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Histopathological analysis of the gills of *Channa gachua* exposed to sedaxane

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ABSTRACT : The present study is aimed to assess the damage caused to the fish *Channa gachua* (family : Channidae) exposed to sub lethal concentration (0.4ppm) of sedaxane for 96 hours. Respiration in *Channa gachua* mainly occurs through their gills. Any change in the chemical quality of water directly affects the structure and function of gills. Fish gill also helps in osmoregulation and excretion besides respiration. The fish can survive even for 24 hours or more on moist grassy surface as they are able to take oxygen from air through their airbreathing organs the histopathological changes in the gills due to exposure of Sedaxane include hyperplasia, epithelial lifting, fusion at the tip of lamellae, curling and fusion in secondary lamellae, breakage of gill filament.

Key Words : Histopathology, gills, effect, *Channa gachua*, sedaxane.

Water is universal solvent and prime need of every living organism. Continuous release of industrial wastes and agricultural wastes has decreased the quality of air and water that not only harms the aquatic organism but also to the organism of higher tropic level like vertebrates. In modern agricultural practices pesticides has become an indispensable part to control the insect pests. Pesticides are the active chemical compounds which are used in great extent for pest control in domestic and argricultural field. Sedaxane have systematic properties that effects target pests by inhibition of succinate dehydrogenase (SDH), a key enzyme in circular respiration and energy production. It is used as a seed treatment chemical for the control of various seedling diseases in barely, oats, wheat, soyabean etc. It is applied as a water based slurry to seeds which are then planted according to protect against certain seedborn and soil-born diseases, including *Rhizoctonia* species in plants. Sedaxane is particularly effective against certain smut diseases in cereal crops.

Histopathology means the pathological alterations in normal cellular architecture of tissues, which indicate presence of toxic substances in the body of organisms (Rithamma and Joseph, 2014). The effect of pesticides on histology of gill in numerous fishes have been reported by number of workers e.g. Bhuiyan *et al*. (2001) in fish, *Channa punctatus* exposed to submithion, by Ortiz *et al*. (2003) in fish, *Cyprinus carpio* and Barbus exposed to lindane, by Veimurugan *et al*. (2009) *Channa gachua* (Bloch) inhabits muddy, marshy and derelict water. It has five pairs of gill arches out of which the frontal four pairs are remain jointed with epibranchial and hypobranchial surface facing towards the back. The last pair of gill arches transforms into a pharyngeal bone which do not play role in respiration (Pseudobranch). The surface of gill filament is covered with simple squamous epithelial cells. Secondary lamellae are the actual sites of gaseous exchange and are arranged on both sides of gill filaments. Parashar and Banerjee (2002) had studied the toxicopathological impact of lead nitrate on the gills of air-breathing cat fish *Heteropneustes fossilis*. When fish is exposed to environmental pollutants the are deleteriously affected and the functional impairment of the gill can significantly damage the health of fish (Alazemi *et al.*, 1996; Munshi, 1993; Kumar and Tembhre, 2010). In the present study efforts have been made to examine the toxicity of sedaxane on the gills of *Channa gachua*.

Materials and Methods

Channa gachua (Bloch) were obtained from the low lying paddy fields in the vicinity of district Muzaffarpur (Bihar) by the help of fisherman and then brought to laboratory in earthen pots. Fish were washed with $KMnO_4$ (0.05 mg/l) to remove skin infections. After proper washing with several changes of water the fish were allowed to acclimatize in tank of about 70 litre capacity in the normal laboratory condition between 27-30ºC for 15 days. During those days fish were fed with commercial fish foods and chopped earthworms on alternate days. The water was changed every day to eliminate faecal matter, unconsumed food and to restore the concentration of dissolved O2. Two groups of ten healthy fishes were taken and considered as control and treated respectively.

The treated fish were exposed to 0.4ppm (Sub-lethal

concentration for 96 hours) of sedaxane solution prepared in tap water. During the entire period of experimentation fish were not provided with food. After 96 hours fish were taken from each group control and treated were dissected and the entire gills from both sides of fish were taken and washed with salt solution and they were fixed in 10% neutral formalin. After dehydration blocks were trimmed and sliced by the help of microtome each with thickness of 5 to 6 µm. They were processed with double staining method using haematoxylin and eosin for further histopathological analysis by the help of compound microscope.

Results and Discussion

Channa gachua (Bloch) having four pairs of typical teleostean gill arches bearing two rows of primary gill filaments and each gill filament bears a series of alternately arranged semi-circular secondary lamellae on both side (Fig.-1). Simple squamous epithelial cells forming the surface lining of gill lamellae (Fig.-2). After getting the exposure of sedaxane solution various degree of damages were found. The changes include formation of sub-epithelial space; inter lamellar space, necrosis, lamellar fusion and curling of secondary gill filaments (Fig.-3). The size of mucous pore becomes increased and the swelling of tip of secondary gill lamellae and their erosion were observed. At some places breakage of gill filaments and dilation of blood vessels were also observed (Fig.-4). Separation of epithelial cells from the basement membrane and fusion of secondary lamellae were observed at few places. Epithelial hyperplasias, swelling of epithelial cells, disorganisation of epithelial lining were found more evident. Gills are the good indicator of water quality (Rankin *et al.*, 1982) as it remain in direct contact with surrounding water and acts as an organ for respiration, osmoregulation and excretion. Santhakumar *et al.* (2001) observed mucous extrusion, lamellar swelling and disorganisation of microridges in the gills of *Anabas testudineus* exposed to monocrotophos. Kumarguru *et al.* (1982) reported that the gills are the target organ for pyrethroid in fish which enters the blood and directly effecting the gill movements and oxygen uptake. Erkman *et al.* (2000) and *Channa gachua* gill exposed to sedaxane Cengiz and Ulnu (2002) observed secondary distortion and detached pillar cells under toxicity stress. Velmurugan *et al.* (2007,2009) studied the effect of monocrotophos on *Cirrhinus mirgala*. Zaki *et al.* (2009) observed the de-

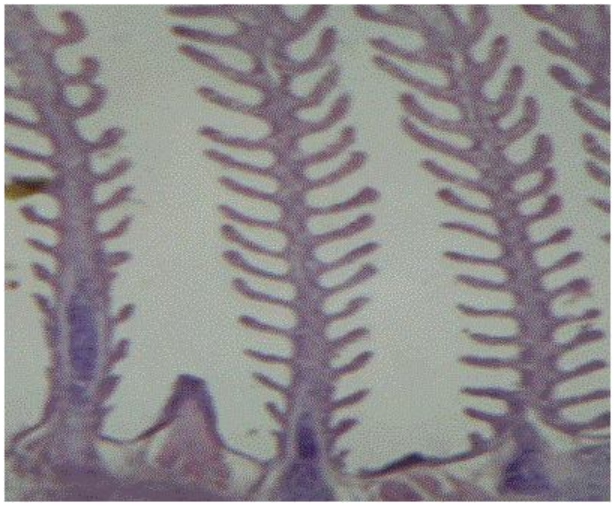

Fig.-1 : Control Gill Showing Gill Filament (H/Ex100).

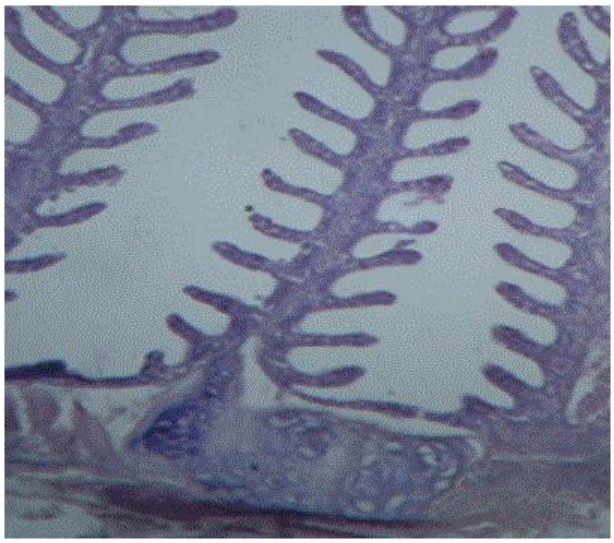

Fig.-2 : Control Gill Showing Normal Epithelial Lining (H/E x 100)

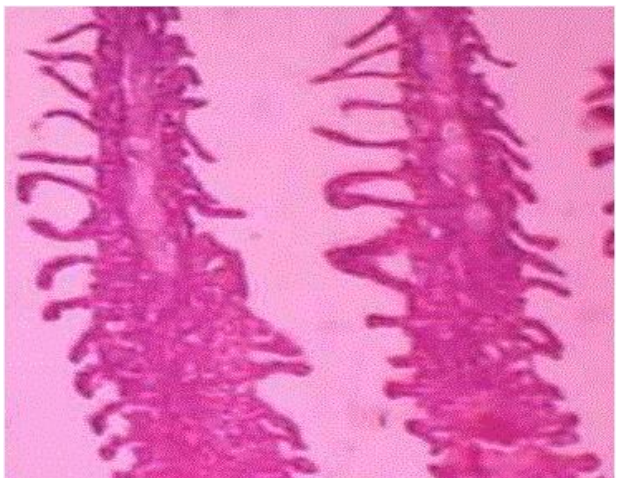

Fig.-3 : Treated Gills Showing fusion of secondary Lamellae.

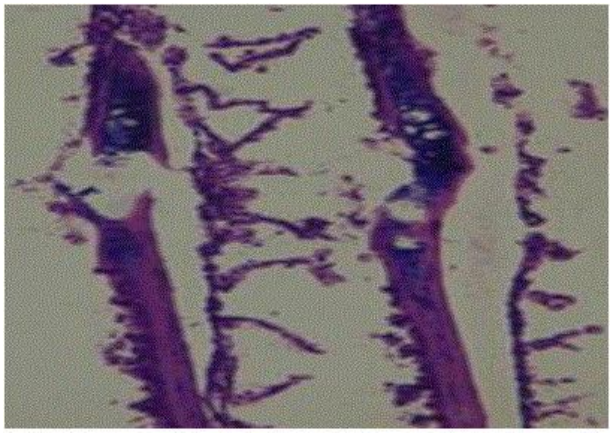

Fig.-4 : Treated Gill Showing Breakage of Gill Filament and Sub epithelial space (H/Ex200)

generation of pillar cells and vacuole formation in the epithelium of atrazine exposed *Labeo rohita*. Dimethonate toxicity to the gills of *Puntius ticto* (Ham) was studied by Ganeshwade (2012). The excess and periodic secretion of mucous might be a means for eliminating the toxicant from the surface of gills. The finding matches with the work of Pandey *et al.* (2011). The secretion of mucous has led to decreased ventilation and low O_2 uptake through gills. The similar observation was also reported by Prashanth (2011).

The respiratory system provides the most extensive surface of fish with the aquatic environment. The primary aquatic air breathing organ of *Channa gachua* has four pairs of functional gills. Fish gill remains in direct contact with ambient water. It is easily affected with the toxicants like pesticides. The present investigation have revealed that sedaxane which is usually released into the water system through leaching or run off water from agricultural operation have enough potential to cause different cellular alterations and even death of the fish. The pathological alteration in the gill of *Channa gachua* have been observed in laboratory condition after exposing to sub-lethal concentration of sedaxane (.4ppm) for 96 hours. The gross pathological changes after sedaxane exposure includes curling and fusion of secondary gill lamellae, hyperplasia of epithelial cells, fusion at the tip of secondary lamellae, sub lamellar space ,breakage of gill filament and sub epithelial space. Hence, the result suggest that the altered respiration, behavioural changes and histopathological changes that have occurred in gill can be used as a biological monitor to check the water quality which directly effects the aquatic animals an indirectly to all other vertebrate of higher tropic level.

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