



HISTOPATHOLOGICAL ANALYSIS OF THE GILLS OF *Channa gachua* (BLOCH) EXPOSED TO CHLORANTRANILIPROLE

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ABSTRACT

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. In the present investigation histopathological effects caused by the exposure of Chlorantraniliprole on the gills of a teleost *Channa gachua* was studied. 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 air breathing organs. Under experimental condition when it is exposed to the sub-lethal concentration (0.45 ppm) of Chlorantraniliprole for 96 hours it showed, several behavioural and histological changes. At the initial phase opercular activity and surfacing behaviour increased. Restlessness and disorientation finally leads to severe changes in different parts. Excessive secretion of mucous over the entire surface of body and microscopical structural alterations like breakage of microridges, primary lamellar swelling, enlarged mucous pores, and fusion of adjacent secondary lamellae were very pronounced.

KEY WORDS: Histopathology, Gills, Effect, Chlorantraniliprole.

INTRODUCTION

Life depends upon water and continuous availability of clean water is essential for the survival of living beings. 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. Mixing of organic waste lowers the oxygen content of water whereas the non-biodegradable agro-chemicals entering the food chain and gradually accumulated in each tropic level and posing threat to humans. *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*. Pandey Govind *et al.*, 2011 have studied the detergent toxicity on the gills of *Puntius ticto*. Prashanth *et al.*, 2011 studied the effect of sodium cyanide on behaviour and respiratory surveillance in *Labeo rohita*. In present study efforts have been made to examine the toxicity of Chlorantraniliprole on the gills of *Channa gachua* (Bloch).

MATERIALS & 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 27-30°C 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 O_2 . Two groups of ten healthy fishes were taken and considered as control and treated respectively.

The treated fish were exposed to 0.45ppm (Sub-lethal concentration for 96 hours) of Chlorantraniliprole 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.

RESULT & 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 chlorantraniliprole 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 (Fig. 4). At some places breakage of gill filaments and dilation of blood vessels were also observed. Separation of epithelial cells from the basement membrane and fusion of secondary lamellae were observed at few places. It matches with the result of Jha *et al.*, 2014. 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. Santha Kumar *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 Cengiz

and Ulu, 2002 observed secondary distortion and detached pillar cells under toxicity stress. Velmurgan *et al.*, 2007 studied the effect of monocrotophos on *Cirrhinus mirgala*. Zaki *et al.*, 2009 observed the degeneration 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(a). 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 Govid *et al.*, 2011. The secretion of mucous has led to decreased ventilation and low O₂ uptake through gills. The similar observation was also reported by Bradbury *et al.*, 1987; Bradbury and coats, 1989 and Prasanth, 2011.



FIGURE 1. Control gills showing the gill filament. (H/E x100)



FIGURE 2. Control gill showing the normal epithelial lining (H/E x100)

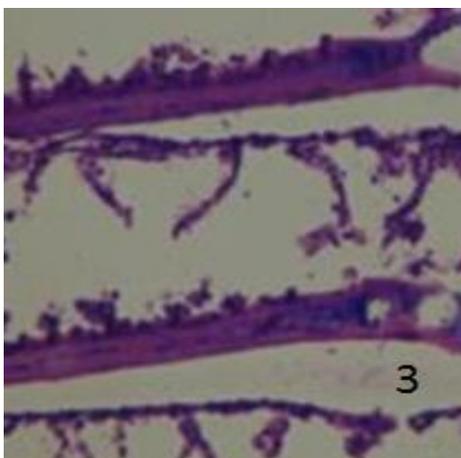


FIGURE 3. Fig 3. Treated gill showing sub epithelial space and curling. (H/E x 200)

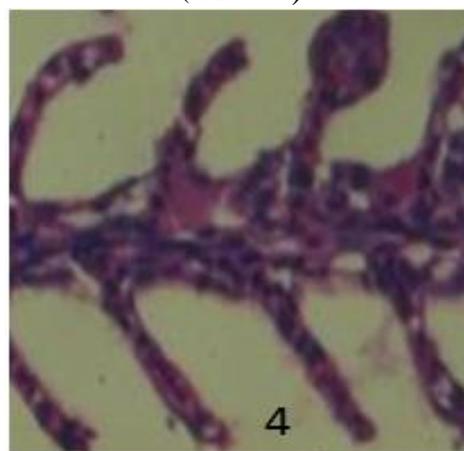


FIGURE 4. Fig.4 Treated gill showing the gill tip (H/E x 200)

CONCLUSION

Chlorantraniliprole intoxication caused severe aerobic distress in *Channa gachua* (Bloch) due to the increasing amount of toxic material in fish blood leads to architectural disorientation of gills and thus altered the process of gaseous exchange and hence it become very difficult for the fish to survive. The initial behavioural changes like restlessness, disorientation, slow response, increased surfacing and decreased opercular activity showed the fish wants to prevent themselves from the toxic effect of the pesticide. 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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