UNIVERSITI PUTRA MALAYSIA

STUDY ON LIFE CYCLE OF GOLDEN APPLE SNAIL, Pomacea canaliculata, PEST OF RICE

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STUDY ON LIFE CYCLE OF GOLDEN APPLE SNAIL, *Pomacea canaliculata*, PEST OF RICE

BY

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A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science

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This project report entitled "**Study on Life Cycle of Golden Apple Snail, Pomacea Canaliculata, Pest of Rice"** is prepared by Fharaazie Syahira Binti Saedon and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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ABSTRACT

Malaysia produce eighty percent to support the population and import rice if still not enough for consumption which 82.3 kilograms of rice per year. Lately, several species of Apple Snails are serious pest of rice worldwide and had infected 6,000 hectares of paddy field in 2004. The objectives for this experiment which to determine the life cycle and to establish a rearing technique for *Pomacea canaliculata*, commonly known as Golden Apple Snail (GAS). The adult snails were collected from the rice field in Pulau Pinang and reared in the Glasshouse Unit and the Entomology Laboratory, Department of Plant Protection, Faculty of Agriculture of University Putra Malaysia. After GAS produce egg, five eggs cluster were put into petri dish for five cohorts. Twenty juvenile was transferred into five aquariums (32×18×26 cm) in the glasshouse. Parameters that recorded were the number of egg per cluster, hatched and unhatched snail, shell length, width and height of juvenile and adult, duration taken for snails mating, mortality and duration taken to complete life cycle of GAS. The distribution of number of eggs per cluster varies from 72 to 92 eggs per cluster with mean of 84.6±5.5. The hatching success of the eggs showed great variation with mean hatchability of 51.4±14.5 and the maximum hatching percentage of eggs observed was 75%. The growth parameters for 16 weeks showed a positive correlation between different growth parameters which are shell height (SH), shell length (SL) and shell width (SW) and the week duration. It also shows the growth pattern which upward growth continuously of snails which cause the linear graph is formed. The adults were observed only for snail mating at week-16 and no mortality of the snails occurred during this period.

ABSTRAK

Malaysia menghasilkan 80% padi dan mengimport beras jika tidak mencukupi untuk keperluan harian yang memerlukan 82.3 kilogram beras setiap tahun. Kebelakangan ini, beberapa spesis dari siput gondang adalah perosak yang serius di seluruh dunia dan telah menyerang 6,000 hektar sawah pada tahun 2004. Objektif eksperimen ini untuk menentukan kitaran hidup dan mewujudkan teknik penternakan untuk *Pomacea canaliculata* (Siput Gondang Emas). Siput dewasa dikumpulkan di Pulau Pinang dan dipelihara di Unit Glasshouse dan Makmal Entomologi, Jabatan Perlindungan Tumbuhan, Fakulti Pertanian Universiti Putra Malaysia. Selepas siput menghasilkan telur, 5 kelompok telur diletakkan di dalam piring petri untuk 5 kohort. 20 juvenil dipindahkan ke dalam 5 akuarium (32×18×26 cm) di dalam rumah kaca. Parameter yang direkodkan ialah bilangan telur per kelompok, bilangan telur yang menetas dan tidak menetas, panjang siput, lebar siput dan tinggi siput, kadar kematian, masa diambil untuk siput matang dan masa yang diambil untuk siput melengkapkan kitar hidupnya. Taburan bilangan telur setiap kelompok berbeza-beza iaitu 72-92 telur setiap kelompok dengan min 84.6 ± 5.5. Kejayaan penetasan telur menunjukkan perubahan yang besar dengan penetasan purata 51.4 ± 14.5 dan peratusan penetasan telur maksimum diperhatikan adalah 75%. Parameter pertumbuhan selama 16 minggu menunjukkan korelasi positif antara parameter pertumbuhan yang berbeza ialah tinggi siput, panjang siput dan lebar siput dalam tempoh seminggu. Ia juga menunjukkan corak pertumbuhan yang berterusan ke atas pertumbuhan siput yang menyebabkan graf linear terbentuk. Siput dewasa yang diperhatikan hanya untuk pengawanan siput pada minggu-16 dan tiada kematian siput berlaku dalam tempoh ini.

CHAPTER 1

1.0 INTRODUCTION

Rice (*Oryza sativa* L.) is the most important source and staple food crop for more than half of the world's population and regarded as a first cultivated crop in Asia (Omar, 2007; Akinbile *et al.*, 2012). There are 23 species of genus *Oryza*, only two of them (*Oryza sativa* and *Oryza glaberrima*) are cultivated for food purpose and remaining are wild that have recently been crossed, producing hybrid (Olga, 2002). *Oryza sativa* is grown in all rice growing areas (Normile, 2004), but *Oryza glaberrima* is confined to the West Africa (Ahn *et al*. 1992; Murray 2005). Rice is cultivated as a wetland crop which accounts for 90% whereas remaining is upland (Khush, 2007).

Rice, after wheat, is the world's most consumed food grain, with global consumption reaching 444 million metric tons in 2011. The total area under rice cultivation in 2011 was 46 million/ ha of land planted to rice that produce 3.8 millions tons while the global average of almost 4.4 tons per ha (FAO, 2013). Rice is mostly grown and consumed in Asian countries as total area used for rice cultivation in Asia is 73.9 million ha (FAO, 2010) with total production of 110,867 million metric tons (FAO, 2013). China and India are the two largest producers of rice in the world. Most of the rice production is used for the domestic purpose of the producing countries and only about 4% of the world's rice production is traded internationally (Khush, 2007).

In Malaysia rice is mostly cultivated in the eight granary areas in Peninsular Malaysia covering an area of about 209,300 hectares (Akinbile *et al*., 2011), Sabah with 43,168 ha area cultivated and total area used for rice cultivation in Sarawak is 62,910 ha (Department of Agriculture Sarawak, 2011). In 2011, total rice production in Malaysia was 1,649 million tons from 0.672 million ha of rice (USDA, 2011). The average of yield of rice in Malaysia is 3.77 million tons/ha (IRRI, 2011).

The current rice production is not sufficient to meet the domestic requirements of Malaysia and is only sufficient for 73% requirements of the country. Rest of the rice is imported from different countries of world that increased the import bill of the Malaysia (Akinbile *et al*., 2011). Accordingly, government has set target of 2015 to achieve 100% self-sufficiency in rice production for the domestic purpose and have taken many initiatives including the allocation of additional land for rice cultivation, breeding of high yielding rice varieties (Akinbile *et al*., 2011). However, there are many hurdles to achieve the self sufficiency target of rice production including the low rice yield, inefficient labour force and problem of pest and diseases (Khush, 2007).

Rice is attacked by many pests and diseases that not only reduce the quantity of rice but it is also deteriorating its quality. Weeds, diseases, insects, birds and rodents are the major pest of rice that attack rice at different growth stages and affects its yield (Jahn *et. al*., 2007). In fact, *P. canaliculata*, recognized as one of the most serious threats to rice production, also alters both the state and functions of invaded

wetland ecosystems (Carlsson, 2006) and it is currently listed as Invasive Alien species (Lowe et al. 2000). In a survey conducted by Carlsson *et al*. (2004), high densities of golden applesnails (*P. canaliculata*) were associated with an almost complete absence of aquatic plants.

Recently, several species of apple snails (*Pomacea* spp.) have become major pests of rice and widespread in all the rice-growing areas of the world, especially in Southeast Asia including Malaysia (Joshi *et al*., 2003; Hayes *et al*., 2008; Horgan *et al.*, 2012). They were mostly introduced for the food and aquarium trade from their native habitats (South America) during 1980's but soon they lost their values and were discarded in wild and become pests of many macrophytes including rice. According to Estebenet, (1995); Estebenet and Martin, (2002), *P. canaliculata* snails actively locate and select those freshwater macrophytes that promote faster growth when the snails are reared on monospecific diets, growth rates depending partially on the ingested macrophyte biomass.

In Malaysia, apple snails were first recorded in 1991 and identified as *Pomacea canaliculata* and *Pomacea insularum* (Yahaya *et al*., 2006). Now, both of the species have spread in all the rice growing areas of the Peninsular Malaysia, Sabah and Sarawak and only in Peninsular Malaysia they have infested more than 20,700 ha of rice (DOA, 2012). The estimated costs of damage caused by the *Pomacea* spp. in granary area of Peninsular Malaysia were estimated at RM82.5 million in 2009 (DOA, 2012).

Further, impact of apple snail infestation is more serious in Malaysia than elsewhere in the world because mostly growers adopt direct seeding rice that is more vulnerable to apple snails (*Pomacea* spp.) than transplanted rice (Yahaya *et al*., 2006). For the management of *Pomacea* spp. below economic threshold level, mostly growers use molluscicides along with cultural, mechanical and biological methods but none of them has proved effective. The use of synthetic pesticides for apple snail control usually pollutes the aerial, soil, and aquatic environments and poses hazards to applicators; farm workers; and non-target organisms such as fish, frogs, and beneficial arthropods (Ranamukhaarachchi & Wickramasinghe, 2006).

When *P. canaliculata* has began to become a serious pest of rice threatening its yield significantly, information on its ecology, biology and control measures is lacking especially in Peninsular Malaysia. This situation helps the invasive *P. canaliculata* to invade huge rice growing areas without proper management options in hand. Therefore, the study on life cycle of *P. Canaliculata* was done by using suitable rearing technique so that to maintain sufficient and adequate population of *P. Canaliculata* for future experiments. Accordingly, this study was conducted with following objectives:

- To determine the life cycle of *P. canaliculata*.

- To establish a rearing technique for *P. canaliculata*.

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