CHEMICAL CONSTITUENTS AND BIOLOGICAL ACTIVITIES FROM *GARCINIA MAINGAYI* AND *GARCINIA PARVIFOLIA*

By

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CHEMICAL CONSTITUENTS FROM *GARCINIA MAINGAYI* AND *GARCINIA PARVIFOLIA* AND THEIR BIOLOGICAL ACTIVITIES

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Chairman : Associate Professor Gwendoline Ee Cheng Lian, PhD

Faculty : Science

In this present study, the stem bark of *Garcinia maingayi* and *Garcinia parvifolia* were investigated and resulted in the isolation of nine compounds. There are no previous reports on chemical components and biological activities from *Garcinia maingayi*. The structures of these compounds were elucidated by using spectroscopic experiments namely NMR, MS, IR and UV.

Being the first report on *Garcinia maingayi,* detailed chemical studies have afforded two triterpenoids, stigmasterol and sitosterol, two xanthones, 1,3,7-trihydroxy-2-(3-methylbut-2-enyl)-xanthone and 1,3,6,8-tetrahydroxyxanthone, one benzophenone, isoxanthochymol, and one benzoic acid derivative methyl 3,4-dihydroxybenzoate. The findings are significant as it contributes to the knowledge of the chemotaxonomy on *Garcinia* species and all these compounds are new to the species.

Meanwhile investigations on *Garcinia parvifolia* have afforded one triterpenoid, α-amyrin and two xanthones, cowanin and rubraxanthone. Acetylation reaction was carried out on rubraxanthone to yield triacetate rubraxanthone.

This is also the first report on cytotoxic and larvicidal activities of *Garcinia maingayi*, *Garcinia parvifolia* and rubraxanthone. Cytotoxic tests were performed using HL-60 and CEM-SS cell lines. The crude hexane and chloroform extracts of *Garcinia maingayi* were active against HL-60 cell line with IC_{50} values of less than 30 μg/ml. The crude hexane and acetone extracts of *Garcinia parvifolia* were found to be active against CEM-SS cell line with IC_{50} values of less than 30 μg/ml meanwhile, the crude chloroform extract gave a significant activity with an IC_{50} value of 6.5 μg/ml.

The antimicrobial assay was carried out against four pathogenic bacteria, Methicillin resistant *Staphylococcus aures*, *Pseudomonas aeruginosa*, *Staphylococcus typhimurium* and *Bacillus subtilis*. Most of the crude extracts tested against these microbes gave only moderate or weak activity. The antifungal activity testing of the plant extracts were carried out against the fungi *Candida albican*, *Aspergillus ochraceaus*, *Sacchoromyces cerevisiae* and *Candida lypolytica*. No activity was observed for all the crude extracts

The larvicidal test was carried out towards the larvae of *Aedes aegypti*. All the crude extracts of *Garcinia maingayi* were weakly active against the larvae with LC_{50} values of more than 150 μg/ml. The crude extracts of *Garcinia parvifolia* showed moderate activities against the larvae by giving LC_{50} values of less than 100 μg/ml. The pure

rubraxanthone showed a strong activity against the larvae with a LC_{50} value of 15.49 μg/ml.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

KANDUNGAN KIMIA DAN AKTIVITI BIOLOGI DARIPADA *GARCINIA MAINGAYI* DAN *GARCINIA PARVIFOLIA*

Oleh

CHEOW YUEN LIN

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Pengerusi : Profesor Madya Gwendoline Ee Cheng Lian, PhD

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Untuk projek ini, kulit *Garcinia maingayi* dan *Garcinia parvifolia* telah dikaji dan berjaya menghasilkan sembilan sebatian. Tidak ada sebarang laporan mengenai sebatian kimia mahupun aktiviti biologikal untuk *Garcinia maingayi*. Struktur sebatian-sebatian ini ditentukan dengan mengunakan eksperimen spekstroskopi seperti NMR, MS, IR dan UV.

Sebagai laporan pertama untuk *Garcinia maingayi,* kajian kimia terperinci telah menghasilkan dua triterpenoid, stigmasterol dan sitosterol, dua xanthone, 1,3,7-trihidroksi-2-(3-metillbut-2-enil)-xanthone dan 1,3,6,8-tetrahidroksixanthone, satu benzofenon, isoxanthokimol, dan satu terbitan asid benzoik, metil 3,4-dihidroksibenzoat. Hasil kajian ini adalah penting dalam sumbanganya terhadap

kimotaxonomi spesies *Garcinia* dan sebatian ini adalah pertama dilaporkan untuk spesies ini.

Sementara itu, kajian atas *Garcinia parvifolia* telah menghasilkan satu triterpenoid, α-amirin dan dua xanthone, cowanin and rubraxanthone. Pengasetilan telah dijalankan ke atas rubraxanthone untuk menghasilkan rubraxanthone triasetat.

Laporan ini juga adalah yang pertama untuk ujian sitotoksik dan larva bagi *Garcinia maingayi*, *Garcinia parvifolia* dan rubraxanthone. Ujian sitotoksik telah dijalankan dengan menggunakan sel CEM-SS and HL-60. Ekstrak mentah heksana dan kloroform *Garcinia maingayi* dianggap sebagai aktif ke atas sel HL-60 dengan nilai IC_{50} kurang daripada 30 μg/ml. Ekstrak mentah heksana dan aseton *Garcinia parvifolia* juga dianggap aktif ke atas sel CEM-SS dengan nilai IC_{50} kurang daripada 30 μg/ml di mana ekstrak mentah kloroform menunjukkan aktiviti yang kuat dengan nilai IC_{50} 6.5 μg/ml.

Ujian anti-mikrobial dijalankan dengan menggunakan bakteria-bakteria jenis Methicillin Resistant *Staphylococcus aures*, *Pseudomonas aeruginosa*, *Staphylococcus typhimurium* dan *Bacillus subtilis*. Kebanyakan ekstrak yang diuji menunjukkan keaktifan yang sederhana atau rendah terhadap bakteria-bakteria. Aktiviti anti-fungal ekstrak tumbuhan telah dijalankan ke atas *Candida albican*, *Aspergillus ochraceaus*, *Sacchoromyces cerevisiae* dan *Candida lypolytica.* Tiada aktiviti diperhatikan ke atas semua ektrak mentah.

Ujian larva telah dijalankan dengan menggunakan larva jenis *Aedes aegypti*. Kesemua ekstrak mentah *Garcinia maingayi* mempunyai aktiviti yang lemah terhadap terhadap larva dengan nilai LC_{50} melebihi 150 μg/ml. Ekstrak mentah *Garcinia parvifolia* menunjukkan aktiviti yang sederhana terhadap larva dengan memberikan nilai LC_{50} kurang daripada 100 μg/ml. Rubraxanthone menunjukkan aktiviti yang kuat terhadap larva dengan nilai LC_{50} 15.49 μg/ml.

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I certify that an Examination Committee met on to conduct the final examination of Cheow Yuen Lin on his Master of Science thesis entitled "Chemical Constituents From *Garcinia maingayi* and *Garcinia parvifolia* and Their Biological Activities" 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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CHEOW YUEN LIN

Date:

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α	alpha
β	beta
δ	chemical shift in ppm
γ	gamma
μg	micro gram
brs	broad singlet
^{13}C	carbon-13
$CHCl_3$	chloroform
$CDCl_3$	deuterated chloroform
COSY	Correlated Spectroscopy
d	doublet
dd	doublet of doublet
DEPT	Distortionless Enhancement by Polarization Transfer
DMSO	dimethylsulfoxide
dt	doublet of triplet
EA	ethyl acetate
EIMS	Electron emission mass spectroscopy
g	gram
GC	Gas Chromatography
GC-MS	Gas Chromatography- mass spectroscopy
^{1}H	proton
HETCOR	Heteronuclear Chemical Shift-correlation
HMBC	Heteronuclear Multiple Bond Connectivity by 2D Multiple Quantum
HPLC	High Performance Liquid Chromatography
Hz	Hertz
IC	Inhibition Concentration
IR	Infra Red
J	coupling constant in Hz
l	litre
LC	Lethal Concentration
LD	Lethal Dose
m	multiplet
ml	mili litre
Me_2CO	acetone
MeOH	methanol
m.p.	melting point
MS	Mass Spectrum/Spectra/Spectrometer/Spectroscopy
NMR	Nuclear Magnetic Resonance
ppm	part per million
s	singlet
t	triplet
TLC	Thin Layer Chromatography
UV	Ultra Violet

WHO	World Health Organization