EVALUATION OF TOPICAL BIOASSAY METHOD OF IMIDACLOPRID AND THIAMETHOXAM INSECTICIDES ON STINGLESS BEE (TRIGONA ITAMA)

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BY

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A project report submitted to Faculty of Agriculture, University Putra Malaysia, in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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CERTIFICATION FORM

This project report entitled "Evaluation of Topical Bioassay Method of Thiomethoxam And Imidacloprid Insecticides on Stingless Bees (*Trigona Itama*)" is prepared by Nur Aida binti Zulkiffly and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT4999 (Final Year Project) for the award of degree of Bachelor of Agricultural Science.

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ABSTRACT

Stingless bees (*Trigona itama*) are restricted to the tropical regions of the world and are considered as important pollinators of various wild and cultivated plants. Commercially important plants such as coconut, carambola, mango, strawberry, rambutan and others were confirmed pollinated by stingless bees. Unfortunately, nowadays most farmers rely too much on insecticide to protect the crops. Researchers have found that insecticides are dangerous to bees and may kill them. Many insecticides toxicity studies are commonly conducted on honey bees and very lack study on the stingless bees. As the size of the stingless bees (*Trigona itama*) is smaller than honey bees, therefore it would be more sensitive to the insecticides. The main purpose of this study is to determine the toxicity level of neonicotinoid insecticides, which are Thiamethoxam and Imidacloprid on stingless bees. This study was conducted by using topical bioassay method on *Trigona itama* to determine the LD_{50} (in ppm value) of the insecticides. Four different concentrations for each insecticides and a control were prepared for four replications. Every replication requires ten individual foragers of *Trigona itama*. The mortality number of *Trigona itama* were recorded at 24 hours and 48 hours after treatment. The results showed that stingless bees were highly susceptible to Imidacloprid (LD_{50}=0.225 ppm, 24 HAT and 0.122 ppm, 48 HAT) compared to Thiamethoxam (LD_{50}=2.009 ppm, 24 HAT and 1.057 ppm, 48 HAT). Comparison of LD_{50} values for both insecticides between *Apis mellifera sp.* and *Trigona itama* showed that *Trigona itama* is more easily harmed than *Apis mellifera sp.*

ABSTRAK

Lebah kelulut (*Trigona itama)* adalah terhad di kawasan tropika dan adalah agen pendebungaan penting kepada pelbagai tumbuhan liar mahupun tanaman yang ditanam. Tanaman komersial yang penting seperti kelapa, jambu batu, mangga, strawberi, rambutan dan banyak lagi telah disahkan didebungakan oleh lebah kelulut secara eksperimen. Kebanyakkan petani hari ini terlalu bergantung kepada penggunaan racun serangga untuk melindungi tanaman. Penyelidik mendapati pendedahan racun serangga kepada lebah madu (*Apis mellifera*) adalah bahaya dan mungkin akan menyebabkan kematian. Namun, tidak banyak penyelidikan mengenai kesan toksik racun serangga terhadap lebah kelulut berbanding lebah madu. Oleh kerana saiz lebah kelulut lebih kecil berbanding lebah madu, ia lebih sensitif terhadap racun serangga. Tujuan kajian in dijalankan adalah untuk mengkaji tahap ketoksikan racun serangga neonicotinoid iaitu Thiomethoxam and Imidacloprid ke atas lebah kelulut. Kajian ini dijalankan menggunakan kaedah bioassay topikal terhadap lebah kelulut untuk menentukan nilai LD_{50} (ppm) racun serangga. Terdapat empat kepekatan yang berbeza dan rawatan kawalan bagi 4 replikasi untuk setiap racun. Setiap replikasi menggunakan 10 individu *Trigona itama.* Bilangan kematian *Trigona itama* telah direkodkan untuk 24 jam dan 48 jam selepas rawatan. Hasil kajian menunjukkan lebah kelulut mempunyai daya tahan yang rendah terhadap Imidacloprid (LD_{50}=0.225 ppm, 24 HAT and 0.122ppm, 48 HAT) berbanding Thiamethoxam (LD_{50}=2.009ppm, 24 HAT and 1.057 ppm, 48 HAT). Perbandingan nilai LD_{50} untuk kedua-dua racun serangga antara *Apis mellifera sp.* dan *Trigona itama* menunjukkan *Trigona itama* adalah lebih mudah terancam berbanding *Apis mellifera sp.*

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURES

Figures **Pages**

LIST OF PLATES

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

Stingless bees are a large group of bees (about 500 species), simply called as meliponines (sometimes called as stingless honey bees). They belong to family Apidae and are closely related to common honey bees, carpenter bees, orchid bees, and bumblebees. Meliponines have stingers, but they are highly reduced and cannot be used for defense. They are mainly found in tropical countries such as Australia, Africa, Southeast Asia and parts of Mexico and Brazil (Kwapong et al., 2010). Stingless bees are excellent pollinators of crops and flowers. These insects are a diverse group that includes more than 400 species that show high variability in physiology, morphology, and size, ranging from 0.2 mm in the genus Trigonisca to almost 20 mm in some Melipona species (Michener, 2000).

Commercially important plants such as coconut, carambola, mango, strawberry, rambutan, tomato, cucumber, avocado and coffee were experimentally confirmed pollinated by stingless bees (Slaa et al., 2006). Moreover, honey produced by stingless bee also get high demands due to stingless bee honey give a lot of benefits in terms of health, fitness and beauty. Stingless bee honey is twice as nutritious as ordinary honey, according to the Malaysian Agricultural Research and Development Institute (MARDI). Many products can be produced by this honey such as foods products, cosmetics and soap.

Stingless bee honey is called mother of medicine and an increasing number of traditional practitioners and researchers has suggested for its use. In term of health,

stingless bee honey can treat diabetes, cures asthma, cure arthritis and many others, while in term of fitness it can overcome insomnia, overcome obesity and also increase stamina (Mail, 2014). Nowadays, many of cosmetics product also contains honey bee which really helps on smooth and whiten the skin. Moreover, other products which are pollen or called as beebread are a great source to provide energy, help treat inflammation and good for skin in term of reducing wrinkles and make the skin smoother and healthier.

In Malaysia, there are about 30 species of stingless bee and most of them are found in the forest area. Comparing to bees that only produce honey, stingless bee is very unique because they produce three products which are pollen, propolis and honey. Observation on the marketing of stingless bee honey, the price can be reached RM 120 per bottle for 350 mL, while the normal honey only sold at RM30 for the same quantity. Thus, meliponiculture start to bloom in Malaysia because of it has high potential in generating income (Kelly et al., 2014).

In addition, honey production started to increase gradually; a positive Malaysia's balance of trade (BOT) of RM5.26 million was recorded in 2009, and RM16.38 million in 2010 (Ismail, 2008). For instance, through the development of agro-entrepreneurs in beekeeping, Malaysian farmers can achieve income RM5000 per month (Ismail, 2014). Simultaneously, stingless beekeeping was starting to attract major attention, as it is more easily set up and expanded for commercial purposes (Idris, 2013). Other than that, some of the beekeepers also selling the colony of the stingless bees which cost from RM400 up to RM1000 per colony depends on the type of the species.

1.2 Problem Statement and Objective

Modern agriculture in Malaysia relies too much on chemical pesticides to control the pest due to it is easy to handle and faster effect towards the pest compare to mechanical and biological methods. However, it may be toxic for beneficial crop-visiting insects or pollinators such as bees. As the farmers trying to reduce the population of the pest, they also will kill the pollinators that are needed for pollinating the crop which is important to increase the yields. Therefore, the objective of this study was to determine the toxicity effect of neonicotinoids insecticides which are Thiamethoxam and Imidacloprid on the stingless bee. This helps to avoid decrease in honey production and colony size due to exposure of insecticides on stingless bees and to know specific dosage that can cause mortality to the stingless bees. Thus, the recommended dosage can be obtained from this study in order to ensure the survival of larvae to form the colony which needed in the production of honey.

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