

UNIVERSITI TEKNOLOGI MARA

**PHYTOCHEMICAL STUDY AND
BIOLOGICAL ACTIVITIES OF
Garcinia nervosa (CLUSIACEAE)**

NURR MARIA ULFA BINTI SERUJI

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Applied Sciences

March 2017

ABSTRACT

Although there were many studies conducted on the *Garcinia* species, but there are very few studies reported on *Garcinia nervos*, especially *Garcinia nervosa* from Sarawak since it has not been explored yet. *Garcinia nervosa* (Clusiaceae) was investigated for its chemical constituents and biological activities. Seven chemical constituents were successfully isolated and identified for the first time from *Garcinia nervosa* where six are well known compounds, including ferulic acid (**154**), 3, 4-dimethoxycinnamic acid (**155**), 3-*O*-acetyloleanolic acid (**156**), scopoletin (**157**), stigmasterol (**128**) and friedelin (**127**). However, 3, 4-dimethoxycinnamic acid, 3-*O*-acetyloleanolic acid and scopoletin were isolated from *Garcinia* genus for the first time together with the unknown compound (*E*)-2-methyl-6-(1,6,6,12a-tetramethyl-7-oxo-1,2,3,3a,5,5a,6,7,8,9,10,11,12,12a-tetrahydrocyclopenta [α]-cyclopropa[ϵ]phenanthren-1yl)hept-2-enoic acid (**158**). The structural elucidation was obtained from the spectroscopic data of 1D and 2D nuclear magnetic resonance (^1H NMR, ^{13}C NMR, HMBC, and HMQC), ultra-violet (UV), Infra-red (IR), mass spectroscopy (MS) and comparison with literature data. The methanolic extracts and the major compounds of *Garcinia nervosa* was evaluated for total phenolic content, free radical scavenging activity, anti-inflammatory, cytotoxicity and antibacterial activities. The bark extracts exhibited higher total phenolic contents than the leaves extracts. Both of the extracts showed very strong antioxidant activity and anti-inflammatory activity. Moreover, in the cytotoxicity assay, the barks extract gave weak inhibition against the three cell lines while twigs showed weak inhibition to MCF-7 (human breast cancer cell lines) and HT-29 (human promyelocytic leukemia) but not active for HeLa (cervical cancer cell lines) and leaves extracts showed inactive cytotoxic activity against all the tested cancer cell lines. The antimicrobial activity which was measured by minimum inhibitory concentration (MIC) and minimum bacterial concentration (MBC) for the extracts and the major pure compounds exhibited the activity with the minimum concentration ranging from 450 to 112.5 ($\mu\text{g}/\text{mL}$). This study finding provide useful information to the chemotaxonomy of *Garcinia* for further biotechnology research and development which in line with National Biotechnology Policy.

ACKNOWLEDGEMENTS

In the name of Allah the Most Gracious, Most Merciful.

Alhamdulillah. Many thanks to Allah SWT, whom His blessings that allows me to complete this thesis entitled “ **Phytochemical Study and Biological Activities of *Garcinia nervosa* (Clusiaceae)**” as a requirement for the Degree of Masters of Science in the Faculty of Applied Sciences, Universiti Teknologi MARA.

First and foremost, my biggest gratitude to my supervisor, Assoc. Prof. Dr. Khong Heng Yen for all her tireless guidances, advices and time contribution to accomplish my research works. With all the hard works and brilliant ideas and good production in my research experience. Thank you very much for not just being a great supervisor but also as an a good example as a successful person, lecturer and motivator.

Not forgetting my fellow friends in the postgraduate research laboratory, Mdm Nyotia Nyokat, Clifford Junaidi Kutoi, Saidi Rasemi and Che Rahmah Che Sudin for their assistance, support, encouragement and ideas throughout my duration of study from the beginning until the end. I would also like to express my appreciation to staffs and research fellows from Faculty of Applied Sciences and Atta-ur-Rahman Institute for Natural Products Discovery (AuRiNs) for their kind assistance.

My deepest gratitude to my beloved parents, Mr. Seruji Bin Abid and [REDACTED] [REDACTED] for everything in my life especially for their prayers and financial support. They are the reason for all I have now and thank you so much for all their love, sacrifices and good teaching. Never to forget my siblings and family members, Moair Saard, Nurfatila, Mohd. Moanir and Nurfarahin for their help and moral support.

To my husband, Mr. Zakini Bin Rosli, thank you for your moral and financial support, your love and kindness, help, understanding and patience in my effort to complete my study. Finally to my most love son, Muhammad Hanzalah Khair bin Zakini, you are the reason and the greatest motivation for me to continue and end this journey successfully. Thank you very much.

TABLE OF CONTENTS

	Page
CONFIRMATION BY PANEL OF EXAMINERS	ii
AUTHOR'S DECLARATION	iii
ABSTRACT	iv
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF SCHEMES	xii
LIST OF SYMBOLS	xiii
LIST OF ABBREVIATIONS	xv
CHAPTER ONE: INTRODUCTION	
1.1 Research Background	1
1.2 Problem Statement	3
1.3 Objectives of the Research	4
1.4 Significance of Study	4
1.5 Scope and Limitations of Study	4
CHAPTER TWO: LITERATURE REVIEW	
2.1 Clusiaceae (Guttifera)	6
2.2 <i>Garcinia</i> Genus	7
2.2.1 <i>Garcinia nervosa</i>	10
2.3 Chemical Constituents of <i>Garcinia</i> Species	10
2.3.1 Xanthones	11
2.3.2 Benzophenones	19
2.3.3 Flavonoids	22
2.3.4 Triterpenoids	24

CHAPTER ONE

INTRODUCTION

1.1 RESEARCH BACKGROUND

Natural products are always exists in the history of medical purposes. This ancient medicine idea will never be outdated and neglected yet still in common use in these days due to its promising and proven effectiveness to treat illness. Medicinal plants have long been an excellent source of pharmaceutical agent. Herbal medicine contains rich active ingredients which are crucial to cure diseases named as herbs, herbal materials, herbal preparations and finished herbal products developed from parts of plants or other plants materials. The demand for medicinal plants as health supplements or alternative medicine have been increasing worldwide. The renewed interest of knowledgeable consumer could be associated with increasing information and availability of herbal supplements globally (Jamal, 2006).

Medicinal plants grow in a great number of populations especially in the tropical biodiversity. Tropical plants are beneficial and can be explore for therapeutic purposes due to the high content of potential biological active compounds. Natural products are worthwhile in the optimizing the use of chemical for human consumption (Bhuwan & Vinod, 2011).

The natural materials of interest are the secondary metabolites or the chemical compounds, which are present in the living organism. The chemical compounds that were extracted from their sources which then examined for their potential uses leading to the development of new medicine. This chemical diversity of secondary metabolites resulted from plant evolution may be equal or superior to that found in synthetic combinatorial chemical libraries (Fabricant & Farnsworth, 2001). The discovery of natural chemicals from plants is crucial to develop natural product based drugs as the alternative for the modern medicine.

In some Asian and African countries, 80% of the population depends on traditional medicine for primary healthcare. About 70% to 80% of the population in Asian countries has used some form of alternative or complementary medicine. The