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ORIGINAL ARTICLE

Comparative Studies on Histological Alterations in Liver and Kidney of *Channa punctatus* (Bloch) under Stress of Folidol

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ABSTRACT

Pesticide is physical, chemical or biological agent that will kill an undesirable plant or animal pest, the term 'pest' includes harmful, destructive or troublesome animals, plants or microorganisms. They have been widely used all over the world. Agrochemical, especially organophosphorous compounds, chlorinated hydrocarbons are routinely employed as part of the integrated forming practice to protect crops and animals from insects, weeds and diseases. Widespread use of pesticide in agriculture is now a world wide phenomenon. Many of the pesticides currently in use are biocides that have high mammalian toxicity and necessitate considerable precautions in their application. Several workers investigated in the toxicity of organophosphate pesticides in fish. The concentration of pesticides is increasing day by day in the aquatic ecosystem. This concentration is at to limits there is bioconcentration and bioaccumulation of these pesticides in the tissues and organ of fish which has harmful effect on human being when consumed by them. The effect of Folidol at 40ppm sub-lethal doses was investigated on histopathology of liver and kidney in full grown specimen of Channa punctatus (Bloch.). Significant alterations were observed in liver and kidney sections of treated fishes as compared to control group. These changes may be due to damage caused to the hepatic tissue.

Key words: *Histological Alterations, Liver, Kidney, Channa punctatus, Folidol*

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INTRODUCTION

The concentration of pesticides is increasing day by day in the aquatic ecosystem. These concentration is at to livable limits there is bioconcentration and bioaccumulation of these pesticides in the tissues and organ of fish which has harmful effect on human being when consumed by them. The effect of Folidol at 20ppm sub-lethal doses was investigated on histopathology of liver in full grown specimen of *Channa punctatus* (Bloch.). Significant alterations were observed in liver sections of treated fishes as compared to control group. These changes may be due to damage caused to the hepatic tissue. Water is a fundamental part of life. Human survival is dependent on water. Water is essential for all activities such as domestic, industry, agriculture and power sector. Water covers three-fourths of earth's surface and constitutes 60-75% of the living world. Infact only 1% of the world's water is usable to us, about 97% is salty sea water and it is frozen in glaciers and polar ice caps. Thus, the world's water supply, is a precious commodity. Due to development and industrial growth there is heavy water pollution. The sources of water pollution are domestic wastes, industrial effluents, plankton blooms, radio activity, heavy metals like

mercury and excessive use of fertilizers and pesticides etc. Human beings are the worst victims of water pollution. It is noticed that two-third of the illness in India is related to water pollution. Illnesses such as typhoid, jaundice, cholora, dysentery etc, are caused, mainly due to contaminated drinking water. With this background, an attempt is made for sustainable environmental safeguard measures for the water pollution problems.

Pesticide is physical, chemical or biological agent that will kill an undesirable plant or animal pest, the term 'pest' includes harmful, destructive or troublesome animals, plants or microorganisms. They have been widely used all over the world. Agrochemical, especially organophosphorous compounds, chlorinated hydrocarbons are routinely employed as part of the integrated forming practice to protect crops and animals from insects, weeds and diseases. Widespread use of pesticide in agriculture is now a world wide phenomenon. Many of the pesticides currently in use are biocides that have high mammalian toxicity and necessitate considerable precautions in their application. Several workers investigated in the toxicity of organophosphate pesticides in fish Insecticides are widely used in house and field to eradicate pests and protect stored grains. Insecticides reach to the aquatic ecosystem and application like aerial spraying, washing from the atmosphere by precipitation, erosion of land and discharge of effluent from the factories. They pollute the air through volatilization, some can evaporate along with water drops and some are carried into air over dust particles. The return of these insecticides to the earth is mainly through rain and to a lesser extent through falling dust. The insecticides pollute the aquatic ecosystem as they are carried by rain water. Here they pass into food chain and finally came to man.

Every year the Government's Pesticide Residues Committee tests a small proportion of the food sold in our shops for pesticide residues. Since 2004 around 100 different types of pesticide residue have been found in the various fruits and vegetables tested. 20 percent of fruit and vegetable sold in supermarkets contain more than one type of pesticide residue. The fishes are the most sensitive of all aquatic animals. Such pollutant are most sensitive, area of the fish body is gills, from which these insecticides get enter into the circulatory system, therefore it is necessary to know the toxicity of insecticide with references to biochemical aspects the toxicity of different insecticides varies in different aquatic organisms. Folidol is an organophosphorous systemic insecticide and acaricide applied to a variety of field, crops, fruit, nut trees and vegetable to control and broad range of insect and mites. It is formulated in emulsifiable concentration. It is moderately persistant insecticides with residual effects of vertebrates and invertebrates.

MATERIALS AND METHODS

Full grown specimen of *Channa punctatus* (Bloch.) also known as snake hood fish, measuring 12-15 cm in length and 29-65 gm in weight, were selected for the experiments. They were acclimatized at the room temperature in glass aquaria (75 cm X 37.5 cm X 37.5 cm) containing 25 liters non-chlorinated tap water to assess the effect of Folidol the fish, *Channa punctatus* (Bloch.). The LC_{50} value has been calculated as by log dose/probit regression line method (Finney, 1971).

Liver and kidney tissue was fixed in the Bouin's fluid. After washing and dehydration, the tissue was embedded in paraffin wax. The sections were cut at 5 micron and stained with haemotoxylin and eosin (Humason, 1979). Sections were examined under trinocular research microscope and photomicrographs were taken at 400X.

RESULTS AND DISCUSSION

The photomicrograph of the liver (Plate- 1 Control) shows the hepatocyte cells (H), Parenchyma cells (PC) arranged to form a lattice network. The interspaces are the sinusoids (S) of thin strip with sparse connective tissue (CT). The sinusoids make continuous communication as they are seen converging into the portal vain (PV). The Kupffer cells (KC) are attached to the walls of the sinusoids and shows the hepatic acini (Ha), the hepatocytes cells and other cells of liver in control group were normal and

systematically arranged. In 15days 20ppm treated set vacuolation in hepatic cells and hypertrophy in hepatocyte cells, repture of blood vessel causing haemorrhage were observed in the test fish *Channa punctatus* (Plate- 2). The photomicrograph of kidney section shows Uniferus tubule (UT), Collecting tubule (CT), Renal corpuscle (RC), Collecting duct (CD), Proximal segment (PS), Tubular lumen (TL), Glomerrulus (G), Blood vessels (Bv), Renal vein (Rv), Portion of basement membrane (BM) are also normal and systematically arranged (Plate-3), while 15days 20ppm treated section (T.S.) of the kidney of a showing vacuolization and hypertrophy in the epithelial cells of renal tubules (Plate-4).

Considerable interest has been shown in recent year in histopathological study while conducting sub-lethal test in fish. Tissue changed in test organism exposed to a sub-lethal concentration of toxicant, a functional response of organisms which provide information on the nature of the toxicant. Histopathological changes associated with pesticides in fish have been studied by many authors Narayan and Singh (1991); Mercy *et al*. (2004). The liver is the primary organ for detoxification of organic Xenobiotics. Wide varieties of insecticides and other toxicants by products tend to accumulate in high concentration within it. Metelev *et al*. (1971) and the organ suffer harmful effects. Hinsen *et al*. (1971) studied fish exposed to pesticides under laboratory conditions and observed that the liver contained highest pesticides concentration. King (1962) found many vacuoles in hepatic cells in brown trout fry and adult guppies exposed to 0.0032 to 3.2 ppm DDT. According to resorption of fatty yolks by the young trout. It appears to be a general feature of the liver of intoxicated fish that the degree of structural heterogencity, is enhanced with increasing concentrations of the toxicant. Narayan and Singh (1991) observed extensive degeneration of cytoplasm with pyknosis of nuclei, loss of glycogen in Hypertrophy of hepatocytes, minor vacuolation and haemorrhage in liver tissue of *Heteropneustes fossilis*, while subjecting them to acute thiodan toxicity. Similarly changes were recorded in our present study, with Folidol at different concentration.

Histopathological changes in the liver and kidney of *Tilapia massambica* after exposure to the organophosphate monocrotophos were reported by Desai *et al*. (1984) at the initial stage of intoxication, necrosis, Vacuolization of hepatocytes cells and coagulation of hepatocytes cells were recorded, while fatty degeneration was observed, lateron. Treatment with the endrin produced acute pathological changes in the liver and kidney of *C. punctatus* (Bloch.) by Sastry and Sharma, (1979). Elezabi *et al*. (2002) studied the effect of malathion on the fish *Oreochromis nilotica* and their result showed that this insecticide induced many histopathological changes in liver, kidney and gills of the fishes. These changes were Hypertrophy of hepatocytes, pyknosis cells resulting in empty space, coagulation of hepatocytes cells and haemorrhage, necrosis, lipidosis in the liver. Similarly changes were recorded in our present study, with folidol after exposure period.

Saker *et al*. (2001) studied the effect of the organophosphorus insecticide (Hastathion) on the liver and kidney of the cat fish *Clarias gariepinus*. Their result showed that this insecticides produced histopathological changes in the liver represented by disarry Cord, Cytoplasmic vacuolization of the hepatocytes, hypertrophy in hepatocyte cells and rupture of blood vessel causing hemorrhage and inflammatory leucocytic infilterations. Shastry and Sharma (1979) exposed *C. punctatus* (Bloch.) to a sub-lethal concentration (10.01) mg/l) of Endrin and observed hypertrophy of hepatic cell and liver disarrycord, vacuolization of cytoplasm and necrosis, rupture of hepatic cell membrane and necrosis centralobular area in kidney also.

Angelo *et al*. (2005) observed liver narrow zone, necrosis and hepatocyte reduction of glycogen on *Leuciscus cephlus* and brown trout *Salmo trutta* Fario in evaluating river environment. The folidol concentration of 20 ppm were recorded at different days mild pyknosis, necrosis heptocytes cell, hypertrophy, cytoplasmic vacuolization, reduction of glycogen, fatty infiltration, heptocyte reduction of glycogen hypertrophy and severe necrosis were also recorded for the *C. punctatus* species, while at the highest dose of

folidol, (20ppm), severe fatty degenerative changes of heptocytes and in some samples, severe degenerative changes of heptocytes like necrosis, vacuolization, rupture of blood vessel causing haemorrhage were observed in the fish *C. punctatus* (Bloch.).

Plate 1: Section (T.S.) of the liver of a control fish (S), Sinusoidal lumen, Hepatocytes cells (H), Parenchyma cell (PC), Connective tissue (CT), Portal vein (PV), Hepatic aeini (HA), Kupffer cell (KC) where normal and systematically arranged. [400X]

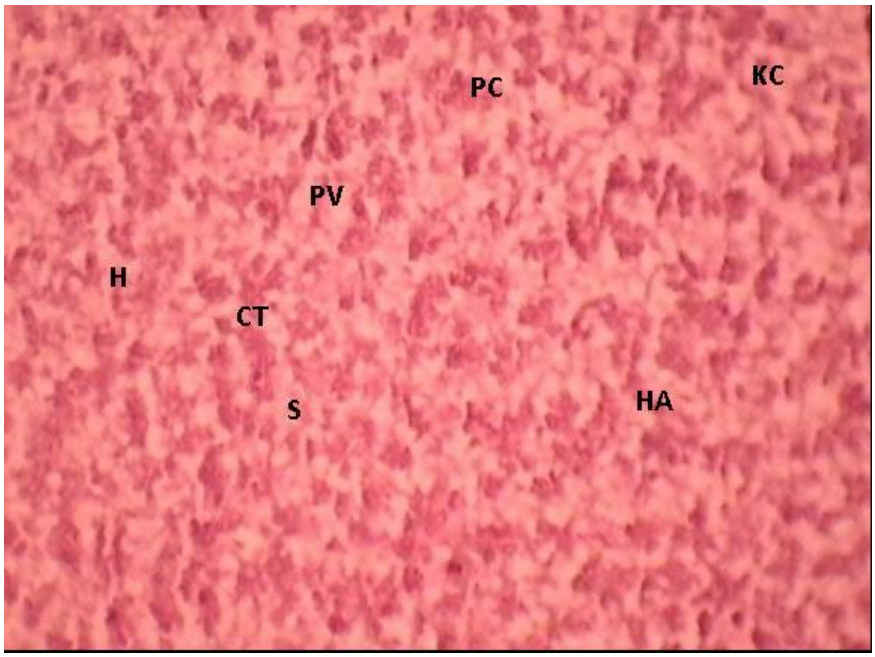

Plate 1: Control liver section

Plate 2: Section (T.S.) of the liver of a treated fish showing severe degenerative changes of hepatocyte like haemorrhage, cytoplasmic vacuolization and hypertrophy of hepatic cells. [400X]

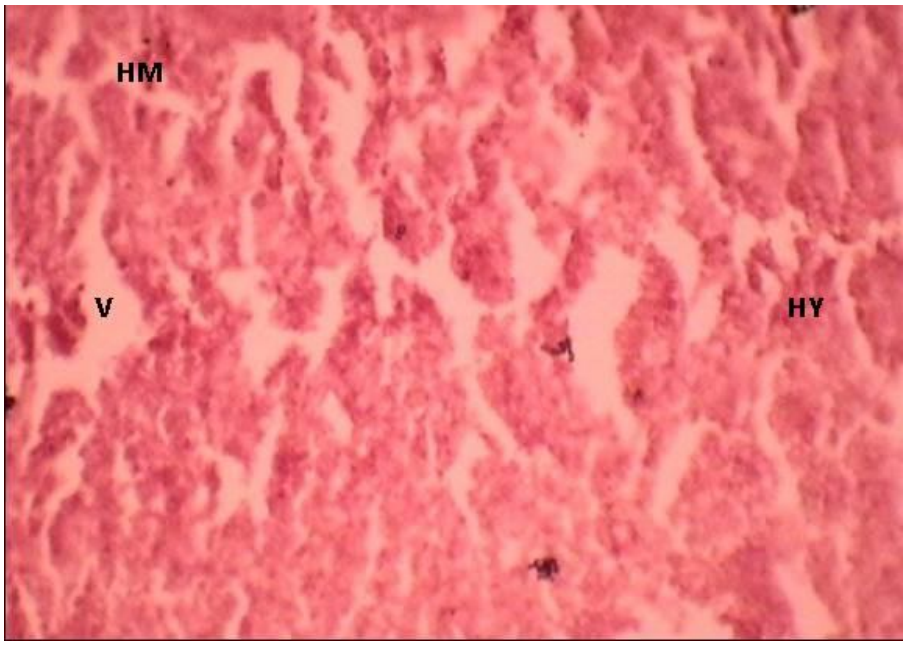

Plate 2: 20ppm treated liver section

Plate 3: Section (T.S.) of the kidney of a control fish, showing Uniferus tubule (UT), Collecting tubule (CT), Renal corpuscle (RC), Collecting duct (CD), Proximal segment (PS), Tubular lumen (TL), Glomerrulus (G), Blood vessels (Bv), Renal vein (Rv), Portion of basement membrane (BM) are also normal and systematically arranged [400X]

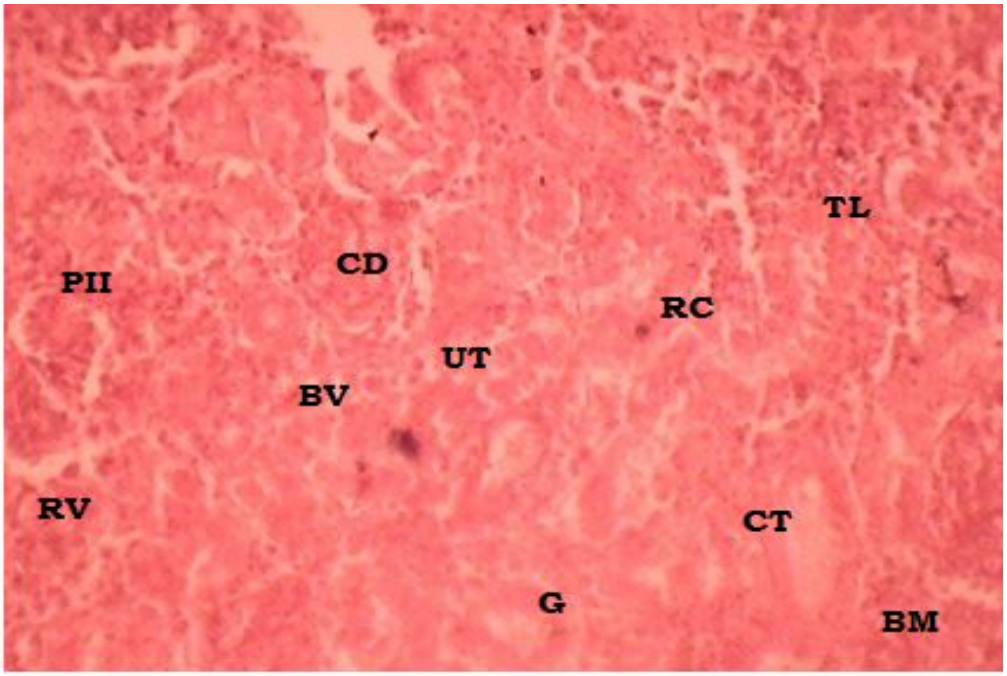

Plate 3: Control kidney section

Plate 4: Section (T.S.) of the kidney of a treated fish showing vacuolization and hypertrophy in the epithelial cells of renal tubules [400X]

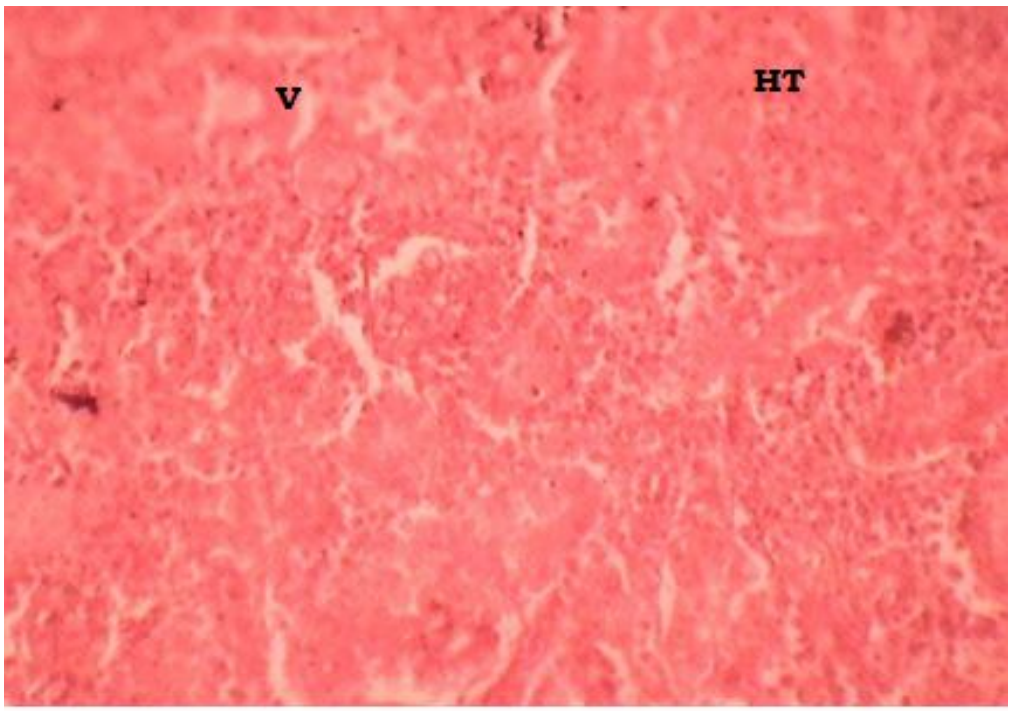

Plate 4: 20ppm treated kidney section

Kabir and Begum (1978) reported cytoplasmic degenerative, pyknotic in liver tissue, vacuolation in hepatic cells and rupture of blood vessels, hypertrophy in hepatocyte cells, cytoplasmic vacuolization, cirrhosis and necrosis of biliary epithelium. Omitoyin *et al*. (2006) exposed to acute toxicity of Lindane to African cat fish *Clarias gariepinus* to a sub-lethal concentration (1.8and 0.8mg/L) respectively, fish showed uncoordinated behaviour such as incessant gulping of air and increase in opercular ventilation with increasing period exposure to lindane and observed diffuse fatty degenerative hepatocytes, necrosis and degenerative change of liver were the major histopathological effects. Similarly changes were recorded in our present study, with folidol at various concentrations.

Sanker and Jamal (2005) and the hazardous effect of the pyrethroid insecticides fenvalerate on the histopathology and histochemistry on the liver and kidney of the cat fish *Clarias gariepinus* after exposure 1/10 LC_{50} for 5 and 15 days was investigated. The result showed that the histopathological changes induced in the liver were mainly represented by cytoplasmic vacuolization of the hepatocytes, blood vessel congestion in laminatory leucocytic infiltration, necrosis and fatty infiltration. The histochemistry observation revealed market reduction in glycogen contents and total protein contents of the liver cells. Das and Mukharjee (2000) studied a histopathology of carp *Labeo rohita* were exposed to 1/10 and 1/5 sub-lethal doses of hexachlorocyclohexane during a 45 days trial period, to study under light microscopic changes associate with toxicity were observed. Organ tissue liver, kidney, gills, skin, muscle, heart and brain were examined for histopathological study and observed swelling of the hepatocytes with diffuse necrosis and marked swelling of blood vessels, hypertrophy of hepatocytes in the liver cells. Tubules of the kidney were distended, with tubular cells of posterior kidney exhibiting marked necrotic changes. Gill tissue showed fusion of primary lamellae, congestion of blood vessels and hyperplasia of branchial plates. Pericardial sac was moderately thickened and extensively infiltrated with leucocytes. Neuronal cell degeneration with loss of Nissl's substances and microgial nodules could be observed at the cerebrum. Similar observation in liver by histopathologically was found with folidol sub-lethal concentration for different days.

Joshi and Bose (2002) who reported that lindane creates haematological disturbances and causes metabolic disorders to fish which may ultimately lead to the deterioration of general health of fishes. Thus the use of lindane should be properly and strictly controlled and regulated by appropriate legislation in order to prevent its bioaccumulation in the environment and imminent disastrous consequences on the aquatic ecosystem. Dixon and Ledue (1981) studied the chronic cyanide poisoning of rainbow trout and its effects on growth, respiration and liver histopathology. Juvenile rainbow trout *Salmo gairdneri* exposed to concentration of 0.01, 0.02, or 0.03 mg/l hydrogen cyanide for 18 days showed widespread degenerative necrosis of hepatocytes at all concentration tested, while hepatic damage to be severe and diffuse to result in liver failure due to the large hepatic reserve (Ruben and Rousseaux, 1991). Liver toxicity doses, however, result in altered fat metabolism, and digestion, thereby resulting in generalized stress of the fish (Klaassen, 1996).

Anees (1976) studied, intestinal pathology in a fresh water teleost, *C. punctatus* (Bloch.) exposed to sub-lethal and chronic levels of two organophosphorous insecticides (dimethoate and diazinon) observed in histopathological changes in liver and kidney were recorded, hepatotoxic lesion of fatty infiltration, nuclear or general hypertrophy of hepatocytes, and other degenerative changes in parenchyma, loss of hepatocyte cell, coagulative hepatocytes necrosis, haemorrhage and necrosis of biliary epithelium. Similarly observations in liver histopathology were found with folidol for different days. Similar observations was noticed by several workers like Crandall and Goodnight (1963); Matton and Lattam (1969); Walsh and Ribelin (1975); Wood (1976) and Hendrieles (1979).

REFERENCES

1. Anees M.A. (1976): Acute toxicity of 4-organophosphorus insecticides to a freshwater teleost, *Channa punctatus* (Bloch.). Pak. J. Zool., 7: 135-141.
2. Angelo A.D. and Berti M. (2005): Use of histopathology indicators on chubs *Leuciscus cephalus* and brown trout *Salmo trutta* fario in evaluating river environments. Vet. Italiana., 41(3): 189-198.
3. Ashley L.M. (1975): Comparative fish histology. The Pathology of Fishes. W.E. Ribelin and G. Migaki (eds.). University of Wisconsin Press; Madison, Wisconsin. pp. 3-32.
4. Bhattacharya M.C. (1987): Glucose and hepatic glycogen interrelationship in *Channa punctatus* (Bloch.). A parameter of non lethal toxicity bioassay with industrial pollutants. Indian J. Exp. Biol., 25: 539-541.
5. Crandall C.A. and Goodnight C.J. (1963): The effects of sub-lethal concentrations of several toxicants to the common guppy *Lebistes reticulatus*. Trans. Am. Microsc. Soc., 83: 59-73.
6. Das B.K. and Mukherjee S.C. (2002): A histopathology study of *Labeo rohita* carp exposed to hexa-chloro-cyclohexane. Vet. Archiv., 70 (4): 169-180.
7. Desai H.S. (2002): Toxicological effect on some biochemical parameter of fresh water fish *Channa punctatus* under the stress of nickel. J. Environ. Biol., 23(3): 275-277.
8. Dixon D.G. and Ledue G. (1981): Chronic cyanide poisoning of rainbow trout, *Salmo gairdneri* and its effects on growth, respiration and liver histopathology. Arch. Environ. Contam. Toxicol., 10: 117-131.
9. Eller E.E. (1971): Histological lesions in *Salmo clark* exposed chronically to insecticide endrin. Am. J. Pathol., 64: 321-336.
10. Finney D.J. (1971): Probit analysis Cambridge University Press, London, pp. 333.
11. Gupta, A.K. and V.K. Rajbanshi. (1988). Acute toxicity of cadmium to *Channa punctatus*. Acta. Hydrochim. Hydrobiol., 16(5): 525-535.
12. Hinsen D.J., Parrish P.R. and Wilson P.D. (1971): Chronic toxicity uptake and retention of aroclor 1254 in two estuarine fish. Bull. Environ. Contam. Toxicol., 6: 113.
13. Humason G.L. (1979): Animal Tissue Techniques (4th edition). W.H. Freeman and Company, San Francisco. 661 pp.
14. Joshi P., Harish D. and Bose M. (2002): Effect of lindane and malathion exposure to certain blood parameters in a fresh water teleost fish *Clarias batrachus*. Poll. Res., 21: 55-57.
15. Kabeer A.I., Begum R., Siviah S. and Ramana Rao K.V. (1978): Effect of malathion on free amino acids, total protein, glycogen and some enzymes of pelecyped, *Lamellidenns marginalis*. Proc. Ind. Acad. Sci., 87: 377-380.
16. King S.F. (1962): Effects of DDT on the guppy and the brown trout. U.S. Fish Wildlife Serve. Spec. Sci. Res. Fish, 20: 399.
17. Narayan A.S. and Singh B.B. (1991): Histopathological lesions in *Heteropneustes fossilis* subject to acute thiodon toxicity. Acta Hydrochem. Hydrobiol., 19: 235-243.
18. Omitoyim B.O. and Okuagu C.N.F. (2006): Toxicity of lindane to *Clarias batrachus*. International Digital Organization for Scientific Information, 1(1): 57-63.
19. Ruben Z. and Rousseaus C.G. (1991): The limitations of toxicologic pathology. In: Handbook of Toxicologic Pathology. W.M. Haschek and C.G. Rousseaus (eds.). Academic Press, San Diego, pp 131-142.
20. Sanker S.A. and Jamel S.M. (2005): Fenvalerate induced histopathological and histochemical changes in the liver of the cat fish *Clarias batrachus*. J. Appl. Sci. Res., 1(3): 263-267.
21. Sastry K.V. and Gupta P.K. (1978): Effect of mercuric chloride on the digestive system of *Channa punctatus*. A histopathological study. Environ. Res., 16: 270-278.
22. Sastry K.V. and Sharma K. (1979): Effect of mercuric chloride on the activities of brain enzymes in a fresh water teleost *Ophiocephalus punctatus* (Bloch.). Arch. Environ. Contam. Toxicol., 9: 425-30.
23. Sorensen E.M.B., Harlan C.W. and Bell J.S. (1982): Renal changes in selenium exposed fish. Am. J. Forensic Med. Pathol., 3: 123-129.
24. Stehr C.M. and Myers M.S. (1990): The ultrastructure and histology of cholangiocellular carcinomas in English Sole from Puget pound, Washington, D.C. Toxicol. Pathol., 18(3): 362-372.