains the brain, venom gland and stomach (Levi & Levi,1996). The abdomen is connected to the front half of the body by a narrow waist called the pedicel. The abdomen contains the heart, digestive tract, the reproductive organs, respiratory openings and the silk glands.

Spiders make use of two different respiratory mechanisms: book-lungs and the tracheae. Each book lung can be viewed as a series of parallel plates or lamellae, each representing a flattened air sac that extends into a hemolymph chamber (Hill,2001b).

Spiders have eight legs; these legs are not only for mobility but also for sensing. They are sensory organs. Their legs have many sensitive hairs. These hairs are used to sense vibrations, chemicals, detect movement and so on. Each leg consists of seven segments.

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