World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 5.088

# TOXICITY OF DIEMETHOATE TO THE FRESHWATER FISH *RASBORA DANICONIUS* ON HISTOLOGY OF GILL

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**Article Received on 08/01/2018** **Article Revised on 29/01/2018** **Article Accepted on 19/02/2018**

## ABSTRACT

In the present investigation freshwater fish, *Rasbora daniconius* was exposed to sub lethal concentrations of dimethoate at $Lc_{50}$ of 96 hours i.e. 9.136 ppm to determine histopathological changes in the gill morphology. The gills showed various histopathological changes were partial degeneration of epithelium of secondary gill lamellae, vacuolation, fusion, degeneration of gill lamellae and separation of basement membrane where as the shortening of secondary gill lamellae, thickness and fusion of primary gill lamellae and Fusion of secondary gill lamellae resulting in reduction of respiratory surface and vacuolization was also observed.

**KEYWORDS:** Diemethoate, *Rasbora daniconius*, gill.

## INTRODUCTION

Histology is an important tool for determining the action of any toxicant at tissue level, providing data concerning tissue damage (Sprague, 1973). Histopathology deals with the study of pathological changes induced in the microscopically structure of body tissue. Histopathological studies have been used to evaluate the effects of contaminants none the health of fish in the environment and to help establish a causal relation between exposure to toxic substances and the various biological responses (Schwaiger *et.al*, 1997). Histological changes not only give an early indication of pollution hazard, but also provide useful data on nature and degree of damage to cells and tissues (Shaikh, *et.al* 2010).

The test fish, *Rasbora daniconius* were exposed to 96 hrs $LC_{50}$ concentration of dimethoate. (9.136 ppm) served as experimental group and simultaneously a control was also maintained. In the present investigation an attempt has been made to observe the possible histological change in the vital tissues of gill of *Rasbora daniconuis* exposed to the dimethoate.

## MATERIALS AND METHODS

For the study of histopathological effects the live test fish *Rasbora daniconius* were collected from Manjara river, Latur and brought to laboratory. The fishes were then maintained in laboratory conditions. For the histopathological alteration in the gill of *Rasbora daniconius* were used standard methods suggested by the (Ramnik Sood, 2006).

The test fish, *Rasbora daniconius* were exposed to 96 hrs $LC_{50}$ concentration of dimethoate. (9.136ppm) served as experimental group and simultaneously a control was also maintained. Fishes showing normal activity were selected for each test. At the end of acute exposure (96 hr) the survive fish were decapitated and immediately the gills were removed and fixed in aqueous bouin's fluid for 24 hours.

These tissues were dehydrated in different grade of alcohol and blocks were prepared in paraffin wax (60-62$^{o}$C). The sections of 5-6m thickness were cut and stained with hematoxyline and Eosin. Each individual stained tissue slide was mounted with paraffin. Place one drop of paraffin on cover slip and glass slide was reverse in position kept for drying for one day. These mounted slides of individual slide were used for microscopic examination. The tissue microscopic view taken at high-resolution power with the help of Panasonic 7 megapixel digital camera. All the slides were observed under low and high resolution for their histological findings.

## RESULTS AND DISCUSSION

In the present investigation, the histopathological alterations induced by treatment of dimethoate in gill were observed at 96 hours $Lc_{50}$. The gill of *Rasbora daniconius* was showed that the primary gill lamella bears a series of secondary gill lamellae. The secondary gill lamellae of the gill in control fish appeared as leaf

like structure. The respiratory lining of the secondary gill lamellae on each side consist of thin layer of epithelium which rests on a basement membrane covering the pillar cells , blood channels system and which constitutes the main vascular component of the gills. It is clearly shows the primary gill lamellae and secondary gill lamellae with gill arch and piller cells are clearly seen in the control group (Fig No. A). In contrast, the gill of fish treated with lethal concentration of dimethoate for 96 hours Lc50 9.136 ppm exhibited marked pathological changes were partial degeneration of epithelium of secondary gill lamellae, vacuolation, fusion, degeneration of gill lamellae and separation of basement membrane where as the shortening of secondary gill lamellae, thickness and fusion of primary gill lamellae and Fusion of secondary gill lamellae resulting in reduction of respiratory surface and vacuolization was also observed. (Fig no. B). Brown, *et al.*, (1968) studied the damage of gills by detergent alone and by mixture of detergent and zinc. Dutta *et al.*, (1990), observed that with malathion exposure the fish acquires several defensive structural modifications in the affected gill such as dilated lymphoid spaces, proliferation and migration of the leucocytes in the lymphoid spaces and the vascular capillaries, lifting of the epithelial layer, thickening of the basement membrane and formation of a large number of chloride cells. Rao and Munshi (1991) observed the destruction of gills of Gaddus exposed to rotenone and reported that the changes in the gill surface morphology of *Cirrhinus mrigala* an exposure to malathion.similar results were observed in the present investigation. Skidmore *et al.* (1972) studied effect of zinc sulphate on the gill of *Rainbow trout* and reported that the subepithelial space between pilaster cells and epithelial lining reduces the effective respiratory and osmoregulatory surface over the central lamellar blood space, since flow through this region is reduced. Jauch, (1979) studied effect of insecticide fenthion on gill of *Cichlid fish* and reported epithelial hyperplasia in secondary gill lamellae and lamellar separation in lower (2-8 mg/l) concentration of fenthion, while in higher (8.3 mg/l) concentration, completely fused secondary gill lamellae with several hyperplasia of respiratory epithelium were observed. Ghate and Mulherkar (1979) worked on histopathological changes unduced by copper sulphate on two freshwater prawn species reported that damage and necrosis in gill. Ali (1982) studied effect of pesticides, dimecron and aldicarb on gills of *Channa gachua*, found that gill lamellae were congested with blood, lamellar cells shows cloudy, swellings, intracellular space enlarged and gill epithelium became highly swollen.

Jothinarendiran (2012) studied on effect of dimethoate pesticide on oxygen consumption and gill histology of the fish, *Channa punctatus* and observed toxicant may lead to defection of normal respiratory area that is damage of gill tissue which in turn may reduce the diffusion capacity of the gill. It is clearly shows that the dimethoate is a toxicant to changes the histology of gill of *Rasbora daniconius*. The earlier results correlate with the Shanta Satyanarayan *et.al* (2012) studied on histsopathological changes due to some chlorinated hydrocarbon pesticides in the tissues to *Cyprinus carpio* and reported that aldrin treated gills showed severe damage both 20 and 30 days period; with shrinkage of secondary lamellae with a slight curling bnd in 20days exposure and in 30 days exposure gill showed curling of the tips of secondary lamellae. The gills exposed to BHC showed complete destruction of epithelial walls, secondary lamellae shrinkage. Akinsorton *et.al* (2013) reported that severe areas of lesion, necrosis, malignancy, pigment and inclusion bodies were observed in fish exposed to glyphosate herbicide in concentration of 19.2mg/l. Kamble (1983) studied effect of pesticides on gills of freshwater fish, *Lepidocephalichthyes thermalis* and observed adhered gill lamellae and pyknotic nuclei in gills after sumithion and BHC treatment.

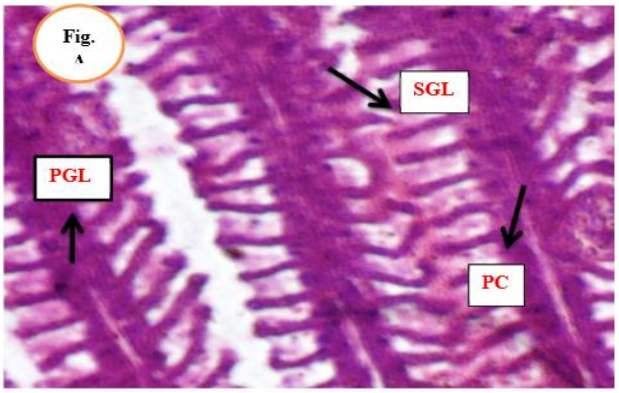


**Fig. (A) Photomicrograph of the gill section of control fish *Rasbora daniconius* showing the primary gill lamellae (PGL), secondary gill lamellae (SGL) and pillar cells (PC)**

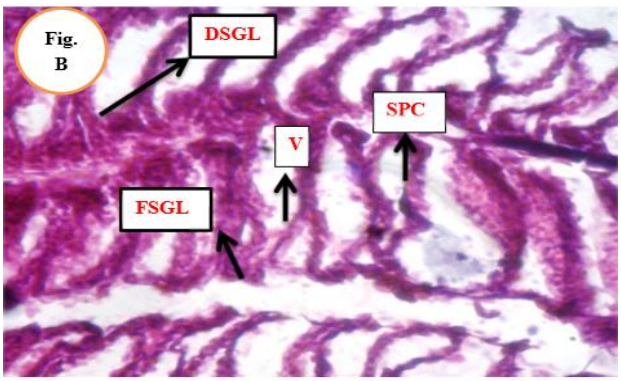


**Fig. (B) Photomicrograph of gill section exposed to dimethoate at 96 hours $LC_{50}$ showing degeneration of secondary gill lamellae (DSGL), Voculation (V), Fusioin of secondary gill lamellae (FSGL) and separation of pillar cells (SPC.)**

## CONCLUSION

Histopathology study help to the examine the pathological changes in the body tissues and it is the way of understanding the pathological conditions of the

animal by helping in diagnosing the abnormalities or damages in the tissues exposed to the toxic stress of pesticides. In the present investigation toxicity of dimethoate to the freshwater fish *Rasbora daniconius* exposed to 96 hours $LC_{50}$ histopathological changes observed in the tissues gills. The gills exhibited histopathological changes partial degeneration of epithelium of secondary gill lamellae, vacuolation, and fusion, degeneration of gill lamellae, shortening and fusion of secondary gill lamellae resulting in reduction of respiratory surface and vacuolization was also observed.

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