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Analysis the histopathological changes in the gills of Clarias batrachus and air breathing teleost

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Abstract
In this paper the Mechanical gushing containing substantial metals, on entering oceanic climate causes biochemical unsettling influences in the fish. Hefty metals furthermore, their salts comprise a significant gathering of ecological contaminations since they are powerful metabolic inhibitors. The inalienable harmfulness of a metal relies on its ability to upset the dynamic life measures in natural framework by consolidating with cell organelles, macromolecules and metabolites. The perseverance and pervasive nature of these poison mixes combined with their inclination to collect in living beings eventually produce harmful response in oceanic biota particularly, fish. The persistence and ubiquitous nature of pollutant compound coupled with their tendency to accumulate in organisms ultimately procedure toxic reaction in aquatic biota especially, Fish. In this paper the effects of heavy metal on the gills of clarias batrachus is demonstrated, clarias batrachus, a freshwater teleost were exposed to copper sulphate for 24, 48 72 are 96h at 0.25, 0.30 and 0.40ppm to determine the LC_{50} values as well as any histopathological to the Gills.

Keywords: batrachus, histopathological, batrachus, substantial, breathing

Introduction

Fish live in personal contact with the encompassing water through their gills whose surface includes over portion of the body surface territory. A couple micron of fragile gill epithelium separate the inside climate of the fish from a consistently streaming outer climate Thus, it makes the fish entirely vulnerable to amphibian poisons. The continuous amassing of harmful material in water because of run-off from the agrarian land containing bug sprays, pesticides, herbicides and so on Dutta *et al*. have shown the impact of a few weighty metals truly harm the gills of teleostean fish.

Hemalatha and Banerjee have studied the toxic impact of the trace element zinc chloride ($ZnCl_2$) on the gills and accessory respiratory organs of Heteropneustes fossilis. Parashar *et al*. have studied the toxicopathological impact of lead nitrate on the gills of air breathing catfish Heteropneustes fossilis. Organophosphates are considered highly toxic to many aquatic species. Pandey Govind *et al*. studied the effect of sodium cyanide on behaviour and respiratory surveillance in Labeo rohita (Ham). Baker [1-11] has studied the detergent toxicity on the gill of Puntius ticto. In 2012, Rani and Venkataraman reported the effect of Malathion on the gills of G. giuris (Ham). Therefore, in the present study efforts have been made to examine the toxicity of copper sulphate on the gills of Clarias batrachus.

Materials and Methods

Adult and live fish Clarias batrachus were collected from the fish farm Benipur, Darbhanga (Bihar) brought to the laboratory, cleaned by using 0.1% $KMnO_4$ to avoid dermal infection. Only healthy fishes (Length: 12-15 cm, Weight: 50-60 g) were taken for experiment. Fishes were acclimatized in glass aquaria for 15 days and were fed with earthworms…”) and water in the aquaria was replaced by freshwater at every 24 h.

After proper washing with several changes of water the fish were acclimated in clean tap water under normal laboratory condition between 27°C to 30°C for 15 days. They were fed with commercial fish food (fish tone) and chopped earthworm on alternate days and water was renewed after every 24 h, to eliminate faecal matter and unconsumed food. However, feeding was stopped 24 h prior to the commencement of the experiment. Prior to the bio-assay test, 96 h median lethal concentration (96h LC_{50}) was estimated by standard log-probit method (Sprague, 1976). Five groups of 10 fish each were exposed to 0.4 ppm (96 h LC_{50} value) of copper sulphate. Each group was exposed separately to 20 L of copper sulphate solution, prepared in tap water (having dissolved O2 7.2 ± 0.66 mL/L, pH 7.51 ± 0.20, water hardness 34.2 mg/L and water temperature 25°C ± 2°C). Five separate battery jars containing 20 L of fresh tap water having 6 fish in each were used as control.

After the exposure period of 24 h, 48 h, 72 h and 96 h, five fish each from the respective experimental, as well as control jars were dissected and the entire gill from both the sides of the fish were taken out and were fixed in 10% neutral formalin, aqueous bouin’s fluid and zenker helly’s fluid. 6 µm paraffin sections were stained with Harris haemotoxylin and Eosin (H&E) for routine histopathological analysis.

Results and Discussion

The gill is composed of two parts gill head and gill filaments. The gill head is covered over by a thick tissue composed of mucus glands, taste buds, and connective tissue. The gill head contains bony part of gill arch and gill rackers. The surface epithelium of gill arch showing parallel arrangement of epithelial cells having mucus pores. Examination of thin sections of gill arch of Clarias batrachus (Control) showing four pairs of typical teleostean gill arches bearing two rows of primary gill filaments. Each gill filament bears a series of alternately arranged semicircular secondary lamellae on both sides as shown Figure 1.

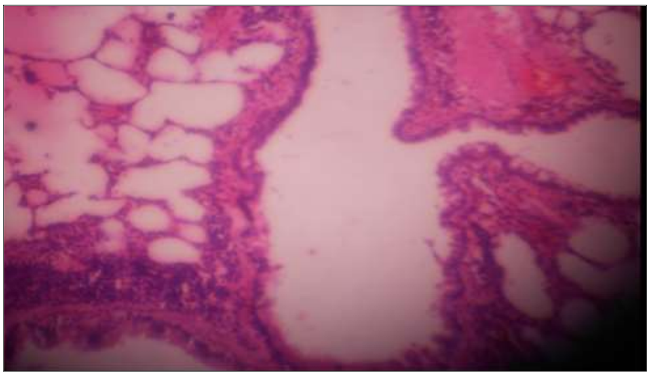

Fig 1: Part of control gill showing structural organization. Note the gill lamella, taste bud and gill arch. H/E 100X.

The surface of gill lamella is lined by a thin layer of simple squamous epithelium which rests on basement membrane covering the pillar Cell-blood channel system and which constitutes the main vascular area of the gills as shown in Figure 2.

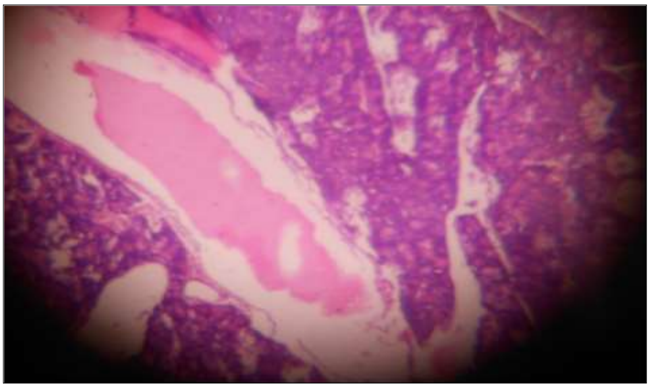

Fig 2: Magnified view of the gill of control fish showing mucous Cell, blood channel and epithelial cell. H/E 400X.

Gills of Clarias batrachus exposed to copper sulphate solution exhibited varying degree of damage in sublethal concentration (<0.4 ppm) after 48 h. Mucus cell hyperplasia was generally more pronounced towards the proximal end of the filament. After 96h of exposure, hyperplasia of epithelial cells resulted in the fusion of many lamellae as shown in Figure 3.

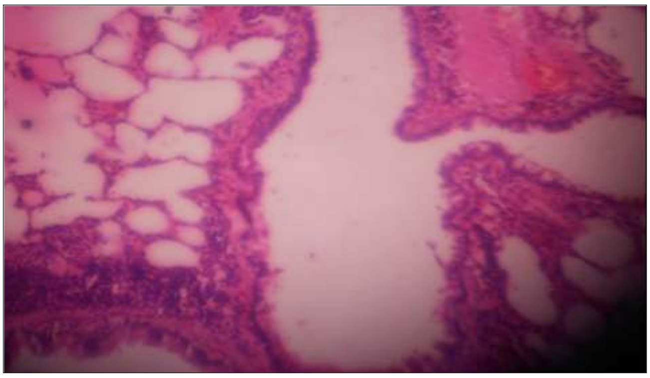

Fig 3: A part of copper sulphate treated gill showing hyperplasia of Epithelial lining the secondary lamella. H/E 150X.

In 0.35 ppm exposure up to 96 h the mucus cells were fed with earthworms…and become enlarged. Some lamellae appeared thickened and retracted while some were reduced and subepithelial space developed as shown in Figure 4.

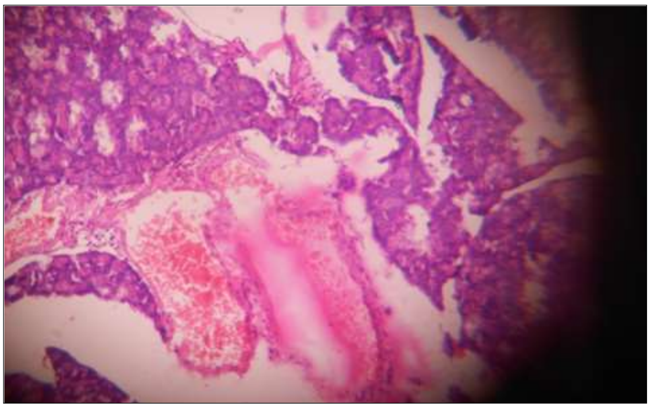

Fig 4: Gill showing sub epithelial space and hyperplasia of epithelial cells after 96 h exposure of copper sulphate. H/E 150X.

After 96 h of exposure, in <0.4 ppm (sublethal concentration), buldging of taste bud as shown in Figures 5 and 6 gill racker, formation of interlamellar space, fusion of secondary lamellae, breakage of lamellar blood capillaries, swollen tip, telangiectatic secondary lamellae and clotting of blood were observed.

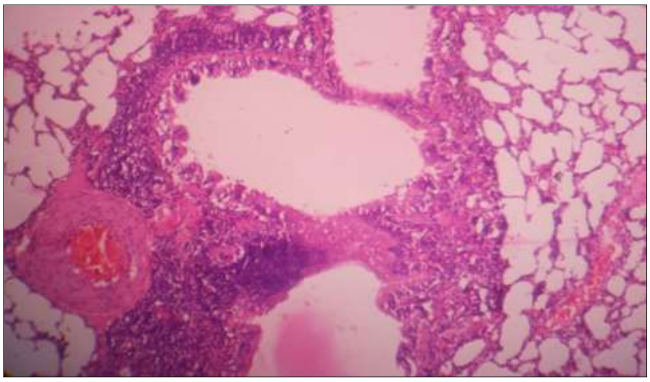

Fig 5: Epithelial cells showing fusion and hyperplasia Along with enlarged mucous cell of secondary lamella. H/E 520X.

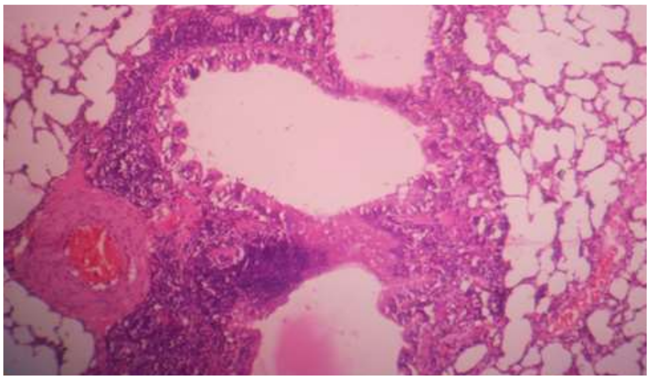

Fig 6: Section of gill arch showing bulged taste bud and mucous cell after 96 h of exposure. H/E 300X.

Gills have an extensive surface area and minimal diffusion distance between dissolved O_2 and blood capillaries for efficient gaseous exchange. Fish gills are marvellously equipped with a defence mechanism working against the environmental irritants which essentially is the mucus cell. The mucus cells react instantaneously to the pollutants and secrete copious mucus to form a thick protective layer over the entire exposed surface, which remain stuck to the mucus. The mucus layer creates a microenvironment that may act as an ion trap, concentrating trace elements in the water. The histomorphological response of the gills of fish exposed to ambient insecticides (including metal salts) is often manifested by a prominent increase in the density of its mucus cells.

Conclusion

In sub lethal concentration it may be fatal for an individual organism and it also affect the growth rate and reproduction resulting in disturbance to whole community and also tropic levels of food chains, ultimately the ecosystem.

References

1. Pratap HB, Fu H, Lock RAC, Bonga SE. Effect of water borne and dietary cadmium on plasma ions of the teleost *Oreochromis mossambicus* in relation to water calcium levels. Arch Environ Contam Toxicol. 1989; 18:568-575.
2. Wood CM, Soivio A. Environmental effects on gill function-An introduction. Physiological zoology. 1991; 64:1-3.
3. Dutta HM, Munshi JSD, Roy PK, Singh NK, Adhikari S. Ultrastructural changes in the respiratory lamellae of the catfish *Heteropneustes fossilis* after sublethal exposure of malathion. Environ Pollut. 1996; 3:329-341.
4. Parashar RS, Banerjee TK. Toxic impact of lethal concentration of lead nitrate on the gills of air breathing catfish *Heteropneustes fossilis* (Bloch). Vet Arhiv. 2002; 72:167-183.
5. Qin JG, Dong P. Acute toxicity of trichlorfon to juvenile yabby Cherax destructor (Clark) and selected zooplankton species. Aquacult Res. 2004; 35:1104-1107.
6. Prashanth MS, Sayeswara HA, Goudar MA. Effect of sodium cyanide on behaviour and respiratory surveillance in freshwater fish *Labeo rohita* (Ham). Recent Research in Science and Technology. 2011; 3:24-30
7. Pandey Govind, Varsha J, Mishra KD, Madhuri S. Linear alkyl benzene sulphonate a detergent induced toxicity on the gill of *Puntius ticto* fish. IRJP. 2011; 2:76-78.
8. Baker JTP. Histological and electron microscopical observations on copper poisoning in the winter flounder *(Pseudopleuronectes americanus).* J Fish Res Board Can. 1969; 26:2785-2793.
9. Cardeilhac PT, Simpson CP, Loverlock RL, Yosha SE, Calderwood HW, *et al*. Failure of osmoregulation with apparent potassium intoxication in marine teleosts primary toxic effect of copper. Aquaculture. 1979; 17:231-239.
10. Matey VE. Comparative analysis of the gill epithelium ultrastructure in the perch *Perca fluviatillis* from basins with different composition. Tsitologiya, 1984, 778-782.
11. Wise ML, Stiebel CL, Grizzp JM. Acute toxicity to nitrofurazone to channel catfish *Ictalurus punctatus* and goldfish *Carassius auratus*. Bull Environ Contam Toxicol, 1987, 42-46.