

**HISTOLOGICAL ALTERATION IN THE
GILL TISSUES OF *CYPRINUS CARPIO* AND
CARASSIUS AURATUS FISHES AFTER
EXPOSURE TO SUBLETHAL
CONCENTRATIONS OF MALATHION
INSECTICIDE**

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SUMMARY

This study aimed at evaluation the effect of malathion insecticide upon *Cyprinus carpio* and *Carassius auratus* . The study revealed that gills of fishes were infected after 16 days of exposure to sub lethal concentration in the range 0.01 - 0.05 mg/l of malathion insecticide. Fishes which exposed to different concentrations of the insecticide were characterized by randomly circular movement and an increased in the movements of operculum, enlargement of eye ball, increase in the excrement of mucus material and the fish come close to the aeration source and water surface. As time passed the fish color changes and the pectoral fin became wider. During the death hours the fish turned over on both sides close to water surface and after death a bad smell released.

Key words: Gill tissues, histological effects, *C. carpio*,
C. auratus, Malathion insecticide

Introduction

Pesticides have been realized as one of the major sources of water pollution as they eradicate the beneficial species either indirectly through breaking the biological chains or directly by producing toxic stress and chemical changes [1].

The environmental pollution due to extensive usage of the pesticides without proper managements for reaching effects on the survival potential of aquatic animals for some toxic chemicals may persist in the environment for a long period and often unchanged [2]. Certain pesticides such as organochlorines and their metabolites, accumulate in the wild fish, particularly in liver and fatty tissues [3]. Due to their low cumulative ability and short-term persistence in the environment, organ phosphorous pesticides such as malathion have replaced the persistent pesticides during the last decades of 19th century [4]. Pesticides can act as stressing agents in aquatic ecosystems, altering physiological as haematological parameters and biochemical functions like reduction in the synthesis of protein, glycogen, or enzymes, causing damage to organ systems [5]. Fish gill, liver and kidney are target organs known to be severely affected by pesticides more than skin, heart and central nervous system [6]. The gills are prone to change, being vital organs involved in respiration and in constant contact with the external medium. Hence, gills have the potential to act as indicators of contamination toxicity in the aquatic environment. In this study, histological changes in the gill and associated changes in protein pattern of the commonly fresh water fish *Cyprinus carpio* and *Carassius auratus* exposed to sub lethal concentrations of malathion were investigated.

Materials and methods

Studied fishes were supplied from Marine Science Centre/Basrah University which caught by using net with 20 mm mesh size. They characterized as: *C. carpio*, body length 13 ± 3 cm, weight 15 ± 2 gm, and for *C. auratus*, body length 10 ± 3 cm and weight 12 ± 2 gm.

The fishes were acclimated before being used for the experiments in a plastic aquarium (4200 cm³) at a constant temperature (20 ± 2°C) and pH value of water in the range 7.6 - 7.2. Fishes were fed daily with dry algae. Each species of fish were divided into three groups in which one group serves as a control and two groups were exposed to sub lethal concentrations of malathion insecticide 0.01 and 0.05 mg/l for *C. carpio* and 0.01 and 0.04 mg/l for *C. auratus* for 16 days, according to earlier study. The chemical name of malathion is Dimethoxy Phosphino Thioyl Thio Butanedioic Acid Diethyl Ester (C₁₀H₁₉O₆PS₂).

Histological studies

Small pieces of gills from treated fishes were dissected out and fixed for 24 hours in Boun's fluid, and then they were dehydrated by passing through a graded series of alcohol and embedded in paraffin wax. Sections of 7μ thickness were cut by rotary microtome and stained with haematoxylin and eosin, and then the sections were studied with the help of compound microscope [7].

Results and Discussion

Effect of malathion upon the behaviour and movements phenomenon of *C. carpio* and *C. auratus*:

Throughout the experimental study of *C. carpio* and *C. auratus* fishes which exposed to malathion insecticide were monitored thoroughly and it is found that fishes showed randomly circular movement and increased swimming activity in random way as well as they were loosing balance with sudden movements and increased movement of operculum. Moreover, the eyes became wider and an increased excretion of mucus (on the whole body) leading to difficulty in catching the fish. After a short time fishes were accumulated around aeration source and became close to water surface which indicated their effect by the insecticide and lost their ability for respiration of gills for functioning to supply the fish with oxygen. The decrease in

mucus excretion (in the gills) may be due to destruction of respiration tissues. Therefore, the oxygen absorption is affected in reverse way, hence a behaviour response taking place according to the alteration of oxygen concentrations in the aquatic environment. This is represented by escalating to the water surface and increase movements of gills cover [8].

Among other observations it is noted that the colour of the body of the fish was changed and turned to pale yellow as indicated earlier[9].The pectoral fins became wider and longer [10].During death hours, the fish turned on both sides close to water surface as well as widen the holes in the gills operculum and widen the eye ball. Finally, bad smell was released after the death of fish. This behaviour aspects was in agreement with other researchers [8,9,11].

Effect of malathion on the respiratory system of *C. carpio* and *C.auratus*

Gills are the first and the main route of entry of pollutants in the fish and has a large surface area exposed to water which enhance the adsorption and binding of pollutants leading to many pathological alterations [12].

Structure of gills in *C. carpio* is similar to that described in most freshwater teleosts [13].The four pairs of gill arches possessed slender gill filaments forming two lines facing towards the back; those two lines were joined to each other at the base by a gill septum. Each primary lamella consisted of numerous secondary lamellae that lined up a long both sides of gill filament, between the two adjacent secondary lamellae was the inter lamellar region, as shown in figure 1 for control fishes, which is largely consisted of respiratory epithelial cells along with a few mucus cells.

Histological study of *Cyprinus carpio* gills indicated that all types of tissues in the respiratory system for control samples were neither histological alterations nor the presence of any infectious agents. Figures 2 and 3 show a section of gills tissue from *C. carpio* exposed to 0.01 and 0.05 ppm of malathion insecticide for a period of 16 days respectively. Occurrence of lamellar thrombosis, curling and ballooning of secondary lamellae were observed [2].

For 16 days exposure of *Cyprinus carpio* to low concentration of 0.01 ppm malathion, histopathological changes in the gills observed were hyperplasia (A in fig.2), necrosis (B in fig.2), clubbing shape (C in fig.2) and separation of lamella epithelial (D in fig. 2). For the higher concentration of 0.05 ppm, histological changes observed were; hyperplasia (A in fig.3), fusion of secondary filaments (B in fig.3) and hypertrophy (C in fig. 3)[14].

For *C. auratus* sections of gill tissues exposed to 0.01 and 0.04 ppm of malathion insecticide for a period of 16 days are shown in figures 4 and 5 respectively.

For 16 days exposure of *C. auratus* to low concentration of 0.01 ppm malathion, the only histopathological change in the gills observed was degeneration of secondary lamellae (as shown in fig.3). For the higher concentration of 0.05 ppm, histological changes observed were; necrosis (A in fig. 5), degeneration (B in fig. 5), clubbing (C in fig. 5), bleeding (D in fig. 5) and fusion of secondary filament (E in fig. 5)[14].

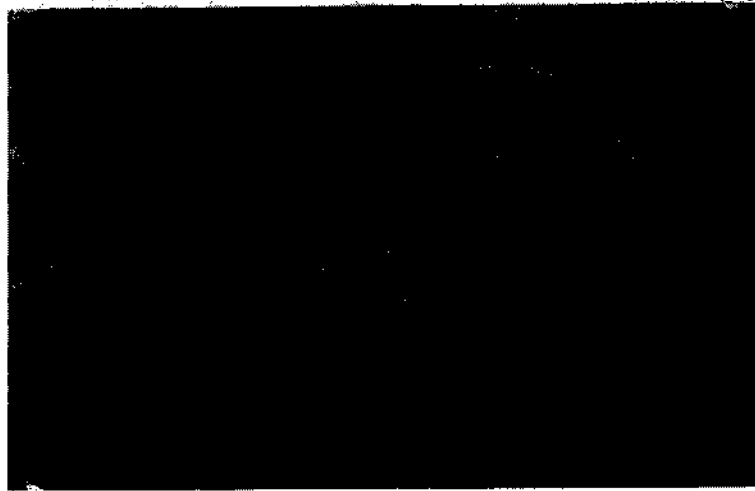


Fig.(1) Section of primary lamella of untreated gill(control fish)

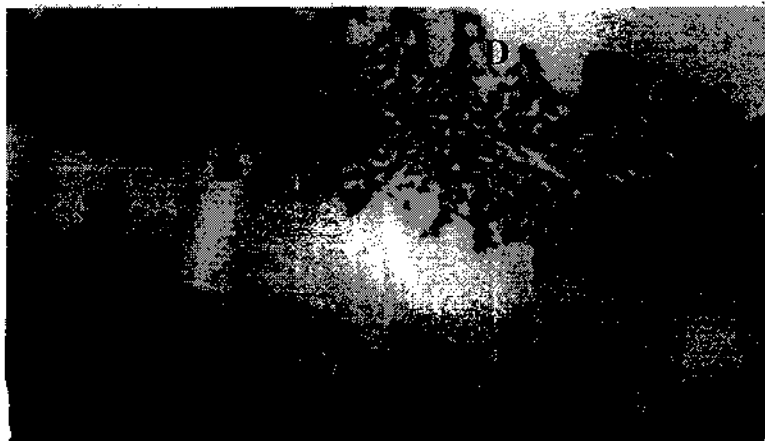


Fig.(2) Section of secondary lamella of gill from C. carpio after 16 day of exposure to 0.01 ppm malathion



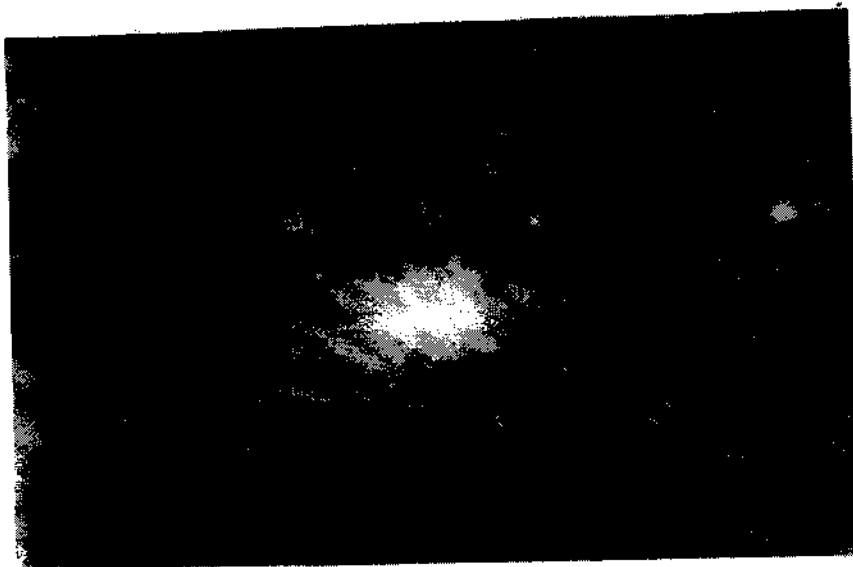


Fig.(4) Section of secondary lamella of gill from *C. auratus* after 16 day exposure to

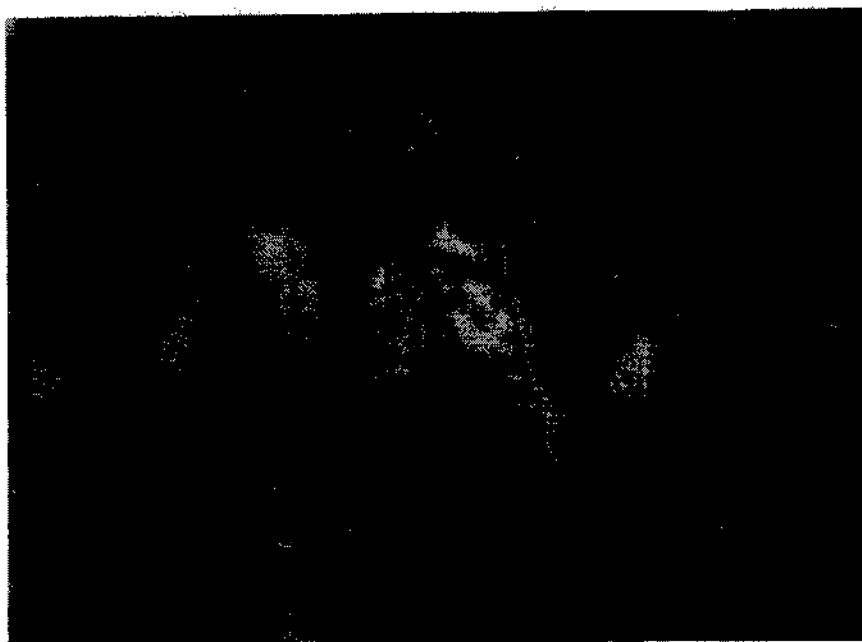


Fig.(5) Section of secondary lamella of gill from *C.auratus* after 16 day exposure to 0.05 ppm malathion

Fish are affected by the use of malathion insecticide causing fish kills including *C. carpio* and *C. auratus* which are greatly reflected by the concentrations of malathion. Malathion alters the behaviour of exposed fishes leading to disorient the fish in their habitat .

After 16 h exposure to 0.04 - 0.05 ppm malathion some mild degenerative changes were seen in the interlamellar region in the gills of both fishes as shown in figures 3 and 5 for *C. carpio* and *C. auratus* respectively.

More damage will be expected if the exposure period is increased. Depending upon a certain conditions damages such as necrosis or fusion of the secondary lamellae could be seen.

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التأثيرات السلوكية على أنسجة غلاصم سمكتي المياه العذبة، الكارب الاعتيادي و السمكة الذهبية بعد التعرض لجرعات تحت المميتة من مبيد الملاثيون

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الخلاصة

تهدف هذه الدراسة إلى تقييم تأثير مبيد الملاثيون على سمكتي المياه العذبة الكارب الاعتيادي والسمكة الذهبية. أظهرت الدراسة حدوث تلف في تركيبة الغلاصم للسمكتين بعد 16 يوم من التعرض لتراكيز تحت مميتة بحدود 0.01 - 0.05 ملغم/لتر من مبيد الملاثيون . تميزت الأسماك بعد تعرضها إلى تراكيز مختلفة من المبيد بالحركة الدورانية العشوائية وزيادة في حركات الغطاء الغلصمي وتوسع في كرة العين وزيادة في إفراز المادة المخاطية. واقترب السمكة من مصدر التهوية و سطح الماء، ومع مرور الوقت يحدث تغير في لون جسم السمكة وزيادة في توسع الزعنفة الصدرية. وخلال ساعات الاحتضار يحدث تقلب للسمكة على الجانبين بالقرب من سطح الماء وبعد الوفاة تنبعث رائحة كريهة.

كلمات دالة: أنسجة الغلاصم، تأثيرات سلوكية، سمكة الكارب، السمكة