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The effect of quinalphos on histopathological changes in the Kidney of fresh water fish, *Anabas testudineus*

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Abstract
The present study investigates histology of kidney of fresh water fish, *Anabas testudineus* on exposed to 0.5 ppm of quinalphos pesticide. Quinalphos for short term duration (24, 48, 72 and 96 hours) lead to the formation of histopathological lesions of varying intensities on the kidney tissues. Quinalphos is one of the organophosphate insecticides represent one of the most widely used classes of pesticide with high potential for human exposure in both rural and residential environments. The fresh water fish, *Anabas testudineus* was selected as the test species. 1/10th of 96 hrs LC_{50} was taken as sublethal concentration of Quinalphos pesticide. After the stipulated period of exposure (24, 48, 72 and 96 hrs) fishes were sacrificed and kidney tissue was isolated and analysed histological changes. Histology of kidney showed pyknosis, vacuolization, nuclear hypertrophy, vacuole formation and defect in renal tubule. The study described the histological structures of kidney of *Anabas testudineus* during short term exposure period of quinalphos showed occlusion of tubular lumen, cloudy swelling, edema and disorganization of glomerulus were seen in the fish on exposed to quinalphos for short term period.

Keywords: Quinalphos, *Anabas testudineus*, Sublethal, Histopathology

1. Introduction
Histopathological changes have been widely used as biomarkers in the evaluation of the health of fish exposed to contaminants, both in the laboratory and field studies. One of the great advantages of using histopathological biomarkers in environmental monitoring is that this category of biomarkers allows examining specific target organs, including gills, kidney and liver, that are responsible for vital functions, such as respiration, excretion and the accumulation and biotransformation of xenobiotics in the fish [1]. Furthermore, the alterations found in these organs are normally easier to identify than functional ones [2].
Histopathology techniques can be used in contaminant studies to solve two interrelated problems in aquatic toxicology. The primary objective of the studies designed to identify mechanisms of toxicity is to describe the mode of action of a toxicant on an organism by identifying the structure (e.g. Target organs, cells or organelles) and the functions (e.g. Respiration, reproduction, ion transport etc.) that the toxicant affects directly. The primary objective of the studies is designed to predict "Safe" contaminant concentrations in laboratory, the concentrations of toxicants that will not adversely affect populations or communities in the environment.

2. Materials and Method
Fresh water fish, Anabas testudineus were exposed to 24 hrs, 48 hrs, 72 hrs and 96 hrs to a sublethal concentration of Quinalphos pesticide. At the end of exposure period, fish were randomly selected for histopathological examination. They were collected from the Aliyar fish farm, pollachi stocked during October 2015 and acclimatized for a time period of `10-15 days in the laboratory conditions in glass aquaria containing dechlorinated water. The water of the aquarium was aerated continuously through stone diffusers connected to a mechanical air compressor. Water temperature ranged between 26±50 ºC and the pH was maintained between 6.6 and 8.5.Fish were fed twice daily alternately with rice bran and oil cakes. For the present study, matured adult fishes were exposed to 1/10th concentrations of LC_{50} of quinalphos for 24, 48, 72 and 96 hrs continuously. Three replicates of ten fishes for each exposure of the

Pesticides were used. In these aquaria water was replaced daily with fresh treatment of pesticides. Each experiment was accompanied by its respective control.

Three groups of fishes were exposed to 1/10th of the pesticide 'quinalphos' for 24, 48, 72 and 96 hrs. Another group was maintained as control. All the groups received the same type of food and other conditions were maintained similarly. At the end of exposure period, fish were randomly selected for histopathological examination. Tissues of gills were isolated from control and experimental fish. Physiological saline solution (0.85% NaCl) was used to rinse and clean the tissues. They were fixed in aqueous Bouin's solution for 48 hrs, processed through graded series of alcohols cleared in xylene and embedded in paraffin wax. Kidneys alone were processed by double embedding technique. Sections were cut at 6µ thickness stained with Hematoxylin Eosin, dissolved in 70% alcohol [3] and were mounted in Canada Balsam. The photographs at 200x magnification were taken with computer aided microscope (Intel play Qx3, Intel Corporation, Made in China).

3. Results

The kidney consisted of head and body kidneys. Head kidney, the anterior portion consisted of lymphoid tissues. Body kidney composed of many nephrons and interstitial lymphoid tissues. The glomerular capsule was formed of an inner and outer layer of single flattened epithelia. Renal tubules consisted of a single layer of epithelial cells. Mesangium filled the space between the loops of glomerular capillaries (Fig. 1). When the fish was exposed for 24 hours to the short term exposure of quinalphos, the kidney showed degenerative changes with dilated glomeruli and Bowman's capsule (Fig. 2). After 48 hours of exposure highly degenerative changes were found in haemopoietic tissues (Fig. 3). After 72 hours of exposure severe necrosis and moderately dilated renal tubules with infiltration of parenchyma by inflammatory cells (Fig. 4). After 96 hours of exposure, shrunken of glomerulus and nephritic changes were seen, Bowman's capsules were dilated. Vacuolar degeneration (cloudy swelling) in the epithelium of renal tubules and dilation in the capillary tubes of renal tubules were observed. Also edema in Bowman's capsules with atrophy in the glomeruli and dilation in renal blood vessels were observed (Fig. 5).

Histopathology of the Kidney of *Anabas testudineus*

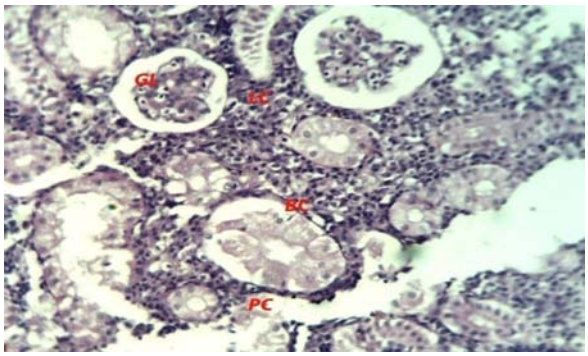

Fig 1: Control kidney section of Anabas testudinae

GL - Glomeruli
LC - Lymphoid cells
PC - Parenchyma cells
BC - Bowman's capsule

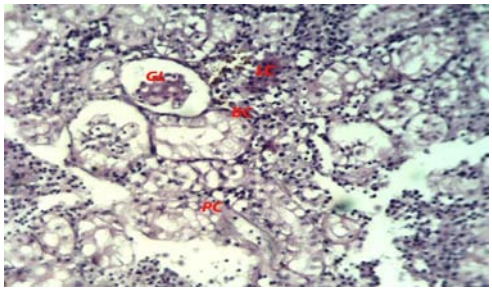

Fig 2: Kidney section of fish exposed to 24 hours of quinalphos

GL - Glomeruli
LC - Lymphoid cells
PC - Parenchyma cells
BC - Bowman's capsule

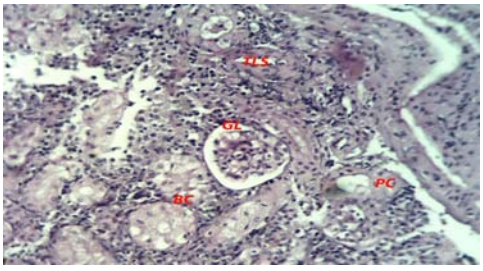

Fig 3: Kidney section of fish exposed to 48 hours of quinalphos

PC - Parenchyma cells
BC - Bowman's capsule
T - Tubules
GL - Glomeruli

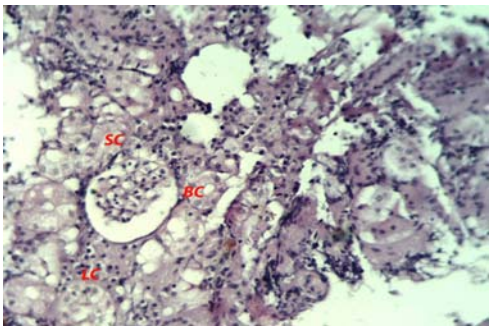

Fig 4: Kidney section of fish exposed to 72 hours of quinalphos

LC - Lymphoid cells
BC - Bowman's capsule
SC - Shrunken of glomerulus

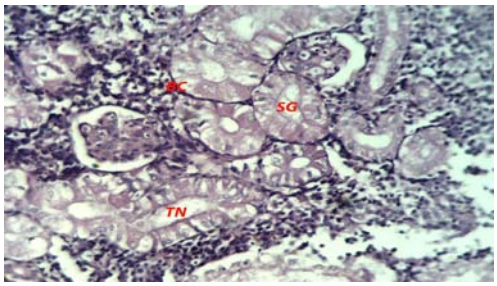

Fig 5: Kidney section of fish exposed to 96 hours of quinalphos

BC - Bowman's capsule
SG - Shrunkene of glomerulus
TN - Tubules Nucleus

4. Discussion

Degeneration and necrotic changes were also found [4] stated that pathological changes noticed in the kidney might have been due to renal excretion of under toxified fenvalerate [5]. have found that the presence of hemosiderosis and vacuolation in the renal tubules of effluent treated fish, *Heteropneustes fossilis* reveals the dynamic process of events involving vascular and exudative stages occurring due to toxicity induced by the toxicants in the effluent. The kidney of fish receives much of the largest portion of postbranchial blood and therefore renal lesions might be expected to be a good indicator of environmental pollution. Tubular degeneration, intertubular and intratubular deposits in catfish, *Ictalurus punctatus* upon exposure to methyl mercury [6]. Notopterus notopterus upon exposure to sublethal concentration of phenolic compounds exhibited degeneration and dissolution of epithelial cells of renal tubules, hypertrophy and necrosis [7]. Similar observations were reported in *Cyprinus carpio* when exposed to Anthio 40 EC, Stox and Basuden 10G, organochlorine and organophosphate compounds [8].

Acute cytological necrosis of haemopoietic tissue was observed in case of 30 days dieldrin treated kidney. Vacuolation and complete disintegration of cuboidal cells of epithelial layer of glomeruli was observed with BHC. Kidney of 30 days DOT treated fish showed haemopoietic necrosis and vacuolation. The glomeruli were shrunken when exposed to dieldrin. Generally aldrin, dieldrin, DOT and BHC treated kidney after 20 days exposure showed acute necrosis. Poor supply of oxygenated blood due to pesticide toxicity may be the cause of necrosis [9]. Degeneration in the epithelial cells of renal tubules, pycnotic nuclei in the hematopoietic tissue, dilation of glomerular capillaries, degeneration of glomerulus, intra cytoplasmatic vacuoles in the epithelial cells with hypertrophied cells and narrowing of the tubular lumen were observed in the kidney tissues of fish exposed to deltamethrin [10, 11]. Reported pycnotic nuclei in tubular epithelium, hypertrophied epithelial cells of renal tubules, contraction of the glomerulus and expansion of space inside the Bowman's capsule in the kidney of *Cirrhinus mrigala* exposed to monocrotophos [12]. Reported various histopathological changes such as degeneration of tubular epithelium, nuclear deterioration like karyorrhexis and karyolysis, and collapsing glomeruli in the kidney of *Puntius conchonius* following exposure to cadmium. They also found progressive increase in severity of degenerative changes with increasing duration of exposure.

In conclusion, this study has provided the histology of kidney in the fresh water fish, *Anabas testudineus* on exposed to quinalphos for short term duration period. It is suggested that adequate care should be taken to neutralize and detoxify the toxicants present in the agricultural effluent and follow the treatment procedure before let out into aquatic systems. And we should decrease the pesticide consumptions in agricultural fields. Indiscriminative usage of pesticide will leads into bioaccumulation and bio magnification in humans and other vertebrates it will leads to sever histological and physiological changes.

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