UTILIZATION OF AQUATIC INVERTEBRATES IN THE BIOLOGICAL CONTROL OF MOSQUITOES

BY

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/استمارة معلومات الرسائل التى تمت مناقشتها

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٤ - المشرفون على الرسالة :

الاسم	القسم	الكلية	الجامعة
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٥ - مستخلص الرسالة (Abstract)

٥ - ١ باللغة العربية : بشرط ألا يزيد عن ٧ أسطر

هدفت الرسالة الى دراسة بعض العوامل التى تؤثر على انتاج نيماتودا Mermithidae مثل العمر اليرقى حيث كان العمر اليرقى الاول هو الاكثر حساسية للاصابة بنسبة ٩٦% ونسبة العدوى ١:٥ اعطت اعلى نسبة اصابة ٩٨%. كما اعطت نسبة عدوى ٣:١ افضل توازن بين اعداد ذكور واناث النيماتودا . كان البعوض *Anopheles pharoensis* حساسا للاصابة بالنوع *Romanomermis iyengari* فقط و كانت اعلى نسبة اصابة فى الاوعية ذات مساحة السطح الاقل بينما لم يؤثر عمق الماء على الاصابة. و ادى تخزين الاطوار المعدية على درجة حرارة منخفضة الى الاحتفاظ بحيويتها لفترة اطول. تم دراسة النوع *Gammarus* sp. وقدرته على افتراس يرقات البعوض و تاثير كل من التهوية والاضاءة عليه.

الكلمات الداله: (النيماتودا المتطفلة ، يرقات البعوض ،نسبة العدوى، نسبة الاصابة)

٥ ـ ٢ باللغة الأجنبية : بشرط ألا يزيد عن ٧ أسطر

This study aimed to investigate the effect of some factors on the mosquito infection with nematodes. Using first larval instars gave the highest infection (96%) and also 1:5 exposure ratio gave the highest infection (98%). The most balanced sex ratio was when 1:3 exposure ratio was used. *Anopheles pharoensis* mosquitoes were susceptible to infection with only *Romanonmermis iyengari*. The highest infection was in the containers with the smallest surface area while depth had no effect. Storing preparasites at low temperature preserved their survival and infectivity. *Gammarus* sp. predation on mosquitoes and the effect of aeration and light on their activity were investigated.

(Key Words :– parasitic nematodes, Mermithids, mosquito larvae, host:parasite ratio, infection rate)

٦ - **<u>أهم النتائج التطبيقية التى تم التوصل إليها</u>** :

(لا تزيد عن سطرين لكل منها)

٦ - ١- يمكن استخدام النيماتودا من عائلة Mermithidae فى المكافحة البيولوجية للبعوض بنجاح فى مصر.

٦ - ٢- يمكن انتاج النيماتودا بصورة كمية فى المعمل بشرط مراعاة العوامل التى تم ذكرها فى الرسالة

٦ - ٣- يمكن استخدام النوع *Gammarus* sp. فى المكافحة البيولوجية للبعوض ولكن يجب ان تتم دراسة تأثيره على الكائنات النافعة.

٦ - ٤

٧ ـ ما هى الجهات التى يمكن أن تستفيد من هذا البحث :

(اذكر هذه الجهات مع شرح أهمية البحث لهذه الجهة بما لا يزيد عن أربعة سطور لكل جهة

٧-١- وزارة الصحة

البحث يقدم طريقة جديدة لمكافحة البعوض من الممكن ان تستخدم فى مصر وتقلل من التأثير الضار للمبيدات الكيميائية

٧ -٢- المراكز البحثية

يقدم البحث بعض المعلومات التى من الممكن ان تستخدم فى ابحاث اخرى خاصة بالمكافحة البيولوجية للبعوض

٧ ـ ٣

٧-٤

٨ ـ هل توجد علاقة قائمة بإحدى هذا الجهات : **نعم** ☐ **لا** ■

فى حالة نعم اذكر هذه الجهات :

٨ ـ ١

٨ ـ ٢

٨ ـ ٣

ما هى طبيعة العلاقة :

مشروع بحثى ☐

تعاون أكاديمى ☐

مشروع ممول من جهة ثالثة ☐ (اذكر ما هى :)

أخرى ☐ (تذكر)

٩ - <u>هل توافق على التعاون مع جهات مستفيدة من خلال الجامعة :</u>

لا ☐ **(لماذا**)

نعم ■

(أ) لتطبيق البحث : ■

(ب) لاستكمال البحث : ■

(ج) أخرى ☐ **(تذكر**)

١٠ - <u>هل تم نشر بحوث مستخرجة من الرسالة فى مجلات أو مؤتمرات علمية</u>

(تذكر مع جهة النشر و المكان و التاريخ)

١٠ - ١- وصف ودراسة بعض العوامل المؤثرة على نشاط النوع *Gammarus* sp., احد القشريات المفترسة لبعوض *Culex pipiens* فى مصر (تم قبوله للنشر فى مجلة الجمعية المصرية للمكافحة البيولوجية-كلية الزراعة-جامعة القاهرة)

١٠ - ٢

١٠ - ٣

١١ - <u>هل سبق التقدم لتسجيل براءات اختراع</u> (تذكر مع الجهة و المكان و التاريخ)

لا

١٢ - <u>هل توافق على إعطاء البيانات المذكورة فى هذه الاستمارة لجهات أخرى</u>

نعم ■ لا ☐

توقيع الطالب : توقيع المشرفين :

-

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وكيل الكلية (المعهد) للدراسات العليا و البحوث : التاريخ

APPROVAL SHEET

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Title of Thesis: Utilization of aquatic invertebrates in the biological control of mosquitoes.
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Dr. Shahira Muhammad Onsy Elbishlawy
Department: Zoology and Agricultural Nematology
Approval: / /

ABSTRACT

This research work was divided into two parts. The first part of this work was carried out to study factors affect successful infection of mosquito larvae with mermithid nematodes (*Strelkovimermis spiculatus* and *Romanomermis iyengari*) such as larval stage, host parasite ratio, mosquito species, water surface area, water depth and storage of preparasites at two different temperatures. Data from this part showed that first instar larvae are the most susceptible to infection with mermithids; 96% of first instars were infected when three preparasites were used for each larva. This infection rate decreased in late instars and reached only 3% infection in the fourth instar larvae. Mosquito infection reached its highest rate when 1:5 host-parasite ratio was used; 98% percent of larvae were infected while at 1:1 host-parasite ratio, only 55% of larvae were infected. Host parasite ratio also affected sex ratio of the emerging nematodes; the percentage of males was 10 % when one nematode was used for each larva and increased to 89% at 1:5 host-parasite ratio. Larvae of *Culex pipiens* were found more susceptible to infection with the nematode *Strelkovimermis spiculatus* than *Anopheles pharoensis* larvae; infection rate was 96% in *C. pipiens* and 2% in *A. pharoensis*. On the other hand, *Anopheles pharoensis* larvae were susceptible to infection with *Romanomermis iyengari*; infection rates were 12, 23, 35, 41, 49, 53, 59, 65, 72 and 81% when the host-parasite ratios were 1:1, 1:2, 1:3, 1:4, 1:5, 1:6, 1:7, 1:8, 1:9 and 1:10 respectively.

Water surface area had a significant effect on infection; infection rates were 49, 69 and 90% when water surface area was 71, 182 and 259 cm^2, respectively while water depth had no significant effect on lab infections. Storing preparasites at low temperature (7-10° C) increased their longevity and viability; preparasites stored at low temperature survived to the 11^{th} day while preparasites kept at room temperature died in the fifth day. Also , preparasites stored at low temperature infected 74% of larvae in the fourth day compared with only 48% infection when preparasites stored at room temperature were used. The second part of this research work was carried out to study *Gammarus* sp., a potential mosquito predator. *Gammarus* sp., a species isolated from Fayoum governorate was described morphologically. Predation rate of *Gammarus* sp. on mosquito larvae was calculated and was found that *Gammarus* sp. feed on second instars more than first instars (4 2^{nd} instar larvae/day and 2 1^{st} instar larvae /day) and they didn't feed on third or fourth instar mosquito larvae. The effect of light and aeration on the survival of *Gammarus* sp. was also tested. Light had no significant effect on the survival of *Gammarus* while aeration significantly increased their life period in the laboratory.

Key words: Parasitic nematodes, Mermithids, mosquito larvae, host:parasite ratio, infection rate.

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GENERAL INTRODUCTION

Mosquitoes are the single most important group of insects. They are responsible for the transmission of disease to millions of people around the world each year. These diseases include yellow fever, dengue fever, rift valley fever, filariasis, encephalitis and malaria. Malaria alone causes or contributes to 2-3 million deaths and up to 300 million acute clinical cases each year. Dengue fever causes more than 50 million infections and at least 12000 deaths per year. Mosquito-borne diseases are becoming more common due to global warming and international trade and travel. West Nile Virus for instance, appeared for the first time in U.S.A in 1999 and became a permanent fixture of the U.S. medical landscape. West Nile Virus is transmitted by a number of mosquito species and it's considered the best documented introduction of a new, vector-borne human pathogen to the United States. This case also proves that mosquito-borne diseases are not limited to a country or a continent and they can be introduced to new areas by travel and commerce.

In Egypt, mosquito vectors of malaria, rift valley fever and filariasis are dominant and causing several cases each year. Significant resurgence of malaria is unlikely in Egypt now but the risks of localized outbreaks exist as a result of imported cases and the existence of malaria vectors. The number of imported malaria cases reported in 2008 was 80 cases according to WHO report (http://www.emro.who.int/emrinfo/index.asp?Ctry=egy).

Mosquito control is a major component in any successful control program for mosquito-borne diseases. Mosquitoes are usually controlled using chemical insecticides, resulting in serious problems including pollution, development of mosquito resistance, and applicator safety. Biological control, the use of natural enemies, offers an environmentally friendly alternative.

Parasitic nematodes belonging to family Mermithidae are ideal biological control agents against mosquitoes; they are safe to environment, easy to use and lethal to their mosquito host. The main problem of mermithid nematodes is that little is known about most species. The scientific literature dealing with these