CHEMICAL CONSTITUENTS AND BIOLOGICAL ACTIVITIES OF
GARCINIA CUNEIFOLIA, MESUA BECCARIANA AND MESUA FERREA

By

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Investigations on the stem bark of *Garcinia cuneifolia, Mesua beccariana* and *Mesua ferrea* (Guttiferae) have resulted in the isolation of eight compounds. The structures of these compounds were elucidated by using spectroscopic techniques such as nuclear magnetic resonance (NMR), mass spectroscopy (MS), infra red (IR), ultraviolet (UV) and also by comparison with previous reports.

The stem bark of *G. cuneifolia* collected from Sarawak, yielded three new compounds: a new xanthone, cuneifolin, a new triterpenoid benzoate lactone, 3-benzoyloxyoleane-19-en-13,28-olide and a new aromatic compound, 3-methoxy-4-heptyloxy cinnamic acid. Beside that, there are two more known compounds have been isolated, rubraxanthone and stigmasterol. From the stem bark of *M. beccarianna*, a new
hexatrione, 6-(19-hydroxy-20-oxo-19-phenyl-propyl)-3-methyl-8,8-bis-(11,16-methyl-but-10,15-enyl)-2,5H-naphthalene-1,4,7-trione, and a suggested compound, 10[2,4,6-tris-(14,25,36-methyl-but-13,24,35-enyl)-(3,17,5,28)terphenyl-1-yloxy]-butyric acid methyl ester, together with two known triterpene, friedelin and stigmasterol were isolated. *M. ferrea* gave the common steroidal triterpenes friedelin and stigmasterol.

The essential oil was obtained by hydrodistillation using fresh flowers of *M. ferrea* (collected from UPM, Serdang) and analysed using GC-MS spectrometry. The main essential oil component is germacrene D (48.96%).

Both the crude extracts of *G. cuneifolia* and *M. beccariana* (stem bark) were not active towards CEM-SS cells line, except for the hexane extract of *M. beccariana*, which showed weak cytotoxic effect. Two pure compounds, stigmasterol and friedelin, together with the essential oil from the flower of *M. ferrea* were found to be inactive towards this bioactivity.

The antimicrobial activity test against five types of bacteria i.e., *Bacillus subtilis* mutant, *Bacillus subtilis* wild type, *Staphylococcus aureus* (MRSA), *S. typhimurium* and *Pseudomonas aeruginosa* (ATCC 60690) were also carried out on the crude extracts, pure compounds and essential oil. The crude ethyl acetate and methanol extracts of the stem bark of *G. cuneifolia* were found to have significant activity. However, both stigmasterol and friedelin, gave no activity against all the pathogenic
bacterial used. The results showed that all the samples tested gave no activity against *S. typhimurium*. The methanol extract of *M. beccariana* produced significant activity against *Bacillus subtilis*, ATCC 60690 and MRSA. The oil of *M. ferrea* showed the result was only active towards MRSA.

The crude hexane, ethyl acetate and methanol extracts of *G. cuneifolia* were screened for larvicidal activity. The crude hexane extract of *G. cuneifolia* showed moderate activity against larvae *Aedes aegypti*, followed by ethyl acetate and methanol extracts. The crude hexane extract of *M. beccariana* has the highest activity towards the larvae, followed by the chloroform extract. The acetone extract showed weak activity towards the larvae. Lastly, the crude methanol extract gave no activity towards the larvae of *Aedes aegypti*. The result also showed that the larvae of *Aedes aegypti* is highly susceptible to the essential oil of the flowers of *M. ferrea*. 
KANDUNGAN KIMIA DAN AKTIVITI BIOLOGI DARIPADA
GARCINIA CUNEIFOLIA, MESUA BECCARIANA DAN MESUA FERREA

Oleh

MONG XIAO HUI

Januari 2005

Pengerusi : Profesor Madya Gwendolin Ee Cheng Lian, Ph. D.
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Kajian ke atas ekstrak mentah kulit batang Garcinia cuneifolia, Mesua beccariana dan Mesua ferrea (Guttiferae) telah menghasilkan lapan komponen. Struktur sebatian-sebatian ini telah dapat dikenalpasti dengan menggunakan kaedah spektroskopi seperti NMR, MS, IR dan UV dan juga perbandingan dengan kajian-kajian yang lepas.

Kulit batang G. cuneifolia yang diperolehi dari Sarawak telah menghasilkan tiga sebatian baru: satu xanthone baru, cuneifolin, satu benzoate lakton triterpenoid baru, 3-benzoxyloxyoleane-19-en-13,28-olida dan satu sebatian aromatik baru, acid sinamik-3-metoksi-4-heptiloksi. Selain itu, satu xanthone lain, rubraxanthone dan juga triterpena, stigmasterol juga dihasilkan dari pokok yang sama. Daripada kulit batang M. beccariana, satu hexatrione baru, 6-(19-hydroxy-20-oxo-19-phenyl-propyl)-3-methyl-8,8-bis-(11,16-methyl-but-10,15-enyl)-2,5H-naphthalene-1,4,7-trione, dan satu...
komponen lagi, ester metal asid butirik 10[2,4,6-Tris-(14,25,36-methyl-but-13,24,35-enyl)-(3,17;5,28)terphenyl-1-yl]oxy], bersama-sama dengan dua triterpena, friedelin dan stigmasterol telah dipisahkan. 

M. ferrea pula menghasilkan dua steroidal triterpena biasa, friedelin dan stigmasterol.

Minyak pati bunga segar M. ferrea (diperolehi daripada UPM, Serdang) telah diperolehi dengan teknik penyulingan hidro dan dianalisa dengan menggunakan kaedah spektrometri GC-MS. Komponen utama minyak pati ini ialah germacrene D (48.96%).

Kesemua ekstrak G. cuneifolia dan M. beccariana (kulit batang) didapati tidak aktif terhadap sel CEM-SS, kecuali ekstrak mentah heksana daripada M. beccariana dimana menunjukkan kesan sitotoksik yang lemah. Dua komponen tulen, stigmasterol dan friedelin bersama dengan minyak pati bunga M. ferrea telah didapati tidak aktif terhadap bioaktiviti ini.


Metanol ekstrak daripada M. beccariana telah menghasilkan aktiviti signifikan terhadap
B. subtilis, ATCC 60690 dan MRSA. Pati minyak daripada bunga M. ferrea hanya memberikan aktiviti terhadap MRSA.

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I certify that an Examination Committee met on 17 January 2005 to conduct the final examination of Mong Xiao Hui on her Master of Science thesis entitled “Chemical Constituents and Biological Activities of *Garcinia cuneifolia*, *Mesua beccariana* and *Mesua ferrea* (Guttiferae)” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>2</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>5</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>8</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>9</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>11</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>15</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>17</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>23</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>24</td>
</tr>
</tbody>
</table>

## I INTRODUCTION

General Introduction

Botanical Notes of Plant Species Studied

Family Guttiferae (Clusiaceae)

Genus *Garcinia*

Species *Garcinia cuneifolia*

Genus *Mesua*

Species *Mesua beccariana*

Species *Mesua ferrea*

Essential Oils from the Flower of *Mesua ferrea*

Bioassays for Cytotoxicity, Antimicrobial and Larvicidal Activities

## II LITERATURE REVIEW

Chemistry of *Garcinia* and *Mesua* Species

Xanthones

Previous Works on Xanthone in *Garcinia* Species

Previous Works on Xanthone in *Mesua* Species

Benzophenones

Previous Works on Benzophenone in *Garcinia* Species

Previous Works on Benzophenone in *Mesua* Species

Coumarins

Previous Works on Coumarin in *Garcinia* Species

Previous Works on Coumarin in *Mesua* Species

Flavanoids

Previous Works on Flavanoid in *Garcinia* Species

Previous Works on Flavanoid in *Mesua* Species
Other Types of Compounds
  Previous Works on Other Types of Compounds in *Garcinia* Species 61
  Previous Works on Other Types of Compounds in *Mesua* Species 61
  Essential Oil from the Flowers of *Mesua ferrea* 66
  Previous Works on Oils of Guttiferaeous Plant 66
  Bioassays of Cytotoxicity, Antimicrobial and Larvicidal Activity 67
  Previous Works on Bioassays of *Garcinia* Species 71
  Previous Works on Bioassays of *Mesua* Species 77
  Previous Works on Bioassays of Oils in Guttiferaeous Plants 77

III EXPERIMENTAL 78
  Extraction and Isolation of Chemical Constituents from *Garcinia cuneifolia, Mesua beccariana* and *Mesua ferrea* 78
    Material and Methods 78
    Extraction of *Garcinia cuneifolia* (Stem Bark) 82
    Extraction of *Mesua beccariana* (Stem Bark) 89
    Extraction of *Mesua ferrea* (Stem Bark) 94
  Essential Oil from Flowers of *Mesua ferrea* 96
    Plant Materials 96
    Isolation of the Oils 96
    GC-MS Analysis 98
  Bioassays of Cytotoxicity, Antimicrobial and Larvicidal Activity 99
    Cytotoxicity Assay 99
    Antimicrobial Activity 100
    Larvicidal Assay 102

IV RESULTS AND DISCUSSIONS 103
  Bioactive Principles from the Stem Bark of *Garcinia cuneifolia* 103
    Isolation of Stigmasterol (82) 103
    Isolation of Cuneifolin (83) 114
    Isolation of 3-benzoyloxyoleane-19-en-13,28-olide (84) 138
    Isolation of Rubraxanthone (15) 158
    Isolation of 3-Methoxy-4-Heptyloxy Cinnamic Acid (85) 183
  Bioactive Principles from the Stem Bark of *Mesua beccariana* 201
    Isolation of Friedelin (86) 201
    Isolation of Stigmasterol (82) 207
    Isolation of 6-(19-Hydroxy-20-oxo-19-phenyl-propyl)-3-methyl-8,8-bis-(11,16-methyl-but-10,15-enyl)-2,5H-naphthalene-1,4,7-trione (87) 207
    Isolation of 10[(2,4,6-Tris-(14,25,36-methyl-but-13,24,35-enyl)-(3,17;5,28)terphenyl-1-yl oxy]-
butyric acid methyl ester (88)  223

Bioactive Principles from the Stem Bark of Mesua ferrea  233
  Isolation of Friedelin  233
  Isolation of Stigmasterol  234
Essential oil from Mesua ferrea  234
Cytotoxicity Screening  237
Antimicrobial Activity  241
Larvicidal Activity  244

V  CONCLUSION  247

BIBLIOGRAPHY  249
APPENDICES  257
BIODATA OF THE AUTHOR  276