

بسم الله الرحمن الرحيم



HOSSAM MAGHRABY



شبكة المعلومات الجامعية التوثيق الالكتروني والميكرو فيلم



HOSSAM MAGHRABY

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
على هذه الأقراص المدمجة قد أعدت دون أية تغيرات



يجب أن

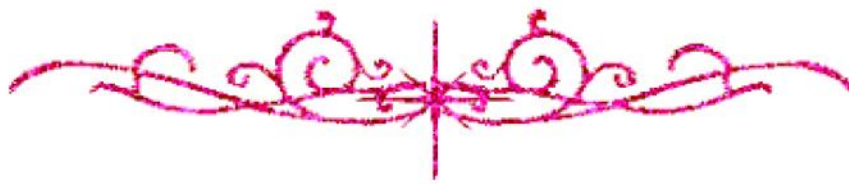
تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



HOSSAM MAGHRABY



بعض الوثائق الأصلية تالفة



HOSSAM MAGHRABY



بالرسالة صفحات

لم ترد بالأصل



HOSSAM MAGHRABY

B16520

**FISH PARASITES AS BIOLOGICAL
INDICATORS OF POLLUTION
WITH HEAVY METALS**

A Thesis Submitted

By

**Sayed Abd El-Monem Ahmed Mohamed
(M.Sc.)**

**Faculty of science, Cairo University
Zoology Department**

**For
The Ph. D. degree of Science
Zoology Department**

**Faculty of Science
Cairo University**

2001

APPROVAL SHEET

Title of the Ph. D. Thesis

Fish parasites as biological indicators of pollution with heavy metals

Name of Candidate:

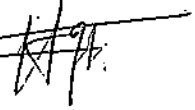
Sayed Abd El-Monem Ahmed Mohamed

Submitted to the

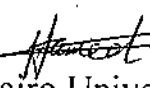
Faculty of Science, Cairo University

Supervision Committee:

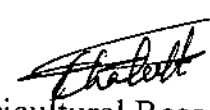
1- Prof. Dr. Haggag Ali Mohamed

Professor of ecology and environmental pollution, Cairo University. 

2- Dr. Hamed Mohamed Fayed

Associate Professor of Parasitology, Cairo University 

3- Dr. Khalid Hussein Zaghloul

Researcher of ecophysiology, Agricultural Research Center 

Head of Zoology Department


Prof. Dr. Mohamed Ismail Mohamed

ABSTRACT

The River Nile and its branches are exposed to many kinds of chemical and biological pollutants as a result of increasing industrial and other urbanization activities where effluents are discharged directly into the water without prior treatment. Therefore, fish health may suffer unless the water quality is fully evaluated by chemical analyses to assess the levels of heavy metals that could be incorporated into fish tissues and hence become a threat to man.

The present study aims to determine the effect of heavy metals on some physiological and biochemical aspects of two important fish species in Egypt: the Nile tilapia; *Oreochromis niloticus* and the Nile catfish; *Clarias gariepinus* collected from three different localities. Two are located along the River Nile (Helwan, polluted area and El-Zamalek, unpolluted area). The third locality is the agricultural drainage canal at El-Fayoum Governorate, Egypt.

The data declared that the percentage distribution of heavy metals in the intestinal parasites of the studied fish were much higher than those accumulated in fish tissues. Moreover, the acanthocephala; *Acanthosentis tilapiae* accumulate much higher heavy metals than the cestode; *Polyonchobothrium clarias* and the trematode; *Orientocreadium lazeri*.

The study detected a significant decrease in the growth indices and meat quality of fish collected from the polluted area with a disturbance in some physiological and biochemical parameters associated with a clear damage in fish tissues.

Finally, the present investigation focused on the role of the water hardness in modifying the toxic effect of heavy metals on fish collected from the agricultural drainage canal.

Key words: Pollution, parasitism, heavy metals, water hardness, bioindicators.

CONTENTS

	Page
INTRODUCTION	1
AIM OF WORK	17
MATERIALS AND METHODS	19
RESULTS	
Water quality	29
Prevalence of helminth infection	32
Blood parameters	35
Serum constituents	
Serum glucose	37
Serum total protein	39
Serum total lipids	39
Serum transferases (AST & ALT)	39
Serum creatinine	40
Serum uric acid	40
Serum electrolytes	40
Chemical muscle composition	42
Growth indices	44
Residual heavy metals	46
DISCUSSION	64
SUMMARY	90
REFERENCES	97
ARABIC SUMMARY	

Acknowledgment

Firstly, I am greatly thankful to my God, who gave me every thing I have, and enabled me to overcome all the problems which I faced during this work..

I would like to express my deep thanks to **Prof. Dr Haggag Ali Mohamed**, Professor of ecology and environmental pollution, Faculty of Science, Cairo University, for his supervision and for his illuminating guidance, constructive suggestion and keen interest about the whole work and critically reviewing the manuscript.

My deep thanks are due to **Dr. Khalid Hussein Zaghloul**, Researcher of ecophysiology, Agricultural Research Center, for sharing the supervision and continuous guidance and helpful assistance from which I have got great benefit and for reviewing the manuscript.

My deep thanks are also due to **Dr. Hamed Mohamed Fayed** Associate Professor of Parasitology, Cairo University for sharing the supervision.

My special deep thanks and appreciation are also due to **Prof. Dr. Abd El-Rahman M. Bashtar**, Professor of Parasitology, Faculty of Science, Cairo University, for his sharing in planning the work. I am greatly indebted for his continuous encouragement and valuable guidance and advice all the time.

Thanks are also due to **Prof. Dr. Mohamed Assem Marie** for his profitable advice.

I wish to extend my deep thanks to my wife and to all staff members of Zoology Department, Faculty of Science, Cairo University.

List of Tables

Table:	Page
Table (1): Quality of water collected from different studied localities.....	30
Table (2): Prevalence of infection of <i>Oreochromis niloticus</i> with <i>Acanthosentis tilapiae</i> in the studied localities.....	33
Table (3): Prevalence of infection of <i>Clarias gariepinus</i> with <i>Orientocreadium lazeri</i> and <i>Polyonchobothrium clarias</i> in the studied localities.....	34
Table (4): Blood parameters of the Nile tilapia; <i>Oreochromis niloticus</i> and the Nile catfish; <i>Clarias gariepinus</i> collected from different localities.....	36
Table (5): Serum constituents of the Nile tilapia; <i>Oreochromis niloticus</i> and the Nile catfish; <i>Clarias gariepinus</i> collected from different localities.....	38
Table (6): Serum electrolytes of the Nile tilapia; <i>Oreochromis niloticus</i> and the Nile catfish; <i>Clarias gariepinus</i> collected from different localities.....	41
Table (7): Meat quality of the Nile tilapia; <i>Oreochromis niloticus</i> and the Nile catfish; <i>Clarias gariepinus</i> collected from different localities.....	43
Table (8): Condition factor (k), hepatosomatic index and the liver water content of the Nile tilapia; <i>Oreochromis niloticus</i> and the Nile catfish; <i>Clarias gariepinus</i> collected from different localities.....	45
Table (9): Heavy metal concentrations in serum (mg/l) of the infected and non-infected fish collected from different localities.....	47
Table (10): Residual iron concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.....	49

Table (11): Residual copper concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.....	51
Table (12): Residual zinc concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.....	53
Table (13): Residual lead concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.....	55
Table (14): Residual cadmium concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.....	57
Table (15): Percentage distribution of the accumulated heavy metals in the intestinal parasite and some selected vital organs of <i>Oreochromis niloticus</i> collected from the studied polluted area of the River Nile.....	60
Table (16): Percentage distribution of the accumulated heavy metals in the intestinal parasites and some selected vital organs of <i>Clarias gariepinus</i> collected from the studied polluted area of the River Nile.....	61

List of Figures

Figure:

Fig. (1): The studied localities (El-Zamalek, Helwan and agricultural drainage canal).

Fig. (2): Quality of water collected from different studied localities.

Fig. (3): Percentage of infection of *Oreochromis niloticus* with *Acanthosentis tilapiae* recorded in the different studied localities.

Fig. (4): Percentage of infection of *Clarias gariepinus* with *Orientocreadium lazeri* and *Polyonchobothrium clarias* recorded in the different studied localities.

Fig. (5): Blood parameters of the Nile tilapia; *Oreochromis niloticus* and the Nile catfish; *Clarias gariepinus* collected from different localities.

Fig. (6): Calculated blood parameters of the Nile tilapia; *Oreochromis niloticus* and the Nile catfish; *Clarias gariepinus* collected from different localities.

Fig. (7): Serum glucose, total proteins and total lipids of the Nile tilapia; *Oreochromis niloticus* and the Nile catfish; *Clarias gariepinus* collected from different localities.

Fig. (8): Serum transaminase (AST and ALT) activities, creatinine and uric acid of the Nile tilapia; *Oreochromis niloticus* and the Nile catfish; *Clarias gariepinus* collected from different localities.

Fig. (9): Serum electrolyte concentrations of the Nile tilapia; *Oreochromis niloticus* and the Nile catfish; *Clarias gariepinus* collected from different localities.

Fig. (10): Meat quality of the Nile tilapia; *Oreochromis niloticus* and the Nile catfish; *Clarias gariepinus* collected from different localities.

Fig. (11): Condition factor, hepatosomatic index and liver water content of the Nile tilapia *Oreochromis niloticus* and the Nile catfish; *Clarias gariepinus* collected from different localities.

Fig. (12): Heavy metal concentrations in serum (mg/l) of the Nile tilapia; *Oreochromis niloticus* and the Nile catfish; *Clarias gariepinus* collected from different localities.

Fig. (13): Residual iron concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.

Fig. (14): Residual copper concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.

Fig. (15): Residual zinc concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.

Fig. (16): Residual lead concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.

Fig. (17): Residual cadmium concentrations in the intestinal parasites and some selected vital organs (mg/kg dry weight) of the infected and non-infected fish collected from different localities.

Fig.(18): Histological sections of gills of the Nile tilapia; *Oreochromis niloticus* collected from polluted, unpolluted area of the Rive Nile and agricultural drainage canal .

Fig.(19): Histological sections of gills of the Nile catfish; *Clarias gariepinus* collected from polluted, unpolluted area of the Rive Nile and agricultural drainage canal .

Fig.(20): Histological sections of liver of the Nile tilapia; *Oreochromis niloticus* collected from polluted, unpolluted area of the Rive Nile and agricultural drainage canal .

Fig.(21): Histological sections of liver of the Nile catfish; *Clarias gariepinus* collected from polluted, unpolluted area of the Rive Nile and agricultural drainage canal .

Fig.(22): Histological sections of kidney of the Nile tilapia; *Oreochromis niloticus* collected from polluted, unpolluted area of the Rive Nile and agricultural drainage canal .

Fig.(23): Histological sections of kidney of the Nile catfish; *Clarias gariepinus* collected from polluted, unpolluted area of the Rive Nile and agricultural drainage canal .

List of abbreviations

Non. T : Non- infected Nile tilapia; *Oreochromis niloticus*.

Inf. T : Infected Nile tilapia; *Oreochromis niloticus*.

Non. C : Non- infected Nile catfish; *Clarias gariepinus*.

Inf. C : Infected Nile catfish; *Clarias gariepinus*.

(E& H) : Eosin and Haematoxylin.

E. C. : Electric conductivity.

K factor: Condition factor.

HIS : Hepatosomatic index.

MCV : Mean corpuscular volume.

MCH : Mean corpuscular haemoglobin.

MCHC : Mean corpuscular haemoglobin concentration.

P.l. : Permissible limit