

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

**By**

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**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
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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  $\alpha$ - 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<sub>50</sub>

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<sub>50</sub> values 11.9, 12.6 and 13.3 µg/ml, respectively, while curcumin (**5**) showed strongest inhibitory activity with IC<sub>50</sub> 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**

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Lima sebatian kimia telah berjaya dipencilkan dari *Curcuma xanthorrhiza*. Ekstrak heksana menghasilkan tiga sebatian tulen dan dikenal pasti sebagai  $\alpha$ - 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 antioksidan telah dilaporkan. Keputusan ujian bioaktiviti menunjukkan bahawa ekstrak mentah mempunyai kesan yang lebih baik berbanding kebanyakan sebatian tulen yang telah dipisahkan hanya menunjukkan aktiviti yang lemah dan sederhana. Ujian larva kedua-dua pokok

menunjukkan ekstrak yang kurang polar lebih tinggi ketoksikannya dengan nilai  $LC_{50}$  antara 26.4  $\mu\text{g/ml}$  dan 34.9  $\mu\text{g/ml}$ . Namun begitu, sebatian tulen yang dipencilkan iaitu kurkumin (**5**) dan kurkumenol (**32**) mempunyai keaktifan antimikrob ke atas mikroba *Staphylococcus aureus* dan *Pseudomonas aeruginosa*. Keputusan yang diperolehi untuk antioksidan menunjukkan kurkumin (**5**) mempunyai kesan yang kuat dalam aktiviti antioksidan, 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  $\mu\text{g/ml}$ , masing-masing, sementara kurkumin (**5**) menunjukkan aktiviti perencatan yang kuat dengan nilai  $IC_{50}$  9.1  $\mu\text{g/ml}$ .

## 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 2<sup>nd</sup> 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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## **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**

Date:

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