SELECTION ON SPINOSAD AND EMAMECTIN BENZOATE INSECTICIDE RESISTANCE LEVEL IN FIELD-COLLECTED DIAMONDBACK MOTH

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By

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A project report submitted to 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 Agricultural Science

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CERTIFICATION

This project report entitled **'Selection on Spinosad and Emamectin benzoate Insecticide Resistance Level in Field-Collected Diamondback Moth'** is prepared by Nur Nabihah binti Hasran and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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LIST OF TABLES

LIST OF GRAPHS

LIST OF PLATES

ABSTRACT

Plutella xylostella (L) also known as Diamondback Moth (DBM) is the main insect of crucifers such as cabbage, broccoli, canola and cauliflower. It is also the most destructive pest of cruciferous worldwide including Malaysia. DBM has become difficult insect to control in the world because of its resistance evolution to every insecticides class used extensively against it and due to repeated use of same insecticide in controlling it. DBM developed resistant to many insecticides due to the polyvoltin features and overlap of generations. Many of the resistant study conducted concentrate on the resistant level of insecticide in DBM. However, there is a need to understand how fast a resistance toward specific insecticide developed in DBM. The objective of this study was to determine the increase of insecticide resistant levels in DBM through selection process. In this study, two types of insecticides (Spinosad and Emamectin) were tested on DBM. DBM from organic farm were collected and cultured in glasshouse. The population were cultured until four generations. Bioassay on parent population shown Spinosad has higher toxicity level with LC_{50} at 15.106 ppm. Compared to Emamectin with LC_{50} at 48.660 ppm. Insecticide selection experiments were conducted with feeding the DBM population with LC_{15} values from parent and F_2 bioassay experiment. The insecticide selection shown DBM developed resistant to Emamectin was faster compared to Spinosad. The DBM resistance ratio to Emamectin was 1.76 and 1.84 fold for F_2 and F_4, respectively. While, the resistance ratio to Spinosad was 1.58 and 1.28 fold for F_2 and F_4, respectively.

ABSTRAK

Plutella xylostella (L) juga dikenali sebagai Kupu-kupu Intan (DBM) merupakan sejenis serangga tanaman krusifer seperti kubis, brokoli, kanola dan bunga kubis. Ianya juga merupakan serangga perosak tanaman krusifer di seluruh dunia termasuk Malaysia. DBM menjadi serangga yang sukar dikawal dalam dunia disebabkan oleh evolusi kerintangannya terhadap setiap kelas racun serangga yang digunakan dengan meluas dan pengulangan penggunaan racun serangga yang sama. Perkembangan kerintangan DBM terhadap banyak racun serangga disebabkan ciri-ciri polyvoltin yang ada dan terdapatnya pertindihan generasi. Terdapat banyak kajian yang telah dijalankan ke atas paras kerintangan racun serangga dalam DBM. Objektif kajian ini adalah untuk mengenal pasti peningkatan paras kerintangan dalam DBM melalui proses pemilihan. Dalam kajian ini, dua jenis racun serangga telah diuji keatas DBM. DBM dari ladang organik telah dikutip dan dipelihara di rumah kaca. Populasi DBM telah dipelihara sehingga empat generasi. Bioassay ke atas populasi induk telah menunjukkan bahawa racun serangga Spinosad mempunyai paras ketoksikan yang lebih tinggi dengan LC_{50} pada 15.106 ppm. Berbanding racun serangga Emamectin dengan LC_{50} pada 48.660 ppm. Eksperimen pemilihan racun serangga telah dijalankan dengan memberi makan populasi DBM pada nilai LC_{15} dari induk dan F_2 eksperimen bioassay. Pemilihan racun serangga menunjukkan perkembangan kerintanagn DBM pada Emamectin adalah lebih cepat berbanding Spinosad. Nisbah kerintangan DBM pada Emamectin masing-masing ialah 1.76 dan 1.84 ganda untuk F_2 dan F_4. Manakala, nisbah kerintangan pada Spinosad masing-masing ialah 1.58 dan 1.28 untuk F_2 dan F_4.

TABLE OF CONTENT

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Nowadays the demand of cruciferous vegetables especially cabbage, mustard and collard were increasing. Cruciferous vegetables, primarily brassicas are important component for the human diet which is grown on small subsistence farms. Breast and colon cancer can be prevented by consuming the cabbage crop and other cole crops (Pathak *et al*., 2006). Besides, it also helps against Alzheimer's disease (Heo *et al.*, 2006). However, there is always problem with pest as cruciferous production particularly in Malaysia is seriously affected by the diamondback moth insect since 1940's. There are several methods used to control these pests, for example by biological control, cultural control and chemical control. However, insecticide is the most frequently used as control method.

While the diamondback moth, *Plutella xylostella* (L), is the main insect pest of crucifers, such as cabbage, broccoli, and cauliflower. It is also the most destructive insects of crucifers worldwide. The conservative estimate of total cost for DBM managements US$4 billion-US$5 billion (Zalucki *et al*., 2012). *Plutella xylostella* (L) become the cosmopolitan pest because of two factors which are rapid development to multiple pesticides and able to migrate and disperse for a over long distance (Talekar and Shelton 1993; Tabashnik, 1994; Chapman *et al.,* 2002; Chapman *et al.,* 2003). *P. xytlostella* has become among the most difficult insect to control in the world, because it's resistance evolution to every insecticides class used extensively against it (Shelton *et*

al., 2000; Sarfaz and Keddie, 2005). This owing to its polyvoltin features and overlap of generations causing this pest easily develop resistance to many kinds of insecticides (Cao and Han, 2006).

There are several new insecticides were introduced to control DBM due to the frequent outbreaks of this pest and the failure of the other control methods (Syed, 1992). DBM has developed resistance to large number of synthetic insecticide in tropical region (Miyata *et al*., 1986). It is because of the production of crucifers are continuous and the heavy use of insecticide. The synthetic pesticides have adequately controlled populations (Shelton *et al.*, 1993). In some areas there are the most important insecticides to control *P. xylostella* (Zhao *et al.*, 2002; Mau and Gusukuma-Minuto, 2004). Consequently, farmers facing problem in controlling the DBM on cruciferous crops due to its resistance to the various types of insecticides used to control its population. Therefore the objective of this study is to determine how fast DBM increase resistance toward both Spinosad and Emamectin benzoate insecticide. The result will give information on how long a certain insecticide can be used continuously before it should be change to others for effective DBM control.

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