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Impact of Monocrotophos on the Histopathological Changes in the Gills of Mosquito Fish, *Gambusia Affinis*

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Abstract

Gambusia affinis is a fresh-water fish, but occurs also in brackish water. In aquatic resources, fishes are sensitive to the toxic substances mixed into water and deleterious effect of metals or heavy metals on fishes. The mosquitoes are breeding the larvae into the water which is the feeding source of the mosquito fish, called as Mosquito fish. The toxic substances are damage to the organism and degree of the cell damage reflects the various concentrations of the pollutants. In the present study an attempt is made to the Monocrotophos, an industrial as well agricultural effluence on Gambusia affinis. 50% mortality was exposure to Monocrotophos on 0.4 ppm at 96 hrs. The impact of Monocrotophos on the gill of Gambusia affinis, gill filaments are twisted and primary axis is in filtered of Gambusia affinis. The gill exhibited a film of coagulated mucous over the gill surface.

Keywords: Mosquito fish, Monocrotophos, *Gambusia affinis,* histopathology, toxicity.

Introduction

Organophosphate insecticides are liquids of liphophilic character, and some volatility; a few are solids. Organophosphorous are inhibits the variety of esterase's, but associated with cholinesterase inhibition. Increasing industrialization leads to continuous addition of harmful pollutants in the environment especially in water. Monocrotophos is one of the organophosphate is becoming the serious pollution threats to public health. The insecticides were affected the aquatic ecosystem, especially fishes. This biochemical changes inhibited the slow blood flow as compared to the cardiac output as well as association of hepatocytes in mammals[1]. The domestic sewage, agricultural pesticides, industrial waste are harmful to the threatened status of fishes or aquatic life. The fish population was hampered because of the daily used agricultural pesticides. The worldwide uses of chemicals are very hazardous to high risk of toxicity and environmental pollution of the other organisms[2].

The polluted water has not suitable for drinking water by physico-chemical properties and microbial activities which showing microbial content infection. The deeper depth of water should carry out at the tar sand in which presence of potential elements[3, 4]. Pollution has been occurred most of the human being interference and daily used products which are hazardous to the environment[5]. Uncontrolled discharged of pollutants into any water body degrades the water quality to such an extent that it produced lethal effects on the fish fauna. The extent and degree of their harmful effect on fish can be gauged to a greater extent by experimental studies in a laboratory[6]. In the environment, metals are anthropogenic sources and natural spectrum[7]. The submerged and industry less zone surrounding supply of water was tolerant to fish cultivation[8]; the water conductivity Total Dissolve Oxygen (TDS) and Carbon Oxygen Demand (COD) was significant[9].

Fishes are comes in contact to the various metals which are very hazardous to the aquatic environment. The aquatic life, fishes are highly sensitive to a toxic substances present in water and deleterious effect of the metals on fishes can be easily established[10, 11]. *Gambusia affinis* is distributed in Gulf Slope drainages and Atlantic of the USA up to the southern Alabama and east into north of New Jersey and Florida[12, 13, 14]. The *Gambusia affinis* is introduced as a bio-control for mosquito larvae into various countries. Mosquito fish, *Gambusia affinis* is commonly present in ponds and lakes and are easy to maintain in the aquarium. Gills perform various functions like respiration, osmoregulation and excretion of nitrogenous wastes. Hence gills are an important biomarker of water pollution and good indicator of water quality. Previous histopathological studies of gills of *Gambusia affinis* on exposure to malathion, result shows primary makers gills are aquatic pollution[15, 16].

Material and Methods

The experiment was carried out as the laboratory, Department of Zoology, Hutatma Rajguru Mahavidyalaya, Rajgurunagar, Pune- 410505, India during February 2013. The live specimen of fishe, *Gambusia affinis* were collected from the small pond at Rajgurunagar, Pune using net and put into big glass container containing water from their natural habitat. *Gambusia affinis* body weight is about 0.2 ± 0.02 gm and 3 ± 0.5 cm length. The water was stored for 15 days so as to be free from chlorine. The

aged water was used for acclimatization and for making test solution. Fishes were fed with commercial fish feed. After acclimatization, fishes were collected, weight on weight balance and divided into six groups which having ten fishes, out of six groups, one group were consider for control and remaining five groups exposed to 0.2, 0.4, 0.6, 0.8 and 1.0 ppm concentration to chonic duration of 24, 48, 72 and 96 hours[17]. The tests were carried out at again for about 10 times and the results were calculated. The experiment was carried out at 24^0-28^0C temperature. After stipulate time, the fishes were sacrificed; tissue was fixed in 10% formalin and processed for histological slides were prepared[18].

Results and Discussion

The impact of Monocrotophos on the mortality of Mosquitofish shows that 0.4 ppm at 96 hrs exposure. The gills exhibited a film of coagulated mucous over the gill surface figure-4. The gills of *Gambusia affinis* shows lamellar epithelial cells were changes, twisted the tips of gill filaments and primary axis infiltration of cells figure-2 and 3.

The epithelial cells of secondary gill filaments are also degenerative changed by the effect of Monocrotophos (Figure 1 and 2). Also, fusion and shortening of secondary lamellae was evidenced figure-3. Edematous separation of gill epithelial and desquamated secondary lamellae was observed (Figure 2). Degenerated secondary lamellae and evidenced pycnotic nuclei were also observed. All the changes were pronounced in 0.4 ppm at 96 hours Monocrotophos exposed Mosquitofish, *Gambusia affinis.*

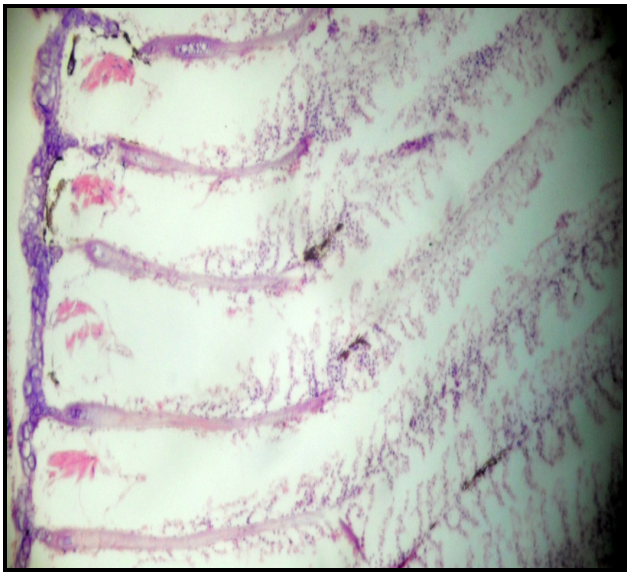

Figure-1
Control gill at 96 hr exposure showing, Secondary Gill Filament (SGF), Respiratory Gill Filament (RGF), Primary Axis (P) and Respiratory Filament (RF)

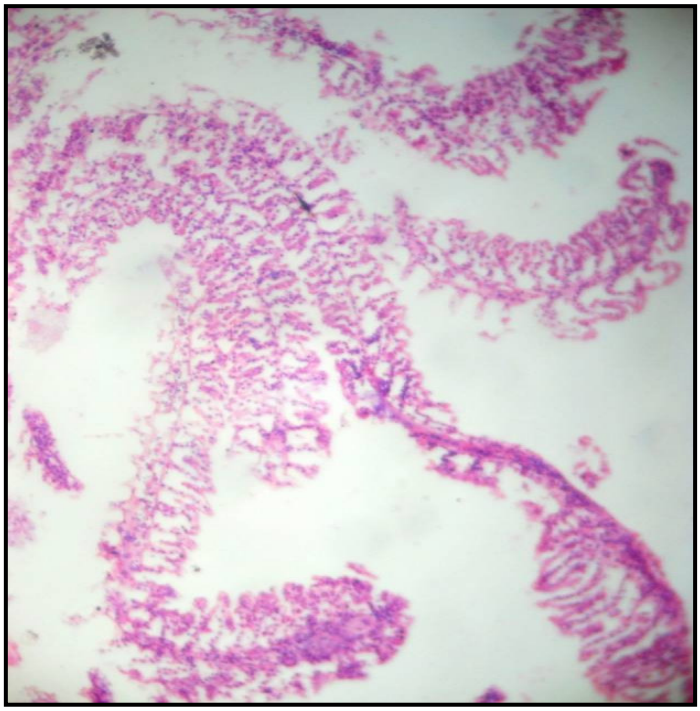

Figure-2
Experimental gills at 96 hr, Secondary Gill Filament (SGF) and Respiratory Filament (RF)

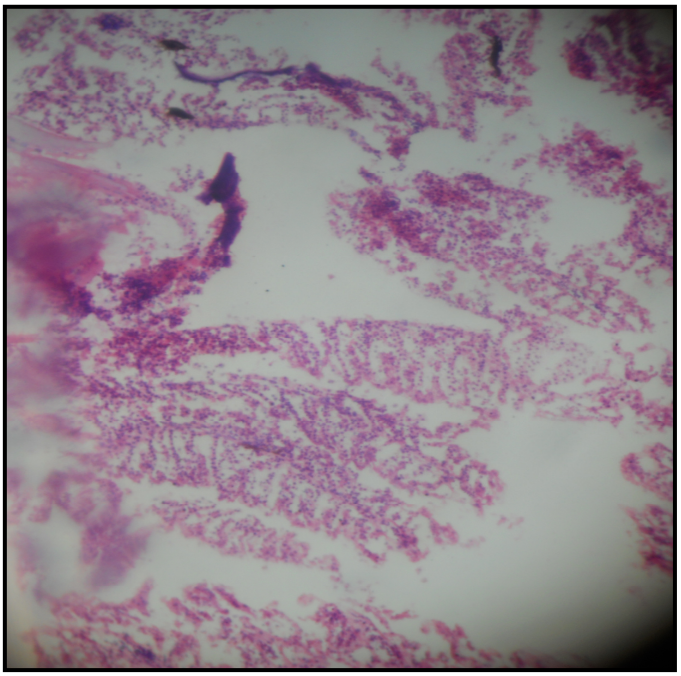

Figure-3
Gill showing, Hemorrhages in Secondary Gill Filaments (HGSGF) and Necrosis in Secondary Gill Filaments (NGSGF)

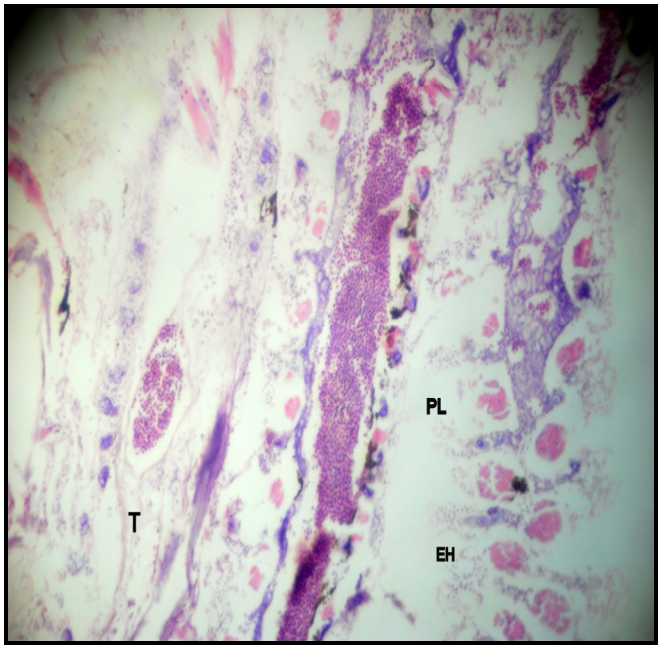

Figure-4
Gill showing, Clubbing of Secondary Gill Filaments (CSGF), Seviour Necrosis in Inter Lamellate Space (SNILS) and Separation of Epithelial Layer in SGF and Infiltration of Respiratory lamellae

In the present investigation the Monocrotophos induced architectural changes in gill of *Gambusia affinis*. It includes bulging of lamellae, structural disorganization of primary gill lamellae. There is fusion and destruction of secondary gill lamellae, which is main seat of gaseous exchange. In respiratory epithelium hyperplasia is observed. Excess of mucus secretion and disorganization of gill lamellae takes place. The fish exposed to monocrotophos indicates that disturbance in proper gaseous exchange and also affect osmoregulation. Swelling in the gill epithelia, that there was unusual enhancement in the rate of mitosis it stimulate epithelial cells to give effect to bulged out or swollen condition. Vacuoles and damaged gill lamellae and damage to respiratory epithelium hematomas. The epithelial lesions observed on the respiratory surface, due to collapse of pillar cells, increasing number of mucous openings and mucus secretions are due to the hyper plastic condition. In gills clubbing, hyperemia, and edema were observed. The toxic substances or pesticides are normally attacks on respiratory organ[19]. If oxygen decreases, the gills are probably consume the more pesticide through the polluted water[20]. The intimate contact of the gills with the polluted water may lead to alterations in normal respiratory mechanism, lower the diffusion mechanism through the gill and thereby oxygen consumption is reduced, which creates a physiological imbalance to the organism[21].

After some time they showed vigorous fin movement with fast swimming than normal swimming. The fish remained at the corner of the bottom part of container with continuous gill or operculum movements. They loss balance and went deep by keeping head down in position and touching the bottom of container. If fishes were disturbed, they showed sudden body pulses. When they died they appeared slimier than control due to the secretion of large amount of mucus on their body. There are also little changes in body weight and water content of body due to susceptibility of fish to monocrotophos pesticide. That pesticide alters some changes in body of fish. Supportive cartilage was also observed in secondary gill lamellae, in primary gill filament of cartilage or fusion of supportive cartilage. Destruction of epithelial lining of gill lamella and supporting cartilage directly affect on the respiration of fish. Due to accumulation of Monocrotophos in the nucleus of cells, it is densely staining and this can affect nuclear function. Due to the secretion of mucus which filled the space between gill filament and gill lamellae, ultimately affecting the gaseous exchange leading to stasis of blood and death of the fish. In support of this, done in laboratory conditions, proved that heavy metal mixtures cause the histopathological changes[22].

Conclusion

The present result concluded that the histopathological changes found in gills of the examined freshwater Mosquito fish are typical for the clinical finding in polluted with heavy metals water of habitat. Influence of water pollution is not only devastating to human being, animals, insects but also aquatic organisms. The more polluted industrial are destroys the aquatic ecosystem and reduced its biodiversity. The decrease in the rate of oxygen consumption after exposure to monocrotophos due to the sluggishness of the fish, as a result of the pesticide stress and also the secretion of excessive mucous, which formed a thin film over the gill thereby preventing absorption of oxygen during the process of gaseous exchange. The present study also suggests that, the Monocrotophos pesticide is very harmful to the aquatic life especially to the fishes, and its urgent need to control this water pollution.

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