MACROFUNGAL DIVERSITY OF HUTAN SIMPAN SUNGAI MENYALA AND HUTAN SIMPAN KENABOI, NEGERI SEMBILAN

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MACROFUNGAL DIVERSITY OF HUTAN SIMPAN SUNGAI MENYALA AND HUTAN SIMPAN KENABOI, NEGERI SEMBILAN

By

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A Project Report Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Wood Science and Technology in the Faculty of Forestry
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DEDICATION

For my beloved family:

Bulou @ Jainuddin Bin Kasim

Tuti Suparti Binti Ahmad Yasir

Supardin Bin Jainuddin

Shahalan Bin Jainuddin

Samsudin Bin Jainuddin

Sharinah Binti Marakus

To all my friends,

Macrofungal team members

Thank you for your encouragements supports

And the sacrifices that you have given to me.

Last but not least,

I dedicated this dissertation to my family

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

Thank you for everything. May Allah bless all of us.

ABSTRACT

Macrofungal diversity is largely ignored in terms of biodiversity conservation of forests in Southeast Asia, especially for fragmented forests. Hence, this study is conducted to study the impact of microclimate, soil moisture, soil pH and canopy cover, on macrofungal diversity in fragmented forests. A total of 133 macrofungal morphospecies found in Hutan Simpan Sungai Menyala and Hutan Simpan Kenaboi. Six environmental parameters, soil moisture, temperature, soil pH, relative humidity, canopy cover and canopy closure were observed and recorded from all sites. Result showed that the most significant factors affecting macrofungal abundance are temperature, soil pH, soil moisture, canopy cover and type of substrate. Two significant factors affecting macrofungal morphospecies richness are type of substrate and relative humidity. These result showed that both HSSM and HSK had high biodiversity values of macrofungi. This study proved that macrofungal diversity is very important in conservation and preservation of biodiversity despite the fragmented forests.

ABSTRAK

Kepelbagaian kulat makro sebahagian besarnya kurang diberi perhatian dari segi pemuliharaan kepelbagaian biodiversiti hutan di Asia Tengara terutamanya kepada hutan fragmentasi. Oleh itu,kajian ini dijalankan untuk mengkaji kesan keadaan mikroklimat, kelembapan tanah, pH tanah, dan penutupan silara terhadap kepelbagaian kulat makro di hutan yang fragmentasi. Sebanyak 133 morphospecies kulat makro yang terdapat di Hutan Simpan Sungai Menyala and Hutan Simpan Kenaboi. Enam parameter, kandungan kelembapan, suhu, nilai pH, kelembapan relatif, perlindungan kayu dan penutupan silara diperhatikan dan direkodkan dari semua habitat. Keputusan kajian menunjukkan faktor penting yang mempengaruhi lambakan kulat makro iaitu suhu, nilai pH, kandungan kelembapan, penutupan silara dan jenis substrat. Dua faktor yang penting mempengaruhi kekayaan makrofungal morfospesis ialah jenis substrat dan kelembapan relatif. Keputusan ini menunjukkan bahawa semua kajian-kajian hutan mempunyai nilai-nilai biodiversiti tinggi kulat makro. Kajian ini membuktikan bahawa kepelbagaian kulat makro amat penting dalam pemeliharaan dan pemuliharaan biodiversiti walaupun hutan yang terfragmentasi.

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APPROVAL SHEET

I certify that this research project report entitled “Macrofungal Diversity of Hutan Simpan Sungai Menyala and Hutan Simpan Kenaboi, Negeri Sembilan” by Safawati Binti Jainuddin has been examined and approved as a partial fulfilment of the requirements for the Degree of Bachelor of Wood Science and Technology in the Faculty of Forestry, Universiti Putra Malaysia.

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HSK	HUTAN SIMPAN KENABOI
HSSM	HUTAN SIMPAN SUNGAI MENYALA

CHAPTER 1

INTRODUCTION

1.1 Background

Biodiversity defines as a comprehensive umbrella term for the variety of natures. In general, it refers to variety forms of life on earth. Biodiversity not only includes all organisms, species, and populations; but also includes the variation of genetic among these, and their complex assemblages of communities and ecosystems (Mutia, 2009). Biodiversity play an important role in the forest and the impact of it is huge enough to affect the forest itself because of the species itself (Paquit & Pampolina, 2017). Nowadays, scientists become more interested in studying fungi in the context of biodiversity and taxonomy due to the emerging technologies and discoveries unveiling the importance of the group.

Fungi refers to various eukaryotic organisms, most of these organisms are 'true fungi' and classified in Eumycota kingdom. Fungi are one of the most important components of the ecosystem. It comprise the largest biotic community after insects and include thousands of lineages, from the mushroom-forming fungi to yeasts, rusts, smuts, mould, and other symbionts with differing phenotypic and genotypic features (Hasan & Gupta, 2012). There are 1.5 million fungi present in the world but only half of it have been identified and characterized so far (Hasan & Gupta, 2012).

Macrofungi are a group of fungi which produce mature spore-bearing and morphologically distinct fruiting bodies (Arnolds, 1992; Redhead & Berch, 1997). In an earlier study, Chang and Miles (1987) defined macrofungi as

large and clear fruiting body, can be observed with the naked eye and easily picked up by hand. There are a large variation and number in macrofungi. Therefore, the variation in size, colour, texture and shape of the cap and stalk are the obvious characters that need to be observed in identifying macrofungi (Chang & Miles, 1987).

Malaysia is listed as one of the top 17 mega-biodiverse countries in the world and suspected to hold a rich fungal biota (Lee et al., 2012). Yet, the forests in Peninsular Malaysia are underexplored and even less attention was given to the study of fungi. Previously, Corner (1970; 1994) was the only researcher who actively searched for and documented fungi in Malaysia. However, the efforts of one researcher are hardly sufficient to cover the diversity in the vast Malaysian forests. Hutan Simpan Sungai Menyala and Hutan Simpan Kenaboi are forest reserves rich in macrofungal. Strange puff-ball like fungi and bright yellow mushrooms are the fungi can be seen in Hutan Simpan Sungai Menyala (Rahman, 2009). Richness in macrofungal can be a very interesting tourist attraction for both forest reserves. Unfortunately, there is limited information about macrofungi can be provided and used a guidelines.

Moreover, the depletion of forest and climate changes brings negative effects to macrofungal species and richness. Macrofungal diversity could be one of the key drivers to ecosystem change which is expressed by the number of species and its richness (Tedersoo et al., 2014). Changes in community of fungi may well reflect the degree of decline of a forest (Tedersoo et al., 2014). The change of landscapes and its effect in macrofungal diversity is reported by Syuhada and co-workers (2016). They found that environment condition such as air temperature, humidity, soil pH, soil moisture and wind speed affect

macrofungal diversity in Peat swamp forest, monoculture oil palm smallholding and polyculture oil palm smallholding. These shows that the species abundance and richness of macrofungi is closely related to the environmental condition such as temperature and relative humidity which can be considered as microclimate, soil condition which include moisture and pH and canopy closure (Anon,2005).

Therefore this study intends to answer these questions by investigating the effect of microclimate (temperature and relative humidity), soil condition (moisture and pH) and canopy closure on macrofungal species abundance and richness; generating a baseline data on macrofungal species composition found in Hutan Simpan Sungai Menyala and Hutan Simpan Kenaboi.

1.2 Problem Statement and Justification

Although macrofungi have perhaps the longest history of diversity of any group of fungi, they are nevertheless understudied over most of the world. More data are available from North America and Europe compared to other regions (Mueller et al., 2006). Mueller et al. (2006) reported that they have compiled an estimated total of 56, 679 macrofungi, but their compiled list includes little to no data from most of South East Europe, Africa, western Asia or Tropical Eastern Asia. Same situation goes to Malaysia. Corner (1972), in his report suggested that the forests in Malaysia are the most complicated in the world, yet the diversity in Malaysia is underexplored. There is no accurate figure for the fungal diversity of macrofungi in Malaysia, and many taxonomic groups remains undocumented for the country (Noorlidah et al., 2005). In

Malaysia, the earlier records of macrofungi were by Chipp (1921). Corner (1972) had documented the Malaysian bolete diversity with 140 species from Peninsular Malaysia of which 100 were new to science. Corner (1972) has predicted that approximately 300 bolete species existed in Malaysia. Later, there were new records and clarifications from Malaysia by Watling and Hollands (1990) and Watling (2000). However, there are 66% of the species of ectomycorrhizal fungi from Malaysia are undescribed (Lee, 2005). It is exciting to know that Chew and his team (2014) found out that *Neonothopanus nambi*, *Mycena chlorophos* and *Filoboletus manupularis* from bioluminescent species occurred in Kenaboi Forest Reserve, meanwhile strange puff-ball like fungi and bright yellow mushrooms can be seen in Hutan Simpan Sungai Menyala (Rahman, 2009). Although there are some researchers reported about fungi in Hutan Simpan Kenaboi and Hutan Simpan Sungai Menyala, but macrofungal diversity found in the forests are yet to be documented.

Apart from empirical report on macrofungal diversity, factors affecting macrofungal abundance and species richness in the forests of Malaysia are understudied. Previous studies by Boddy (1992), found that it is closely related to environment conditions. The variation of microclimate, pH and moisture of the soil condition or canopy closure in forest also have significant effects (Boddy 1992; Salerni et al. 2002). For example, one of the main factors that influence macrofungal diversity is water. Steady moisture flow will help the transportation of nutrients from mycelium to the fruiting bodies (Oei & Nieuwenhuijzen, 2005). High moisture content in substrate will result in difficult breathing for the mycelium; while, low moisture content will result in

the death of fruiting body (Chang & Miles, 2004). Humidity is another factor that can affect macro fungi diversity. For most fungi, the wide humidity range is about 20% to 70% (Pandey et al., 2001). Other factors that affect mushroom growth include moisture content, temperature, pH and light intensity (Stamet, 1993; Kadiri and Kehinde, 1999).

Based on the studies mentioned in the first and second paragraph, our knowledge of fungal community responses to environmental variation is biased by research history (1) the studies have rarely been focused on few particular species only; (2) the majority of studies only give an overview of macrofungal obtained in Peninsular Malaysia, thus, limited macrofungal information on sampling site can be obtained; (3) to obtain a clearer picture, many authors have used a limited pool of environmental factors and hence, several environmental impacts with probable significant effects remained unexplored on sampling sites. Given these complexities and research gaps, the present study has been designed in forest reserve for identification of macrofungal and investigates the relationship between microclimate, soil condition and canopy closure on macrofungal species abundance and richness.

This study can provide a new site of contiguous forest as a baseline data about macrofungal diversity that can be obtained in Hutan Simpan Sungai Menyala and Hutan Simpan Kenaboi. Since both forest reserves can be transformed to Eco-Edu Tourism Park (Rahman, 2009), identification of macrofungal can help forestry department to prepare inventory for tourism purpose. Macrofungal diversity in both reserved forest can be a new attraction for tourists and enjoy the beauty of nature.

On the other hand, the growing environment of the macrofungal community also will be recorded, and it can be used as a guideline for the growth of macrofungal. Climate change, deforestation and conversion of forest into oil palm plantation, those are some issues that can affect macrofungal species abundance and richness. It alters the growing environment of fungi and lead to death of macrofungal and decrease in macrofungal growth. Systematic study was undertaken to understand the ecology, diversity, distribution, taxonomy and economic potential of macrofungi in Hutan Simpan Sungai Menyala and Hutan Simpan Kenaboi.

After that, fungi derive nutrients from decaying organic material. Fungi found in decaying wood, litter, and duff serve to recycle nutrients (Fogel and Hunt, 1983; Hattenschwiler et al., 2005), particularly nitrogen and carbon, as well as minerals, which can then use by other organisms. Such decomposition processes also serve to physically and chemically break down soil organic matter and alter soil structure. In 2013 and 2015, Van der Wal and his research team reported finding unique fungal communities in freshly cut trees and in younger stumps, and noted that old stumps harboured more random assortments of fungal species in studying the role of fungi in decomposition of oak stumps. In southern Sweden, Tyler (1992) likewise found distinct communities of ectomycorrhizal fungi associated with early decay stages of hardwoods. These show that fungi act as decomposers, an important role in forest.

1.3 Objectives

This study aimed to identify the macrofungal species composition found in Hutan Simpan Sungai Menyala and Hutan Simpan Kenaboi and some selected environmental factors affecting macrofungal diversity. The specific objectives are as follows:

1. To identify the macrofungal species composition found in Hutan Simpan Sg.Menyala (HSSM) and Hutan Simpan Kenaboi (HSK).

2. To determine the effect of microclimate (temperature and relative humidity), soil condition (moisture and pH) and canopy closure in HSSM and HSK on macrofungal species abundance and richness.

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