



UNIVERSITI PUTRA MALAYSIA

**CHEMICAL CONSTITUENTS AND TOXICITY EFFECTS OF
SELECTED BOTANICAL EXTRACTS ON *Spodoptera litura*
Fabricius (LEPIDOPTERA: NOCTUIDAE).**

LOH SIEW FAN

FP 2011 29

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NOCTUIDAE).**

By

LOH SIEW FAN

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

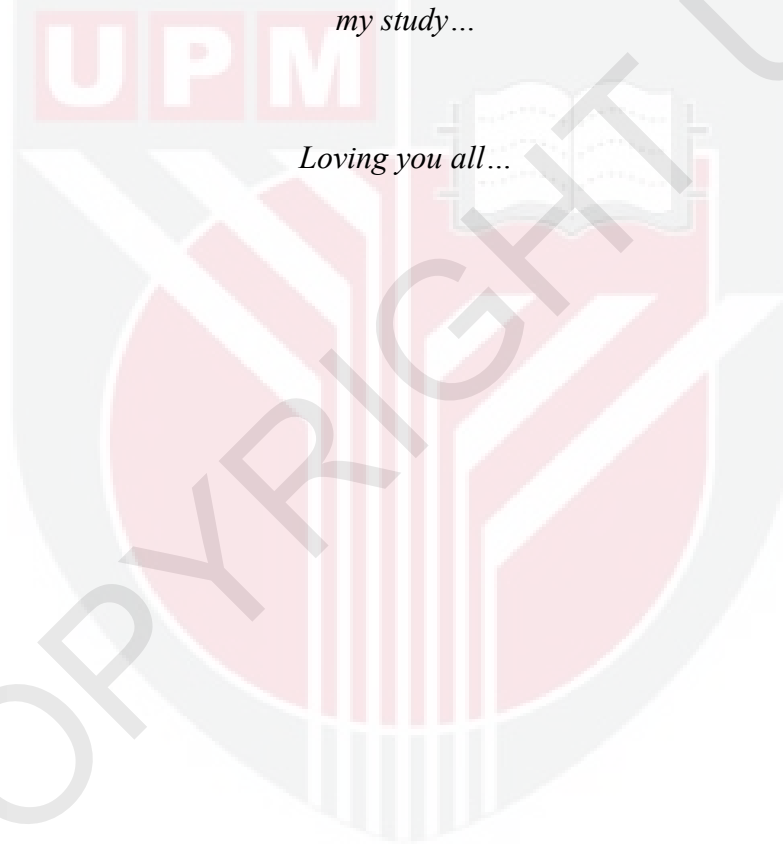
APRIL 2011

DEDICATION

*To my dearest father, mother and sisters,
Special dedication for your endless and boundless love...*

*To my lovely husband and daughter,
Thank you for your endless support, understanding and encouragement throughout
my study...*

Loving you all...



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

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LOH SIEW FAN

April 2011

Chairperson: Professor Rita Muhamad Awang, PhD

Faculty: Agriculture

Sustainable and environmental friendly control methods such as botanical insecticides are urgently needed to reduce the negative impact caused by chemical insecticides. Experiments were conducted to search for potential plant extracts against the armyworm, *Spodoptera litura* (F.). Solvents extracts and essential oils from black pepper fruits (*Piper nigrum* L.), kaffir lime (*Citrus hystrix* DC) and lantana leaves (*Lantana camara* L.) were used to test the toxicity and their effect on larvae development. Dried plant materials were used for solvent extraction while essential oils were extracted from the fresh plant materials. Solvent extractions were conducted using hexane, chloroform and acetone to elute compounds of different polarities. Essential oils were obtained by hydrodistillation and their compositions were analyzed by GC-MS. A total of 39 compounds were detected in the essential oil fraction of *P. nigrum* fresh fruits, which contained high percentage of monoterpenes compounds. A total of 29 compounds were detected in the essential

oil fraction of kaffir lime leaves, which contained high percentage of oxygenated monoterpenes while a total of 40 compounds were identified in lantana oil which contained high number of sesquiterpenes and oxygenated sesquiterpenes.

Plant extracts and essential oils were applied by topical bioassay to the uniform weighted second instar larvae. Different doses were tested on the larvae and the mortality was recorded at 24h and 48h after treatment. Data were evaluated through Probit Analysis to determine the LD₅₀. Among the three plants tested, highest mortality was recorded in black pepper treated colony. Results showed that the toxicities decreased followed by *P. nigrum* hexane extract, *P. nigrum* acetone extract, leaf oil of *L. camara*, leaf oil of *C. hystrix* and *P. nigrum* chloroform extract. All of the solvent extracts of *C. hystrix* and *L. camara* leaves shown non toxic to the larvae.

Essential oil of *Citrus hystrix* and hexane extract of *Piper nigrum* were used to test their efficacy in suppressing the larvae development by topical bioassay. Larvae mortality, larvae head capsules, larvae weight gained, percentage of pupation, pupae weight, malformed pupae, adult emergence and sex ratio were recorded. Antifeedant activity of the *C. hystrix* oil and *P. nigrum* extracts were evaluated through leaf dip bioassay. Feeding behaviour was recorded at 24h and 48h after treatment. From the investigation, both of the plant extracts showed effects against the larvae development and pupae formation. Hexane extract of *P. nigrum* showed outstanding results especially in pupae mortality and adult emergence. Total development growth index (TDGI) of *C. hystrix* and *P. nigrum* treatments were relatively lower as compared to control treatment. *C. hystrix* essential oil had higher repellency activity against the *S. litura* larvae as compared to *P. nigrum*.

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

**KONSTITUEN KIMIA DAN KESAN KERACUNAN DARIPADA EKSTRAK
BOTANI TERPILIH TERHADAP *Spodoptera litura* Fabricius
(LEPIDOPTERA: NOCTUIDAE).**

Oleh

LOH SIEW FAN

April 2011

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Kaedah pengurusan yang mesra alam seperti racun perosak botanika amat diperlukan untuk mengurangkan kesan negatif dan masalah penggunaan racun perosak kimia. Eksperimen ini dijalankan untuk mencari ekstrak tanaman yang berpotensi untuk menangani perosak *Spodoptera litura* (F.). Ekstrak pelarut dan minyak pati daripada buah lada hitam (*Piper nigrum* L.), daun limau purut (*Citrus hystrix* DC) dan daun bunga tahi ayam (*Lantana camara* L.) telah diuji kadar toksik dan keberkesannya terhadap tumbesaran larva. Bahan tanaman yang kering digunakan bagi pengekstrakan oleh pelarut manakala minyak pati diekstrak daripada bahan tumbuhan yang segar. Pengekstrakan dengan pelarut dijalankan dengan menggunakan heksana, kloroform dan acetone untuk mendapat kompaun yang berbagai polariti. Minyak pati diekstrakkan dengan cara 'hydrodistillation' dan dianalisis dengan GC-MS. Sejumlah 39 sebatian telah dikesan dalam pecahan minyak pati buah lada hitam, dimana mengandungi peratus monoterpenes yang tinggi. Sejumlah 29 sebatian telah

dikesan dalam pecahan minyak patidaun limau purut, ia mengandungi peratus oxygenated monoterpenes yang tinggi manakala sejumlah 40 sebatian telah dijumpai dalam minyak pati daun bunga tahi ayam, dimana mengandungi peratus sesquiterpenes dan oxygenated sesquiterpenes yang tinggi.

Ekstrak tumbuhan dan minyak pati diuji secara bioasai topikal terhadap larva instar kedua yang beratnya sekata. Kadar racun yang berlainan diuji terhadap larva dan kadar kematian direkod pada jam ke-24 dan ke-48. Data dianalisis menggunakan analisa Probit untuk menentukan LD₅₀. Antara 3 tumbuhan yang diuji, paling tinggi kematian direkodkan pada populasi yang diuji dengan lada hitam. Keputusan menunjukkan bahawa ketosikan menurun mengikut ekstrak heksana lada hitam, ekstrak acetone lada hitam, minyak pati daun bunga tahi ayam, minyak pati daun limau purut dan ekstrak kloroform lada hitam. Walau bagaimanapun, semua ekstrak pelarut daripada daun limau purut dan daun daun bunga tahi ayam tidak menunjukkan keracunan terhadap larva.

Minyak pati daun limau purut dan ekstrak heksana buah lada hitam digunakan untuk menguji keberkesannya dalam membantut tumbesaran larva dengan kaedah bioasai topikal. Kematian larva, kapsul kepala, peningkatan berat larva, peratusan kepompong, berat pupa, pupa cacat, kemunculan dewasa dan nisbah jantina telah direkodkan. Aktiviti antimakan oleh ekstrak limau purut dan lada hitam diuji melalui kaedah dip daun. Aktiviti permakanan direkod pada jam ke-24 dan jam ke-48 selepas ujian. Keputusan menunjukkan kedua-dua ekstrak memberi kesan terhadap tumbesaran larva dan kepompong. Pada keseluruhannya, ekstrak heksana buah lada hitam menunjukkan keberkesanan terutamanya pada kematian kepompong dan

mengurangkan kemunculan dewasa. Indeks Jumlah Peningkatan Tumbuhan (TDGI) oleh minyak pati daun limau purut dan ekstrak heksana lada hitam adalah kurang dibandingkan dengan rawatan kawalan. Minyak pati daun limau purut menunjukkan aktiviti mengusir larva *S. litura* yang lebih baik daripada ekstrak heksana buah lada hitam.



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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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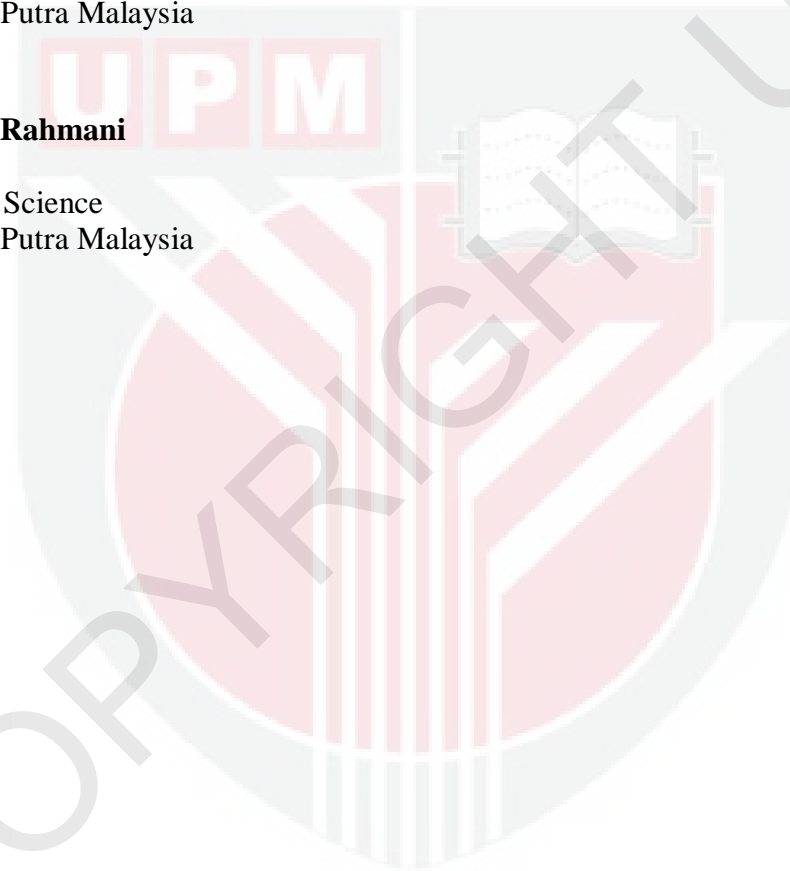
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I certify that a Thesis Examination Committee has met on the 25 April 2011 to conduct the final examination of Loh Siew Fan on her thesis entitled “Chemical Constituents and Toxicity Effects of Selected Botanical Extracts on *Spodoptera litura* Fabricius (Lepidoptera: Noctuidae)” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or any other institutions.

Loh Siew Fan

Date: 25 April 2011



TABLE OF CONTENTS

	Page
DEDICATION	ii
ABSTRACT	iii
ABSTRAK	v
ACKNOWLEDGEMENTS	viii
APPROVAL SHEETS	ix
DECLARATION	xi
LIST OF TABLES	xiv
LIST OF FIGURES	xv
LIST OF PLATES	xvi
LIST OF APPENDICES	xvii
LIST OF ABBREVIATION	xviii
CHAPTER	
1 INTRODUCTION	1
2 LITERATURE REVIEW	
2.1 <i>Spodoptera litura</i> Fabricius	5
2.1.1 Distribution, Host Plant and Damage Caused by <i>S. litura</i>	7
2.1.2 Control Methods and Insecticides resistance	8
2.2 Botanical Insecticides	11
2.2.1 Mode of action, advantages and limits of botanical insecticides	13
2.2.2 <i>Piper nigrum</i> Linnaeus	16
2.2.3 <i>Citrus hystrix</i> DC	19
2.2.4 <i>Lantana camara</i> Linnaeus	22
3 CHEMICAL CONSTITUENTS OF THE ESSENTIAL OILS OF BLACK PEPPER, KAFFIR LIME AND LANTANA	
3.1 Introduction	26
3.2 Materials and Methods	27
3.2.1 Preparation of plant materials	27
3.2.2 Extraction of the essential oils	30
3.2.3 Identification of chemical components (GC-MS)	31
3.3 Results and Discussions	32
3.4 Conclusion	42

4	TOXICITY OF PLANT EXTRACTS OF BLACK PEPPER, KAFFIR LIME AND LANTANA AGAINST ARMYWORM	
4.1	Introduction	43
4.2	Materials and Methods	44
4.2.1	Test Insect	44
4.2.2	Preparation of Plant Materials, Essential Oils and Solvent Extract from Various Plant Parts	45
4.2.3	Topical Toxicity Bioassay	47
4.2.4	Data Analysis	48
4.3	Results and Discussions	48
4.4	Conclusion	54
5	EFFECTS OF ESSENTIAL OIL OF KAFFIR LIME AND HEXANE EXTRACT OF BLACK PEPPER AGAINST DEVELOPMENT OF ARMYWORM	
5.1	Introduction	56
5.2	Materials and Methods	57
5.2.1	Test Insect	57
5.2.2	Preparation of botanical insecticides	57
5.2.3	Bioassay	59
5.2.4	Parameter and Data Analysis	60
5.3	Results and Discussions	63
5.4	Conclusion	75
6	CONCLUSION	77
	REFERENCES	80
	APPENDICES	93
	BIODATA OF STUDENT	103
	LIST OF PUBLICATIONS	104