UNIVERSITI PUTRA MALAYSIA

TOXICITY OF BOTANICAL INSECTICIDES AGAINST THE OIL PALM POLLINATING WEEVIL, ELAEIDOBIUS KAMERUNICUS FAUST

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A project report submitted of Faculty of Agriculture, Universiti Putra Malaysia, in fulfillment of the requirement of PRT4999 (Final Year Project) for the award of the Degree of Bachelor of Agriculture Science.

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CERTIFICATION

This project tittle is "Toxicity Of Botanical Insecticides Against The Oil Palm Pollinating Weevil, *Elaeidobius kamerunicus* Faust" prepared by Muhammad Iqbal bin Johar and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT4999 for the award of the Degree of Bachelor of Agriculture Science.

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENT	i
TABLE OF CONTENT	ii
LIST OF FIGURES	iv
LIST OF PICTURE	v
LIST OF TABLE	vi
ABSTRACT	vii
ABSTRAK	viii
CHAPTER 1: INTRODUCTION	1
CHAPTER 2: LITERATURE REVIEW	
2.1 Botanical Insecticides	4
2.1.1 Azadirachtin	7
2.1.2 Garlic Oil	10
2.1.3 Rotenone	12
2.1.4 Cnidiadin	14
2.2 Oil palm pollinating weevil	
2.2.1 Overview of Oil Palm Pollinating Weevils	16
2.2.2 Host specificity	18
CHAPTER 3: MATERIALS AND METHOD	
3.1 Source of *E. kamerunicus*	19
3.2 Mass rearing of *E. kamerunicus*	19
3.3 Insecticide preparation	19

3.4 Exposure to insecticide 20

3.5 Parameters 22

3.6 Data Analysis 25

CHAPTER 4 : RESULT AND DISCUSSION 26

CHAPTER 5 : CONCLUSION 39

REFERENCES 40

APPENDICES 46

LIST OF FIGURES

Figure 1: Insecticide efficacy, E_t of azadirachtin, garlic oil, plant based rotenone, mineral based rotenone and cnidiadin on adult oil palm pollinating weevil, *E. kamerunicus* 28

Figure 2: The insecticides efficacy values at day 0 (E_0) and at day 2 (E_2) for five botanical insecticides, azadirachtin, garlic oil, plant based rotenone, mineral based rotenone, and cnidiadin. 31

Figure 3: Dynamics of insecticides efficacy changes over time for the selected botanical insecticides, azadirachtin, garlic oil, plant based rotenone, mineral based rotenone and cnidiadin. 34

Figure 4: Lethality index of, azadirachtin, garlic oil, plant based rotenone, mineral based rotenone and cnidiadin. 35

LIST OF PICTURE

Plate 1: Chemical structure of azadirachtin, active ingredients of neem 9

Plate 2: Structure of major compound of the essential oils of garlic, diallyl trisulfide and diallyl sulfide 11

Plate 3: Chemical structure of rotenone 13

Plate 4: Chemical structure of cnidiadin 15

Plate 5: Adult of oil palm pollinating weevil 17

Plate 6: Selected botanical insecticides involved in experiment. 21

Plate 7: Plastic container covered with filter paper for bioassay 21

LIST OF TABLES

Table 1: Botanical insecticides tested on adult oil palm pollinating weevil *E. kamerunicus* 20

Table 2: Lethality index, initial efficacy, E_0 and efficacy change over 2 days trial for garlic oil, rotenone, and azadirachtin 38

ABSTRACT

Botanical insecticides are naturally occurring insecticides derived from any type of plants that can be formulated as insecticides. Botanicals insecticides are widely used due to their lower toxicity to human and environmental friendly. However, the use of these insecticides in the oil plam plantation can also affect the beneficial insects that act as pollinators. *Elaeidobius kamerunicus* is one of the essential beneficial insects for oil palm plantation in terms of pollinating activity. To ensure the botanicals insecticides product is harmless to the oil palm pollinating weevil, the toxicity of five types of botanicals insecticides namely, azadirachtin, garlic oil, 2 formulations of rotenone and cnidiadin were tested on the adult of *E. kamerunicus.* By using residual exposure method, adult *E. kamerunicus* were exposed individually to the insecticide residues for two hours then the insect were monitored daily for survivorship over a period of two days. The conditions of the insect after two days of exposure were recorded using three criteria that are alive, moribund or dead. By calculating the total insect moribund or dead, we estimated the efficacy of insecticides. Lethality index for the botanical insecticide was created in view of evaluation of immediate and delayed effect of insecticides exposure on the adult *E. kamerunicus.* At the end of experiment, azadirachtin showed the highest lethality index (58.89%) on the adult weevil, followed by plant based rotenone (57.22%), mineral based rotenone (50.00%), cnidiadin (41.67%) and garlic oil (6.67%). The high index values indicate the botanical insecticides tested give detrimental effect on the adult oil palm pollinating weevil, *E. kamerunicus,* except garlic oil.

ABSTRAK

Racun serangga botani adalah sejenis racun serangga yang diekstrak daripada pelbagai jenis tumbuh tumbuhan untuk dijadikan racun serangga. Racun serangga botani digunakan secara meluas masa kini kerana ketoksikan yang lebih rendah untuk mesra pengguna dan alam sekitar. Walaubagaimanapun, penggunaan racun serangga ini dalam perladangan kelapa sawit mungkin juga boleh memberi kesan kepada serangga berfaedah yang bertindak sebagai agen pendebungaan. Elaeidobius kamerunicus adalah salah satu serangga yang memberikan manfaat yang sangat penting untuk perladangan kelapa sawit dari segi aktiviti pendebungaan. Untuk memastikan produk racun serangga botani tidak berbahaya kepada kumbang pendebunga kelapa sawit, ketoksikan lima jenis ramuan botani racun serangga, azadirachtin, minyak bawang putih, 2 penggubalan rotenone dengan komposisi yang berbeza dan cnidiadin telah diuji pada serangga dewasa E. kamerunicus. Dengan menggunakan kaedah pendedahan sisa, serangga dewasa E. kamerunicus telah didedahkan secara individu kepada sisa-sisa racun serangga selama dua jam kemudian serangga dipantau setiap hari dengan dalam tempoh dua hari. Keadaan serangga selepas dua hari pendedahan telah direkodkan dalam tiga kriteria iaitu masih hidup, lumpuh ataupun mati. Dengan mengira jumlah serangga yang lumpuh dan mati, keberkesanan racun dan indeks lethality telah dikira untuk mengaggarkan tahap toksik racun botani kepada serangga. Pada akhir eksperimen, azadirachtin menunjukkan indeks lethality tertinggi (58.89%) pada kumbang dewasa, diikuti oleh rotenone berasaskan tumbuhan (57.22%), rotenone berasaskan mineral (50.00%), cnidiadin (41.67%) dan minyak bawang putih (6.67%). Nilai indeks yang tinggi menunjukkan semua racun serangga botani yang diuji memberikan kesan buruk kepada kumbang pengdebunga kelapa sawit dewasa , E. kamerunicus

CHAPTER 1

INTRODUCTION

Botanical insecticides are naturally occurring chemicals (insect toxins) extracted or derived from plants or minerals. They are also called natural insecticides. Numerous plants and minerals have insecticidal properties which they are toxic to insects. According to Silva-Aguayo (2005), the evolution of plant for over 400 million years has created protection mechanism such as repellents and insecticidal effect to protect themselves against insects. Botanicals insecticides are harmless to the human and surroundings compared to the synthetic insecticides because it contains less toxic than synthetic insecticides. Most organic farmers prefer to use these types of insecticides because it can conserve the non-target organism that can be beneficial for cropping system.

Botanicals insecticide is not a new product that has not been commercialized. The first botanical insecticide is nicotine that derived from tobacco leaves in early XVII Century. After the Second World War, few plants and plant extracts that had shown promising effects, and widely use were replaced by synthetic insecticides. When synthetic insecticides appeared in the 1940's some people thought that botanical insecticides would disappear forever but problems like environmental contamination, residues in food and feed and pest resistance brought them back to the fore (Aguayo, 2005).

Cypermethrin and trichlorfon is a type of synthetic insecticides commonly used in oil palm plantation to control rhinoceros beetle, *Oryctes rhinoceros* and Javanese grasshopper, *Valanga nigricornis.* Although the synthetic insecticides are effective to control the population of pest, it can also disrupt the population of beneficial insecticides such as *Elaeidobius kamerunicus.* Najib et al (2009) stated that spraying cypermethrin at 7.5% w/w was highly toxic and causing 100% mortality of the beneficial insects. Farmers suggested the use botanical insecticides to avoid this problem and reduce the residue in food, and less costly compared to synthetic insecticides.

Oil palm pollinating weevil, *E. kamerunicus* is one of the important beneficial insects in Malaysia. Before the oil palm pollinating weevil was introduced in Malaysia, the pollination process depends on wind pollination. There is another species of oil palm pollinators but a study conducted by Wahid and Kamarudin (1997) shown that insect are inefficient for the pollinating process. To improve the pollinating process, the sector developed hand pollination system but the pollinating process involved a lot of workers. In 1981, African pollinating weevil was introduced in Sabah. The admittance of this exotic insect shows a positive impact in our oil palm industry as the insect improves the fruit set development. The population of the oil palm weevil must be conserved in order to improve pollination and increased fruit set.

Chemical control is the most popular method to control the pest of many cultivars because of the immediate effect and ease of application. In oil palm industry, trichlorfon and cypermethrin are common pesticide for pest control such as *Oryctes rhinoceros* and *Apogonia spp*. The use of chemical control of insect pest must be done effectively to preserve the population of beneficial insect such as *E. kamerunicus.* Although it is known that botanical products do not affect the non-target organism, it is still important to research about the toxicity of botanicals insecticide namely azadirachtin, garlic oil, rotenone and cnidiadin against the oil palm pollinating weevil.

Therefore, this experiment was conducted based on objectives to: 1) to determine the effects of botanical insecticides immediately after exposure to oil palm pollinating weevil 2) to identify the mortality rates and recovery of oil palm pollinating weevil over 2 day period and 3) to compare the lethality index among all tested botanical insecticides and to identify most relevant chemical for oil palm insect pest control. At the end of project, the outcome from experimental result will enable us to plan the best insecticide in controlling the insect pest and at the same time preserving the population of beneficial insecticides in the field

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