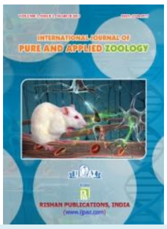
ISSN Print/Online: 2320-9577/2320-9585
INTERNATIONAL JOURNAL OF PURE AND APPLIED ZOOLOGY
Volume 1, Issue 1, March 2013
Available online at: http://www.ijpaz.com
RISHAN PUBLICATIONS



RESEARCH ARTICLE **OPEN ACCESS**

LAMBDA CYHALOTHRIN INDUCED BIOCHEMICAL AND HISTOLOGICAL CHANGES IN THE LIVER OF *OREOCHROMIS MOSSAMBICUS* (PETERS)

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Article History: Received: 26.02.2013, Accepted: 09.3. 2013

ABSTRACT

To investigate the sublethal effects of pesticide lambda cyhalothrin on biochemical and the liver histology of *Oreochromis mossambicus* under long term exposure. The toxicity tests were conducted following method of Finney (1964). Based on the acute toxicity assay the fish were exposed to 0.0025 ppm sublethal concentration. The glycogen content in liver tissue and glucose content in blood were estimated at the end of 10, 20 and 30 days. The liver tissues were removed and fixed in Bouin's fluid and then they processed for microphotograhs. Glycogen content was found to be depleted in liver at all periods after treatment. In contrast to the observation of glycogen, the glucose level was elevated in the blood at all periods. In control tilapia, the liver was comprised of polygonal hepatocytes with centrally placed nucleus. Pesticide induced dilation of blood sinusoids, vacuolization and disintegration of cell boundaries were noticed in the 10 and 20 days of exposed fish. The complete damage of hepatocytes and loss of integrity of cell wall was noticed about 30 days of exposure. From the results stated above it can be concluded that the finding of the present study indicate that histological changes observer serve as "biomarkers" for assessing pesticide toxicity in aquatic environment.

Key words: Lambda cyhalothrin, toxicity, liver, histology and *O. mossambicus*.

INTRODUCTION

Pesticides have been reported to make a revolution in the agriculture production in India by controlling pests of various crops (Matsumura,1985). Pesticides used in pest control programes resulted contaminate the ecosystem and enter food chains causing damaging effects on the ecosystem and non - target species (Ruvio,1972 and Bakre *et al.*,1990).

Lambda cyhalothrin is a synthetic pyrethroid insecticide insecticide widely used for pest management and public health applications to control insects. Lambda cyhalothrin is categorized as a restricted use pesticide in Extension Toxicology Network for its toxicity to fish (Mound,1998). But its usage for the control of major pest in agriculture is being continued in developing countries like India. The pesticide exposure causes severe alterations in the tissue biochemistry and histology of fishes (Velisek *et al.*, 2009; Anita Susan, *et al.*, 2010 and Saravanan, *et al.*, 2010). In view of this in the present study the effect of sublethal concentration of lambda cyhalothrin on the liver biochemistry and histology of a freshwater teleost, *Oreochromis mossambicus*.

MATERIALS AND METHODS

The fish, *Oreochromis mossambicus* weighing approximately 20g were collected from ponds in and around Adirampattinam. They were acclimatized for 15 days in large cement tanks (temperature 28 ± 2 °C; pH 8.0 ± 0.02 & DO 6.2 ± 0.4) previously washed with 1% potassium permanganate. The water was renewed every 24 hr. A stock solution of Lambda cyhalothrin was prepared and the toxicity tests were conducted following method of Finney (1964).Based on the acute toxicity studies (96 h), LC_{50} value for test fish was found to be 0.025 ppm. For biochemical and histological studies, *O. mossambicus* were reared in 10% sub lethal concentration for a period of 10, 20 and 30days. After treatment, both the control and experimental fishes were sacrificed at the end of 10, 20 and 30days. The glycogen content was estimated in liver tissue by the method as described by Seifter *et al.*(1950) and the blood glucose was estimated by O-toluidine method of Hartel *et al.(*1969).The liver tissues were removed and fixed in Bouin's fluid and then they processed adapting the usual procedure (Gurr, 1950).The sections (8µm) were stained with Haematoxylin and Eosin.

RESULTS

Blood glucose and liver glycogen interrelationship

The fish was exposed to sublethal concentration for a period of 30 days. Glycogen content was reduced in liver of pesticide exposed fishes with a concurrent increase in blood glucose concentrations. The percentage change in the liver over the control was decreased by -12.07, -29.71 and -57.77 at 10, 20 and 30 days of exposure (Table: 1). The increased trend of blood sugar level over the control was observed at sublethal concentrations at respective exposure period. The increased percentage changes over the control were +18.92, + 47.84 and + 93.29 (Table 2).

Table 1. Glycogen content (mg/gm) in the liver of *O. mossambicus* exposed to lambda cyhalothrin.

Treatment	**Exposure period (Days)**		
	10	**20**	**30**
Control	28.67±0.42	27.39±0.23	28.82±0.37
Sublethal	25.21±0.16	19.25±0.31	12.17±0.26
% Change	-12.07	-29.71	-57.77

Values are mean ±SE of 6 individual observations.

Table 2. Blood glucose levels (mg/100ml) in the *O. mossambicus* exposed to lambda cyhalothrin.

Treatment	**Exposure period (Days)**		
	10	**20**	**30**
Control	36.42 ± 0.24	39.51 ± 0.38	38.47 ± 0.29
Sublethal	43.31 ± 0.37	58.41± 0.26	74.36± 0.41
% Change	+18.92	+ 47.84	+ 93.29

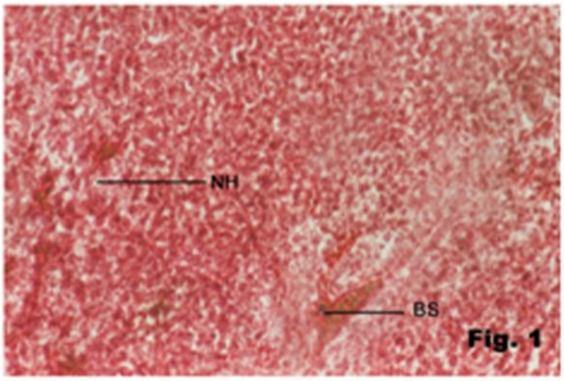
Values are mean ±SE of 6 individual observations.

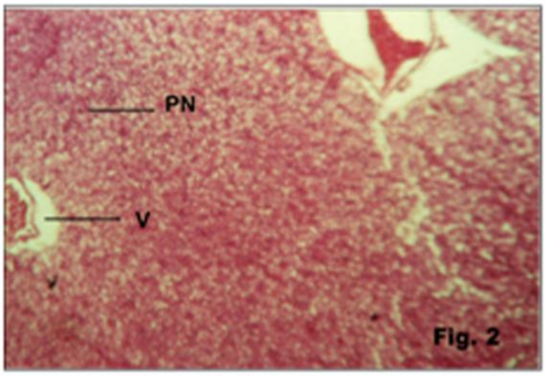
Histology of fish liver

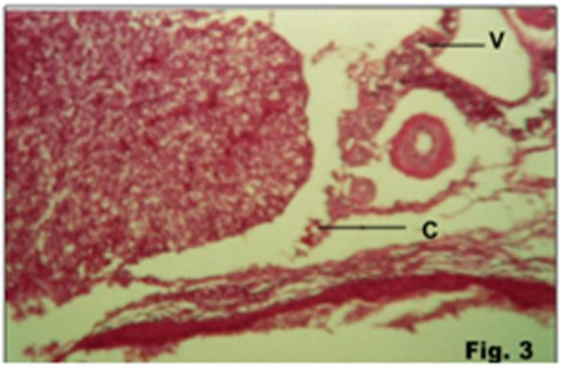
In untreated *O. mossambicus*, the liver is made up of continuous mass of hepatocytes arranged in irregular cords. The hepatic cells are polygonal in shape with distinct central nuclei. A large number of blood sinusoids were also seen around the hepatocytes (Figure1).

Pathology of liver tissue under Lambda cyhalothrin toxicity

Marked toxic effects were observed at the structural and cellular level in the liver. In 10 days exposed fish, disintegration of cell boundaries and slight dilation of blood sinusoid was observed (Figure 2). After 20 days, many hepatic cells were completely damaged. Intracellular vacuolation was also apparent (F Figure 3). After 30 days, damage to the hepatocytes was prominent. In most of the hepatic cells the integrity of cell wall was completely lost (Figure 4).







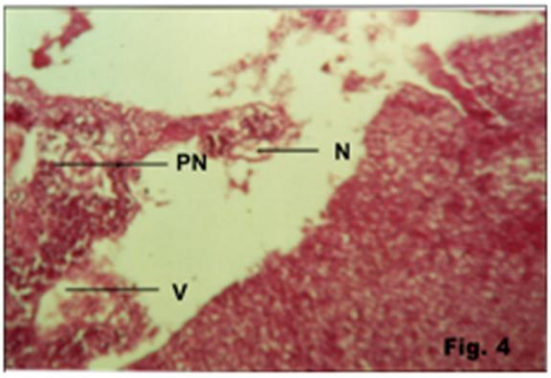


Figure 1. Control liver of *O. mossambicus*: NH-Normal hepatocytes and BS-blood sinus.

Figure 2. Exposed liver of *O. mossambicus* in 10% SLC of lambda cyhalothrin(10days): PN- pycnotic nuclei and V- vacuolization.

Figure 3. Exposed liver of *O. mossambicus* in 10% SLC of lambda cyhalothrin(20days): C- cytolysis and V- vacuolization.

Figure 4. Exposed liver of *O. mossambicus* in 10% SLC of lambda cyhalothrin(30days): PN- pycnotic nuclei,V- vacuolization and N-necrosis.

DISCUSSION

The hepatic cells have many vital functions such as secretion of bile, detoxification, synthesis of several components of blood plasma, storage of glycogen and release of glucose in the blood. Glycogen content was found to be depleted in liver tissue at all periods after treatment with a sublethal dose of lambda cyhalothrin. The results suggest that glycogen being a ready source of energy, reduction in glycogen is probably due to its more rapid breakdown (glycogenolysis) which releases glucose into the circulatory system to meet the increased energy requirements in a stressed condition. Sastry and Subhadra(1982), Larsson and Haux (1982) and Haux and Larsson (1984) have also made similar observations in cadmium treated *Heteropneustes fossilis* and *Salmo gairdneri*.The observations of Palanivelu *et al.*(2004) on glycogen level in cartap hydrochloride treated *O. mossambicus* was also comparable to those of the present study. In this study the blood sugar gradually increasing with increase in exposure period. Elevation of blood glucose level has been reported in *Labeo rohita* exposed to heavy metals (Neha Bhatkar *et al*.,2004). A similar trend has also been observed in mercury treated fish, *L. rohita* (Rajasubramaniam, 2006).

Morphological and histological alterations related to pesticide toxicity in the liver of fish have been showing that the substances cause severe damage to the liver cells (Ahamed and Srivastava, 1985; Dutta *et al.*,1993 and Ortiz *et al.*, 2003). Liver is an important organ of detoxification and biotransformation process and due to these reasons the hepatic cells are damaged severely. Several works have reported degenerative changes in hepatic tissue subjected to pollution by various pesticides and insecticides (Kumar and Pant, 1984; Gill *et al.*, 1990; Pandey *et al.*,1993; Tilak *et al*., 2005; and Sakr and Jamal Al Lail, 2005). Dubale and Shah (1979) reported that *Channa punctatus* under malathion toxicity showed the degenerative changes in liver. Radhaiah and Jayantha Rao (1992) reported moderate cytoplasmic degeneration in hepatocytes, formation of vacuoles, rupture of blood vessels and picnotic nuclei in the liver of *Tilapia mossambica* exposed to fenvalerate. The liver of pesticide treated fish showed dilation of blood sinusoids, vacuolization, disintegration of cell boundaries and necrosis. The present results are in agreement with those observed by many authors who studied the effects of different pollutants of fish liver (Mohamed,2001; Ptashynski *et al*., 2002 and Fanta *et al.*, 2003). According to Rodrigues *et al.* (2001) the liver is an organ that frequently undergoes changes when exposed to insecticide at sublethal doses. The changes may be attributed to direct toxic effects of pollutants on hepatic cells, since the liver is the site of detoxification of all types of toxic substances (Soufy *et al*., 2007).

CONCLUSION

The finding of the present study indicates that the biochemical and histological changes observed serve as biomarkers for assessing pesticide toxicity in aquatic environments.

ACKNOWLEDGEMENT

The authors are thankful to the Secretary and Principal, Khadir Mohideen College, Adirampattinam for providing necessary laboratory facilities.

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Cite this article as:

K. Muthukumaravel, O. Sathick and S. Raveendran, 2013. Lambda cyhalothrin induced biochemical and histological changes in the liver of *Oreochromis mossambicus* (Peters). *Int. J. Pure Appl. Zool.,* **1**(1): 80-85.