CHEMICAL CONSTITUENTS AND BIOLOGICAL ACTIVITIES OF *CURUCMA XANTHORRHIZA* AND *CURCUMA HEYNEANA*

By

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

November 2004

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

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Chairman: Associate Professor Mohd. Aspollah Hj. Sukari, Ph.D

Faculty: Science

Five compounds were isolated from *Curcuma xanthorrhiza.* The hexane extract afforded three pure compounds*, which* were identified as α- curcumene **(21)**, germacrone **(17)** and zederone **(66)**, while dichloromethane extract gave yellow powder product, which was characterized as curcumin **(5)** together with colourless oil, xanthorrhizol **(16)**. The studies on *Curcuma heyneana* afforded four compounds. The hexane extract yielded oxycurcumenol epoxide **(64),** which is a new natural product, isocurcumenol **(31)** and curcumenol **(32)**. In addition, dichloromethane extract produced stigmasterol **(65)**.

The following biological activities; larvicidal, cytotoxicity and antimicrobial activities carried out on these plants have not been reported previously. However the antioxidant activity has been reported. The results of bioactivity tests revealed that some of the plant crude extracts showed strong biological activities. Nevertheless, most of the isolated pure compounds showed only weak to moderate activity. Larvicidal test results both on the plants crude extracts showed that non polar extracts exhibited high toxicity with a LC_{50}

value between 26.4 μg/ml and 34.9 μg/ml. On the other hand, curcumin **(5)** and curcumenol **(32)** showed antimicrobial activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. The results obtained for antioxidant activity test revealed that curcumin **(5)** possessed stronger antioxidant activity, while the isolated pure compounds from *C. heyneana* were not active in the assay. Cytotoxicity activity on the isolated pure compounds from *C. heyneana* including oxycurcumenol epoxide **(64)**, curcumenol **(32)** and isocurcumenol **(31)** exhibited moderate cytotoxic activity with IC_{50} values 11.9, 12.6 and 13.3 μg/ml, respectively, while curcumin **(5)** showed strongest inhibitory activity with IC_{50} value 9.1 μg/ml.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia bagi memenuhi keperluan Ijazah Master Sains

KANDUNGAN KIMIA DAN AKTIVITI BIOLOGI *CURCUMA XANTHORRHIZA* DAN *CURCUMA HEYNEANA*

Oleh

NUR YUHASLIZA ABD RASHID

November 2004

Pengerusi: **Profesor Madya Aspollah Hj. Sukari, Ph.D**

Fakulti: **Sains**

Lima sebatian kimia telah berjaya dipencilkan dari *Curcuma xanthorrhiza.* Ekstrak heksana menghasilkan tiga sebatian tulen dan dikenal pasti sebagai α- kurkumene **(21)**, germakron **(17)** dan zederon **(66)**, manakala ekstrak diklorometana memberikan sebatian minyak tak berwarna dan serbuk kuning yang dikenal pasti masing- masing sebagai xantorhizol **(16)** dan kurkumin **(5)**. Penyelidikan ke atas *Curcuma heyneana* memperolehi empat sebatian, di mana ekstrak heksana menghasilkan tiga sebatian dan dikenal pasti sebagai oksikurkumenol epoksida **(64)**, isokurkumenol **(31)** dan kurkumenol **(32)**, manakala ekstrak diklorometana menghasilkan stigmasterol.

Aktiviti biologi seperti ujian larva, sitotoksik dan antimikrob yang telah dijalankan belum pernah dilaporkan. Manakala laporan tentang aktiviti antioksida telah dilaporkan. Keputusan ujian bioaktiviti menunjukkan bahawa ekstrak mentah mempunyai kesan yang lebih baik berbanding kebanyakkan sebatian tulen yang telah dipisahkan hanya menunjukkan aktiviti yang lemah dan sederhana. Ujian larva kedua-dua pokok

menunjukkan ekstrak yang kurang polar lebih tinggi ketoksikkannya dengan nilai LC_{50} antara 26.4 μg/ml dan 34.9 μg/ml. Namun begitu, sebatian tulen yang dipencilkan iaitu kurkumin **(5)** dan kurkumenol **(32)** mempunyai keaktifan antimikrob ke atas mikrob *Staphylococcus aureus* dan *Pseudomonas aeruginosa*. Keputusan yang diperolehi untuk antioksida menunjukkan kurkumin **(5)** mempunyai kesan yang kuat dalam aktiviti antioksida, sementara sebatian tulen daripada *Curcuma heyneana* tidak aktif. Aktiviti sitotoksik mendapati sebatian yang telah dipencilkan dari *C. heyneana* seperti oksikurkumenol epoksida **(64)**, kurkumenol **(32)** dan isokurkumenol **(31)** menunjukkan aktiviti sitotoksik yang sederhana dengan nilai IC_{50} 11.9, 12.6 and 13.3 μg/ml, masing-masing, sementara kurkumin **(5)** menunjukkan aktiviti perencatan yang kuat dengan nilai IC_{50} 9.1μg/ml.

DEDICATION

This thesis is dedicated to my beloved family and my husband

My father, Abd Rashid Yusoff

My mother, Maimunah Che Yunus

My siblings,
Nur Rashidawaty
Nur Haslindawaty
NurArbaeyah
Nur Faezah
Mohd Faizal
Nurul Hakimah Fatehah
Mohd Faizul
Nurul Atikah
Mohd Hafiz Quraini
Nurul Syahidu Syuhada
Mohd Ilman Ikhwan
Nurul Anis
Nurul Sara Syamimi

and

My beloved husband Sharin Ruslay

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I certify that an Examination Committee met on 2nd November 2004 to conduct the final examination of Nur Yuhasliza Binti Abd. Rashid on her Master of Science thesis entitled "Chemical Constituents and Biological Activities of *Curcuma xanthorrhiza* and *Curcuma heyneana*" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulation 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment in the requirements for the degree of Master Science. The members of the Supervisory 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 dully acknowledgement. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Putra Malaysia or other institutions.

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NUR YUHASLIZA ABD RASHID

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