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Histopathological study of kidney of the fish *Channa gachua* (Bloch) exposed to the pesticide sedaxane

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ABSTRACT : The present Investigation is conducted to assess histopathological alternations caused in kidney of an air breathing teleost *Channa gachua* (Bloch) after exposure of sedaxane (sublethal concentration of sedaxane for 96 hours is 0.045 ppm). Light microscopic studies showed many alternations in the kidney of fish. These alternations are observed as pathological biomarkers indicating the load of pollution of toxic stress. Due to this kidney showed vacuolization, degeneration of cell membrane, damage of hematopoietic tissue, hypertrophy of nuclei, necrosis etc. These observations are thus indicative of the toxic affect caused by sedaxane at histopathological level in kidney of *Channa gachua* (Bloch).

Key Words : Histopathology, kidney, *Channa gachua,* sedaxane, toxicity.

Pesticides encompass a wide range of chemicals used to kill insects, fungi or weeds for massive production in agriculture. Pesticides are extensively used in world for pest control. Pesticides are used as important component in agricultural development and protection of public health in India, as the climate of India is very suitable for plant breeding (Kumar *et al*., 2010). Use of Pesticide in agricultural field to control pests is very toxic to non-target organisms like fish and affects fish health through impairment of metabolism, sometimes leading to mortality (Shankar *et al*., 2013).

Among all pesticides, sedaxane is widely used to control pests. It inhibits respiration by binding to the succinate dehydrogenise complex of fungi. These insecticides enter into the aquatic ecosystem and then food chain and are responsible for adverse effect in aquatic ecosystem and finally human.

We know that fisheries and aquatic resources supply long term profits to people. These profits are direct financial one as they provide employment, save money and other benefits. Fishes are most suitable aquatic species and can be used as indicator of aquatic pollutants, hence, fishes are used as test organism. Au (2014) stated that fishes are rapidly exposed to a wide variety of aquatic pollutant showing harmful effect, when these pollutants are slightly decomposable and show high potential for accumulation. Fish is the protein source for human and other consumers. Fishes are important component of food chain and any toxic alternation has adverse effect on the nutritional value of fish and human being through consumption (Gupta and Srivastava, 2006). Fishes are sensitive to different concentration of pesticides and their tissues show histopathological effects (Murthy, 1986).

Toxicants affect both the physiological and metabolic activities of any organism. But physiological study is not enough for the complete and accurate description of pathological effect of chemical agent. Hence, it is necessary to view histopathological effect to determine the health status of fish. The extent of severity of tissue damage depends on potentiality of pesticides in the tissue of organism. Besides this, tissue damage is concentration and time dependent.

Histopathological changes are used as biomarkers in the evaluation of the effect of pollutants on health of fish both in laboratory (Wester *et al*., 1991 and Thophon *et al*., 2003) and field study (Hinton *et al*., 1993 and Teh *et al*., 1997). These biomarkers not only help in observing specific target organ, responsible for vital functions but also give information relating to damage of animal health.

Hence, our present investigation is conducted to test toxicity. This test is essential to figure out pesticide limit and safe concentration so that there will be minimum harm to aquatic ecosystem in future (Nikkam and Shejule, 2015). Hence, it is useful to insight the histopathological effect of sedaxane on the kidney of *Channa gachua* at different concentration of sedaxane.

Materials and Methods

Adult healthy specimen of *Channa gachua* (Bloch) of length 7-10 cm and weight 10-12.5 gm were taken without any sex differentiation from paddy field of my home town Mehsi, East Champaran, Bihar. After that these fishes were transported to the laboratory in aerated containers and then these fishes were treated with 0.5% $KMnO_4$ solution for 10 minutes to remove dermal infection. After that these fishes were acclimatized in the tank for 15 days and provided with chopped earthworm

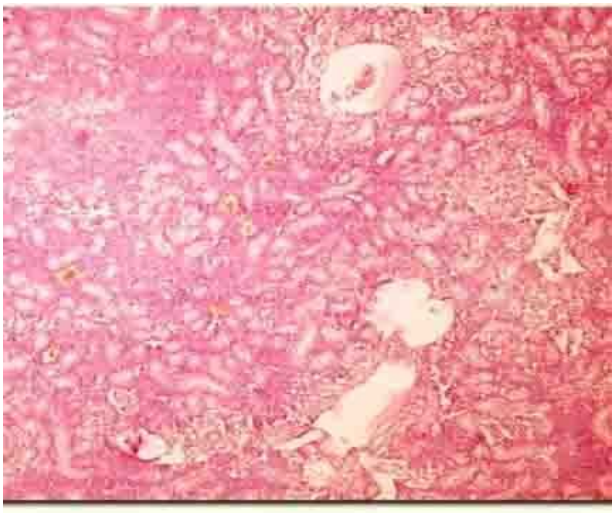

Fig.-1 : Kidney of control fish showing distribution of glomerulous, hematopoietic tissue & renal tubule (H&E x 200).

Fig.-2 : Kidney of control fish showing distribution of PCT & DCT (H&E x 400).

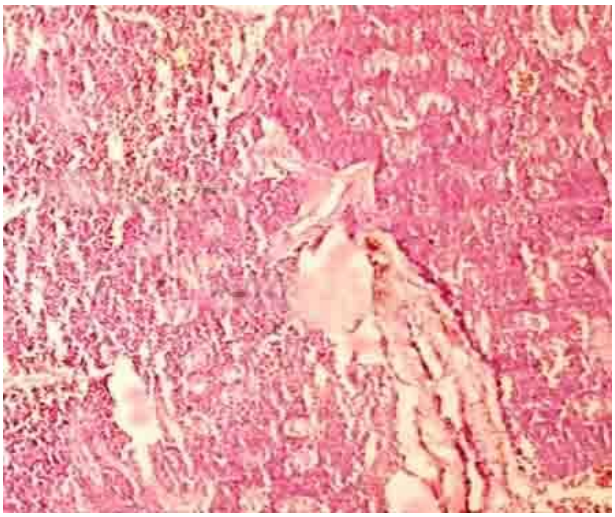

Fig.-3 : Sedaxane treated kidney showing degeneration of renal tubule (H&E x 200).

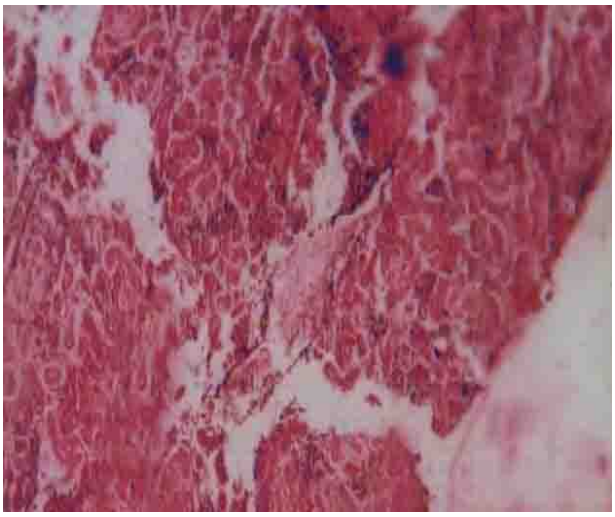

Fig.-4 : Sedaxane treated kidney showing vacuolization and hypertrophy (H&E x 400).

or fish tone. To maintain dissolve O_2 concentration water was changed on alternate day. During experiment no food was given to them. Important parameters to maintain the fish were strictly followed by as par condition recommended by APHA (2005). After that fishes were exposed to sedaxane. After exposure kidney was isolated from the control and experimental fish and then they were cleaned and fixed by using saline solution for 24 hours. This vital organ was kept in formaldehyde and then dehydrated, embedded in paraffin wax and then sliced by using microtome of thickness 5 micrometre. They were stained by using double staining technique (Haematoxylin and Eosin) and viewed in compound microscope.

Results and Discussion

Histology of control fish kidney

The kidney of *Channa gachua* consists of head and body kidney. It is made up of parenchymal cells, hematopoietic and lymphoid tissue. Head is the anterior part of kidney, composed of lymphoid tissue. Body kidney is the posterior part, composed of nephrons (functional unit of kidney) and interstitial lymphoid tissue which is the major hematopoietic tissue. The nephron of fish consists of glomerulus, renal tubules and collecting duct (Fig.-1). Renal tubule, made up of cuboidal epithelial cells consists of PCT, DCT and collecting

duct (Fig.-2). PCT has brush border but DCT and collecting duct have no brush border.

Histology of treated fish kidney

After treated with sedaxane kidney showed many histopathological changes. These changes include necrosis of glomerular cells and renal tubular epithelium, disorganization of hematopoietic tissue, decrease in size of epithelial cells of DCT, vacuolization in renal interstitial tissue, degeneration of renal tubule, degeneration of cytoplasm with pyknotic nuclei, degeneration of collecting duct, hypertrophy of nuclei (Fig.-3&4).

Introduction of deltamethrin in *Labeo rohita* due to hormonal and enzymatic homeostatic responses noticed by Suvetha *et al*. (2015). They reported prominent alternations in kidney. Histopathological alternations of kidney of *Cyprinus carpio* exposed to cypermethrin (25% EC) was observed by Neelima *et al*. (2015) causing damage of glomerulus. There is change in histology of kidney of *Heteropneustes fossilis* after exposure of malathion, studied by Deka and Mahanta (2012). Magar *et al*. (2013) observed the effect of malathion on kidney of *Channa punctatus* and found similar results. David and Kartheek (2014) found necrosis, cytoplasmic vacuolization, damage of collecting duct, change in size of tubular lumen, degeneration of glomerulus in *Cyprinus Carpio* after exposure of sodium cyanide. Prashanth (2011) also noticed similar effect in fresh water fish, *Cirrihinus mrigala* (Hamilton) exposed to cypermethrin. Bhatanagar *et al*. (1987) also noticed dissolution of cellular wall of renal tubule in *Channa gachua* exposed to endosulfan. Butchiram *et al*. (2009) found the similar result in kidney of *Channa punctatus* (Bloch) exposed to alachlor. Reddy *et al*. (2015) examined disorganization of connective tissue in kidney of *Labeo rohita* (Hamilton) exposed to confidor. Sriniwasarao *et al*. (2018) also worked on kidney of fish *Ctenophanygodon idella*, exposed to deltamethrin and found similar result.

The present investigation showed the toxicopathological effects of sedaxane on kidney of fish *Channa gachua* exposed to sublethal concentration of pesticide. It can be concluded that pesticide reaches in kidney though circulatory system ant altered the cellular function and due to necrosis, degeneration of collecting tubules and hypertrophy of nuclei the metabolic activity of fish is decreased. This pesticide is biomarker of aquatic pollution. The fish affected by the pesticide may pose a health problem to the consumers. Hence, pesticide amount in aquatic medium should be monitored to prevent fish mortality. Hence, more or less similar histopathological changes are induced in the kidney of different fishes by different pesticides but the extent of damage depends on dose of pesticide, dose of duration, exposure of pesticide, toxicity of pesticide and susceptibility of fish.

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