UNIVERSITI PUTRA MALAYSIA

COMPARATIVE ASSESSMENT OF MOSQUITO BIOCONTROL EFFICIENCY BETWEEN ANABANTOIDEI NATIVE FISH: CLIMBING PERCH (Anabas testudineus) AND THREE-SPOT GOURAMI (Trichogastertrichopterus)

LIM CHIA HUI

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LIM CHIA HUI

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It is hereby certified that we have read this project paper entitled "COMPARATIVE ASSESSMENT OF MOSQUITO BIOCONTROL EFFICIENCY BETWEEN ANABANTOIDEI NATIVE FISH: CLIMBING PERCH (Anabas testudineus) AND THREE-SPOT GOURAMI (Trichogastertrichopterus)" by Lim Chia Hui and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfillment of the requirement for the course VPD 4999 – Project

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CONTENTS

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3.0 MATERIALS AND METHODS

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LIST OF TABLES

Tables

Page

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LIST OF FIGURES

Figure **Page**

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LIST OF ABBREVIATIONS

CP	Climbing perch
CP.D	Climbing perch in drain water
CP.L	Climbing perch in lake water
CP.C	Climbing perch in non-chlorinated water
GR	Gourami
Ppt	part per trillion
^{o}C	degree Celsius
UPM	Universiti Putra Malaysia

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ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfillment of the Course VPD 4999 – Project

COMPARATIVE ASSESSMENT OF MOSQUITO BIOCONTROL EFFICIENCY BETWEEN ANABANTOIDEI NATIVE FISH: CLIMBING PERCH (Anabas testudineus) AND THREE-SPOT GOURAMI (Trichogastertrichopterus)

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Over one million people die from mosquito-borne diseases every year urging the need to control mosquito population effectively. A study was carried out for comparison of mosquito biocontrol efficiency between two species of native Anabantoids, which were climbing perch (Anabas testudineus) and three-spot gourami (Trichogastertrichopterus). For each species, three fish were used to observe their feeding on mosquito larvae for three continuous days to determine the maximum daily intake of mosquito larvae. The mosquito larvae varying in length from 5 to 6mm were placed in each tank containing either A. testudineus or T. trichopterus. The mean maximum daily intake of mosquito larvae for a 3-day period was shown to be higher in A. testudineus as compared to the T. trichopterus. Amount of mosquito larvae fed was determined by enumerating the total number of larvae ate by the fish for each day. There was significant difference ($p<0.05$) in mean maximum daily intake of mosquito larvae between A. testudineus(71.1±4.37) and T. trichopterus(39.2±1.57). A. testudineus which was determined with higher predatory capacity was then further tested on the mean maximum daily intake of mosquito larvae when conditioned in tanks filled with three water sources: lake water, drain water and non-chlorinated water. It was found that the maximum daily intake of A. testudineus on mosquito larvae remained consistent regardless of the different water sources introduced. There was no significant difference ($p>0.05$) in the mean maximum daily intake of A. testudineus conditioned in three different water sources.

Keywords: Anabantoids, climbing perch (Anabas testudineus), three-spot gourami (Trichogastertrichopterus), mean maximum daily intake, mosquito larvae

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999 – Projek Ilmiah TahunAkhir

PENILAIAN PERBANDINGAN ATAS KECEKAPAN KAWALAN BIOLOGI NYAMUK ANTARA IKAN ANABANTOIDEI TEMPATAN: IKAN PUYU (Anabas testudineus) DAN IKAN SEPAT (Trichogastertrichopterus)

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Lebih daripada satu juta orang mati dijangkiti penyakit bawaan nyamuk, menggesakan keperluan untuk mengawal populasi nyamuk secara berkesan. Satu kajian telah dijalankan untuk membandingkan kecekapan kawalan biologi nyamuk ke atas jejentik nyamuk diantara dua jenis ikan Anabantoids tempan, iaitu ikan puyu (*Anabas testudineus*) dan ikan sepat (*Trichogastertrichopterus*). Bagi setiap sepsis ikan, tiga ikan telah digunakan untuk menelitikan pemakanan mereka keatas jejentik nyamuk selama tiga hari bagi menentukan min pemakanan maksimum harian ke atas jejentik nyamuk bagis etiap jenis ikan. *A.testudineus* yang telah ditentukan dengan tahap pemakanan maksimum harian yang tinggi kemudian diuji lagi dengan meletakkan ikan dalam tiga jenis air berlainan iaitu air kolam, air longkang dan air tanpa klorin untuk menentukan min pemakanan harian ikan ke atas jejentik nyamuk. Min panjang jejentik nyamuk yang digunakan untuk diberi makan kepada *A.testudineus* ataupun *T.trichopterus*. adalah diantara 5 hingga 6mm. Jumlah jejentik nyamuk yang dibagi makan ditentukan berdasarkan jumlah keseluruhan jejentik nyamuk yang dimakan oleh ikan setiap hari. Tahap min pemakanan maksimum harian ke atas jejentik nyamuk di antara *A.testudineus* dan *A.testudineus* (71.1±4.37) and *T.trichopterus* (39.2±1.57) mempunyai signifikasi yang berbeza ($p<0.05$). Min pemakanan maksimum harian ke atas jejentikn yamuk oleh *A.testudineus* yang diletakkan dalam tiga jenis air tidak mempunyai signifikasi yang bebeza ($p>0.05$).

Kata Kunci: Anabantoids, ikan puyu (*Anabas testudineus*), ikan sepat (*Trichogastertrichopterus*), tahap pemakanan maksimum, jejentik nyamuk

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1.0 INTRODUCTION

Mosquitoes

Mosquitoes belong to the family Culicidaeand are distributed worldwide. They comprise of approximately 3400 species belonging to 34 genera. Among the common genera are *Aedes, Anopheles, Culex* and Psorophora. Mosquitoes are two-winged flying insects, with a long slender bodies and needle-shaped, piercing mouthparts. (Manguin and Boëte,2011).

Mosquitoes are one of the most common insect vectors that transmit diseases, affecting the health of both humans and animals worldwide. They cause a variety of health problems, acting as a vector by transmitting disease-causing pathogens. Female mosquitoes require blood meals for egg production. During feeding on the host, either humans or animals, the pathogenic agents are transmitted to the host. The disease transmitted varies from one species of the Culicidae to another. The *Anopheles* acts as a vector transmitting diseases such as, malaria, and lymphatic filariasis. The *Culex* transmits Japanese encephalitis disease. The well-known *Aedes* mosquito could transmit several diseases namely, yellow fever, dengue, and other viral diseases. (Manguinand Boëte, 2011)

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Mosquitoes require water to complete their life cycle. There are four distinct stages in their cycle: egg, larva, pupa and adult. Female mosquitoes usually mate only once, produce and lay eggs at certain time intervals throughout their life. Females require blood-meals from humans and animals to attain protein mainly for egg production. Males on the other hand do not suck blood but feed only on plant juices. In females, a period of 2 to 3 days is required from the starting of blood meal intake, followed by blood meal digestion, until they reach the stage for development of eggs. The gravid females will then lay eggs at suitable places with availability of water resources. Another blood meal will be taken to produce and lay the next batch of eggs. The process is repeated until the mosquito dies. Different species of mosquitoes lay eggs in different forms, either singly as seen in the eggs of *Culex* species, whereas the eggs of *Anopheles* are seen to be wedged together in raft. In the tropical region, the eggs usually hatch within 2 to 3 days due to the higher climatic temperature comparedto the temperate region.

The larvae formed develop into four different stages. The first instar measures about 1.5mm in length, and increase to approximately 8 to 10mm at the fourth instar. At each instar, the larvae molt and shed their skin for growth and body development. The mosquito larvae are most commonly observed hanging and wiggling on the surface of the water. There is a siphon tube attached at the tip of the slender abdomen of the larvae for breathing. Once in a while, they can be seen diving to the bottom for the purpose of feeding or escaping from danger. The larval period lasts for about 4 to 7 days. The larval period can be extended when there is a shortage of food.

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Fully grown larvae develop into comma-shaped pupae. The pupal stage is a resting and non-feeding stage. This stage normally takes for about 2 days before a fully developed adult mosquito emerges. The newly emerged adult rests on water surface for a short time to dry its body and wings before takeoff. The entire cycle from development of egg to adult takes about 7 to 13 days under circumstances of suitable environmental conditions.

Native Fishes- Climbing Perch (*Anabas Testudineus*) andThree-Spot Gourami (*Trichogastertrichopterus*)

Climbing Perch (*Anabas Testudineus*)

The climbing perch, *Anabas Testudineus,*belongs to the family of Anabantidae and order of Perciformes. It is a native fish species that is common in our country, Malaysia. This species is naturally distributed in other southern Asia countries as well as Thailand, India, Sri Lanka, Phillipines and Southern China. It is found mainly in low lying water bodies such as swamps, lakes, ponds, paddy fields, small pits and estuaries. They are very hardy fish and able to survive and strive through areas with depleted dissolved oxygen, by possessing a special accessory air breathing organs, which facilitate the utilization of atmospheric air for respiration. As such, they are well known for the ability to migrate between ponds over land. They are omnivorous feeders and feed mainly on insects, invertebrates and plants. Additionally, this species has been reported as one of the successful biological control organisms in controlling mosquitoes, for example *Aedes sp., Culex sp.* and *Anopheles sp.* in sewage water. (Chandra et al., 2008)

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Three-Spot Gourami (*Trichogastertrichopterus*)

The three-spot gourami, *Trichogastertrichopterus,*also known as the blue gourami belongs to the family of Osphronemidae and order of Perciformes. It is an air-breathing fresh water fish, indigenous to Africa and South East Asia (Nelson, 2006).It can be found in most water bodies such as the paddy fields, river, and stream. This species of fish is omnivorous, feeds mainly on zooplankton, macroinvertebrates such as insects and larvae, as well as detritus and terrestrial macrophytes. Besides, they do eat insect larvae and algae which are harmful to man especially when being integrated in paddy field. As such, this fish species has been recommended to be used as biological control for mosquito.

Both fish species are well known to be used as biocontrol of mosquito. Being native, accompanied with their active, resilient behavior as well as their compatible nature make them to be suitable candidates for the control of mosquitoes. Since both fish species possess similar ability, it is interesting to know whether there are differences in their efficacy on mosquito control.

Thus the objectives for this study were:

1. To determine whether water inhabited by the climbing perch (*Anabas testudineus*) or three-spot gourami (*Trichogastertrichopterus*) can control mosquito breeding.

2. To compare the mean maximum daily intake on mosquito larvae between the climbing perch (*Anabas testudineus*) and the three-spot gourami (*Trichogastertrichopterus*).

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For future research, it is suggested the species of the mosquito larvae obtained is to be determined so as to see whether the different species of mosquito larvae fed to the fish could affect their predatory potential on mosquito larvae. Different species of mosquito larvae can have different behavior and characteristic mainly in their preference of hideout places.

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