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Research Article

Histopathological effect of organochloride endosulfan on gills of larvivorous fish *Rarbora daniconius*

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Abstract

In present investigation pathological effects produced by acute and chronic exposure of pesticide organo-chloride endosulfan on gills of larvivorous fish *Rasbora daninonius* was studied. The changes noticed after acute treatment were found to be more pronounced than changes appeared after chronic treatment. The chronic exposure of gills to the pesticide endusulphan at three sub-lethal concentrations 0.0120 ppm, 0.0060 ppm 0.0040 ppm for 45 days showed changes like degenerated secondary gill lamellae necrosis of respiratory epithelium and damage primary gill lamellae. The effects were similar in all the three sublethal concentrations and the intensity of damage was dose dependent.

INTRODUCTION

Pollution of aquatic environment by pesticides and their residues is well known. Pesticides and their residues find their way into water bodies of aquatic organisms like fishes through gills. Pesticides after entering in the body of fish bring about histo-pathological and biochemical changes in different target and non-target organs (Ganeshwade, 2012).

Fishes are very sensitive to a wide variety of toxicants in water, various species of fish show uptake and accumulation of many contaminants or toxicants such as pesticides (Herger *et al*, 1995) Due to accumulation of pesticides in tissues produces many physiological and biochemical changes in the fishes and freshwater fauna by influencing the activities of several enzymes and metabolites (Nagarathnamma and Ramamurthi, 1982). The pervious histo-pathological studies of fish exposed to pollutants revealed that fish organs are efficient indicators of water quality (Cardoso *et al*., 1996 and Cengiz *et al*., 2001). The gills are important organ in fish to perform respiration, osmoregulation, acid base balance and nitrogenous waste excretion (Heath, 1987). Fish gills are also vulnerable to pollutants in water because of their large surface area and external location. For this region, fish gills are considered to be most appropriate indicator of water pollution levels (Alazemi *et al*., 1996). Many investigators have reported the histopathological changes in the gills of different fish species exposed to pesticides (Cengiz and Unlu, 2002; Vermurugan *et al*., 2007; Butchiram *et al*., 2009; Nutan *et al*., 2011). However there has been little information on the impact of endosulfan on gills of *Rarbora daninonius*.

Therefore, the present investigation was undertaken with a view to study in detail about histopathological changes in the gills of larvivorous fish *Rarbora daninonius*, to endosulfan toxicity.

MATERIALS AND METHODS

The test fish *Rasbora daniconius* was exposed to 96 hr. LC50 concentration of the pesticide organochloride endosulfan. Ten healthy fishes showing normal activity were selected for each test. Simultaneously a control was also maintained. After end of acute exposure (96 hr) the survived fishes decapitated immediately, gills removed and fixed in Bowins fluid for 24 hrs.

In second set of experiment the test fish *R.daniconius* were exposed to three sub lethal concentration of endosulfan (0.0120 ppm, 0.0060 ppm, 0.0040 ppm) as for a period 45 days. After exposure period the survived fishes were taken out dissected to remove tissue. Removed tissues were kept in bowin's fluid for 24hrs and blocks were prepared in paraffin wax at 58-60^{0}C. The sections were cut (6-7um) and stained with Ehrichs Haematoxylin–eosin and also by Mallorys triple stain (MTS). After studying the tissues under microscope histopathological observations of the gills were recorded.

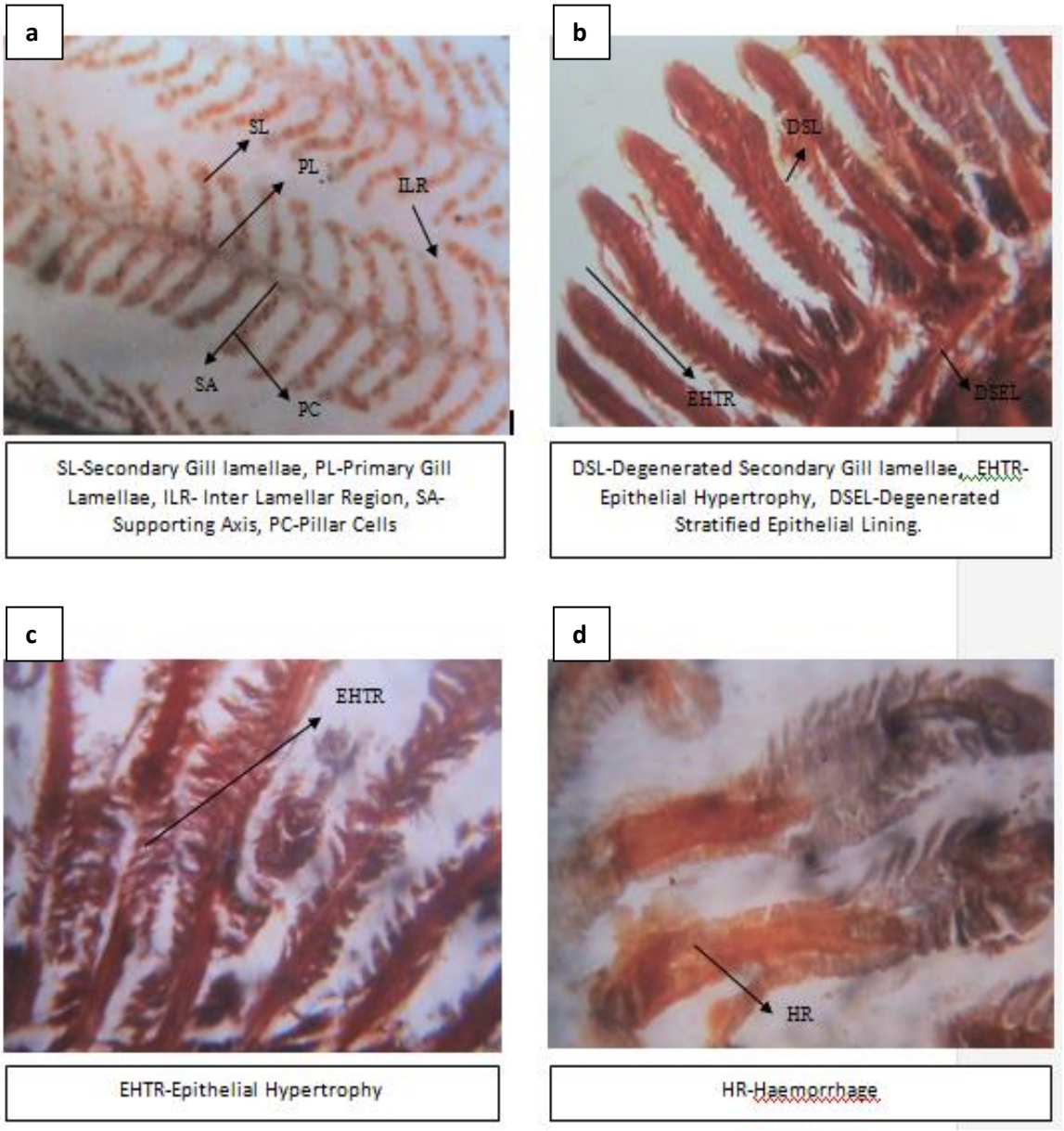

Fig. 1 (a, b, c, d) : Gills of *Rasbora daniconius* exposed to 96 hr. LC50 concentration of the pesticide organochloride endosulfan.

RESULTS AND DISCUSSION

Rasbora daniconius possesses gills situated in brachial chamber as in other teleost. Each gill arch bears a double row of elongated, laterally projecting structures called gill filaments on upper and lower surfaces of which are leaf like projections called as secondary gill lamella. Each secondary gill lamella is a delicate flattened structure comprising of two epithelial sheets which are continuous at its free end and separated along its length by a large number of widely separated pillar cells. The space between two pillar cells formed continuous blood space of the gill. The primary gill lamellae consist of centrally placed rod like supporting axis .The secondary gill lamellae is lined by a Squamous epithelium (Fig. 1 a). The changes in gill histology noticed after acute exposure to endosulfan were vacuolization in primary lamella epithelial hypertrophy of the secondary gill lamellae (Fig. 1 b; Fig. 1 c) and haemorrhage in pillar cells (Fig. 1 b).

The chronic exposure of gills to the pesticide endosulfan at three sublethal concentration 0.0120 ppm 0.0060 ppm 0.0040 ppm for 45 days showed changes like degenerated secondary gill lamellae necrosis of respiratory epithelium and damage to primary gill lamellae. The effects were similar in all the three sublethal concentration and the intensity of damage was dose dependent.

The changes noticed after acute treatment were found to be more pronounced than changes appeared after chronic treatment. Similar observations were recorded by Jauch (1979) with fenithiar in *tilapia multispinosa.* Srivastava (1984) reported histopathological changes induced by melathion and chlorodane in gills of *C. gauchua*) Gills of pearl dace and fathead minnows from experimentally acidified condition exhibited necrosis and rupture of gill epithelium result in hypoxia and respiratory failure. Leiono et al. (1987) Wagh *et al.* (1985) observed that gills of *Barbus ticto* exposed to $CdSO_4$, $ZnSO_4$ and $CuSO_4$ showed hyperplasia and degenerative changes. Nowak and Barbara (1992) studied effects of endosulphan residues on gills of catfish found hyperplasia and lifting of lamellar epithelium. Pfeiffer *et al.* (1997) also observed secondary distorsion and detached pillar cells in *Carassius auratus* under carbaryl toxicity stress. Similar results were also observed by Erkman *et al.* (2000) and Cengiz and Unlu (2002). Vermurugan *et al.* (2007) found epithelium hyperplasia curling of secondary lamellae in *Cirrhinusmrigala* after exposure to monocrotophos. Zaki *et al.* (2009) observed degeneration of pillar cells and development of vacuoles in epithelium of *Labeo rohita* exposed to atarazine. Ganeshwade (2012, a) also observed hyperplasia, lifting of lamellar epithelium, curling of secondary lamellae in the gills of Puntius titco (HAM) under dimethoate toxicity.

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