

ASSESSMENT OF ANEUPLOIDING POTENTIAL OF SEVERAL
PHENOLIC COMPOUNDS ON GERMINATION AND SEEDLING
GROWTH OF *Eleusine indica* (L.) Gaertn.
AND *Datura innoxia* L.

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FAKULTI SAINS DAN TEKNOLOGI
UNIVERSITI MALAYSIA TERENGGANU

2008

**ASSESSMENT OF ALLELOPATHIC POTENTIAL OF SEVERAL
PHENOLIC COMPOUNDS ON GERMINATION AND SEEDLING GROWTH
OF *Eleusine indica* (L) Gaertn. AND *Lemna minor* L.**

By
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A thesis submitted in partial fulfillment of
the requirements for the award of the degree of
Bachelor of Science (Biological Sciences)

**DEPARTMENT OF BIOLOGICAL SCIENCES
FACULTY OF SCIENCE AND TECHNOLOGY
UNIVERSITI MALAYSIA TERENGGANU
2008**

1100057808



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PENGAKUAN DAN PENGESAHAN LAPORAN PITA I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: **Assessment of Allelopathic Potential of Several Phenolic Compounds on Germination and Seedling Growth of *Eleusine indica* (L) Gaertn. and *Lemna Minor* L.** oleh **Chiong Ai Hua**, No. Matrik: **UK11330** telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Biologi sebagai memenuhi sebahagian daripada keperluan memperoleh Ijazah **Sarjana Muda Sains (Sains Biologi)**, Fakulti Sains dan Teknologi, UMT.

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DECLARATION

I hereby declare that this thesis entitled **Assessment of Allelopathic Potential of Several Phenolic Compounds on Germination and Seedling Growth of *Eleusine indica* (L) Gaertn. and *Lemna Minor* L.** is the result of my own research except as cited in the references.

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ACKNOWLEDGEMENTS

Firstly, I wish to express a special appreciation to my supervisor, Dr. Chuah Tse Seng and co-supervisor, Dr. Cha Thye San for their guidance and unfailing support to fulfill my final year project. I am also particularly thankful to Mr. Mohd Kamarul Izhar b. Kamaruddin, Ms. Maizatul Akmal bt. Abd. Rahman, Ms. Rafidah bt. Hanipah Razali, Mr. Ruzairie Hussin, Mr. Mohd Fazli b. Talib, Mr. Mazlan b. Kasim, Mr. Shahrul Zanudin and all other staffs at the laboratory of Post-harvest Technology and shadehouse who have directly or indirectly helped me to complete my project.

Besides that, I would also like to take this opportunity to thank Oh Hong Yew, Chang Kew Fong and Anne Marie, the master students who have guided me throughout my project and my friends especially my housemates Tiun Siew Mond, See Soo Yin and Lim Pei Ling. I deeply appreciate all guidance, explanation, trust, and help that I received from them. Finally, I would like to express my deepest thanks to my family for their loving, advice and friends for their encouragement for me to complete the final year project.

Thank you.

ABSTRACT

A series of single and binary action of allelochemicals were assessed under controlled laboratory conditions by applying the Additive Dose Model on two weed species, *Eleusine indica* (L.) Gaertn and *Lemna minor* L. to investigate the potential allelopathic effect of five phenolic compounds (gallic acid, vanillic acid, caffeic acid, coumarin and p-vanillin) and the joint action of phytotoxin mixtures on germination and seedling growth of *E. indica* and degree of leaf discoloration of *L. minor*. Dose - response curves and ED₅₀ values for single or binary mixture of phenolics, along with possible observed inhibitory action were determined. In dose - response experiments, coumarin and p - vanillin was demonstrated as the most phytotoxic inhibitors on germination and seedling growth of *E. indica* while caffeic acid and vanillic acid exhibited its strong effect on leaf discoloration of *L. minor*. The action of binary combination of selected phenolic compounds was found to be more synergistic instead of being additive and antagonistic. The mixture ratios which showed synergistic were 30% coumarin + 70% p-vanillin, 50% coumarin + 50% p-vanillin, 60% coumarin + 40% p-vanillin, 70% coumarin + 30% p-vanillin and 100% coumarin + 0% p-vanillin for germination of *E. indica*; 0% coumarin + 100% p-vanillin, 30% coumarin + 70% p-vanillin, 40% coumarin + 60% p-vanillin, 50% coumarin + 50% p-vanillin, 60% coumarin + 40% p-vanillin, 70% coumarin + 30% p-vanillin and 100% coumarin + 0% p-vanillin for root growth of *E. indica*; 30% coumarin + 70% p-vanillin, 60% coumarin + 40% p-vanillin and 100% coumarin + 0% p-vanillin only for fresh weight of germinated *E. indica* and 0% vanillic acid + 100% caffeic acid, 30% vanillic acid + 70% caffeic acid, 40% vanillic acid + 60% caffeic acid, 50% vanillic acid + 50% caffeic acid, 60% vanillic acid + 40% caffeic acid and 70% vanillic acid + 30% caffeic acid for leaf discoloration of *L. minor*. The synergistic action observed could reflect that the mixture compounds may contain different sites of action which interact to form more toxic compound. This study has revealed the potential of phenolic mixture for weed control.

ABSTRAK

Satu siri tindakan alelokimia secara individu dan kombinasi telah dijalankan di makmal dalam keadaan terkawal dengan menggunakan Model ADM (Additive Dose Model) ke atas dua species rumpai, *Eleusine indica* (L.) Gaertn dan *Lemna minor* L untuk menyelidik ciri-ciri alelopati yang terdapat dalam sebatian fenolik (asid galik, asid vanilik, asid kafeik, koumarin dan p-vanilin) dan kesan tindakan kombinasi sebatian fenolik ke atas percambahan dan pertumbuhan anak benih *E. indica* dan darjah penyahwarnaan daun *L. minor*. Ujikaji ini mempamerkan keputusan melalui lengkung dos gerakbalas, nilai ED₅₀ dan tindakan penyekatan yang mungkin berlaku. Dalam eksperimen dos gerakbalas yang melibatkan hanya individu sebatian fenolik, koumarin dan p-vanilin terbukti sebagai agen penyekat yang paling toksik ke atas percambahan dan pertumbuhan *E. indica* manakala asid kafeik dan asid vanilik pula menunjukkan kesan yang kuat ke atas penyahwarnaan daun *L. minor*. Kesan tindakan kombinasi sebatian fenolik adalah lebih menghala kepada aktiviti sinergistik berbanding dengan kesan aditif dan antagonistik. Nisbah kombinasi yang menunjukkan aktiviti sinergistik ialah 30%koumarin + 70%p-vanilin, 50%koumarin + 50%p-vanilin, 60%koumarin + 40%p-vanilin, 70%koumarin + 30%p-vanilin dan 100%koumarin + 0%p-vanilin bagi percambahan *E. indica*; 0%koumarin + 100%p-vanilin, 30%koumarin + 70%p-vanilin, 40%koumarin + 60%p-vanilin, 50%koumarin + 50%p-vanilin, 60%koumarin + 40%p-vanilin, 70%koumarin + 30%p-vanilin dan 100%koumarin + 0%p-vanilin bagi pertumbuhan akar *E. indica*; 30%koumarin + 70%p-vanilin, 60%koumarin + 40%p-vanilin dan 100%koumarin + 0%p-vanilin bagi berat bersih anak benih *E. indica* dan 0%asid vanilik + 100%asid kafeik, 30%asid vanilik + 70%asid kafeik, 40%asid vanilik + 60%asid kafeik, 50%asid vanilik + 50%asid kafeik, 60%asid vanilik + 40%asid kafeik dan 70%asid vanilik + 30%asid kafeik bagi penyahwarnaan daun *L. minor*. Kesan sinergistik ini membayangkan bahawa sebatian fenolik yang terlibat dalam kombinasi mempunyai tapak tindakan berlainan yang saling bertindak antara satu sama lain untuk membentuk satu sebatian yang lebih toksik. Kajian ini telah mendedahkan potensi kombinasi sebatian fenolik untuk kawalan rumpai.