

HISTOPATHOLOGICAL CHANGES INDUCED IN THE LIVER AND KIDNEY OF *TILAPIA NILOTICA* BY NEOPYBUTHRIN

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ABSTRACT

Nile fish Tilapia nilotica was exposed to the pyrethroid insecticide, Neopybuthrin at different concentrations. Histological examination of the liver and kidney revealed many pathological changes. The liver cells showed vacuolation of their cytoplasm. The hepatic tissue lost the original arrangement and necrosis was observed. Pathology in the kidney is characterized by vacuolar degeneration of most tubules. Many dark coloured pigment granules were found spread all over the cells of the proximal tubules and the glomeruli also showed vacuolation. Such histopathological alterations in the liver and kidney were depended on the concentration level of neopybuthrin.

INTRODUCTION

Recent environmental study revealed that most of pesticides applied for pest control enter to the aquatic organisms through various routes (Anees, 1975). This led directly and / or indirectly to environmental pollution in aquatic resources. The biocides accumulate in fresh water organisms causing several adverse effects (Verma *et al.*, 1979). Thus, disturbances in different biochemical events are reported to occur in fish tissues after exposure to various pesticides in water (Jhingran, 1977, Vernberg *et al.*, 1977, El-Elaimy *et al.*, 1977, El-Elaimy *et al.*, 1988). In histopathological studies, lesions induced by malation in liver of fish *Channa punctatus* were observed by Dubale and Shah (1979). The authors indicated that malathion was hepatotoxic and gradual disintegration of blood tissue. Similar histopathological changes were recorded in organs and tissues of fishes exposed to a variety of insecticides (Sastry and Sharma, 1978, Mandal and Kulshrestha, 1980, Desai *et al.*, 1984, Gabr, 1986).

The present work is an attempt to study the histopathological effects induced in the liver and kidney of the fresh water fish *Tilapia nilotica* after exposure to new pyrethroid insecticide " neopybuthrin ".

MATERIALS AND METHODS

Living samples of *Tilapia nilotica* were collected from the High Dam lake, each weighing 200 - 300 gm. The fishes were kept in specially equipped aquaria which were continuously aerated by air pumps, and were provided with suitable food of earth worms. Pyrethroid insecticide neopybuthrin was used in the present investigation. Its LC_{50} was found to be 2.1 mg / liter as obtained from the lethal curve constructed for this purpose in our laboratory. Three groups of fishes, (5 fishes for each) were used. the first group of fishes were exposed to one treatment of $1/2 LC_{50}$ of neopybuthrin for 24 hours, the second group were exposed to two successive treatments of $1/2 LC_{50}$, while the third group were exposed to three successive treatments of neopybuthrin, one as 24 hrs interval. Another group of 5 fishes were used as control. After exposure to different concentrations, living fishes were selected, killed and their livers and kidneys were removed. The tissues were immediately fixed in Bouin's fluid. Paraffin sections of $5\mu m$ thickness were prepared and stained with haematoxylin and eosin.

RESULTS

i. Liver :

The liver in *Tilapia nilotica* is referred to as a hepatopancreas since exocrine pancreatic tissue is usually found within the substance of the liver located around the blood vessels (Fig. 1). The hepatocytes are hexagonal in shape with more or less centrally located nucleus and homogenous cytoplasm. There is no clear division of the hepatic mass into lobules (Fig. 2).

Liver of fishes exposed to one dose of $1/2 LC_{50}$ of neopybuthrin showed that the cytoplasm of the hepatic cells was vacuolated and some nuclei appeared pyknotic with mor or less irregular nuclear membrane (Fig. 3). The sinusoidal lumen is narrow and contain blood cells. The hepatocytes of fishes exposed to 2 doses of neopybuthrin lost their normal arrangement and showed more vacuolation and some cells were found multinucleated (Fig. 4). Some necrotic cells with pale

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homogenous cytoplasm were observed and the lumen of the hepatic sinusoids were difficult to be seen. In fishes exposed to 3 doses of neopybuthrin, the liver cells showed severe vacuolation and lost their original arrangement (Fig. 5). Necrotic cells were observed. There was a considerable decrease in the zymogen granules in the pancreatic acinar cells (Fig. 6).

ii. Kidney :

Histological structure of the kidney of control fish is shown in (Fig. 7). The kidney of fishes exposed to $\frac{1}{2}$ LC₅₀ of neopybuthrin showed slight histological changes. The proximal convoluted tubule lumen was narrow and many dark coloured pigments were spread all over the most cells. The capillary lumens found to be filled with blood cells. The other tubules (distal and collecting) showed a slight vacuolation in the cytoplasm of their cells (Fig. 8). In fishes exposed to two successive dose of $\frac{1}{2}$ LC₅₀ of neopybuthrin, the dense pigments which were present in the cells of the proximal tubule increased in size and vacuolation increased (Fig. 9). The cells of the distal tubule showed necrotic changes. In fishes exposed to 3 doses of $\frac{1}{2}$ LC₅₀, in addition to the histological changes occurred in the animals recieved 2 doses, other changes were present. Most of tubules showed degeneration, and in some tubules, there was separation of the tubular epithelia from their basement membrane. Some of the proximal tubule cells undergo shrinkage and vacuolation. The collecting tubule cells showed vacuolation and its lumen became wider than in the control. The glomerulli showed, also, degeneration (Fig. 10 & 11).

DISCUSSION

In the present investigation, a groups of Nile fishes *Tilapia nilotica* were subjected to one dose, two doses and three doses, respectively of $\frac{1}{2}$ LC₅₀ of neopybuthrin, one each 24 hr. interval. Histological examination of the liver and kidney revealed different pathological changes. The liver cells showed vacuolation of their cytoplasm. The hepatic tissue lost the original arrangement while necrotic

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cells were observed. Pathology in the kidney is characterized by degeneration of most tubules (proximal, distal and collecting). Many dark pigments were spread all over the cells of the proximal tubules and the glomeruli also showed degeneration.

The present investigation are in agreement with those of earlier workers studying the histological effects of different insecticides in fishes and other animals. Eller (1971) found that there were cellular changes in the liver of *Salmo clarki* following food or water exposure of 0.01 mg / kg b. w. or 0.01 ppm of the insecticide endrin. Degenerative changes in the liver were produced in blue gills *Lepomis macrochirus* exposed to heptachlor (Andrews *et al.*, 1966). Malathion was found to induce histopathological lesions in the liver of *Channa punctatus* (Dubale and Shah, 1979). Mandal and Kulsrestha (1980) studied the effects of sublethal concentration of succinon on liver, kidney and intestine of *Clarias batrachus*. They observed liver necrosis, vacuolation and break down of cell boundaries. They observed also vacuolation of epithelial cell of uriniferous tubules and degeneration of the glomeruli in the kidney, while in the intestine, they noticed lesion formation in the wall and enlarged mucous cells. Histological changes in the liver of *Tilapia mossambica* after exposure to the organophosphate monocrotophos were reported by Desai *et al.*, (1984). At the initial stage of intoxication, necrosis and vacuolation of hepatocytes were recorded, while fatty degeneration was observed later. Treatment with endrin produced acute pathological changes in the liver of *Channa punctatus* (Sastri and Sharma, 1979).

Many authors stated that biochemical changes are subsequently accompanied with histopathological alterations. Pyrethroid insecticides were found to be cholinergic inhibitors (Ray and Cremer, 1978). El-Elaimy (1986) found that dermal application of baythroid to rat caused impairment in liver function as indicated by the great elevation in serum transaminases. Elevations in transaminases (GOT, GPT) were considered to be a more sensitive measure in evaluating hepatocellular damage (Oser, 1965). In the present work, it is suggested that exposing *Tilapia nilotica* to neopybuthrin may induce biochemical disturbance leading to the morphological changes obtained in the liver and kidney.

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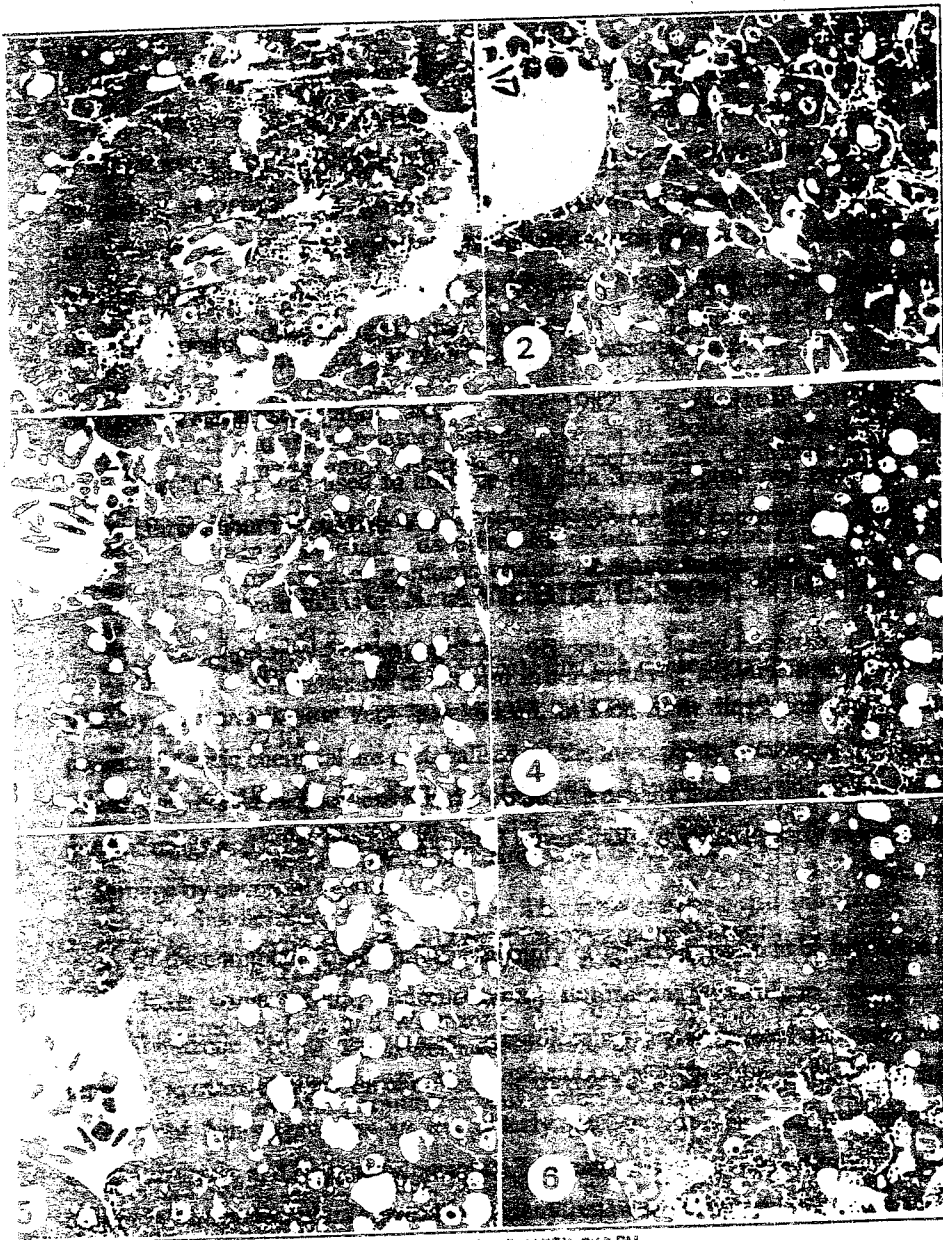
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EXPLANATION OF FIGURES

- Fig.1.** Liver of a control fish showing the pancreatic acini which are arranged around a blood vessel, Z : zymogen granules, HP : hepatocytes, (X 500).
- Fig.2.** Liver of a control fish showing the arrangement of the hepatocytes. The nuclei are with clear nucleoplasm and the cytoplasm shows homogenous colour, (X 500).
- Fig.3.** Liver of a fish treated with $1/2 LC_{50}$ of neopybuthrin showing vacuolation of the cytoplasm. Some nuclei showed pyknotic appearance and the sinusoidal lumen contain blood cells, (X 500).
- Fig. 4.** Section of liver of a fish treated with one LC_{50} of neopybuthrin showing that the hepatocytes lost their arrangement and clusters of dark necrotic tissue are present between the hepatocytes, (X 500).
- Fig.5.** Liver of a fish treated with $1\ 1/2 LC_{50}$ of neopybuthrin showing severe vacuolation, V. (X 500).
- Fig.6.** Section of a fish treated with $1\ 1/2 LC_{50}$ of neopybuthrin showing pancreatic acini (PC). zymogen granules (Z) decreased in number, (X 500).
- Fig.7.** Section of kidney of a control fish showing the different types of tubules, (X 300).
- Fig.8.** Section of kidney of a fish treated with $1/2 LC_{50}$ of neopybuthrin showing dense bodies spread all over the cells of proximal convoluted segment (P), (X 400).
- Fig.9.** Section of kidney of a fish treated with one LC_{50} of neopybuthrin showing the occurrence of dense bodies in the cells of proximal tubule (P). The nuclei of most cells are poor in chromatin and the cytoplasm is faintly coloured, G. : glomeruli (X 400).

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- Fig.10.** Section of kidney of a fish treated with 1 1/2 LC₅₀ of neopybuthrin showing occurrence of dense bodies in the cytoplasm of the proximal tubule and disorganization of the brush border, (X 400).
- Fig.11.** Section of kidney of a fish treated with 1 1/2 LC₅₀ of neopybuthrin showing a collecting tubule (CT) with wide lumen. Vacuoles are present in the apical region of the epithelial cells. The nuclei have poor chromatin content, (X 400).



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**التغيرات المرضية التي تحدث في كبد و كلية البلطى النيلى
بعد التعرض لمبيد نيوبايبوترين**

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فى هذا البحث تم دراسة التغيرات المرضية التى تحدث فى كبد و كلية أسماك البلطى النيلى بعد تعرضها لتركيزات مختلفة من مبيد نيوبايبوترين وأسفرت الدراسة عن وجود بعض التغيرات فى كل من الكبد والكليه وظهور فجوات فى سيتوبلازم خلايا الكبد والكلية وأيضاً تكسير الأنابيب الكلوية . كما ظهرت حبيبات صبغية فى خلايا الكلية وقد ثبت أيضاً من البحث أن كل التغيرات المرضية التى تحدث فى الكبد والكلية تعتمد على تركيز المبيد التى تتعرض له الأسماك .