UNIVERSITI PUTRA MALAYSIA

EFFECTS OF NITROGEN FERTILIZATION ON PREFERENCE OF *COTESIA PLUTELLAE* TO DIAMONDBACK MOTH

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FP 2015 161

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2014/2015

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BY

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A project report submitted to Faculty of Agriculture
Universiti Putra Malaysia
In fulfilment of the requirement of PRT4999 (Project)
For the award of degree of
Bachelor of Agricultural Science

Faculty of Agriculture
Universiti Putra Malaysia
2014/2015

ENDORSEMENT

This project report entitled “Effects of Nitrogen fertilization on preference of *Cotesia plutellae* to Diamondback moth” is prepared by Muhamad Izzuddin Bin Khairuddin and submitted to the Faculty of Agriculture in fulfilment of the requirement of PRT4999 (Final Year Project) for the award of degree of Bachelor of Agricultural Science.

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ACKNOWLEDGEMENT

First of all, thanks to Allah S.W.T. for making possible for me to complete this project. It pleased me to take this opportunity to convey my deepest appreciation and gratitude to my supervisor Dr. Norida Mazlan for her generous help, invaluable guidance, patience and support throughout the completion of this project.

I would also like to thank all the staffs from the Department of Plant Protection and Department of Agricultural Technology, Faculty of Agriculture, Universiti Putra Malaysia (UPM) especially Mr. Selvarajan, Mr. Jarkasi and Mrs. Zauyah Yusof for their help throughout my project. My special and kindly thanks with love towards my parent, Hj. Khairuddin Bin Ahmad Tajuddin and Hjh. Zanariah Binti Abdul Ghani who always encouraged me all this time. I also want to give a big appreciation to all my friends for their help and support, Faeez Khusaini, Amirul Syafiq, Husna Mastura, Amalina Najwa, Adibah and Engku Khairi. And not to forget, thanks to Ladybird Organic Farm, Semenyih, for letting me to do sampling there.

Last but not least, I want to express my sincere appreciation to all those who are not mentioned here who helped me to ensure the completion of my study.

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ABSTRACT

Diamondback moth (DBM), *Plutella xylostella* is a pest of cruciferous plants and has been labelled as the most destructive pest of crucifers in the tropics and subtropics. *Cotesia plutellae* has been found to be an effective parasitoid that helps to kill DBM. The tritrophic interaction between the host plant, insect pest and the parasitoid can be seen when nitrogen (N) supplied to the host plant are shown to gives effect on parasitoid preference to parasitize the insect pest. The objective of this study is to determine N fertilization rate that is most preferred by the *C. plutellae* to DBM. In this study, DBM were collected from a local commercialized mustard farm and reared in 3 different cages which contain mustard that was fertilized with different rates of N, which are 0, 140 and 280 kg N/ha. DBM larvae cultured on these plants were used for the parasitoid preference test. Female *C. plutellae* were used to determine its preference on DBM larvae that fed on different rates of N. The parameter recorded was the time taken by *C. Plutellae* to go the preferred treatment. The result indicates that *C. plutella* prefer to attack DBM that fed on plants that were treated with higher N concentrations. However, there is no significant effect were recorded when the experiment between the normal and high N concentration was conducted. Information obtained from this study can be used by farmers to determine the fertilization rate that can control DBM population by attracting *C. plutellae* to parasitize the DBM.

ABSTRAK

Rama-rama intan (DBM), *Plutella xylostella*, adalah perosak sayur-sayuran dan telah dilabelkan sebagai perosak yang paling merbahaya bagi sayur-sayuran di kawasan tropika dan subtropika. *Cotesia plutellae* telah didapati sebagai parasitoid yang berkesan yang dapat membantu untuk mengurangkan populasi DBM. Interaksi tritrofic antara tanaman perumah, serangga perosak dan parasitoid dapat dilihat apabila nitrogen (N) yang dibekalkan kepada tanaman perumah memberikan kesan kepada pilihan parasitoid untuk menyerang perosak serangga. Objektif kajian ini adalah untuk menentukan kadar pembajaan N yang paling digemari oleh *C. plutellae* untuk menyerang DBM. Dalam kajian ini, DBM dikutip dari ladang sawi komersial dan diternak dalam 3 sangkar yang berbeza yang mengandungi pokok sawi dibaja dengan kadar N yang berbeza iaitu 0, 140 dan 280 N kg / ha. Larva DBM yang memakan pokok-pokok ini digunakan untuk ujian pemilihan parasitoid. *C. plutellae* betina digunakan untuk menentukan pemilihan ke atas larva DBM yang diberi makan pada kadar N yang berbeza. Parameter yang direkodkan adalah masa yang diambil oleh *C. plutellae* untuk pergi kepada rawatan pilihannya. Hasil data yang telah dianalisis menunjukkan *C. plutella* lebih cenderung untuk menyerang DBM yang memakan pokok yang dirawat dengan kepekatan baja N yang lebih tinggi. Namun, tiada kesan yang ketara yang direkodkan apabila eksperimen dijalankan di antara kadar baja yang normal dan yang tinggi. Maklumat yang diperoleh daripada kajian ini boleh digunakan oleh petani untuk menentukan kadar pembajaan yang boleh digunakan untuk mengawal populasi DBM dengan menarik *C. plutellae* untuk menyerang DBM tersebut.

CHAPTER 1

INTRODUCTION

Diamondback moth (DBM), *Plutella xylostella* (Lepidoptera: Plutellidae) is a pest of cruciferous plants such as mustard, cabbages and cauliflower. It has been labelled as the most destructive pest of crucifers in the tropics and subtropics (Talekar and Yang, 1991) and over USD 1 million has been spent to control it annually (Talekar, 1992). DBM larva feeds on the foliage of the plant, hence significantly affects the yield and quality of the plant. There are several methods that are used to control DBM, such as the application of chemical pesticide, and farmers use a large quantity of chemical pesticide to control DBM, especially on Southeast Asia, where crucifers are economically important (Talekar and Yang, 1991). However, there are disadvantages of using this method. In Southeast Asia, DBM has reportedly become resistanct to most chemical pesticides that are sold in the market. This is because of availability of host plant throughout the year, rapid turnover of generations under ideal tropical environment and intensive use of pesticide (Cheng, 1986). Chemical pesticide also may kill the predator or natural enemy of the DBM that may help to reduce the DBM population. That is other the fact that chemical pesticides are harmful and polluting the environment. Thus, an alternative method to control DBM is prefered, such as using biocontrol with the use of natural predators or parasitoids for controlling DBM.

There are several natural predators and parasitoids that attack DBM, but only a few gives significant effect on controlling the DBM population. Among these, larval parasitoids are the most effective, and there are two major genera of larval parasitoids, *Diadegma sp.*and *Cotesia sp.* (Talekar and Shelton, 1993). In Cameron

Highland, an area where vegetables are produced numerously in Malaysia, *Cotesia plutellae* (Hymenoptera: Braconidae) has been introduced to control DBM (Verkerk & Wright, 1997). According to Talekar & Yang (1991), *C. plutellae* could parasitize all stages of DBM instar, but preferred to parasitized instar 2 and 3. The parasitism of parasitoids on the insects are dependent on the host plant, nutrient content and its consequence fitness and sex ratio, with nitrogen levels of plants correlating positively with parasitoid female ratio (Thompson et al., 2001).

With the inclusion of *C. plutellae,* tritrophic interaction between the host plant, insect pest and the parasitoid are formed. This interaction is seen when the nutrients in the host plant is consumed by the insect pest can gives effect on parasitoid preference to parasitize the insect pest. In this case, cruciferous plant is the host plant that is being fed by DBM. It is reported that nitrogen (N) can give effects and potentially significantly alter tritrophic interactions (Chen et al., 2010). The host plant fertilized with different rates of N will gives different parasitism rate of the *C. plutellae* on DBM. Chen et al. (2010) also stated that N also has been shown to affect chemical attractiveness of plants, which the predators use for foraging enemies and herbivores. The chemicals released by the plant as the defend mechanisms when attacked by pest have both direct effect that is reducing herbivory and indirect effect, that is through enhanced parasitization, resulting in increased herbivore mortality (Mattiacci et al., 2001). The natural enemy also use chemical cues (semiochemicals) to locate the hosts. Potting et al. (1999) has proved that *C. Plutellae* predominantly uses plant derived stimuli in its foraging behaviour.

N is an important macro nutrient for plant growth. As studies have shown that N give effects on the parasitism rate of pest (Chen et al., 2010), thus, there is a need to

determine the amount of N that can increase the effective in biocontrol in farm. To have a successful control of pest in farm, there is a need to understand the relationship of amount of N in plant on the rate of parasitism of pest in farm.

Therefore, the objective of this study is to determine the tritrophic effects of different rates of N on DBM host plant (brassica) s on the paratism rate of DBM by *C. plutellae*. The findings from this study can provide important information for the farmers about the N fertilization rate that can increase the preference of *C. plutellae* to parasitize DBM, thus decreasing the population of DBM and reducing the damage caused by DBM on cruciferous plants.

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