Alterations Induced in Gills of *Xiphophorus maculates* in Response to Petroleum Toxicity

Asra Anjum

M.Sc in Microbiology.Instructor in Public Health Department, University of Hail, K.S.A.

Students
Anwar Refada Abdulla Freeh, Nawal Abdulla Mohammed Al Shammri, Najla Ali Eisa Almozini, Ronia Saleh Saud El Rashidi and Eman Naif Albarrak, Preparatory college, University of Hail.

Reviewer: Dr.Asma Hegazy,
Medical tract, Preparatory Year College, University of Hail, K.S.A.
Department of Pathology and Toxicology, National Institute of Oceanography and Fisheries ,Cairo, Egypt.

Abstract: ***To assess the biological effect of the several pollutants that are constantly released to the water, bio-monitoring is a promising approach that may provide early-warning signals of pollutants exposure. Fish gill is the first target of pollutants action, thus histopathological changes may constitute. The histopathological changes in gills of Xiphophorus maculates showed pathological changes as filament epithelium lifting, necrosis, sinusoidal fibrosis and fusions. This make Xiphophorus maculates a good biomonitor for petroleum pollution.***

Keywords: *Xiphophorous maculates*, gills, petroleum, necrosis & sinusoidal fibrosis.

1. Introduction

The presence of petroleum hydrocarbons in an aquatic environment serves an additional source of stress for aquatic organisms. The acute toxic effects of oil spills are attributed to the low molecular weight of aromatic hydrocarbons. **Neff et al. (1987)** reported that acute toxicity is inversely related to the molecular weight of aromatic hydrocarbons while the chronic effects are attributed to the four and five-ring polycyclic aromatic compounds (PAH).In a study on *Oreachromis niloticus,* death was observed within 24 hours at19.2 ppm water soluble fraction of diesel fuel, and was observed even at low concentrations. A 10-week exposure to various sub-lethal concentrations of water soluble fractions of crude oil resulted to a significant decrease in the growth rate of *O. niloticus*.

In the presence of crude oil, the fish increases their metabolic rates in order to degrade and excrete the aromatic hydrocarbons. They allocate more energy to homeostatic energy than storage, ultimately resulting to the reduction of growth rate.

Petroleum hydrocarbons have been reputed to cause a variety of histopathological effects in fish **(Davison et al., 1993; Thiyagarajah et al., 1996; Van den Heuvel, 2000 and Nero et al., 2006).**

2. Material and Methods

Xiphophorus maculates, or Mickey mouse fishes, were taken from an ornamental store located in Hail, and transferred to the research laboratory of University of Hail, Preparatory College. The fishes were placed in aerated round bottomed jars. Petroleum was applied (LC50 = 700 ppm) in sublethal dose 1/10 LC50 for fifteen days. The fish were dissected and the gills were removed and fixed in 10% formalin solution and routinely processed for histological examination. 5 um thick slides were prepared and stained with haematoxlin and eosin staining. The slides examined under the microscope and photographed.

Figure 1: Xiphophorus maculates

Figure 2: The experiment.

3. Results

In control gills (Fig. 3) there was no visible changes in the control in the in gill filaments and secondary lamellae of ***Xiphophorus maculates.***

In gills subjected to petroleum (Figs. 4-6) showed filament epithelium lifting, epithelial hyperplasia, necrosis, sinusoidal

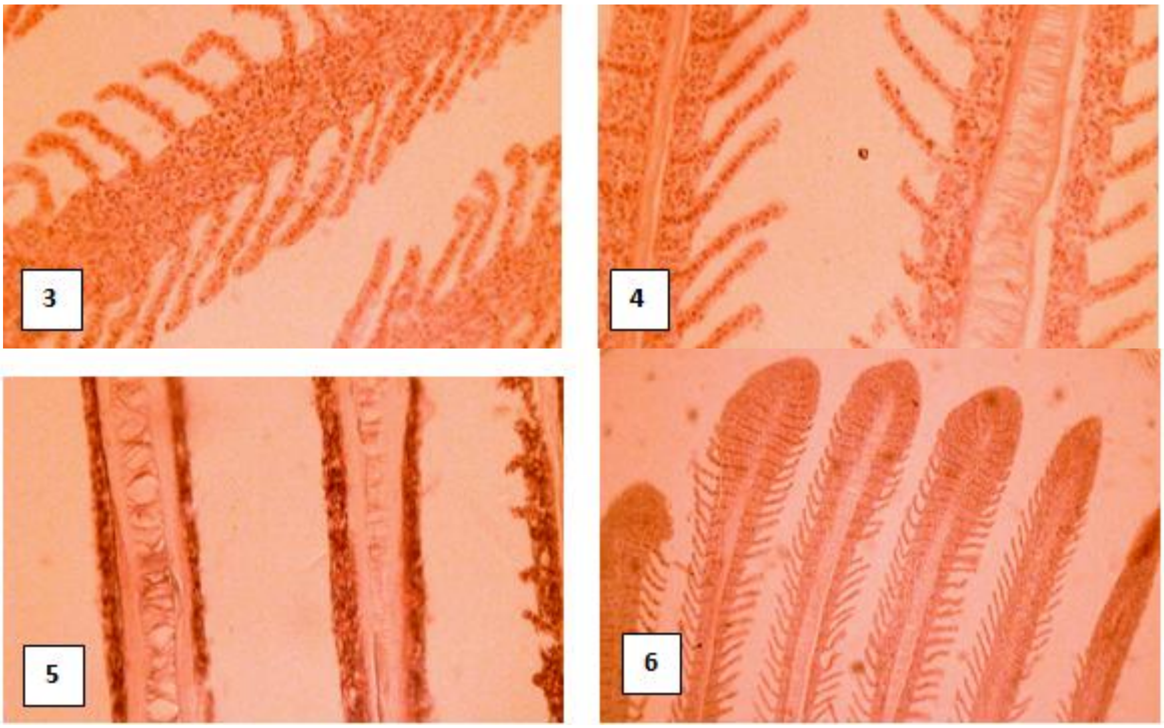

Figure 3: The control fish. Figs. 4-6. Fishes subjected to petroleum for 15 days

4. Discussion

The gills, which is of many important functions in the fishes, such as respiration, osmoregulation and excretion, remain in close contact with the external environment and has sensitivity to changes in the quality of the water. They are considered the primary target of the contaminants. In the present work, the gills showed pathological changes as degenerative, necrotic and proliferative changes in gill filaments and secondary lamellae. These changes may be due to a reaction to toxicants intake or an adaptive response to prevent the action of the pollutants to the gill surface. On the other hand, some observed alterations like proliferation of the epithelial cells, fusions of some secondary lamellae and epithelial lifting are considered as defense mechanisms, serve as a barrier aims to the increase of the distance between the polluted water and the blood. Similar results were obtained by **Nero et al. (2006), Mohammed and Gad (2008) and Mohammed (2009)** in *Tilapia zilli* and *Solea vulgaris* obtained from contaminated areas in Qaron Lake, Egypt. These cellular damages observed in the gills may affect the processes of gas exchange and ionic regulation. Reduction in oxygen uptake is a serious symptom of petroleum toxicity in a variety of fish species (**Davison et. al. 1993**). Numerous studies have related the respiratory effects of petroleum on the gills after exposure **(Thiyagarajah et al., 1996; Van den Heuvel, 2000 and Samuel et al., 2008).**

5. Conclusion

These results suggest *Xiphophorus maculates* a suitable biomonitor for petroleum pollution.

References

[1] **Neff, J.M.; Hillman, R.E.; Carr,R.S.; Buhl, R.L. and Lathey, J.I. (1987):** Histopathological and biochemical responses in Arctic marine bivalve mollusks exposed to experimentally spilled oil. Arctic, 40: 220-229.
[2] **Davison, W.; Franklin, C.E.; Mckenzie, J.C. and Carey P.W. (1993):** The effects of chronic exposure to the water soluble fraction of fuel oil on an Antarctic fish Pagothenia borchgrevinki. Comp. Biochem. Physiol., 104: 67–70.
[3] **Gusmão, E.P.; Rodrigues, R.V.; Moreira, C.B.; Romano, L.A.; Sampaio, L.A.; Miranda-Filho, K.C. (2012):** Growth and histopathological effects of chronic exposition of marine pejerrey *Odontesthes argentinensis* larvae to petroleum water-soluble fraction (WSF). AMBIO, 41: 456-466.
[4] **Johari, S.A.; Kalbassi, M.R.; Yu, I.J. and Lee, J.H. (2015):** Chronic effect of waterborne silver nanoparticles on rainbow trout (*Oncorhynchus mykiss*): histopathology and bioaccumulation. Comp. Clinical Pathol., 24: 995-1007.
[5] **Nero, V.; Farwell, A. Lister, A.; Van Der Kraak, G.; Lee, L.E.J.; Van Meer, T. and Dixon D.G. (2006):** Gill and liver histopathological changes in yellow perch (Percaflavescens) and goldfish (Carassiusauratus) exposed to oil sands process-affected water. Ecotoxicol. Environ. Saf., 63: 365–377.
[6] **Salamat, N. and Zarie, M. (2014):** Fish histopathology as a tool for use in marine environment monitoring: a review. Comp. Clinical Pathol., pp 1-6.
[7] **Mohamed, F.A. and Gad, N.S. (2008):** Environmental pollution-induced biochemical changes in tissues of Tilapia zillii, Solea vulgaris and Mugil capito from Lake Qarun, Egypt. Global Vet., 2: 327-336.

[8] **Mohamed, F.A.S. (2009):** Histopathological studies on *Tilapia zillii* and *Solea vulgaris* from Lake Qarun, Egypt. World J. Fish Mar. Sci., 1: 29-39.
[9] **Sollid, J. and Nilsson, G.E. (2006):** Plasticity of respiratory structures – adaptive remodeling of fish gills induced by ambient oxygen and temperature. Respir. Physiol. Neurobiol., 154: 241–251.
[10] **Thiyagarajah, W.R.A.; Hartley, S.E.M. and Broxson M.W. (1996):** Gill histopathology of two species of buffalo fish from a contaminated swamp. Mar. Environ. Res., 42: 261–266.
[11] **Van den Heuvel, M.R.; Power, M. Richards; J. MacKinnon, M. and Dixon D.G. (2000):** Disease and gill lesions in yellow perch (Percaavescens) exposed to oil sands mining-associated water Ecotoxicol. Environ. Saf., 46: 334–341.
[12] **Samuel O. B.; Suleiman O. Q. And Odiete W. O. (2008):** Synergistic evaluation of oil dispersant and oil-detergent mixtures using African catfish, *Clarias gariepinus* Fry. J. Fish. Aquatic Sci., 3: 280-290.