DETERMINATION OF NEONICOTINOID INSECTICIDES ON STINGLESS BEE, TRIGONA ITAMA THROUGH FILTER PAPER BIOASSAY METHOD

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A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfilment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Horticultural Science

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CERTIFICATION PAGE

This project report entitled "**DETERMINATION OF NEONICOTINOID INSECTICIDES ON STINGLESS BEE, *TRIGONA ITAMA* THROUGH FILTER PAPER BIOASSAY METHOD** " is prepared by Aisyah binti Mahamed and submitted to the Faculty of Agriculture in fulfilment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Horticultural Science.

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ABSTRACT

In Malaysia, stingless bee is known as Kelulut. They are the common visitors to flowering plants and an important pollinators of crops. Nowadays, many farmers are relying on pesticide to protect their crop. The pesticide could be exposed to pollinators during application through drift and contact residue from ingestion of pollen and nectar. In Malaysia, there are no study has been reported on the effect of pesticide on meliponiculture. Therefore, the objective of this study is to evaluate the sensitivity of stingless bee to the insecticide through filter paper disc bioassay. Through this research, information of the lethal toxicity of insecticide to the stingless bee was found and be use as future references. Bioassay was conducted on *T. itama* to identify the LC_{50} (in ppm value) of thiamethoxam and imidacloprid insecticides. Four concentrations of each insecticides and a control were prepared, each concentration has four replications with 10 *T. itama*. The insecticides serial dilutions were prepared from commercial formulation. The data recorded for the number of bees survive after 24 and 48 hours of experiments. The LC_{50} was determined by using Probit Analysis (EPA Probit Ver 1.5 software). The LC_{50} of imidacloprid for 24 and 48 hours are 13.967 ppm and 7.183 ppm respectively. The LC_{50} of thiamethoxam for 24 and 48 hours are 25.253 ppm and 18.444 ppm respectively. Thus, imidacloprid is highly toxic compared to thiamethoxam.

ABSTRAK

Di Malaysia, lebah tanpa sengat dikenali sebagai Kelulut. Mereka adalah pelawat biasa untuk tumbuh-tumbuhan berbunga dan pencemar utama tanaman. Pada masa kini, ramai petani bergantung kepada racun perosak untuk melindungi tanaman mereka. Racun makhluk perosak boleh terdedah kepada pendebunga semasa aplikasi menerusi sisa dan residu sentuh dari pengumpulan debunga dan nektar. Di Malaysia, belum ada kajian telah dilaporkan mengenai kesan racun perosak pada meliponikultur. Oleh itu, objektif kajian ini adalah untuk menilai sensitiviti kelulut kepada racun serangga melalui bioesei cakera kertas penapis. Melalui penyelidikan ini, maklumat mengenai ketoksikan racun serangga dari racun serangga akan dikenalpasti dan boleh digunakan sebagai rujukan masa hadapan. Bioesei telah dijalankan pada *T.itama* untuk mengenal pasti LC_{50} (dalam nilai ppm) racun serangga imidacloprid dan thiamethoxam. Empat kepekatan setiap racun serangga dan kawalan disediakan, setiap kepekatan mempunyai empat replikasi dan memerlukan 10 ekor *T.itama*. Pencairan racun telah disediakan dari formulasi komersial. Data telah direkodkan untuk bilangan lebah selepas 24 dan 48 jam ujikaji. LC_{50} ditentukan dengan menggunakan Probit Analysis (perisian EPA Probit Ver 1.5). LC_{50} untuk imidacloprid selama 24 dan 48 jam adalah 13.967 ppm dan 7.183 ppm. LC_{50} thiamethoxam untuk 24 dan 48 jam adalah 25.253 ppm dan 18.444 ppm. Oleh itu, imidacloprid lebih toksik berbanding thiamethoxam.

CHAPTER 1

INTRODUCTION

Stingless bee is the largest group of eusocial insects on earth. Its belong to five different genera which are *Melipona, Trigona, Meliponula, Dectylurina and Lestrimelitta* (Heard,1999). These bees are closely related to common honey bees such as carpenter bees, orchid bees and bumble bees. Stingless bees can be found in tropical or subtropical regions in the world. It can be found in Australia, Africa, Southeast Asia, Mexico and also Brazil. Stingless bees are quite diverse in Africa and are used widely in medicine. It show a level of a social organization comparable to honey bees and consists of hundred or thousand of workers in a colony. The most popular genus of the stingless bees in Malaysia is Melipona and Trigona. According to Heard (1999), a genus of Meliponi has 50 species that have complex communication system among bees and it has an ability in buzz pollination while genus of Trigona is the most distributed and largest with 130 species.

The honey produced from stingless bees are not only edible but also nutritious. According to Malaysian Agricultural Research and Development Institute (MARDI), the nutrition contained in the stingless honey bee is twice compared to the ordinary honey. The benefit of stingless honey bee includes anti-ageing, enhanced the immune system, fighting bacteria and also good for human skin. A study was done by Mohammed Moniruzzaman et al. (2014), among various honey in Malaysia, the honey produced from Trigona contains a high level of potassium, magnesium, iron and zinc. Stingless honey bee has substantial of nutrients because the meliponine is smaller than the normal

bee and enable the nectar of flower could be sucked into the deepest space. Meliponine honey in form of medicinal honey contains natural antibiotic elements that function as an anti-oxidant, anti-toxic agent and anti-bacterial. It can dilate blood vessel, strengthen the immune system and activates cells. Propolis contains all amino acids, glucose, vitamins A, B, C, D and E, minerals and bioflavonoids. The bioflavonoids help to repair and enhanced human system and livestock. The propolis is produced through saliva mixed with their food. This propolis contains anti-fungus and antibacterial properties that will protect the cleanliness of their nest. The taste of stingless bee honey is slightly sour than honey of other bees (Rao et al., 2016).

The size of the stingless bee is much smaller than another bee which is about three to five millimetres, and have a slimmer body. Even though the stingless bee does not sting like any other bees, it can be aggressive when they are in threatened condition. These species of bees will attack the threatened person at their soft part of skin like eyelids, lip, face and neck.

Bees are important agents for pollination of fruits, vegetables, flowers and other crops (Heard,1999). They play important roles in pollination in order to provide pollinating services to the plant such as vegetables and flowers. The crops are vulnerable from pest attack, thus many farmers are relying on pesticide to protect their crop. The application of insecticide could expose to pollinators through contact with residues or from ingestion of pollen, nectar, guttation fluid containing insecticide (Brittain and Potss, 2010).

The research on the sensitivity of insecticide on the honey bees is more common than on the stingless bee. Through this research, we want to gain information of the lethal toxicity of neonicotinocid insecticide to stingless bee. So that, it can be used as reference for better scheme of insecticide applications and at the same time to avoid detrimental effect on the stingless bee community (Valdavinoz- Núñez et al., 2009). Therefore, the objective of this study is to evaluate the sensitivity of stingless bee to the common neonicotinoid insecticides using filter paper bioassay.

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