ORIGINAL RESEARCH PAPER

Zoology

TOXIC STRESS OF POLLUTANT ON THE GILLS OF FRESHWATER FISH, *CHANNA PUNCTATUS*

KEY WORDS: Gills, *Channa punctatus*, Selenium dioxide

Dr. T. G. Deshmukh

Assistant Professor, Department of Zoology, Shri Shivaji College of Arts, Commerce & Science, Akola.

ABSTRACT

A global issue that all we are facing i.e. Environmental pollution is at the present moment. A number of factors are behind the various types of environmental pollution and the varied effects revealed by the pollutants. Water pollution has directly concern with human life, as water is the main component of living organisms like fish. The harmful effect of any toxicant which was moved to water bodies can be assessed by investigating the health of fish fauna. In the present study, an attempt has been made to examine the sublethal concentration (0.5mg/L) of toxicant, selenium dioxide effects in freshwater, snake-headed fish, *Channa punctatus*. The histopathological lesions in gill architecture have been observed after 7 days, 14 days, 21 days and 28 days of exposure to selenium dioxide, which were duration dependents.

INTRODUCTION:

Pollutants led to a deterioration of aesthetic, physical, chemical and biological qualities of the lake and freshwater bodies. Heavy metal compounds are the main source of water pollution and are through the sewage and industrial effluents in the aquatic environment. Selenium compound can be harmful when consumed in excess than needed. The seriousness of the effect of excess selenium demands on how much selenium is consumed and how often. Accidental swallowing of a large amount of selenium selenite could be life-threatening for the fish. Selenium after being absorbed into the blood is found to be associated with both erythrocytes and plasma albumin and globulin. Albumin appears to be an immediate receptor and is found to be involved in the transport of selenium to more stable sites in the blood and tissue (Stolman and Stewart, 1960). Absorbed selenium is found to be rapid distribution among the tissue.

MATERIALS AND METHODS:

The freshwater snake-headed fish, *Channa punctatus* (Bloch) were selected for the present research work. The fish were procured for the experimental purpose from the Rishi Lake of Karanja (lad), Dist. Washim (M.S.), India. They were washed with 1% KMnO4 solution for five minutes for dermal disinfection. Before conducting the experiment, the fish were acclimatized to the laboratory condition for the period of a fortnight. Particularly in the morning hours, fish were fed on small pieces of boiled eggs, once a day.

A total of 25 fish including males and females, weight between 46- 50 gms were selected for the present work. They were maintained in separate aquaria, containing aged tap water. As per the standard method, the physicochemical parameters of aged tap water were determined periodically, (APHA,1998). To study the toxic effect of selenium dioxide on various vital organs like the gill, the experiment was conducted in two phases.in the first phase of the experiment, lethal concentrations and sublethal concentrations of the experimental toxicant selenium dioxide were studied. 96h LC50value was calculated by Probit Analysis method (Sprague, 1973), as 2.5 mg/L. In the second set of the experiment, the fish were exposed to a sublethal concentration of toxicant selenium dioxide, which was 1/5 of the 96h LC50 i.e.0.5mg/L. The experiment was carried out in sublethal concentration of toxicant selenium dioxide for a period of 7, 14, 21 and 28 days. Parallel sets of control fish were run simultaneously in separate aquaria.

After the period of 7,14,21 and 28 days, male and female fish of control as well as experiment set were weighed and sacrificed immediately by giving a blow on the head and were dissected. The gill from both the control and experimental fish were removed and rinsed in saline to remove the cell debris. Then gill was cut into small pieces of desirable size and fixed to aqueous bouins fixative separately. They were embedded in paraffin wax using routine technique and sections were cut at 5µ thickness and stained with haematoxylin- eosin staining method. Histological observations were made by light microscopy to assess the selenium dioxide toxicity effect on the gill of the fish.

RESULT AND DISCUSSION:

Gill architecture of fish, *Channa punctatus* (Bloch) consist of two rows of primary gill lamellae with a shorter gill septum. The lamellae were supported by gill ray which is partly bony and partly cartilaginous and are connected with the gill arch and with each other by fibrous ligaments. Each primary lamella bears a large number of secondary lamella on both of its sides(fig.1),

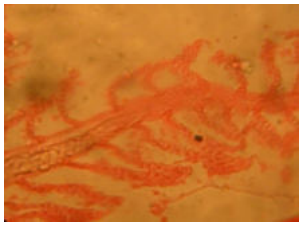

Fig.1: T. S. through the gill of fish *Channa punctatus* control

these flat, leaf-like structures are secondary lamellae consisting of a central vacuolar layer surrounded by a thin layer of connective tissue and epithelial cells containing some mucus cells. The vascular layer consists of a network of capillaries supported by pillar cells. Such gill architecture was observed in the control set fish, *Channa punctatus* in the experiment.

The freshwater, snake-headed fish, Channa punctatus(Bloch) was exposed to sublethal concentration (0.5mg/L) of toxicant selenium dioxide for a period of 7 days observed the damage in the gill architecture. The swelling at the tip of secondary lamellae followed by hypertrophy and mild hyperplasia was noted in the outer layer of lamellar epithelium and enlargement of lymphoid space in between two layers of gill epithelium (fig.2).

Fig.2: T. S. through the gill of fish *Channa punctatus* exposed to sublethal conc, of SeO2 for 7 days.

Degeneration changes were noted in both primary and secondary gill lamellae. The subepithelial space formed in secondary lamellae, which was reduced and collapsed, tips of gill lamellae were fused, when the fish, *Channa punctatus* exposed to sublethal concentration of toxicant selenium dioxide for a period of 14 days (fig.3).

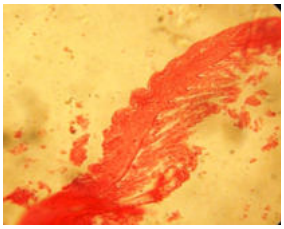

Fig.3: T. S. through the gill of fish *Channa punctatus* exposed to sublethal conc, of SeO2 for 14 days.

After 21days of exposure to sublethal concentration of selenium dioxide, the experimental freshwater fish, *Channa punctatus*observed the toxic impact like excessive haemorrhage in blood vessels, Hypertrophy in the pillar cells, reduction in intercellular space due to the fusion and shortening of gill filaments and hyperplasia in epithelial cells (fig.4).

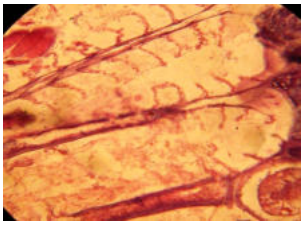

Fig.4: T. S. through the gill of fish *Channa punctatus* exposed to sublethal conc, of SeO2 for 21 days.

Reduced the pillar cells and epithelial linings, disruption of acidophilic cells and formation of a thick film of mucus covering with the damaged of epithelial cells of secondary lamellae and connective tissue was noticed in the transverse section of gill(fig.5), when exposed to sublethal concentration of toxicant, selenium dioxide after 28 days.

Fig.5 :T. S. through the gill of fish *Channa punctatus* exposed to sublethal conc, of SeO2 for 28 days.

Dhanapakiam *et al.*(2004)in their investigation observed hyperplasia, degeneration and eventual death of epithelial cells occurred due to direct deleterious effects of chromatin and natural alkalify effluents, while exposing the major carp Labeo rohita to the lethal and sublethal concentrations of tannery effluents. Elahee and Bhagwant(2007) indicated that though the health of different fish species was impaired due to gill damage, homeostatic mechanisms were in motion to favour adaptations, as demonstrated by haematological alterations.

According to Butchiram*et al. (2009),* the histological damage to the gill surface in their study may be attributed to high accumulations of pesticides in gill, irritation due to elevated mucus secretion, increased ventilation volume and decreased gill-oxygen uptake efficiency in the fish, *Channa punctatus* exposed to herbicides alachlor. Balicheva and Sharova (2011) reported presence of epithelial hyperplasia and fibrosis in the gills of the fish when exposed to long term chronic pollution in the Vygozero reservoir, North-west Russia.

Thus the results of the present investigations with the toxic impact of selected toxicant i.e. selenium dioxide on the histopathology of the gill of *Channa punctatus*are almost similar to those of the above authors.

REFERENCES

1. APHA(1998):In: Standard Methods for the examination of water and waste water. American Public Health Association, 874.
2. Balicheva, L.A., J.N. Sharova (2011): Assessment of fish health under long term water pollution:Vygozero reservoir, North-west Russia. Environmental Technology Resources, Proceeding of 8th International Scientific-Practical Conference vol. 2:368- 373.
3. Butchiram, M.S., K.S. Tilak and R.W. Raju (2009):Studies on histopathological changes in the gill, liver and kidney of Channa punctatus (Bloch) exposed to Alachlor., J. environ. Biol., 30, (2): 303-306.
4. Dhanapakiam, P., V. Sampoomi, M. Kavitha, V.K. Ramaswamy, A. Chandrakala and K.C. Aruna(2004): Gill lesions in the major carp Labeorohita exposed to lethal and sublethal concentration of tannery effluent. J. Environ. Biol., 25, (3): 333-336.
5. Elahee, K. B., S. Bhagwant(2007): Histological and gill histological parameters of three tropical fish species from a polluted lagoon on the West-coast of Mauritius. Ecotoxicol. And Environ. Safety, 68: 361-371.
6. Sprague, J.B.(1973):The ABC's of pollutant bioassay using fish in Biological methods for the assessment of water quality.Special technical publication, 528, of American Society for testing and materials U.S.A., 6-30.
7. Stolman, T. and Stewart, C.P.(1960):Metallic poison in toxicology mechanism and analytical method. Vol. 1, Acad. Press, New York and London.