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Effects of Sumithion on the Histological Changes of Spotted Murrel, *Channa punctatus* (Bloch)

Abdus Salam Bhuiyan, Badrun Nesa and Quamrun Nessa
Fisheries Research Laboratory, Department of Zoology,
Rajshahi University, Rajshahi-6205, Bangladesh

Abstract: *Channa punctatus* was exposed for 7days to sumithion at a concentration of 2.0, 5.0, 5.5, 10.0, 10.5, 15.0, 15.5, 18.5, 20.0, 20.5, 25.5 and 100ppm under laboratory conditions. The fish showed severe histological changes in liver, kidney and ovary tissues. The degenerative changes included hypertrophy of cells and their nuclei, liver cord disarray, vacuolation of the cytoplasm and necrosis. In some cells the membrane was ruptured. The liver on the whole showed distance appearance. Pycnosis, vacuolation, rupture of blood vessels and hematopoietic cells of kidney, fragmentation of ova were recorded in an increasing order towards the higher tested doses.

Key words: Toxicity, histology, sumithion, *Channa punctatus*.

Introduction

Bangladesh is an over populated country with its high growth rate. The country mainly depends on agricultural products to feed its people. So a large amount of agro-chemicals and insecticides are used to enhance the agricultural production from a limited land to meet the demand of food grains for country's ever increasing population. Every year about 7000 metric tons of insecticides are being used in agricultural fields. It is assumed that 25% of these used pesticides drain off into open water bodies through rainfall and floods (Anonymous, 1994). As a result aquatic environment obviously gets polluted. The pollution hazards for aquatic life are increasing significantly. Sometimes their pollution may cause sudden death of fish and other aquatic organisms.

The snakehead, *Channa punctatus* locally called taki is an important and popular fish species in Bangladesh and was abundant in the natural water bodies. Among our inland fish and fisheries, 54 varieties have already become extinct and some are endangered condition (Rahman, 1989). Among the considered endangered fish species, snakeheads or murrels are the most familiar in our country, which includes *Channa punctatus*. Hossain *et al*. (2000) recorded *Channa punctatus* as one of the most rare fish species in Bangladesh floodplains. It very often enters the crop fields from the adjoining water bodies, particularly during monsoon. Since, reservoir fish are now being increasingly needed as a source of animal protein for the people; the effects of insecticides used in cultivation are to be monitored. The purpose of present study was to asses the histological changes in liver, kidney and ovary of *C. punctatus* exposed to sumithion which is commonly used to control the insect pest of paddy fields in Bangladesh.

Materials and Methods

Live specimens of test organism *C. punctatus* were purchased from Shaheb bazar of Rajshahi City. Average length and weight of the experimental fish was 20.74cm ± 1.34 and 99.58g ±33.71 respectively. The experiments were conducted in the laboratory using glass aquarium (40 × 27 × 26 cm^3). The commercial grade Sumithion {O, O-dimethyl- O -(3-methyl-4-nitrophenyl) phosphothionate} was chosen for the experiment. The test solution was made by adding requisites quantity of tap water to the chemicals and the dosages were determined in ppm. The test water was regularly aerated with air stones, and foods were replenished as before. No insecticide was added to the control aquaria. Toxicity of sumithion to *C. punctatus* was determined separately in two trials. Two aquaria in each trial were kept as control. The fish was acclimatized before bioassay experiment.

Disease free, healthy four test fish of uniform size were released into each aquarium. For histological studies at least two fish were removed from each treatment including control at the end of 7days-exposure period. They were randomly selected from each group and immediately sacrificed by pinning through the brain and tissue samples like kidney, liver and ovary were collected from the dissected fish. When the fish showed moribund condition, they were immediately removed for histological examination. The tissues were washed in physiological saline and preserved in plastic vials with Bouin's fluid for at least 18 hours. The samples (liver, kidney and ovary) were then dehydrated, embedded in paraffin wax. The embedded blocks were sectioned (6 µ) by a microtome machine (Buffalo. N. Y. 14215. U. S. A.). Fixed and prepared slides were kept for one night. Then the sections were stained with hematoxylin and eosin and were then mounted for later examination under compound microscope.

Results and Discussion

During experimental period noticeable histological changes in the liver, kidney tissues and ovary of treated fish were observed. For comparison of treated specimens with untreated control fish, sections of liver, kidney and ovary are shown in Plates 1 to 6 respectively.

Liver: In case of controlled fish, normal structure and systematic arrangement of hepatocytes were observed. But in sumithion (@ 100ppm) treated fishes rupture of blood vessel, pyknosis, mild necrosis and vacuolation was observed (Plate 1,2). Release of blood cells causing hemorrhage was also found. Appearance of vacuoles in the hepatocytes of fish exposed to chemical pollutants including pesticides have already been described by several authors (Matton and LaHam, 1969; Smith and Piper, 1975; Kabir and Begum, 1978). Matton and LaHam (1969) considered this effect to be the result of tissue hypoxia. Vacuolation or hydropic degeneration in hepatocytes in *Anabas testudineus* was commonly found with Furadan and Padan treatments. Progressive necrosis and swellings in the hepatic tissue of Rudd resulting from Diuron and Atrazine treatments (Martino, 1973) were comparable with Furadan and Basudin-treated *Anabas testudineus*. Smith & Piper (1975) also found pyknotic hepatocyte centrolobular degeneration and scattered necrotic cells in this study in trout by chronic exposure to

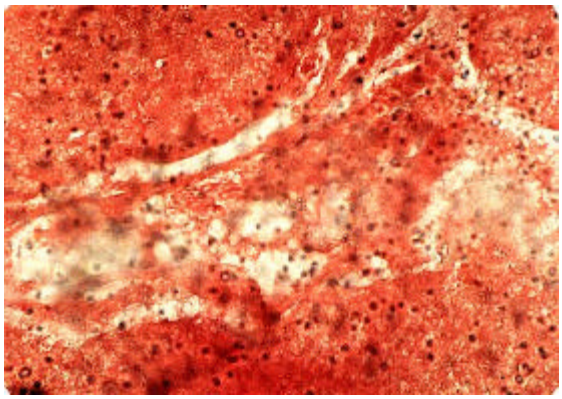

Plate 1: Photomicrograph of the cross section of the liver of *Channa punctatus* from control treatment (X 50)

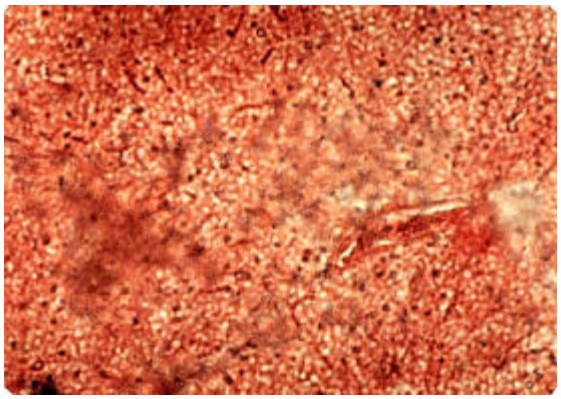

Plate 2: Photomicrograph of the cross section of the liver of *C. punctatus* after exposed to sumithion for 7 days (X 50)

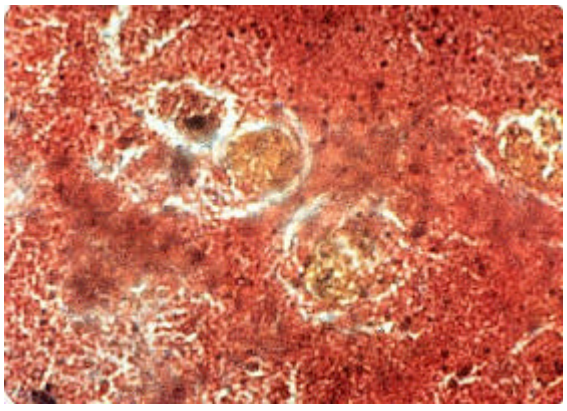

Plate 3: Photomicrograph of the cross section of the kidney of *C. punctatus* from control treatment (X 50)

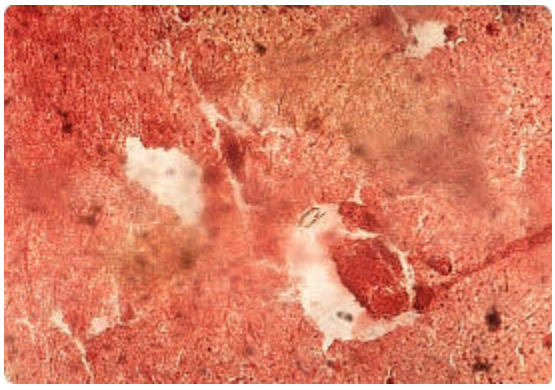

Plate 4: Photomicrograph of the cross section of the kidney of *C. punctatus* after exposed to sumithion for 7 days (X 50)

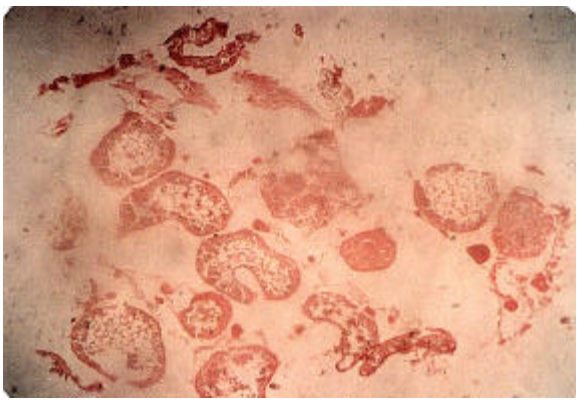

Plate 5: Photomicrograph of the cross section of the ovary of *C. punctatus* from control treatment (X 50)

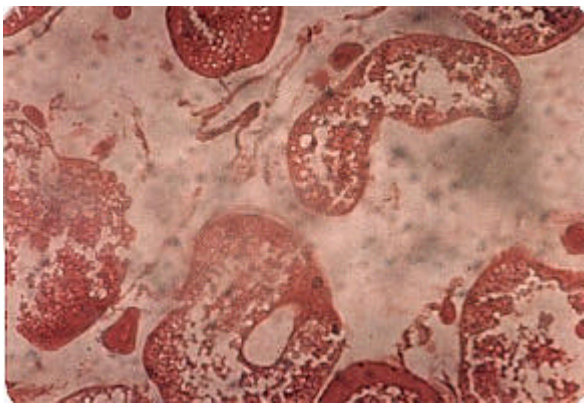

Plate 6: Photomicrograph of the cross section of the ovary of *C. punctatus* after exposed to sumithion for 7 days (X 50).

ammonia. Andrews *et al*. (1966) reported degenerative liver lesions in blue gills from heptachlor. Occasional vacuolation of the liver cells in dylox treated rainbow trout larvae was considered to be the result of tissue hypoxia (Matton and LaHam, 1969). Hepatic lesions have also been reported in *F. heteroclitus* (Decalventi and Nigrelli, 1961) and in *Pseudopleuronectes americanus* (Baker, 1969) following the copper exposure. Sastry and Sharma (1979) exposed *Channa*

punctatus to a sub-lethal concentration (0.01mg/l) of endrin and observed hypertrophy of hepatic cells and their nuclei, liver cord disarray vacuolation of cytoplasm and necrosis.

Kidney: Normal structure of kidney cells were observed in case of controlled fish. But @ 100ppm of sumithion several alterations such as vacuolation, degeneration of kidney tubules and hematopoietic cells, necrosis, pyknosis and hemorrhage were recorded (Plate 3,4). The results are similar to those reported by Rand and Petrocelli (1985) where coho Salmon was exposed to 100ppm Amitrole (herbicide) for 144 hours. Konar (1975) reported degenerated kidney tubules in carp (*Labeo rohita*) and catfish (*Heteropneustes fossilis*), when exposed to 200ppm and 210ppm of phosphamidon (dimecron) for 168 hours. Dhanapakiam and Premlatha (1994) observed hypertrophy of renal cells, changes in the nucleus structure, formation of vacuoles, necrosis and degeneration of renal components in case of *Cyprinus carpio* fingerlings on the effect of LC_{50} (90 hours) concentration of malathion and sevin (after exposure of 15 days). The kidney damage was severe with malathion treatment than sevin. Renal histology of fish affected by chemicals such as cadmium, copper, zinc, salt of metals and other pollutants were recorded by a number of workers (Eisler *et al.,* 1972; Eisler and Gardner, 1973).

Ovary: At the dose of 100ppm of sumithion, fragmented ova with abnormal shape and arrangement were observed in the experimental fish while normal arrangement of ova was found in case of controlled fish (Plat 5,6). Sivarajah *et al.* (1978) reported fragmentation and karyolysis of ova when *Salmo gairdneri* and *Cyprinus carpio* were exposed to aroclor 1254. Jha and Jha (1994) reported the impact of 30-days exposure to sub-lethal concentration of urea (416 ppm) and ammonium sulphate (448ppm) on the ovary of *H. fossilis.* Urea induced initial stimulation of vitellogenesis followed by subsequent arrest of ovarian growth. Besides, the cells of germinal epithelium developed by perplasia lead to the completed fusion of the two follicles. Contrary to urea, ammonium sulphate produced severe adverse effects as evident from large number of early non-vitellogenic oocytes and traces of reovulatory degenerated oocytes. The extent of ovarian damage was such that there was complete breakage and dissolution of ovigerous lamellae. Though the present investigation period was only for 7days the complete breakage and dissolution of ovigerous lamellae were also observed.

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