UNIVERSITI PUTRA MALAYSIA

THE DEVELOPMENT OF Pomacea maculata FED ON Oryza sativa AND Limnocharis flava

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THE DEVELOPMENT OF *Pomacea maculata* FED ON *Oryza sativa* AND *Limnocharis flava*

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A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in the fulfillment of requirement of PRT4999 (Final Year Project) for the award of Degree of Bachelor of Agricultural Science

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DECLARATION

This project report entitled **"The Development of *Pomacea maculata* Fed on *Oryza sativa* and *Limnocharis flava*"** was prepared by Nurul Fatini Binti Shahidan (175097) and submitted to the Faculty of Agriculture in fulfillment of requirement of PRT4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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LIST OF ABBREVIATION

UPM Universiti Putra Malaysia

IRRI International Rice Research Institute

CABI Centre for Agriculture and Bioscience

CRD Completely Randomized Design

SAS Statistical Analysis System

ABSTRACT

Pomacea maculata is a serious pest of paddy in Asia, especially Southeast Asia where Malaysian paddy fields are reported to be particularly highly infested by *Pomacea* spp. Recently, *P. maculata* was discovered to prefer consuming *Limnocharis flava,* a common weed in paddy field raising speculation of its potential use as a trap crop to reduce the damages by *P. maculata* on paddy seedlings. Subsequent to that, an experiment was conducted in the Glasshouse Unit at Ladang 2 and also at the Insects Ecology Laboratory, Department of Plant Protection, Faculty of Agriculture, Universiti Putra Malaysia to study the effect of *Oryza sativa* and *L. flava* as food sources on the growth and development of *P. maculata*. Eighty (80) hatchlings of same ages were equally divided into two groups based on their rearing diets, which were either fresh three (3) weeks old rice seedlings or *L. flava*. Each group was fed ad libitum with their respective diet daily. The experiment was laid out in Completely Randomized Design (CRD) with four replications. The growth parameter of Shell Length, Shell Width, Aperture Length, Aperture Width and Spire Height of *P. maculata* were measured on five randomly selected individuals on weekly basis for two months. Data was analyzed using two sample t-test procedure in SAS. The results show that there is a significant difference ($p<0.05$) between the treatments for all the parameters starting from week six onwards. During the 12^{th} week, *L. flava* gave the highest mean shell length (14.52 ± 0.27), shell width (10.62 ± 0.15), aperture length (11.65 ± 0.20), aperture width (8.27 ± 0.18) and spire height (3.11 ± 0.12). Therefore, *L. flava* is highly recommended to be planted as the trap crop in paddy fields to reduce the damages to paddy plantation by *P.*

maculata. The finding also implies that *P. maculata* may serve as biological control agent for the invasive *L. flava* in ecosystems where it is found to be a menace.

ABSTRAK

Pomacea maculata merupakan perosak padi yang serius di Asia, terutamanya di Asia Tenggara di mana tanaman padi di Malaysia dilaporkan terjejas teruk oleh *Pomacea* spp. Dalam penemuan terbaru, *P. maculata* telah ditemui lebih gemar memakan *Limnocaris flava* yang merupakan sejenis rumpai yang biasa terdapat di kawasan sawah padi menimbulkan spekulasi tentang potensi kegunaannya sebagai tanaman perangkap di sawah padi bagi mengurangkan kerosakan oleh *P. maculata* pada anak benih padi. Berikutan itu, satu eksperimen telah dijalankan di Unit Rumah Kaca di Ladang 2 dan juga Makmal Ekologi Serangga, Jabatan Perlindungan Tumbuhan, Fakulti Pertanian, Universiti Putra Malaysia untuk mengkaji kesan *Oryza sativa* dan *L. flava* sebagai sumber makanan ke atas pertumbuhan *P. maculata*. Sebanyak lapan puluh (80) ekor anak siput gondang hitam yang sebaya telah dibahagikan sama rata kepada dua kumpulan mengikut diet mereka, iaitu sama ada anak benih padi berumur tiga (3) minggu atau *L. flava*. Setiap kumpulan diberi makan secara *ad libitum* mengikut diet masing-masing setiap hari. Eksperimen telah dijalankan di dalam bentuk rawak sepenuhnya (CRD) dengan empat replikasi. Parameter pertumbuhan seperti Panjang Cengkerang, Lebar Cengkerang, Panjang Apertur, Lebar Apertur dan Ketinggian Lingkar *P. maculata* diukur pada lima individu yang dipilih secara rawak pada setiap minggu selama dua bulan. Data telah dianalisis menggunakan prosedur dua sampel t-test dalam SAS. Keputusan menunjukkan terdapat perbezaan yang signifikan ($p < 0.05$) antara rawatan untuk semua parameter bermula pada minggu keenam dan seterusnya. Dalam minggu ke-12, *L. flava* memberikan bacaan tertinggi bagi panjang cengkerang (14.52 ± 0.27), lebar cengkerang (10.62 ± 0.15), panjang apertur (11.65 ± 0.20), lebar

apertur (8.27 ± 0.18) dan ketinggian lingkar (3.11 ± 0.12). Oleh itu, *L. flava* amat disyorkan untuk ditanam sebagai tanaman perangkap di sawah padi bagi mengurangkan kerosakan padi di sawah oleh *P. maculata*. Penemuan dalam kajian ini juga menunjukkan bahawa *P. maculata* sesuai digunakan sebagai agen kawalan biologi kepada rumpai invasif *L. flava* dalam ekosistem di mana rumpai ini ditemui bermasalah dan berbahaya.

CHAPTER 1

INTRODUCTION

Oryza sativa which is globally known as rice is one of the most significant food crops in the world as almost entire world population feed on rice as staple food (Farooqui, 2011; Ricepedia, 2016). Rice has been a favorite food source for many of us due to its higher carbohydrate content compared to whole-grain bread (Bruso, 2016). Half a cup serving of brown rice contains more calories, protein and fat than whole-grain bread of the same quantity (Bruso, 2016). This preference leads to the need to increase the rice production to cope with the increasing demand of the growing world population.

Based on data provided by Ricepedia (2016), the global rice consumption in 2009 was recorded as much as 78% of the total rice production in which, more than 3.5 billion people depended on rice as their staple food globally. Childs *et al*. (2013) also shared that the total global consumption of rice was nearly 444 million metric tons in 2011. In Asia, the production of rice is far greater as they contribute about 90% of the total global rice production with an estimated rice production of nearly 640 million tons (Ricepedia, 2016). However the rice consumption in Asia is also the highest compared to elsewhere with China in the lead at an estimated 144 million metric tons in 2012/2013 (Statista, 2016). Meanwhile, Malaysia has been declared as one of the major rice importing countries which implies that Malaysians consume more rice but produce less (Childs *et al.*, 2013).

In response to this, the government has launched a National Food Security Program to step up the production of food crop, amongst which is rice. In order to increase national rice production and minimizes the rice import value despite the constraints faced due to major pest problem, a 10-year National Agro-Food Policy has been developed by the Ministry of Agriculture and Agro-based Industry Malaysia on 28 September 2011. This policy aims to ensure national food security, increase the contribution of agro-food industry and some other objectives related to expand this significant food producer field (Temasek Agro, 2013).

It was discovered that insects, diseases and weeds had caused yield losses in rice ranging from 120 to 200 million tons annually in the tropical Asia with 37% mean region-wide yield loss due to pest (Gianessi, 2013). This has caused rice production to face a huge challenge in order to ensure sufficient rice production for the entire planet earth.

Among the pests invading the rice fields, apple snails are major pest that has obviously caused damage and high invasion to rice crops. The species of apple snails that are prominent in paddy fields especially in Southeast Asia in recent times are *Pomacea maculata* and *Pomacea canaliculata* (Arfan *et al*., 2014). However, Black Apple Snails or scientifically called as *P. maculata* is the most abundant one and can be found almost easily in Malaysia compared to *P. canaliculata* (Arfan *et al.,* 2014). The interesting part about these black apple snails is that they do not totally depend on rice to

keep growing as they were discovered to easily switch their diet preference by consuming *Limnocharis flava* as rice plant ages (Gilal *et al.,* 2016).

In a research conducted by Arfan *et al.* (2015), it was discovered that *Pomacea* spp. grew faster in paddy fields rather than in glasshouse with rice plant as a sole food source because these *Pomacea* spp. could consume many other weeds and simpler autotrophs plants which may offer more nutrients that enhance their growth and development.

Based on the above observation, this study will be carried out with the main objective of determining which food sources between paddy and Yellow Burr Head promotes better development of *P. maculata.* Therefore, the objective of this experiment is:

1. To study the effect of *O. sativa* and *L. flava* as food sources on the growth and development of *P. maculata.*

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