

**UNIVERSITI TEKNOLOGI MARA**

**THE DIRECT AND INDIRECT  
TOXICITY OF SELECTED  
INSECTICIDES OF COFFEE INSECT  
PESTS TO THE POLLINATOR  
HETEROTRIGONA ITAMA  
COCKERELL**

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Dissertation submitted in partial fulfillment  
of the requirements for the degree of  
**Master of Science  
(Crop Protection)**

**Faculty of Plantation and Agrotechnology**

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## AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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## ABSTRACT

Beverage-yielding plant of Coffee (*Coffea* spp.) is one of the cultivated industrial crops in Malaysia. This crop needs insect pollinators includes honeybee, stingless bee, and butterfly to produce much better quality and quantity of coffee bean. *Heterotrigona itama* Cockerell L. (Hymenoptera: Apidae) is a species of stingless bee that found abundantly in Malaysian forest and reported as one of main pollinators of the coffee plant. This species is actively reared for meliponiculture purposes, especially for its commercial-scale of honey production and among the greatest commercial potential as crop pollinators. The hive of *H. itama* can be placed amongst coffee plant which serves as pollinator as well as an additional income for the farmers. However, this species has been potentially exposed to agronomic practices, among which the use against pests of coffee. Insecticide toxicity to the beneficial insects was considered, as indirect toxicity due to the formulation of insecticide is purposely to manage insect pest. Subsequently, the stingless bee may enter in contact with these insecticides treatment in several ways; by direct contact (when the bee fly through toxic mist or dust during the insecticide application in the treated area) and indirect contact (when the bees walk on the post-insecticide contaminated plant surface). Bioassay toxicity test was conducted to the local stingless bee *H. itama* at Agricultural Research Station, Tenom. Four selected insecticides which commonly used to a managed coffee insect pest, namely deltamethrin, cypermethrin, malathion and chlorpyrifos. All insecticides were tested at five different concentrations against foragers of *H. itama* using topical and residual exposures. All experiments were replicated three times. The aims of this study were to assess the direct and indirect effects of recommended concentrations of four (4) selected insecticides on *H. itama* by using topical and residual bioassay techniques, and to obtain the lethal concentrations (LC) of each insecticide in the range of 50%, 75% and 95% kill. Lethal concentrations were obtained from probit analysis (SPSS 21) after 24-hour mortality post-treatment. The LC<sub>50</sub> values for deltamethrin, cypermethrin, malathion and chlorpyrifos via topical exposure are 0.634ml, 0.333ml, 0.181ml and 0.123ml diluted in 500ml of water, meanwhile, the residual exposure LC<sub>50</sub> values are 1.276ml, 0.328ml, 0.033ml, and 0.091ml in 500ml of water. This study proved that the toxic effect of insecticides is one of the factors affecting the reduction of the stingless bee population, it is advisable to limit the usage and distributions of insecticides chemical near the stingless bee colony and niche area.

*Keywords: Coffee, Heterotrigona itama, Toxicity, Insecticides, Bioassay*

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