

ECOLOGY OF *Melastoma malabathricum* L. IN WEST SABAH

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DECLARATION

I hereby declare that this dissertation contains my original research work. Sources of finding reviewed here in have been duly acknowledged.

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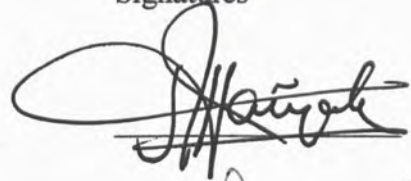

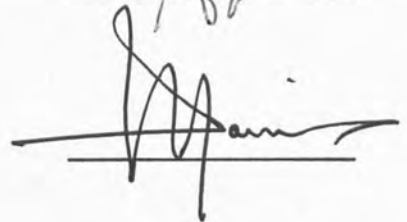
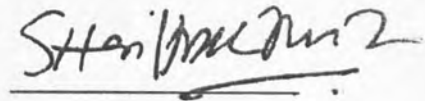
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ABSTRACT

Melastoma malabathricum L. is a well known wayside shrub found commonly in Malaysia and is the commonest member in the family Melastomataceae. In this study, the distribution of *M. malabathricum* in Klias Peat Swamp Forest and Universiti Malaysia Sabah (UMS) Hill was studied and compared by using random selective sampling method. The soil properties such as moisture, organic content and pH of these two study sites were analyzed according British Standard laboratory manual. Growth rate of plants and flower visitor observation were also included in this study. The results showed that there was a significant difference in density between the two study sites ($p < 0.05$). The density and coverage percentage of *M. malabathricum* plants in Klias Peat Swamp Forest was higher than that of UMS Hill. In Klias Peat Swamp Forest, 524 individuals were found and the density was 1.40 plant/m². There were 125 individuals found in UMS Hill and the density was 0.33 plant/m². The moisture content, organic content and pH of soil in the two study sites also showed significant difference. The soil pH acidity, percentage of moisture and organic content of soil in Klias Peat Swamp Forest were higher than in UMS Hill. The density of plants had significant strong positive correlation relationship with moisture content ($r = 0.667$, $p < 0.05$) and organic contents of soil samples ($r = 0.554$, $p < 0.05$). However, the density of plants had significant strong negative correlation with soil pH ($r = -0.615$, $p < 0.05$). Mean of tree growth rate were different in stem and branches. The growth rate of stem is faster compared to branches. Ants were the most common visitor to *M. malabathricum* flowers. Insect activity was highest between 0700 to 1200hrs.



ABSTRAK

Melastoma malabathricum L. adalah sejenis pokok renek yang kerap ditemui di tepi jalan di Malaysia dan ia terkandung di dalam famili Melastomataceae. Dalam kajian ini, taburan *M. malabathricum* di Hutan Paya Gambut Klias dan Bukit Universiti Malaysia Sabah (UMS) dikaji dan dibandingkan dengan kaedah persampelan pemilihan secara rawak. Sifat tanah seperti kandungan kelembapan, organik dan pH tanah di kedua-dua tempat kajian ini telah dianalisis mengikut panduan makmal British Standard. Kadar tumbesaran pokok dan pemerhatian serangga yang mengunjungi bunga *M. malabathricum* juga dilakukan. Keputusan yang terdapat menunjukkan kepadatan pokok di antara kedua-dua tempat kajian ini mempunyai perbezaan yang signifikan ($p < 0.05$). Kepadatan dan kelimpahan pokok di Hutan Paya Gambut Klias adalah lebih tinggi berbanding dengan Bukit UMS. Di Hutan Paya Gambut Klias, sebanyak 524 pokok dijumpai dan kepadatannya ialah 1.40 pokok/m². Sebanyak 125 pokok dijumpai di Bukit UMS dan kepadatannya ialah 1.33 pokok/m². Kandungan kelembapan, organik dan pH tanah di kedua-dua tempat kajian ini juga menunjukkan perbezaan yang signifikan. Keasidan pH tanah, kandungan kelembapan dan organik di Hutan Paya Gambut Klias adalah lebih tinggi berbanding dengan Bukit UMS. Kepadatan pokok mempunyai hubungan signifikan yang kuat dan positif dengan kandungan kelembapan ($r = 0.667$, $p < 0.05$) dan bahan organik ($r = 0.554$, $p < 0.05$). Walau bagaimanapun, kepadatan pokok menunjukkan hubungan negatif yang signifikan dan kuat dengan pH tanah ($r = -0.615$, $p < 0.05$). Min kadar tumbesaran pokok adalah berbeza di antara batang dan cabang pokok. Kadar tumbesaran batang pokok adalah lebih cepat berbanding dengan cabang pokok. Dalam keputusan pemerhatian serangga pada bunga, semut merupakan serangga yang kerap dan biasa mengunjungi bunga *M. malabathricum*. Aktiviti serangga adalah paling aktif di antara jam 0700 ke 1200.



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LIST OF SYMBOLS

Al	Aluminum
cm	Centimetre
g	Gramme
ha	Hectare
in.	Inches
m	Metre
mm	Milimeter
m ²	Metre square
mg kg ⁻¹	Milligram per kilogram
mL	Millimetre
P	Phosphorus
°	Degree
°C	Degree Celsius
%	Per cent



CHAPTER 1

INTRODUCTION

1.1 Background

Malaysia is one of the world's mega biodiversity hotspot. It has 185, 000 species of fauna and about 12,500 species of flowering plants (Premilla, 2002). In order to understand well the Malaysian flora, study on Malaysia's wayside common plants are needed (Jones, 1993). These common wayside plants are found in secondary vegetation and waste places; they also live along the roadside and the margins of forest. Wayside shrubs are able to colonize disturbed ground and spread rapidly to cover large area.

Many shrubs species that belongs to the genus *Melastoma* found in hot, dry degraded soils of wayside places and exposed site in South East Asia (Wong, 1997). *Melastoma malabathricum* L. is a well known wayside shrub found commonly in Malaysia and is the commonest member in the family Melastomataceae. The name *Melastoma* is derived from the Greek "*melas*" which means "black", and "*stoma*" which means "mouth", referring to the staining of the mouth if the



fruits are eaten. The common name of this shrub is “Straits rhododendron” or “senduduk”. It grows in poor nutrient soil. *M. malabathricum* are distributed from Mascarene Island eastward to the Pacific and is a common element of regrowth vegetation in the lowlands and hills of Malaysia, especially along forest margins and in open clearings (Jones, 1993).

Melastoma malabathricum is a free flowering shrub usually about 1-3 meter tall. Their flowers are composed of five petals, with colours ranging from dark purple to pink and white. Their stems are reddish and covered with bristly scales. The leaves are narrow and pointed at both ends. The fruits are berries, often pulpy when ripe. These fruits are usually dispersed by birds and small mammals. *M. malabathricum* is an aluminum accumulating woody plants (Watanabe & Osaki, 2001).

Melastoma malabathricum is important as traditional medicine. The leaves and roots of this plant have been used in traditional treatments for a variety of diseases (Jones, 1993). Besides contributing to folk medicine, *M. malabathricum* plays an important role in ecology. The distribution of *M. malabathricum* in Malaysia including in Sabah state has not been well studied and the value of this plant have not much been identified. Thus, information and research of *M. malabathricum* in Malaysia are important and needed.



1.2 Justification

The aim of this research is to study the ecology of *Melastoma malabathricum* in West Sabah. The density of *M. malabathricum* in two different habitat in West Sabah which are Klias Peat Swamp Forest and Universiti Malaysia Sabah (UMS) Hill were compared. Klias Peat Swamp Forest is categorized as disturbed forest because some of the areas has been burnt by fire. The soil properties of these two study areas were studied by conducting soil test for parameters such as moisture content, pH test and organic content. The relationship between the distributions of *M. malabathricum* and soil properties in these two different habitats were determined. Besides that, visitor insects on *M. malabathricum* were identified in this study. Due to the lack of information on *M. malabathricum* in Sabah, the study of ecology of this plant is important and it can be used as future references for further research.

1.3 Objectives

The objectives of the study are:

1. To compare the distribution of *Melastoma malabathricum* in Klias Peat Swamp Forest area and UMS Hill.
2. To study the soil properties (moisture, pH and organic content) of Klias Peat Swamp Forest and UMS Hill.
3. To study the flower visitors of *Melastoma malabathricum*.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction on *Melastoma malabathricum* L.

Melastoma malabathricum L. is classified under the family Melastomataceae (Jones, 1993). It is a light demanding shrub. The maximum recorded height of this species was 3 m and the height at first flowering is 0.5 m (Metcalf *et al.*, 1998). *M. malabathricum* are found at edge of stream in the forest, on old clearings or landslips. They are evergreen and blossom all year round (Burkill, 1966). This plant spreads from Madagascar and India to Australia and grows commonly in the lowland and mountain forests in Malaysia, mainly in open places (Whitmore, 1972). *Melastoma malabathricum* is native to Malaysia (USDA, 2008).



2.2 Classification

Kingdom	<i>Plantae</i>
Subkingdom	<i>Tracheobionta</i>
Superdivision	<i>Spermatophyta</i>
Division	<i>Magnoliophyta</i>
Class	<i>Magnoliopsida</i>
Subclass	<i>Rosidae</i>
Order	<i>Myrtales</i>
Family	<i>Melastomataceae</i>
Genus	<i>Melastoma</i> L.
Species	<i>Melastoma malabathricum</i> L.

(Source: United State Department of Agriculture, 2007).

2.3 Family Melastomataceae

Melastomataceae is a large family, which is composed of many herbs, shrubs, climbers and trees. This family is mostly tropical. There are about 160 genera of Melastomataceae and they are mainly in the tropical regions. Twenty genera occur in Malaysia. They can be divided into the following three sub-families: Astroniodeae, Memecyloideae dan Melastomatoideae (Hsuan, 2003).

The characteristics of this family are leaves are opposite, simple, tapered at each end, normally showing three or five, more or less equally prominent longitudinal veins. Flowers tend to be showy, pink, purple or blue, with four or five petals and twice as many stamens (Edwards, 1994).



2.4 Morphology of *Melastoma malabathricum*

2.4.1 Leaf

Melastoma malabathricum has simple leaves, narrowly elliptical (Photo 2.1). The leaves have subentire margin, cuneate base and acuminate apex. Besides that, its leaves are hairy with three prominent longitudinal veins and reddish petioles (Faridah & Shamsul, 2004). The leaves are 0.25–2 in. wide and with stalks 0.25–0.5 in. long (Corner, 1951).

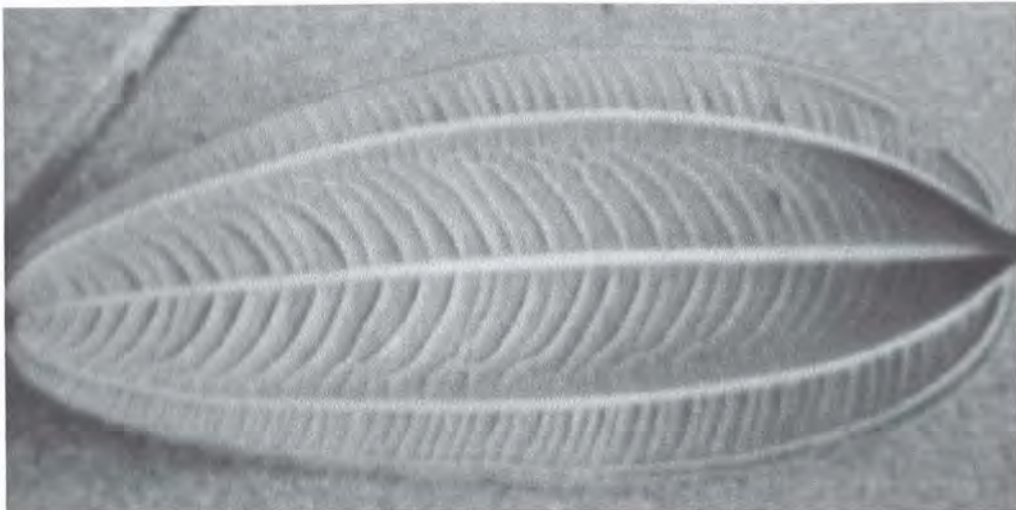


Photo 2.1 Leaf of *Melastoma malabathricum*

2.4.2 Flower

The flowers of *Melastoma malabathricum* are large, with five purple petals and yellow stamens at the end of twigs (Faridah & Shamsul, 2004) (Photo 2.2). The flowers are 1–3 in. wide, calyx closely set with short chaffy and smooth or silvery scale. This plant consists of three varieties with large, medium and small size flowers. They have dark purple-magenta petals, light pink-magenta petals, and white petals which are

considered as rare variety (Corner, 1951). According to Jones (1993), flowers of *M. malabathricum* are pink to violet- mauve.



Photo 2.2: Flower of *Melastoma malabathricum*

2.4.3 Fruits

Melastoma malabathricum has scaly berry-like fruits (Photo 2.3). The fruits are filled with an edible, purple and pulpy mass containing tiny seed. *M. malabathricum* has fruits and ripen all year, but it produce few fruits at a time (Metcalf *et al.*, 1998).



Photo 2.3: Fruits of *Melastoma malabathricum*

2.5 Medicinal Uses

The World Health Organization estimates that 80% of the population in developing countries generally depends on wild plants and animals as traditional medicines for their primary health care. In Malaysia, there are more than 1,000 species of plants reported to have medicinal properties that are used in treating common illnesses such as headaches, coughs and colds (Premilla, 2002).

Melastoma malabathricum with the white flower have healing properties (Corner, 1951). The plants have been used in traditional Malay medicine as an astringent for the treatment of diarrhea, post-partum treatment and haemorrhoids (Burkill, 1966). *M. malabathricum* is a medicinal plant used to stop bleeding in wounds and cuts. The young leaves of the plants are crushed and applied as a paste onto the wounds or cuts (Fasihuddin & Hasmah 1990). Its roots can be boiled and concoction drank to stop vomiting. However, leaves and flowers are used to cure leech bite by forest dweller and applied onto cut (Faridah & Shamsul, 2004). Besides that, the root and leaves of this plant can be used as traditional medicine to treat a variety of ailments such as dysentery, haemorrhoids, ulcers and flatulence (Jones, 1993).

Melastoma malabathricum is used in folk medicine. Different parts of this plant have been used for the treatment of several diseases. Antiemetic and antispasmodic actions are found in the leaves and shoots of this plant (Osman *et al.*, 2000). Besides that, the extraction from the leaves and roots is used to relieve toothache and also used externally to heal some inflamed wounds ((Fasihuddin & Hasmah 1990).



2.6 Economic Uses

Melastomataceae species are used in horticulture. Some of the shrub species which has attractive flower are cultivated in gardens and greenhouses (Heywood, 1978). *M. malabathricum* with large pink flowers are used as ornamental due to its dazzling flower (Premilla, 2002).

2.7 Aluminum Accumulating Plant

Melastoma malabathricum plants often grow in low pH soils with high Al levels (Osaki *et al.*, 1998). *M. malabathricum* can be defined as an Al hyper accumulator species. *Melastoma* accumulates more than 10000 mg kg⁻¹ of Al in mature leaves, and more than 7000 mg kg⁻¹ of Al in young leaves (Watanabe *et al.*, 1997). The development of *Melastoma* is superior by Al application and is accompanied by an increase in P concentrations in the shoots (Osaki *et al.*, 1997). The monomeric Al, Al-oxalate, Al-(oxalate)₂, and Al-(oxalate)₃ are the soluble forms of Al that are found in *Melastoma* tissue (Watanabe *et al.*, 1998a).

2.8 Pollination and Pollinators

Pollination is the transfer of pollen from anthers to the stigma in angiosperms or from male cones directly to the ovule in gymnosperms (Uno *et al.*, 2001). The three main agencies of cross pollination are wind, water and animals (Purohit & Agrawal, 2004).



Insects are the most important and common pollinators of flowers. Insect-pollinated flowers and bird-pollinated flowers are often colourful. The brightly coloured flowers attract the insects because in ultraviolet light, their petals are darker towards the centre of the flower. The UV absorbing pigment which is called flavonoid is found in nectar guides and flowers are visible to insects in the sunlight. Besides that, the attractiveness and sweet odour of the plants is target for insects (Uno *et al.*, 2001).

Most of the tropical plants have fruits and seed dispersed by animals. There are five common groups of dispersing agents in Malaysia: birds, rodents, fruits bats, primates and ground herbivores (Premilla, 2002). Fruits and seeds of *M. malabathricum* are usually dispersed by birds and small mammals (Jones, 1993). *M. malabathricum* also attract beetles to its flowers and for food sources and egg laying spot (Premilla, 2002).

According to Gross & Mackay (1998), native bees visited *M. affine* more frequently than honeybees. Honeybees were poor pollinators of *M. affine* compared to native bees. Honeybees deposited less pollen and actively removed pollen from stigma compared to native bees. The fruits set and seed set were significantly lower in flowers visited by honeybees as compared to those visited by native bees. They concluded that honeybees reduce fitness in *M. affine*.

2.9 Peat Swamp Forest

The most species-rich type of vegetation in the world is found in Malaysia's rainforests. The warm temperature, high humidity and moist climate all year round



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