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# Toxicological Effect of Two Different Concentrations of Captan on The Gills of The Fresh Water Fish *Rasbora daniconius*

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**ABSTRACT**
*Present study aimed to investigate the effect of two different concentrations of captan on the fresh water fish Rasbora daniconius. The fishes treated with 0.5 mg/L concentration of captan results into curling of secondary lamellae, hyperplasia of primary lamellae, fusion of secondary lamellae and telangiectasis of secondary lamellae. The fishes treated with 1.5 mg /L concentration of captan results into shortening of secondary lamellae, upliftment of gill epithelium, degeneration of secondary lamellae, hyperplasia of primary lamellae. epithelial necrosis and vacuolation in primary gill lamellae. Thus, in the present study an attempt has been made to determine pathological changes induced by captan.*
***Keywords:*** *Captan, Necrosis, Hyperplasia, Rasbora daniconius, Gills.*

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## INTRODUCTION

The indiscriminate use of fungicides in agricultural operations affects the aquatic environment to a greater extent. This poses a great danger to freshwater organisms including the fishes. Pollution of aquatic environment by fungicides and their residues is well known. Fungicides and their residues find their way into the water bodies and then entering in the various tissues of the body of fishes. Fishes are very sensitive to a wide variety of toxicants in water. The various fish species show uptake and accumulation of many toxicants. Due to accumulation of toxicants in tissues causes many physiological and biochemical changes in the body of fishes by influencing the activities of several enzymes and metabolites. Captan is a chloroalkylthio fungicide that belongs to the dicarboximide chemical family. It is used on variety of terrestrial and greenhouse food/feed crops, post-harvest fruit dips, indoor non–food uses, seed treatment and ornamental sites [1,2]. Captan is highly to very highly toxic to bluegill sunfish, fathead minnow, brook trout, coho salman, harlequin fish and brown trout [3]. The previous histopathological studies of fish exposed to pollutants revealed that fish organs are efficient indicators of water quality [4]. Now a days industrial effluents as well as agricultural pesticides pollute the aquatic ecosystems and find their way in the body of aquatic animals by means of gills, digestive tract and general body surface. These various chemicals accumulate in the different tissues of body. Therefore, it is necessary to study the detail histopathological alterations or changes in structures of different organs of fishes. Captan can enter the environment from industrial and municipal discharges through agricultural run-off and from spills. As a fungicide it will be present in the environment as a result of its intended use [5]. Fishes have most widely been used as a test organism to evaluate the toxicity of waste and other pollutants may be due to their adaptability to laboratory condition, availability and varying degree of sensitivity to toxic substances. For this reason, present study was conducted to determine the toxicological and histopathological effects of captan to the gills of *Rasbora daniconius*.

## MATERIAL AND METHODS

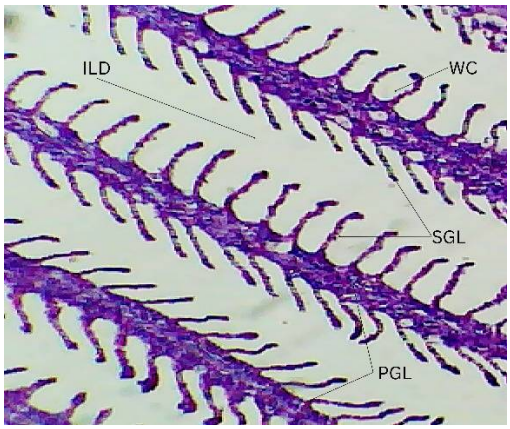
The larvivorous fish *Rasbora daniconius* was used as the test animal having a mean length of 8.2 ± 0.5 cm and a mean weight of 5± 0.3 gm. The test fishes were exposed to 96hr for 0.5 mg/L and 1.5 mg/L concentration of captan. The test fishes were collected from the neighboring fresh water bodies and were acclimatized in the laboratory condition for about 15 days. These fishes were not fed 24 hrs. before the experiment and then healthy fishes were selected for each test. Simultaneously a control was also

maintained. Three different sets of ten fishes in each set were arranged. The set I was a control set, the fishes of set II were treated with 0.5 mg/L concentration of captan for 96 hrs exposure. The set III fishes were treated with 1.5 mg/L captan concentration for 96 hrs exposure. The test fishes were exposed to the above two different concentrations of captan independently. Then control fishes and treated fishes both were used for removal of the gills. Removed gill tissues were kept in fixative for 24hrs and then blocks were prepared in paraffin wax at 58-60 ˚C temperature. The sections were cut (4-5 micron) and stained with Haematoxylin and Eosine stain. Then gill tissues were studied under microscope for the histopathological observations.

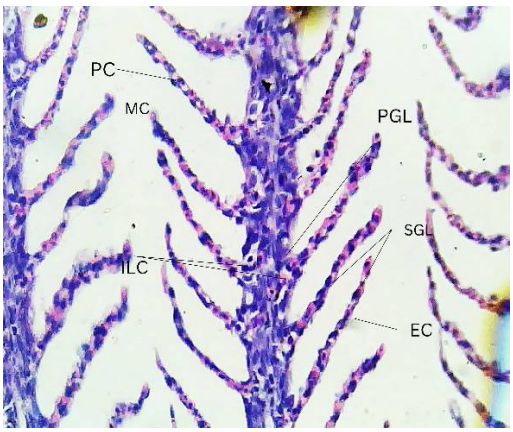
**RESULT AND DISCUSSION**

The gills are important organs of fish which perform various functions such as respiration, osmoregulation, nitrogenous waste material excretion and acid base balance. They are considered to be most appropriate indicator of water pollution. They are suitable organs for histological examination in order to determine the effect of pollution [6]. Histopathological investigations have proved to be a sensitive tool to detect direct effects of chemical compounds within target organs of fish in laboratory experiments [7,8,9]. The present study was the comparison of the normal gill architecture and damage to the gill architecture of the treated fishes with untreated fishes. In present investigation the histology of gills of untreated fishes shows the normal architecture, without any pathological alterations. A typical structural organization of the gills of the untreated fishes was characterized by the presence of normal architecture of primary lamellae (PL), secondary lamellae (SL) along with epithelial cells (EC), interlamellar cell (ILC), mucous cell (MC), pillar cell (PC), water channel (WC) and blood capillaries (BC). After 96 hrs. treatment of two different concentrations of captan to the fishes exhibited moderate to severe alteration in gill structure. Different concentrations of captan used in this study showed various degree of histological changes in gills. The treatment of 0.5 mg/L concentration of captan to the fishes up to 96hrs exposure affects the gills and it results into – curling of secondary lamellae, hyperplasia of primary lamellae, fusion of secondary lamellae and telangiectasis of secondary lamellae. The treatment of 1.5 mg/L concentration of captan to the fishes up to 96hrs exposure affects the gills severely and results into shortening of secondary lamellae, upliftment of gill epithelium, degeneration of secondary lamellae, hyperplasia of primary lamellae. epithelial necrosis and vacuolation in primary gill lamellae. Many investigators have reported the same histopathological changes in the gills of other different species of fishes exposed to the pesticides [10,11]. Ashok and Vinod [11] analysed changes in gill surface of *R.daniconius* exposed to sub lethal concentration of 0.05 mg/L of mercury for 96 hrs and found that fusion, damage, deterioration in surface area of secondary lamellae. Altinok and Capkin [6] observed lesions in gill of rainbow trout exposed to 0.6 or 1.3 mg/L endosulfan concentration lead to swelling of epithelial cells, lamellar fusion, separation of epithelium from lamellae and edema. Nowak and Barbara [12] analysed the effect of endosulphan residues on gills of catfish found lifting of lamellar epithelium and hyperplasia. Erkman et al. [13] investigated histopathological changes induced by cyphenothrin in gill of *Lebistes reticulatus* and observed club shaped lamellae, shortening of secondary lamellae, degeneration and edema. Banaee et al. [14] conducted the study of fish exposed to diazinon and observed dilation of blood capillaries, hyperplasia of epithelium, necrosis and shortening of secondary lamellae and excessive mucous secretion. Ganeshwade [15] studied effect of dimethoate on gill of *Puntius titco* and observed curling of secondary lamellae, hyperplasia and lifting of lamellar epithelium. Hadi and Alwan [16] investigated the histopathological changes in gill of *Tilapia zilli* exposed to aluminium and found epithelial lifting, interstitial edema, hypertrophy, necrosis of gill epithelium and edema. Jabeen and Chaudhry [17] find out the injury to the gill epithelium when exposed to variety of contaminant. Moza et al. [18] investigated pathological changes in gill of *Carassius auratus* induced by Cadmium and found hyperplasia, lamellar fusion and vacuole formation in pillar cells. Saksena and Pandey [19] reported the fusion, hypertrophy, hyperplasia in secondary lamellae and increased mucous cell in gill of *Labeo rohita* exposed to copper sulphate. Vermurugan et al. [9] found epithelium hyperplasia, curling of secondary lamellae in *Cirrhinus mrigala* after exposure of monocrotophos. Ghanbahadur et al. [20] reported vacuolization in primary lamella, epithelial hypertrophy of secondary lamellae and haemorrhage in pillar cell when *Rasbora daniconius* exposed to Organochloride endosulfan. Lokhande M.V. [21] exposed *Rasbora daniconius* to dimethoate and observed degeneration of epithelium of secondary lamellae, vacuolation, fusion, degeneration and separation of basement membrane. In present investigation the fishes treated by captan shows changes in the gill architecture and other various changes in cells of gills and other parts of the gills. These results show similarities with the results obtained by many investigators working in the field of fish toxicology.

**PLATE NO.1**



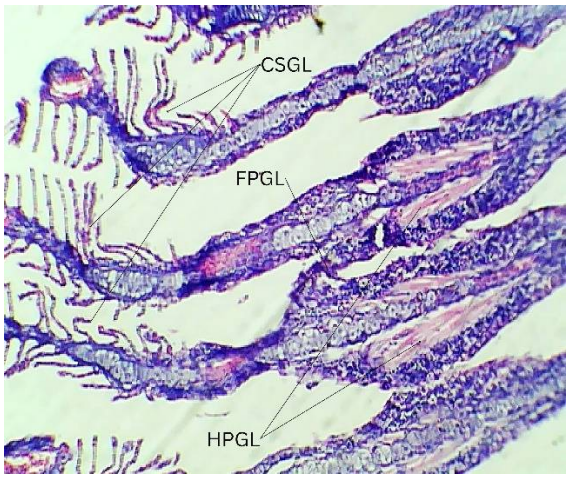

PHOTOGRAPH 1A



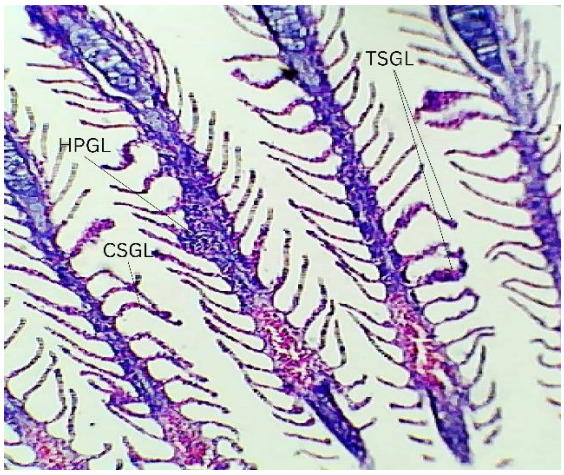

PHOTOGRAPH 1B

**Photograph 1 A: L.S of gill of *R. daniconius*(Control)**
PGL-Primary Gill Lamellae, SGL-Secondary Gill Lamellae, WC-Water Channel, ILD-Inter lamellar Distance
**Photograph 1 B: L.S of gill of *R. daniconius* (Control)**
PC-Pillar Cell, ILC-Inter Lamellar Cells, MC-Mucous cells, EC-Epithelial Cells

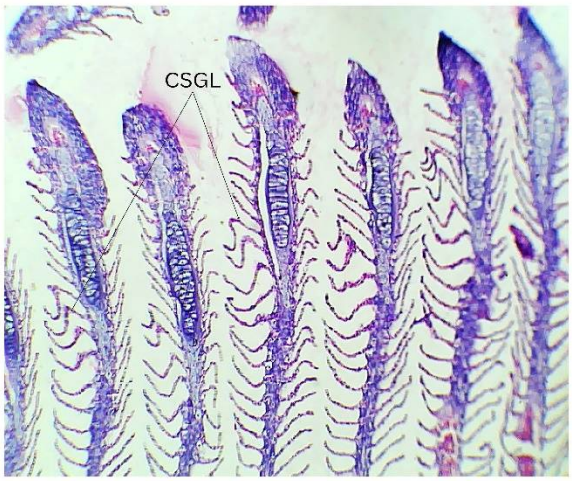
PLATE 2




PHOTOGRAPH 2A



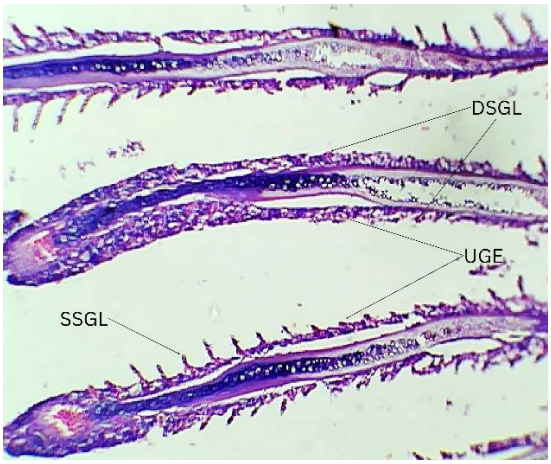

PHOTOGRAPH 2B



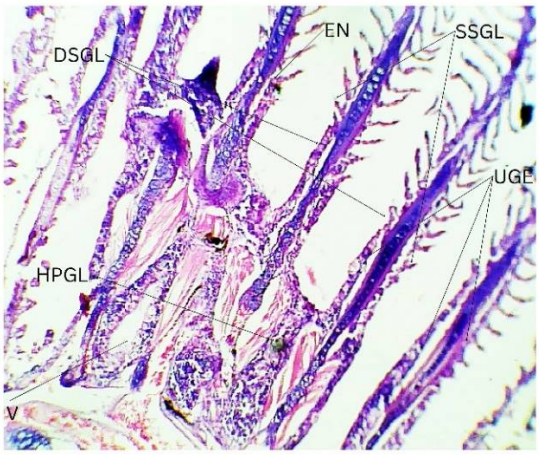

PHOTOGRAPH 2C

**Photograph 2 a: L.S. of Gill of *R.daniconius* (0.5 mg/L)**
FPGL- Fusion of Secondary Lamellae, CSGL-Curling of Secondary Lamellae, HPGL-Hyperplasia of Primary Lamellae
**Photograph 2 b: L. S. of Gill of *R.daniconius* (0.5 mg/L)**
TSGL-Telangiectasis of Secondary Lamellae, HPGL-Hyperplasia of Primary Lamellae, CSGL-Curling of Secondary Lamellae
**Photograph 2 c: L. S of Gill of *R.daniconius* (0.5 mg/L)**
CSGL-Curling of Secondary Lamellae

PLATE 3




PHOTOGRAPH 3A




PHOTOGRAPH 3B


PHOTOGRAPH 3C

**Photograph 3 A: L. S of Gill of *R.daniconius* (1.5 mg/L)**
DSGL-Degeneration of Secondary Gill lamellae, SSGL-Shortning of Secondary Gill lamellae, UGE-Upliftment if Gill Epithelium
**Photograph 3 B: L. S of Gill of *R.daniconius* (1.5 mg/L)**
DSGL-Degeneration of Secondary Gill Lamellae, EN - Epithelial Necrosis, UGE - Upliftment of Gill Epithelium, V - Vacuolation, HPGL- Hyperplasia of Primary Lamella
**Photograph 3 C: L. S of Gill of *R.daniconius* (1.5 mg/L)**
EN -Epithelial Necrosis, SSGL- Shortning of Secondary Gill Lamellae, DSGL-Degeneration of Secondary Lamellae.

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**AUTHORS CONTRIBUTIONS**

Both the authors contributed equally in experimental work and manuscript preparation.

**CONFLICTS OF INTEREST**

The authors declared that they have no conflicts of interest.

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