Detection of *Wuchereria bancrofti* larvae in *Culex pipiens* mosquitoes in relation to filariasis in certain foci in Egypt

Thesis

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بسم الله الرحمن الرحيم

(قالوا سبحانك لا علم لنا الا ما علمتنا إنك أنت العليم الحكيم)

صدق الله العظيم

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Abstract

In the present work, blood samples and mosquitoes were collected from two governorates in Egypt known to be endemic for *Wuchereria Bancrofti*, namely Al Sharqia and Al Monofia governorates. The total number of infected cases with filarial antigen and antibody found within the two governorates was 19 (3.1%) out of the 612 persons examined for filariasis. Of these, 10 (2.15%) out of 464 were found in Al Sharqia governorate and 9 (6.08%) out of 148 were found in Al Monofia governorate. Correlation between cases of filariasis in the two governorates was found to be significant (p value = 0.016). Out of the 1376 female *Culex pipiens* mosquitoes collected from the two governorates, 6 (0.4%) were found to have filarial larvae, whereas 4 (0.4%) out of 994 were found in Al Sharqia governorate and 2 (0.5%) out of 382 in Al Monofia governorate. Correlation between filariasis in mosquitoes in the two governorates was found to be insignificant (p value = 0.760).

Key Words: Filariasis, Al Sharqia, Al Monofia, *C. pipiens*, *W. bancrofti*.

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List of Abbreviations

A.	:	*Anopheles*
ATP	:	Annual Transmission Potential
B.	:	*Brugia*
C.	:	*Culex*
DEC	:	Diethylcarbamazine
DNA	:	Double-Stranded Nucleic Acid
ELISA	:	Enzyme Linked Immunosorbent Assay
EPBs	:	Expanded Polystyrene Beads
GPELF	:	Global Program for Elimination of Lymphatic Filariasis
ICT	:	Immuno-chromatographic Test
IgG	:	Immunoglobulin G
IgM	:	Immunoglobulin M
IGRs	:	Insect Growth Regulators
LF	:	Lymphatic Filariasis
M.	:	Mansonella
MAb	:	Monoclonal Antibody
MDA	:	Mass Drug Administration
MTP	:	Monthly Transmission Potential
NPELF	:	National Program for Elimination of Lymphatic Filariasis
O.	:	Onchocerca
PAb	:	Polyclonal Antibody
PCR	:	Polymerase Chain Reaction
RIME	:	Research Institute of Medical Entomology
RPM	:	Recycle per Minute
SPSS	:	Social Package for Scientific Statistics
TII	:	Transmission Intensity Index
W.	:	*Wuchereria*
WHA	:	World Health Assembly
WHO	:	World Health Organization

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INTRODUCTION AND AIM OF THE WORK

Introduction

Filariasis is caused by several round, coiled and thread-like parasitic worms belonging to the family filaridea (Ottesen and Ramachandran, 1995).

Eight main species infect humans. Three of these are responsible for most of the morbidity due to filariasis: *Wuchereria bancrofti* (*W. bancrofti*) and *Brugia malayi* (*B. malayi*) cause LF, and *Onchocerca volvulus* causes onchocerciasis (river blindness). The other five species are *Loa loa*, *Mansonella perstans*, *Mansonella streptocerca*, *Mansonella ozzardi* and *Brugia timori*. The last species also causes lymphatic filariasis (LF) (WHO, 1989). Filariasis has been a major public health problem worldwide next to malaria (WHA, 1997).

Lymphatic Filariasis, commonly known as elephantiasis, is a disfiguring and disabling disease (Ottesen and Ramachandran, 1995).

Wuchereria bancrofti inhabits the lymphatic system and subcutaneous tissues and causes lymphatic disorders (Dreyer *et al.*, 2002).

Wuchereria bancrofti is the most widespread of the human filariae in the world (WHO, 1994). The majority of infections occur in Asia, but this parasite also causes considerable problems in Africa and the north-west of South America. There is a periodic and a subperiodic form (Durrheim *et al.*, 2004).

Aim of the Work

The aim of the present work is to detect *W. bancrofti* larvae in *Culex pipiens* (*C. pipiens*) mosquitoes (the vector of filariasis in Egypt) in certain foci in Egypt and it's relation to human infection in the same region with *W. bancrofti*.

REVIEW OF LITERATURE

Historical Background

In 1866, the German doctor Otto Wucherer discovered numerous microfilariae in patients with haematuria and chyluria in Bahia, Brazil. In 1870 the Briton, Lewis, in Calcutta discovered that patients with elephantiasis were infected with filariae. Because microfilariae were periodically detectable in the blood, the Scottish doctor Patrick Manson suspected that night-biting mosquitoes might be responsible for transmission. He carried out various experiments in Amoy (Xiamen), China. He allowed mosquitoes to bite his filaria-infected gardener, afterwards dissecting the insects and detecting microfilariae. He was able to follow the metamorphosis of the parasites in the insects. It later became clear that the parasites are transmitted via the bite of infected mosquitoes, primarily by the night-biting *Culex* and *Anopheles* mosquitoes. This biting behaviour is important as the numbers of microfilariae in the peripheral blood systematically fluctuate over a 24-hour period reaching their highest levels at night. There is a remarkable periodicity of the microfilariae. The density of parasites is greatest at the time when the chance of transmission is greatest (at night). In the Pacific Islands, transmission occurs via the daytime-biting *Aedes* mosquitoes so there is no or less diurnal variation (= subperiodic form) (Manson-Bahr and Apted, 1987).

The *W. bancrofti* after getting deposited on skin penetrate on their own or through the opening created by mosquito bites to reach the lymphatic system. In Egypt, they are transmitted by mosquito species *C. pipiens* and the disease is the cause of a great deal of social stigma (Raghavan, 1961).

Taxonomy

Parasitic round worms (nematodes) in the superfamily Filarioidea, family Onchocercidae, are the only metazoan disease agents of vertebrates that undergo true biological transmission by arthropods vectors (Bruce and John, 2004).

Nematodes are classified within the phylum Nematoda, class Secernentea, subclass Spiruria, order Spirurida, suborder Spirurina, this suborder includes a diverse array of parasitic nematodes that have arthropod intermediate hosts (Bruce and John, 2004).

Due to their highly evolved biology characterized by specialized eggs and the microfilariae, which migrate in host lymph or blood and are transmitted by hematophagous arthropods, the filariid Onchocercidae were considered recent nematodes. Currently, their origin is thought to be remote, hidden in the Secondary era, with the first representatives in crocodiles and transmitted by culicids (150 M years). But the main expansion occurred during the Tertiary, synchronously with bird and mammal diversification (Bain, 2002).

The human filariae result from two evolutionary processes: either they have evolved from parasites of primates or humans have been infected by the capture of filariae parasitic in zoologically unrelated groups (Bain, 2002).

Geographical Distribution

Wuchereria bancrofti is the most widely distributed species causing lymphatic filariasis, and its infections are the most prevalent (Bruce and John, 2004).

It occurs in large sections of sub-Saharan Africa, parts of India, China, Bangladesh, Myanmar, Thailand, Malaysia, Laos, Vietnam, Indonesia, the Philippines, Papua New Guinea and among island groups in the South Pacific Ocean (Bruce and John, 2004).

Foci existed in northern Australia, but have been eradicated. Bancroftian filariasis, introduced into the Western Hemisphere along with colonization by Europeans and the slave trade, formerly had a wider geographical distribution, including Trinidad and other islands of the Caribbean and in costal areas of Mexico and Central America (Bruce and John, 2004).

Wuchereria bancrofti infection also occurs in localized areas in Haiti, the Dominican Republic, Guyana, Surinam and the northeast coast of Brazil (Bruce and John, 2004).

Charleston, North Carolina, was endemic for bancroftian filariasis until the early part of the 20th century. However, the distribution of bancroftian filariasis since has shrunk in the Western Hemisphere to its current status (Bruce and John, 2004).

Filariasis in Egypt

Endemic LF caused by *W. bancrofti* has been in Egypt possibly since the time of the pharaohs (Nunn and Tapp, 2000). There was a resurgence of the disease in the 1970s with changes in water levels and agricultural