UNIVERSITI PUTRA MALAYSIA

TOXICITY LEVELS OF INSECTICIDES ON DIAMONDBACK MOTH (Plutellaxylostella) FROM CAMERON HIGHLAND, PAHANG,MALAYSIA

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(Plutellaxylostella) FROM CAMERON HIGHLAND, PAHANG,MALAYSIA

BY

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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 Agricultural Science.

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ENDORSEMENT

This project report entitled Toxicity levels of insecticides on Diamondback moth (*Plutellaxylostella*) from Cameron Highland, Pahang, Malaysia is prepared by MohdSobri bin Ismail and submitted to the Faculty of Agriculture in fulfilment of the requirement of PRT4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture Science.

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LIST OF ABBREVIATION

MARDI	Malaysia Agriculture Research Development Institute
DBM	Diamondback Moth
LC	Lethal Concentration
HAT	Hours after Treatment
RCB	Randomized Complete Block Design
AVRDC	Asia Vegetable Research and Development Centre

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ABSTRACT

Since 1941, the diamondback moth (DBM), *Plutellaxylostella* is one of the major pest of crucifers grown in the Cameron Highlands, Pahang. The larvae feed on leaves tissue, leaving the vein and cause economic losses to the cabbage farmers. Recurrent used of the same types of insecticide to control DBMs has led the insect to develop resistance. When resistance developed, the farmers will use higher dosage of insecticide and make frequent application which could causes detrimental effects to environment. The study was conducted to determine toxicity levels of selected insecticides *on Plutellaxylostella* from Cameron Highland. The leafdipp bioassay technique was used in this evaluation. Early third instar larvae were placed on insecticide treated cabbage leaf discs. Types of insecticide tested were Takumi® (Flubendiamide), Prevathon® (Chlorantraniliprole), Steward® (Indoxacarb) and no insecticide as control. 5 concentrations for each insecticide and 3replications were conducted to obtain LC_{50} values by probit analysis. Parameter recorded was the rate of larval mortality. This study was arranged in Randomized Complete Block Design (RCBD). By comparing three types of insecticides, at 72 hours, Steward® has the highest toxicity level as having the lowest LC_{50} value which is at 86.064ng/g in which needed only small amount a.i insecticides to kill 50% of its population. Meanwhile, Prevathon® and Takumi® have least toxicity at range 283.081ng/g and 2678.992ng/g respectively.

ABSTRAK

Sejak tahun 1941 lagi, Kupu-kupu Intan (DBM), Plutellaxylostella (L) telah menjadi perosak utama tanaman kubis di Cameron Highlands, Pahang. Larvanya memakan tisu daun dan meninggalkan hanya urat daun sahaja ini menyebabkan masalah ekonomi kepada para petani kubis. Penggunaan racun yang sama secara berulang kali telah menyebabkan DBM menjadi semakin rintang kepada racun. Apabila tahap ketahanan semakin tinggi, petani akan menggunakan dos racun serangga yang lebih tinggi dan lebih kerap dan ini akan memberi kesan buruk kepada alam sekitar. Kajian telah dijalankan untuk menentukan tahap toksisitiracun serangga yang berbeza terhadap P. xylostella dari Cameron Highland. Teknik Celup Daun Bioassay digunakan untuk penilaian. Instar larva ketiga diletakkan pada daun kubis yang dirawat di dalam petri disk. Jenis-jenis racun serangga yang telah diuji iaitu Takumi® (Flubendiamide), Prevathon® (Chlorantraniliprole), Steward® (Indoxacarb) dan tiada racun serangga sebagai kawalan. 5 kepekatanuntuk setiap racun serangga dan 3replikasi telah dijalankan untuk mendapatkan nilai LC_{50} menggunakan probit analisis. Parameter yang akan direkod adalah kadar kematian larva. Kajian ini menggunakan Reka Bentuk Blok Rawak Lengkap (RCBD). Daripada perbandingan antara tiga jenis racun di dapati bahawa Steward mempunyai tahap ketoksikan tertinggi dimana nilai LC_{50} terendah pada 72 jam iaitu 86.064 ng/g ini telah menunjukkan bahawa hanya sedikit a.i racun serangga diperlukan untuk membunuh 50% daripada populasi. Diikuti dengan racun serangga Prevathon® dan Takumi® mempunyai ketoksikan yang kurang iaitu 283.081ng/g dan 2678.992ng/g.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Cruciferous vegetables are economically important throughout the world. Cabbage (*Brassica oleracea*) is a member of the Brassicaceae (Mustard) family. This family includes broccoli, brussels sprouts, cauliflower, kale, mustard (greens), and collards. Local production is insufficient to meet domestic needs and Malaysia has to import cabbage worth RM60 million annually (Illias, 2007). Even though the cool climate of Cameron Highlands is conducive for growing cabbage, farmers have to apply generous amount of input such as fertilizer and pesticides in order to maintain crop quality.

Crucifer production has been seriously affected by a steady increase in insect pest, especially the diamondback moth.Chua and Ooi(1986) reported that in Malaysia, it is the principal pest of both upland (e.g. Cameron Highlands) and lowland vegetable-producing region. The diamondback moth (DBM), *Plutellaxylostella* L. (Lepidoptera: Yponomeutidae) is a major and cosmopolitan pest of cruciferous crops.This moth was introduced into Malaysia and probably it came into the country together with cruciferous plants, such as cabbage, “kailan” and mustard.

Due to the frequent outbreaks of this pest and the failure of the other control methods. Farmers in Cameron Highlands used insecticide on a regular basis. However, complete dependence on chemical control is the main reason for the build-up of resistance to a wide range of insecticides. Many farmers insist that this is the only way to achieve satisfactory control of the DBM. The insect is also turning out to be resistance to bioinsecticide such as, *Bacillus thurigiensis* (Mohan and Gujar, 2003). In normal condition, the insect takes about 32 days to develop from egg to adult while 21 to 51 days to complete a generation.

Generation is usually overlapped and all four life stages may be present in the field at the same time. This will lead to increasing number of the insect in one area. The DBM has proved increasingly difficult to control due largely to its marked ability for development of resistance to insecticides, most notably in Southeast Asia and the Far East (Talekar and Griggs, 1986; Tang *et al.,* 1988).The DBM has developed resistance to a large number of synthetic insecticides because of the continuous production of crucifers and the heavy use of insecticides.

Georghiou and Taylor (1976) reported that DBM was resistant to 36 insecticides in 14 tropical countries. According to (Shelton *et al.,* 1993), a synthetic pesticides used have adequately controlled of DBM population. However, experiment were conducted it showed when 41 populations from 19 states were tested for resistance to methomyl, permethrin and methamidophos (Shelton *et al.,* 1993) many populations shown resistance to one or more of the insecticide.

1.2 Problem statement and Study Objective

Uncontrolled use of pesticides applied by farmers has causes detrimental effects on the environments and could cause pesticide resistance on insect. When insect develop their resistance it will be more difficult to control. Therefore, the objective of this study is to determine toxicity levels of selected insecticides against on*Plutellaxylostella* from Cameron Highland, Pahang.

REFERENCES

Capinera, J. (2000). *Handbook of vegetable pests* Academic Press. From: http://entnemdept.ufl.edu/creatures/veg/leaf/diamondback_moth.htm (Accessed on 15/2/2013).

Capinera, J. L. (2009). Relationships between insect pests and weeds: An evolutionary perspective.

Chua, T. H., and Ooi, P. A. C. (1986, March). Evaluation of three parasites in the biological control of diamondback moth in the Cameron Highlands, Malaysia. In Diamondback Moth Management. Proc. First Intl Workshop, Asian Vegetable Research and Development Center. Shanhua, Taiwan (pp. 173-184).

Corbett, G., andPagden, H. (1941). A review of some recent entomological investigations and observations. *Malayan Agricultural Journal, 29*, 347-375.

Dezianian, A., Sajap, A. S., Lau, W. H., Omar, D., Kadir, H., Mohamed, R., andYusoh, M. (2010). Morphological characteristics of *P. xylostella*granulovirus and effects on its larval host diamondback moth *Plutellaxylostella*L.(lepidoptera, plutellidae). *American Journal of Agricultural and Biological Sciences*, *5*(1), 43-49.

Georghiou, G., and Taylor, C. (1976). Pesticide resistance as an evolutionary phenomenon. *Proc XV IntCongrEnt,* 759-785.

Henry W. (2006). Entomological society of America. From: http://www.entsoc.org/category/amt-material/flubendiamide-480sc. (Accessed on 31/5/2013).

Hill, T. A., and Foster, R. E. (2000). Effect of insecticides on the diamondback moth (lepidoptera: Plutellidae) and its parasitoid *Diadegmainsulare* (hymenoptera: Ichneumonidae). *Journal of Economic Entomology, 93*(3), 763-768.

Hopkinson, R., andSoroka, J. (2010). Air trajectory model applied to an in-depth diagnosis of potential diamondback moth infestations on the canadian prairies. *Agricultural and Forest Meteorology, 150*(1), 1-11.

Idris, A., andMukti, N. A. (1997). Biological control of diamondback moth, *Plutellaxylostella*(L.), using parasitoids and bacteria: A review. *Sains Malaysiana, 26*(1), 79-94.

Illias M. K (2007). Production of Lowland Cabbage Using Fertigation In Soil-based System Under Protective Structure Malaysian Agricultural Research and Development Institute, MARDI.

Ismail, F., andMohdNorazam, M. (2012). Toxicity of selected insecticides (spinosad, indoxacarb and abamectin) against the diamondback moth (*Plutellaxylostella* L.) on cabbage. *Asian Journal of Agriculture and Rural Development, 2*(1), 17-26.

Kfir, R. (1997). Parasitoids of *Plutellaxylostella* (lep.: Plutellidae) in South Africa: An annotated list. *Entomophaga, 42*(4), 517-523.

Kirsch, K., andSchmutterer, H. (1988). Low efficacy of a bacillus thuringiensis (berl.) formulation in controlling the diamondback moth, *Plutellaxylostella* (L.), in the Philippines. *Journal of Applied Entomology, 105*(1-5), 249-255.

Lim, G. (1986). Biological control of diamondback moth. *Diamondback Moth Management,* , 86-248.

Mohan, M., andGujar, G. T. (2000). Susceptibility pattern and development of resistance in the diamondback moth, *Plutellaxylostella* L, to *Bacillus thuringiensis*berlvarkurstaki in India. *Pest Management Science, 56*(2), 189-194.

Mohan, M., andGujar, G. (2003). Characterization and comparison of midgut proteases of *Bacillus thuringiensis* susceptible and resistant diamondback moth (Plutellidae: Lepidoptera). *Journal of Invertebrate Pathology, 82*(1), 1-11.

Mordue, A. (2004). Present concepts of the mode of action of azadirachtin from neem. *Neem: Today and in the New Millennium.Kluwer Academic Publishers, Dordrecht,* , 229-242.

Nakahara, L. M., McHugh, J., Otsuka, C. K., Funasaki, G. Y., and Lai, P. (1985). Integrated control of diamondback moth and other insect pests using an overhead sprinkler system, an insecticide, and biological control agents, on a watercress farm in Hawaii. *Proceedings First International Workshop, Diamondback Moth Management. Shanhua, Taiwan: AVRDC,* 403-413.

Ooi, P. (1979). Incidence of *Plutellaxylostella* (L.)(lepidoptera: Yponomeutidae) and its parasite, apantelesplutellaekurdj.(hymenoptera: Braconidae) in Cameron highlands, Malaysia. *Malaysian Applied Biology, 8*, 131-143.

Ooi, P. A. (1992). Role of parasitoids in managing diamondback moth in the Cameron highlands, Malaysia. *Diamondback Moth and Other Crucifer Pests, ,* 255-262.

Rueda, A., and Shelton, A. M. (1996). *Global crop pests: Identification and information* Cornell International Institute for Food, Agriculture and Development.

Santos, V., Siqueira, H. d., Silva, J. d., andFarias, M. d. (2011). Insecticide resistance in populations of the diamondback moth, *Plutellaxylostella* (L.)(lepidoptera: Plutellidae), from the state of Pernambuco, Brazil. *Neotropical Entomology, 40*(2), 264-270.

Sarfraz, M., Dosdall, L., andKeddie, B. (2007). Resistance of some cultivated brassicaceae to infestations by *Plutellaxylostella* (lepidoptera: Plutellidae). *Journal of Economic Entomology, 100*(1), 215-224

Shelton, A., Wyman, J., Cushing, N., Apfelbeck, K., Dennehy, T., Mahr, S., andEigenbrode, S. (1993). Insecticide resistance of diamondback moth (lepidoptera: Plutellidae) in North America. *Journal of Economic Entomology, 86*(1), 11-19.

Srinivasan, K., and Krishna Moorthy, P. (1992). Development and adoption of integrated pest management for major pests of cabbage using indian mustard as a trap crop. *Diamondback Moth and Other Cruciferous Pests: Proceedings of the Second International Workshop. Shunhua, Taiwan. Asian Vegetable Research and Development Center*, 10-14.

Sun, C., Wu, T., Chen, J., and Lee, W. (1986). Insecticide resistance in diamondback moth. *Diamondback Moth Management: Proceedings of the First International Workshop, Asian Vegetable Research and Development Center. AVRDC, Shanhua, Taiwan*, 359-371.

Tabashnik, B. E., and Mau, R. F. (1986). Suppression of diamondback moth (lepidoptera: Plutellidae) oviposition by overhead irrigation. *Journal of Economic Entomology*, *79*(1), 189-191.

Tabashnik, B. E., Cushing, N. L., and Johnson, M. W. (1987). Diamondback moth (lepidoptera: Plutellidae) resistance to insecticides in Hawaii: Intra-island variation and cross-resistance. *Journal of Economic Entomology*, *80*(6), 1091-1099.

Talekar, N., and Griggs, T. (1986). *Diamondback moth management: Proceedings of the first international workshop; Tainan, Taiwan, 11-15 march 1985* AVRDC.

Talekar, N., and Y. Lin (1998), Asian Vegetable Research and Development center Shanhua, Tainan 741, Taiwan.

Tang, Z., Gong, K., and You, Z. (1988). Present status and countermeasures of insecticide resistance in agricultural pests in China. *Pesticide Science, 23*(2), 189-198.

Thorsteinson, A. (1953). The chemotactic responses that determine host specificity in an oligophagous insect (*Plutellamaculipennis*(curt.) lepidoptera). *Canadian Journal of Zoology, 31*(1), 52-72

Ullyett, G. (1947). *Mortality factors in populations of plutellamaculipenniscurtis (tineidae: Lep.), and their relation to the problem of control* Department of Agricultural Technical Services.

Wang, X., Li, X., Shen, A.,and Wu, Y. (2010). Baseline susceptibility of the diamondback moth (Lepidoptera: Plutellidae) to Chlorantraniliprole in China. *Journal of Economic Entomology, 103*(3), 843-848.

Yang, J., Chu, Y.,andTalekar, N. S. (1993). Biological studies of *Diadegmasemiclausum*(hym., ichneumonidae), a parasite of diamondback moth. *Entomophaga, 38*(4), 579-586.

Personal communication

Zarim, A. (2012). Officer in MARDI Cameron Highlands, Pahang Darul Makmur. (30/11/2012).