Ain Shams University
Women's College for Arts,
Science and Education
Zoology Department

EFFECT OF POLLUTION ON SOME PHYSIOLOGICAL PARAMETERS OF FRESHWATER CRAYFISH (*PROCAMBARUS CLARKII*) AND STUDY OF SOME ECOLOGICAL PARAMETERS AND ASSOCIATED CILIATED PROTOZOA IN ITS WATER

A thesis submitted in partial fulfillment for the degree of the M. Sc. Degree in Zoology

By

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جامعة عين شمس
كلية البنات للآداب والعلوم والتربية
قسم علم الحيوان

تأثير التلوث على بعض القياسات الفيسيولوجية لإستاكوزا المياه العذبة (*بروكامبارس كلاركي*) ودراسة بعض القياسات الإكولوجية والأوليات الهدبية المرتبطة بها في الماء

رسالة مقدمة للحصول على درجة الماجستير في العلوم (علم الحيوان)

من

رنا مصطفى عادل إسماعيل
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(٢٠١٣)

بسم الله الرحمن الرحيم

"قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ"

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عنوان الرسالة: تأثير التلوث على بعض القياسات الفيسيولوجية لإستاكوزا المياه العذبة (*بروكامبارس كلاركي*) ودراسة بعض القياسات الإكولوجية والأوليات الهدبية المرتبطة بها في الماء.

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DEDICATION

I dedicate this work to ...

my dear MOTHER who did her best in raising me and spared no effort in helping and encouraging me throughout my whole life,

my dear FATHER (ALLAH bless his soul),

my BROTHERS & SISTER,

and my beloved HUSBAND...

With all my Love & Respect ...

Rana Mostafa

Discussion

One of the most critical problems of developing countries is improper management of vast amount of wastes generated by various anthropogenic activities. More challenging is the unsafe disposal of these wastes into the ambient environment. Water bodies especially freshwater reservoirs are the most affected. This has often rendered these natural resources unsuitable for both primary and/or secondary usage **(Fakayode, 2005)**.

Wastes entering these water bodies are both in solid and liquid forms. These are mostly derived from industrial, agricultural and domestic activities. As a result, water bodies which are major receptacles of treated and untreated or partially treated industrial wastes have become highly polluted. The resultant effects of this on public health and the environment are usually great in magnitude **(Osibanjo *et al.*, 2011)**.

Nubi *et al.* (2008) stated that industrial discharge or wastes include heavy metals, pesticides, polychlorinated biphenyls (PCBs), dioxins, poly-aromatic hydrocarbons (PAHs), petrochemicals, phenolic compounds and microorganisms. Pesticides include insecticides, herbicides, fungicides, molluscides, nematicides and

heavy metals like copper, zinc, arsenic, lead, cadmium, mercury etc **(Jayakumar, 2002)**.

Domestic wastes in the developing countries may contain modern environmental health hazardous substances thus posing additional risk to public health **(Nweke & Sander, 2009; and Adefemi & Awokunmi, 2009)**.

Heavy metals are toxic after large accumulation in the body of flora and fauna and later pass on through the food chain from fish to man **(Ayodele and Abubakar, 2001)**. The toxic effects may result from the bio-concentration of metals and their consequence binding with biologically active constituents of the body such as lipids, amino acids and proteins **(Thangam & Sivakumar, 2004; and Vutukuru, 2005)**.

Crayfish and freshwater shrimp are members of the order Decapoda (**Simon, 2001)**. The natural distribution of crayfish has been disturbed in many countries **(Lodge *et al*., 2000a, b)** by the translocation of species outside of their home range, often for aquacultural and stocking purposes.

Allert *et al.* (2012) found that crayfish densities were significantly decreased downstream of mine waste relative to their upstream reference sites. The same authors concluded that decreased crayfish densities imply a loss of ecosystem function because crayfish are a key structural and functional component in the chosen

ecosystems. They also provided additional support for the use of crayfish in the assessment of the bioavailability and ecological effects of metals in aquatic ecosystems.

Banaee and Ahmadi (2011) reported that biochemical studies are very important from a toxicological point of view. Biochemical parameters and physiological indicators can be used as diagnostic tools to recognize potential environmental problems before the health of aquatic systems is seriously changed.

The presence of heavy metals in aquatic animals is becoming a threat, thereby making them unfit for human consumption. Heavy metals found in crustaceans are known to affect the enzyme balance as well as demobilize them **(Herkovits *et al*., 1996)**.

Detection of *Procambarus clarkii* deformities

In the present study, it was observed that during June, August, September, October, November, and December 2011 *P. clarkii* deformities were detected and appeared frequently in chelipeds rather than carapaces. This is possibly attributed to exposure of *P. clarkii* to heavy metals in water.

The present result is in agreement with **Weis *et al.* (1992)** who presented that many environmental pollutants have toxic effects that can alter normal limb regeneration and molting in crustacea. Chlorophenols and dithiocarbamates caused inhibition of

regeneration without affecting molting in shrimp. Organic toxicants such as aromatic hydrocarbons and dioxins also result in a decrease in the growth increment per molt. The same authors mentioned that a number of toxicants also produce morphological alterations in the regenerated limbs of crabs. These may be relatively minor, such as reduced number of pigment cells, setae, or tubercles in the regenerated limbs (mercury and cadmium), or may be more major deformities, such as abnormal bending in the limb or claw (tributyltin), or defects in chitin formation in the exoskeleton (diflubenzuron).

The present finding also agrees with **Chen *et al.* (2000); Besser *et al.* (2001); Gama-Flores *et al.* (2007) and Burger (2008)** who stated that subchronic exposures of invertebrates and salmonids to various metals are associated with altered behavior and debilitating deformities.

Also, it was mentioned that the processes of limb regeneration and molting in decapod crustaceans are generally coupled with one another under the control of the neuroendocrine system. Inorganic mercury, methylmercury, and cadmium reduce the rate of limb regeneration in the fiddler crab *Uca pugilator*. Retardation of regeneration is generally accompanied by a delay in ecdysis, so that limbs are usually fully formed by the time of molting; in some cases