

PHYTOCHEMICAL PROPERTIES AND ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES OF Macaranga triloba (Thunb.) Müll.Arg. AND Macaranga gigantea (Rchb.f. & Zoll.) Müll.Arg.

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**UNIVERSITI PUTRA MALAYSIA** 

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By

**KEW KOK YONG** 

A Project Report Submitted in Partial Fulfilment of the Requirements for the Degree of Bachelor of Forestry Science in the

**Faculty of Forestry** 

**University Putra Malaysia** 

### DEDICATION

# Specially dedicated to my:

My Family

Prof. Dr. Rozi Mohamed

Lab members in Biotechnology Lab



And All My Friends

Thank you for your supervision and supports.

Deeply appreciation for all the supports along the way.

### ABSTRACT

Macaranga triloba (Thunb.) Müll.Arg. and Macaranga gigantea (Rchb.f. & Zoll.) Müll.Arg. are medicinal plants found in Peninsular Malaysia. However, there are limited scientific evidence to validate the medicinal properties of both species. This study is to identify the phytochemical materials and the antimicrobial and antioxidant activities of the leaves of M. triloba and M. gigantea. In this study, M. triloba and M. gigantea specimends were collected at Ayer Hitam Forest Reserve. Identification of the species was made through morphological characteristcs and DNA identification. Phytochemical screening of the leaf extracts of *M. triloba* and *M. gigantea* using methanol and hexane was conducted. Antimicrobial activities were determined using the agar disk-diffusion and well-diffusion methods while antioxidant activities were determined using the DPPH assay. For phytochemical screening, flavanoids, alkaloids and terpenoids were found in both species. Antimicrobial activity against Bacillus subtilis was detected in the methanol extract of M. gigantea while against Staphylococcus aureus was detected in the hexane extract of *M. triloba*. Comparing to the ascorbic acid as positive control, hexane extract of both species showed 2 times higher antioxidant activities than the methanol extract. The presence of phytochemicals and antimicrobial and antioxidant activities in *M. triloba* and *M. gigantea* indicated the potential medicinal properties of both species.

### ABSTRAK

Macaranga triloba (Thunb.) Müll.Arg. and Macaranga gigantea (Rchb.f. & Zoll.) Müll.Arg. merupakan sejenis tumbuhan ubatan yang digunakan oleh penduduk tempatan di Malaysia. Namun begitu, hanya bukti saintifik yang terhad telah dikemukakan untuk menunjuk kegunaan M.triloba dan M. gigantea sebagai ubatan. Penyelidikan ini adalah untuk mendapatkan fitokimia dan aktiviti antimikrob dan aktiviti antioksida dalam ekstrak bahagian daun M.triloba dan M. gigantea. Spesimens M. triloba dan M. gigantea telah dikumpul di Ayer Hitam Forest Reserve. Pengenalan spesies telah dijalankan melalui pengenalan ciri-ciri morfologi dan penganalan DNA. Fitokimia dalam ekstrak bahagian daun M. triloba dan M. gigantea dengan menggunakan metanol dan heksana telah dikenalpastikan dalam kajian ini. Aktiviti antimikrob oleh ekstrak daun M. triloba dan M. gigantea telah dikenalpasti dengan kaedah kajian perepasan cakera dan kajian penyebaran cakera manakala antioksida dekenalpasti dengan kaedah DPPH assay. Ekstrak telah didapati mengandungi fitokimia seperti alkaloid, fenol dan terpenoid dalam kedua-dua spesies. Aktiviti antimikrob tehadap Bacillus subtilis hanya dapat dikesan dalam ekstrak metanol dari *M. gigantea* manakala aktivity antimikrob terhadap Staphylococcus aureus dapat dikesan dalam ekstrak heksana dari *M. triloba*. Berbanding dengan asid askorbik sebagai kawalan positif, ekstrak heksana menunjukkan aktiviti antioksida yang dua kali lebih tinggi berbanding dengan ekstrak metanol. Kegunaan M. triloba dan M. gigantea sebagai tumbuhan ubatan telah dibuktikan dengan kandungan fitokimia dan aktiviti antimikrob dan antioksida di bahagian daun.

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### **APPROVAL SHEET**

I certify that this research project report entitled "PHYTOCHEMICAL PROPERTIES OF *Macaranga triloba* (Thunb.) Müll.Arg. AND *Macaranga gigantea* (Rchb.f. & Zoll.) Müll.Arg. AND THEIR ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES" by Kew Kok Yong has been examined and approved as a partial fulfillment of the requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry, Universiti Putra Malaysia.

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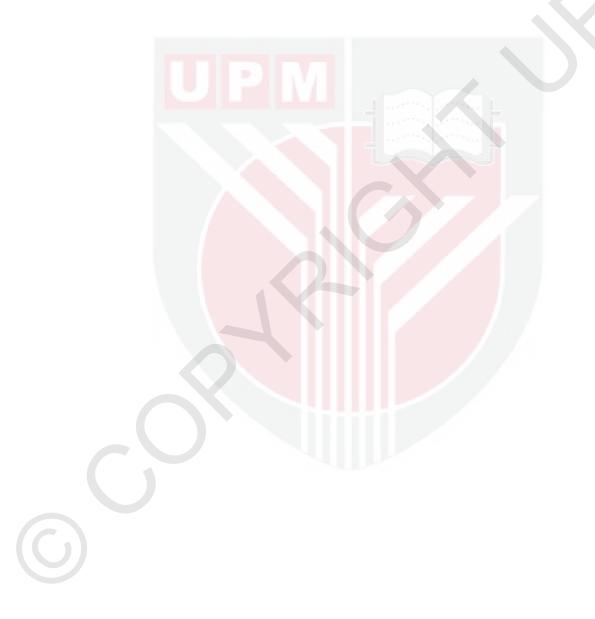
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# LIST OF ABBREVIATIONS

|  | T&CM             | Traditional and Complementary Medicine                  |
|--|------------------|---|
|  | °C               | Degree Celsius  |
|  | mL               | Milliliter  |
|  | μL               | Microliter  |
|  | mg               | Milligram   |
|  | NCBI             | National Center for Biotechnologt Information           |
|  | EtBr             | Ethidium bromide  |
|  | BLAST            | Basic Local Alignment Search Tool                       |
|  | WHO              | World Health Organization                               |
|  | UPM              | Univerisiti Putra Malaysia                              |
|  | AHFR             | Ayer Hitam Forest Reserve                               |
|  | FAO              | Food and Agriculture Organization                       |
|  | DPPH             | 2,2-Diphenyl-1-picrylhydrazyl                           |
|  | СН₃ОН            | Methanol  |
|  | nm               | nanometer   |
|  | UV               | ultraviolet   |
|  | mm               | millimeter  |
|  | TAE              | Tris base, acetic acid, Ethylenediaminetetraacetic acid |
|  | bp               | base pair   |
|  | Ab value         | Absorbance value  |
|  | µg/mL            | Microgram per millimeter                                |
|  | mg/mL            | Milligram per milliliter                                |
|  | IC <sub>50</sub> | Half maximal inhibitory concentration                   |
|  |                  |   |

### CHAPTER ONE

#### INTRODUCTION

#### 1.1 General background

#### 1.1.1 Traditional plant medicine

Traditional medicine comprises medical aspects of traditional knowledge that developed over generation within various societies before the era of modern medicine. The World Health Organization (WHO) defines traditional medicine as the sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness.

A large proportion of the population in a number of developing countries still relies on traditional practitioners, including traditional birth attendants, herbalists and bone-setters and on local medicinal plants to satisfy their primary health care needs. Treatment with medicinal plants is considered very safe as there is no or minimal side effects. These remedies are in sync with nature, which is the biggest advantage. The golden fact is that, use of herbal treatments is independent of any age groups and the sexes.

It is frequently stated in the scientific literature (Stekelenburg et al., 2005; Tilburt & Kaptchuk, 2008; Gude, 2013), official fact sheets and reports (WHO, 2008) and the press (BBC News, 2014) that 80% of people in

Asian and African countries use traditional medicine to meet their primary health care needs. In low and middle income countries where the number of practitioners of modern medicine may not be enough to meet the health care needs of the country, Traditional medicine and its practitioners are considered an important resource for population health. Compared to modern medicine, traditional medicine is perceived to be more affordable, accessible and acceptable to the communities in which it operates (Sato, 2012).

Plant extracts and compounds derived from plants are in use as drug from the ancient times (John & Koperuncholan, 2012). Numerous studies have identified compounds within herbal plants that are effective antibiotics (Basile et al., 2000). Traditional healing systems around the world that utilize herbal remedies are an important source for the discovery of new antibiotics (Okpekon et al., 2004). Studies have shown that many of these antioxidant possess anti-inflammatory, antiatherosclerotic, compounds antitumor, antimutagenic, anticarcinogenic, antibacterial. and antiviral activities (Rice-Evans et al., 1995; Sala et al., 2002). To promote the proper use and to determine their potential as sources for new drugs, it is essential to study the medicinal plants and their derivatives. Therefore, researchers are increasingly turning their attention to folk medicine to develop better drugs against many diseases (Parekh & Chanda, 2007).

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1.1.2 Present and future prospect of traditional and complementary medicine in Malaysia

Thousands of years ago, Malaysia had an extensive variety of plant species and traditional medical systems. More than 1300 medicinal plant species

have been recorded in Peninsular Malaysia alone (Burkill, 1935). The Malaysian system has been affected by Indonesian, Chinese, Indian, and Orang Asli traditional practices (Zakaria, 1994). In the Malaysian medicine system, herbal products form an important component. Approximately 7,411 plant species excluding bryophyta, algae and fungi have been identified in Sabah and about 80% of the indigenous plants were used by local communities. In addition, about 1,200 were used statewide for medicinal purposes (Kulip, 2010).

Malaysian plants are widely valued for their aromas and tastes and many of these plants are medicinal and used to treat various human illnesses. Studies have shown that several plants in Malaysia are poisonous to animals and humans because of the presence of specific components. Screening botanical extracts for potential toxins is a significant step in assessing their appropriateness for the market (Qader, 2011).

Recently, interest has grown in discovering antioxidants derived from plant sources to replace artificial antioxidants. Natural antioxidants are seen as being safer and more desirable than their synthetic counterparts because they occur in plant foods, data from scientific reports and laboratory studies indicate that plants contain a large variety of phytochemicals that have antioxidant activities (Chanwitheesuk, 2005).

#### **1.2 Problem Statement**

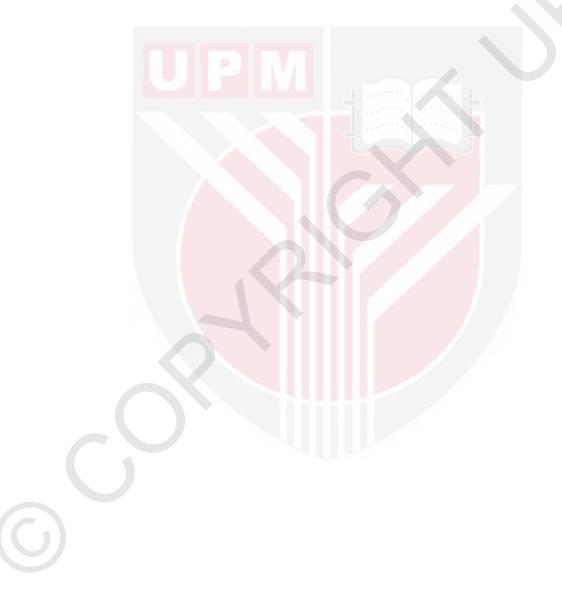
The genus *Macaranga* have a long history of use in traditional medicine to treat cuts, swellings, boils, bruises and sores. In folk medicine, traditional healers use fresh or dried leaves of some *Macaranga* species to treat swellings, cuts, sores, boils and bruises (Nick et al., 1995). An increasing number of phytochemical studies are being carried out on plants belonging to the genus *Macaranga* due to their various traditional uses.

This is a resourceful area of research as many species of *Macaranga* are use in traditional medicine as well as exhibits various pharmacological properties; while their chemistry indicates varied chemical structures. However, not much studies of *Macaranga gigantea* and *Macaranga triloba* have been established in Malaysia. Thus it is important for us to evaluate the phytochemical properties and chemistry contents of *Macaranga* species for future research on plants in this genus and their potential for development as herbal drugs.

# 1.3 Objectives

I) To identify the phytochemical materials present in the leaves of *Macaranga triloba* and *Macaranga gigantea*.

II) To investigate the antimicrobial and antioxidant activities of the leaves of *M*. *triloba* and *M. gigantea*.



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