UNIVERSITI PUTRA MALAYSIA

CHEMICAL CONSTITUENTS AND BIOLOGICAL ACTIVITY OF ASAM AUR AUR (*GARCINIA PARVIFOLIA*) AND JINGGAU (*PLOIARIUM ALTERNIFOLIUM*)

NG SOOK HAN

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By

NG SOOK HAN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfilment of the Requirement for the Degree of Master Science

June 2007

CHEMICAL CONSTITUENTS AND BIOLOGICAL ACTIVITY OF ASAM AUR AUR (*GARCINIA PARVIFOLIA*) AND JINGGAU (*PLOIARIUM ALTERNIFOLIUM*)

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MASTER OF SCIENCE
UNIVERSITI PUTRA MALAYSIA

2007

DEDICATION

To my beloved parents Ng Kum Seong and Lik Chee Keon

For their endless love and concern……

To my beloved Loke Chee Keong

For his romantic love, support, understanding and care……

To my supervisor Assoc. Prof. Dr. Gwendoline Ee Cheng Lian

For her guidance, advice, understanding and endless support……

To my co-supervisors Assoc. Prof. Dr. Mohd Aspollah B Hj Md Sukari

Dr. Emily Goh Joo Kheng

For their kindly advice and indispensable support……

To my senior Dr. Lim Chan Kiang

For his wonderful encouragement and support……

To my friends

For their wonderful love and generous moral support……

Abstract of the thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of requirement for the degree of Master Science

CHEMICAL CONSTITUENTS AND BIOLOGICAL ACTIVITY OF ASAM AUR AUR (*GARCINIA PARVIFOLIA*) AND JINGGAU (*PLOIARIUM ALTERNIFOLIUM*)

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June 2007

Chairman : Associate Professor Gwendoline Ee Cheng Lian, PhD

Faculty : Science

Chemical and biological studies were carried out on two plants, *Garcinia parvifolia* (Guttiferae) and *Ploiarium alternifolium* (Theaceae). The chemical investigations covered xanthones, benzophenones, anthraquinones, and triterpenes.

The stem bark of *Garcinia parvifolia* and *Ploiarium alternifolium* were investigated and this resulted in the isolation of ten known compounds. These compounds were isolated using common chromatographic techniques and were identified by using spectroscopic experiments such as NMR, MS, IR and UV.

Detailed chemical studies on *Garcinia parvifolia* have yielded two triterpenoids, stigmasterol and β-sitosterol, three xanthones, 6-deoxyjacareubin, daphnifolin and

rubraxanthone, one benzophenone, isoxanthochymol and one alkaloid, caffeine. Meanwhile, investigations on *Ploiarium alternifolium* have afforded three anthraquinones, ploiariquinone A, emodin and 1,8-dihydroxy-3-methoxy-6-methyl-anthraquinone.

The larvicidal test was carried out towards the larvae of *Aedes aegypti*. The crude chloroform, ethyl acetate and methanol extracts of *Garcinia parvifolia* were weakly active against the larvae of *Aedes aegypti* with LC_{50} values of 204.26, 194.96 and 236.44 µg/ml respectively while the crude chloroform extract of *Ploiairum alternifolium* was weakly active against the larvae of *Aedes aegypti* with an LC_{50} value of 159.12 µg/ml.

The antimicrobial assay was carried out towards four pathogenic bacteria, Methicillin Resistant *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Staphylococcus choleraesuis* and *Bacillus subtilis*. For the microbes MRSA, *P. aeruginosa* and *S. choleraesuis* there were no inhibition by all the crude extracts of *Garcinia parvifolia*. The crude chloroform and methanol extracts of *Ploiarium alternifolium* showed no activity towards the microbe *S. choleraesuis*.

Cytotoxic tests were performed using HL-60 Cell Line. The crude hexane, chloroform and ethyl acetate extracts of *Garcinia parvifolia* were considered to be active against the HL-60 cell line with IC_{50} values of less than 30 µg/ml. The

crude chloroform extract of *Ploiarium alternifolium* was also considered to be active against the HL-60 cell line with an IC_{50} value of 23.3 µg/ml. The crude methanol extract of *Ploiarium alternifolium* showed the most significant activity with an IC_{50} value of 5.2 µg/ml.

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.

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

KANDUNGAN KIMIA DAN ACTIVITI BIOLOGI DARIPADA ASAM AUR AUR (*GARCINIA PARVIFOLIA*) DAN JINGGAU (*PLOIARIUM ALTERNIFOLIUM*)

Oleh

NG SOOK HAN

Jun 2007

Pengerusi : Profesor Madya Gwendoline Ee Cheng Lian, PhD

Fakulti : Sains

Kajian kimia dan aktiviti biologi telah dijalankan ke atas dua jenis tumbuhan iaitu *Garcinia parvifolia* (Guttiferae) dan *Ploiarium alternifolium* (Theaceae). Kajian kimia terperinci merangkumi jenis sebatian seperti xanton, benzofenon, antrakuinon dan triterpena.

Kulit pokok *Garcinia parvifolia* dan *Ploiarium alternifolium* telah dikaji dan berjaya menghasilkan sepuluh sebatian yang telah dikenalpasti. Struktur sebatian-sebatian ini ditentukan dengan menggunakan eksperimen spekstroskopi seperti NMR, MS, IR dan UV.

Kajian kimia terperinci ke atas *Garcinia parvifolia* telah menghasilkan dua triterpenoid, stigmasterol dan β-sitosterol, tiga xanton, 6-dioksijakarubin, dafnifolin dan rubraxanton, satu benzofenon, isoxantoximol dan satu alkaloid, kaffeine. Sementara itu, kajian ke atas *Ploiarium alternifolium* telah menghasilkan tiga antrakuinon, ploiarikuinon A, emodin dan 1,8-dihidroksi-3-mektosi-6-metil-antrakuinon.

Ujian larva telah dijalankan dengan menggunakan larva *Aedes aegypti*. Ekstrak mentah kloroform, etil asetat dan metanol *Garcinia parvifolia* mempunyai aktiviti yang lemah terhadap larva *Aedes aegypti* dengan nilai LC_{50} masing-masing 204.26, 194.96 and 236.44 µg/ml. Sementara itu, ekstrak mentah kloroform *Ploiarium alternifolium* juga menunjukkan aktiviti yang lemah dengan nilai LC_{50} 159.12 µg/ml.

Ujian anti-mikrob telah dijalankan dengan menggunakan empat jenis bakteria iaitu Methicillin Resistant *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Staphylococcus choleraesuis* and *Bacillus subtilis*. Untuk bakteria MRSA, *P. aeruginosa* and *S. choleraesuis* didapati tidak aktif terhadap semua ekstrak mentah *Garcinia parvifolia*. Ekstrak mentah kloroform dan metanol *Ploiarium alternifolium* juga tidak menunjukkan sebarang aktiviti terhadap bakteria *S. choleraesuis*.

Ujian sitotoksik telah dijalankan dengan menggunakan sel HL-60. Ekstrak mentah heksana, kloroform dan etil asetat *Garcinia parvifolia* dianggap sebagai aktif ke atas sel HL-60 dengan nilai IC_{50} kurang daripada 30 µg/ml. Ekstrak mentah kloroform *Ploiarium alternifolium* juga dianggap aktif ke atas sel HL-60 dengan nilai IC_{50} 23.3 µg/ml. Ekstrak mentah metanol *Ploiarium alternifolium* menunjukkan aktiviti yang kuat dengan nilai IC_{50} 5.2 µg/ml.

Aktiviti anti-kulat ekstrak tumbuhan telah dijalankan ke atas *Candida albican*, *Aspergillus ochraceaus*, *Sacchoromyces cerevisiae* and *Candida lypolytica*. Tiada aktiviti diperhatikan ke atas semua ekstrak mentah.

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The completion of this project is not a one-man work. It is a project, which could only get completed on time with the help of many parties. Therefore I would like to take this opportunity to express my gratitude to all of them to show my appreciation for their support.

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Last but not least, special greetings and thank you to my beloved family for their wonderful love and generous moral support. To a very special friend of mine, Mr Danny Loke Chee Keong, for listening to my complaints and frustrations and for support and encouragement towards the success of this research, a special thank you.

I certify that an Examination Committee has met on 1st June 2007 to conduct the final examination of Ng Sook Han on her Master of Science thesis entitled "Chemical Constituents and Biological Activity of Asam Aur Aur (*Garcinia parvifolia*) and Jinggau (*Ploiarium alternifolium*)" 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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Date:

This thesis submitted to the Senate of Universiti Putra Malaysia and had been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

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Date: 17th JULY 2007

DECLARATION

I do 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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NG SOOK HAN

Date : 13th JUNE 2007

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