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The Efficacy of *Micronecta polhemusi* Nieser 2000 (Insecta: Heteroptera: Micronectidae) as Biological Control of *Aedes* Mosquito in Urban Areas

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MICRONECTIDAE) AS BIOLOGICAL CONTROL OF *Aedes* MOSQUITO IN
URBAN AREAS”

by

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TEH SABARIAH BINTI ABD MANAN

A Thesis

Submitted to the Postgraduate Studies Programme
as a Requirement for the Degree of

MASTER OF SCIENCE

CIVIL ENGINEERING

UNIVERSITI TEKNOLOGI PETRONAS

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hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTP or other institutions.

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The Efficacy of *Micronecta polhemusi* Nieser 2000 (Insecta: Heteroptera: Micronectidae) as Biological Control of *Aedes* Mosquito in Urban Areas

Abstract

Stagnant clear water under tropical environment may become a balance ecosystem and free from mosquito infestation. The existence of mosquito predators in the ecosystems such as Micronectidae provides a natural control of mosquito. Micronectidae is a Family classification of aquatic insect from the Order Heteroptera. They are commonly found in pristine environment with clean water through out the world. The objective of this research was to examine the niche of *Micronecta polhemusi* Nieser 2000 (*MpN2000*) and apply such condition for mosquito control in residential areas. The first phase of the study was focused on the niche of *MpN2000*. It consisted of analytical measurement of the abiotic and biotic components of the ecosystems. The abiotic environment includes the sunlight intensity, water quality analysis (pH, DO, turbidity, COD, TSS, conductivity, Nitrogen Ammonia, Total Phosphorous), the humidity level, DO, BOD and temperature towards its survivability under stress conditions of low DO and various temperature levels. The taxonomy classification of *MpN2000* was determined. The growth population study indicated that *MpN2000* can reach a population of 30 *MpN2000*/L of water. An established population of *MpN2000* was found to predate on mosquito larvae at the average rate of 0.31 mosquito larvae/ *MpN2000*/day. The second phase of the experiment involved the applications of this biological control in three residential areas (Taman Maju, Bandar Universiti and Taman Tasek Putra). The applications of 90 ME (with *MpN2000*) and 90 Controls (without *MpN2000*) in these residential areas was examined based on the observations of the presence of *MpN2000* versus infestation of mosquito for three months. The results were analyzed to obtain the Infested Container index and Micronecta index of the area according to WHO procedure. In the presence of *MpN2000* in MEs, *MpN2000* started a new population in controls. The findings of this study suggest that mosquito in urban areas can be controlled by keeping a healthy environment with clean water that promotes the coexistence of mosquito and its predators.

Keywords Micronectidae, mosquito, model ecosystem, control, aquatic stage.

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Keberkesanan *Micronecta polhemusi* Nieser 2000 (Insecta: Heteroptera: Micronectidae) Sebagai Kawalan Biologi Nyamuk *Aedes* di Kawasan Perbandaran

Abstrak

Air takungan yang jernih dalam persekitaran tropika boleh menjadi sebuah ekosistem yang seimbang dan bebas daripada infestasi nyamuk. Kewujudan predator nyamuk seperti Micronectidae dalam ekosistem ini menghasilkan kawalan semulajadi kepada populasi nyamuk di fasa akuatik. Micronectidae adalah Famili serangga akuatik daripada Order Heteroptera. Serangga ini banyak ditemui di persekitaran yang bersih dan bebas dari pencemaran. Objektif kajian ini adalah untuk mengkaji niche *Micronecta polhemusi* Nieser 2000 (*MpN2000*) dan mengaplikasi keadaan tersebut untuk kawalan nyamuk di kawasan kediaman. Fasa pertama kajian ini berfokus kepada niche *MpN2000*. Ia merangkumi kajian analitikal bagi komponen biotik dan abiotik dalam ekosistem tersebut. Persekitaran abiotik merangkumi tenaga cahaya matahari, analisis kualiti air (pH, DO, turbiditi, COD, TSS, konduktiviti, Nitrogen Ammonia, Total Phosphorous), tahap kelembapan udara serta kesan DO, polutan organik dan suhu ke atas populasi *MpN2000*. Pengkelasan taksonomi bagi *MpN2000* telah dilakukan. Kajian mengenai pertumbuhan populasi *MpN2000* menunjukkan ia boleh mencapai populasi 30 *MpN2000*/L air. Populasi Micronectidae yang telah berkembang boleh menjadi predator kepada larva nyamuk dengan kadar purata 0.35 larva nyamuk/ *MpN2000*/hari. Fasa ke-dua merangkumi aplikasi kawalan biologi ini di tiga kawasan perumahan (Taman Maju, Bandar Universiti dan Taman Tasek Putra). Sebanyak 90 Model Ekosistem (ME: dengan *MpN2000*) and 90 kontrol (tanpa *MpN2000*) diaplikasi di kawasan tersebut. Eksperimen dijalankan berdasarkan pemerhatian ke atas kehadiran populasi Micronectidae dan juga infestasi nyamuk selama tiga bulan. Hasil kajian kemudiannya dianalisa menggunakan Infested Container Index dan juga *Micronecta* Index mengikut prosedur WHO. Kehadiran *MpN2000* di dalam ME *MpN2000* juga memulakan populasi baru di dalam kontrol. Hasil kajian ini menyarankan supaya nyamuk di kawasan perbandaran boleh dikawal dengan mengekalkan persekitaran yang sihat dengan air yang bersih untuk menyokong kewujudan ekosistem yang seimbang di antara nyamuk dengan pemangsanya.

Kata kunci Micronectidae, nyamuk, model ekosistem, kontrol, fasa akuatik.

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PREFACE

The primary goal of this thesis is to present to the reader, the examiners and other parties, the academic contributions and achievements accomplished by the candidate to enhance the awareness on the importance of clean environment to provide a balance ecosystem that can support the co-existent of mosquito predators in urban environment. Thus, the research provides a biological control agent for mosquito problem which is not only a nuisance to the public health but also a global major health concern. Urban areas can be a balance ecosystem free from mosquito and other pest problem if the environment is pristine and free from pollution.

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