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Effect of sublethal concentration of lindane on fish behaviours and histopathological response of the fish liver in *Heteropneustes fossilis*

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Abstract
The experimental fish under the exposure of lindane noticed the surface behaviour restlessness, loss of co-ordination laboured breathing increase mucous secretion and ultimately twisting start swimming with head down position the long exposure the histological alternation of gill revealed that specially the pella ster cell shrunken observation of liver enlarge nucleus cytoplasmic concentration was much distinct and might local forget of necrosis fission of cell might due to carcinogenic formation of neoplastic tissues pesticides passed in the cells by crossing. The cell membranes were interferes the enzyme system in the cells and changed their vital activities of physiological and morphological functions.

Keywords: Fishes, lindane, liver, behavioural responses, morphological functions

Introduction

Pesticide are widely used in modern agriculture with approximately 4.15 million tonnes used per year in a global basis FAO, (2021) [2]. Pesticide Pollution of natural water resources has become more frequent with more extensive used chloride insecticides, in particular are stable compound that persist in the environment and therefore, have been increasingly noticed for agents as chronic exposure in aquatic species Verma *et al.* (1975) [16]. Kungolos *et al.*, (1999) [6], Aquatic organisms fort accumulated and store Lindane, Level of Pesticides in the major River system. Fish are very supertitle to bioaccumulation in their fatty tissues as they tape up lindane residues from the water through the gills and skin Gupta *et al.*, (2018) [3], Ortiz *et al.*, (2002) [8]. Estimation of median lethal concentration or dosage (LC_{50} or LD50) is important as it can be used as an indicator to the Kakade *et al.*, (2020). $C_6H_6CL_6$ Lindane discovered four Isomers of the alpha, beta gamma and delta in (1912). The British group isolated the Toxic gamma Isomers from the chemically product and named it as Lindane in honor of Van der Lindane, Molor Mass: 290.83g/mol, Boiling Point > 3230°C.

Lacerda *et al.*, (2020) [7] many published paper indicated highly mortality of Junvenile fish pradhan and Hota (1993) [11] H. *Fossilis* is a carnivorous fish in order cypriniformes. The accessory respiratory organs for which is quite hard and is usually found in muddy water. It also grow in the estuarine water Srivastava (1968) the present work carried out the behaviour and histopathological liver changed in H. *fossilis* due to the exposed of sublethal dose of Lindane because fish is an Omega-3 fatty and acid protein and various minerals that the men needs to stay meal this. However potentially dangerous pesticides are observed into the body tissue of fish that are transferred to human beings when the take of fish in their diet, fish have great economically values including direct or indirect pathway of toxicant.

The present histopathological study intends to find out responses of liver (endo as exocrine gland) system to their behavioural system to lindane and the species used as model is Heteropnestes *fossilis.*

Materials and Methods

Living specimens of H. *fossilis* were procured from Kanpur local fish market and acclimatized to the laboratory conditions before experimentations.

The animal fed only boiled egg albumin and kept in well aerated glass and bathed in 1% of $KMNO_4$ Solutions the size of glass Aquaria was 75x75x18 cm that contained in the laboratory at the water ambient temperature 26±20°C, at winter session value of water PH≅7.1 both group of male and female fishes were selected for the experiment evolving exposed to the Lindane by dissolving 1gm of Pesticide salt in the 1 liter of distilled water so that obtained a solution of 1 mg/cc and solution was added to aquarium containing 10 litres of water and exposed of intended at the rate of 10 ppm 10 ml of stock solution to desired pesticide to its so that dilution of 10 mg/ liters of (LC_{50}) value to find out prima faces changes in beahviour and in the histology of liver one group were control fish and another groups are exposure under the Lindane toxicant at various sub lethal concentration of dose of lindane.

After the complete process of exposure time, fish were randomly selects for behaviour changes and histology of liver. Remove the liver gland both control and experimental fishes physiological saline solution was used to washed the tissues they were kept under Bouin's solution for 48 hrs. Cut at 4-7 mm thickness. The paraffin section of liver was stained with Harish Haemotoxyline eosin, OF-G Drury and wellington (1987).

Table 1: Physiochemical characteristics of water temperature

Parameter	Value/Range
Temperature	± 2°C
pH of Water	7 to ± 7.1
Dissolved Oxygen	7 to ± 7.4 mg/L
Hardness of Water	208 to 211 mg/L
Chloride Content in Water	36 to 39 mg/L

Table 2: Fish operator movement in per minutes

Parameter	Control Fish	Exposure Fish
Fish Surfacing Behaviour (per 5 min)	± 89 times	± 34 times
Fish Surfacing Behaviour (per 1 hr)	Not specified	8 times

Behavioural Changes

The Behavioural responses of the fish exposed to lindane were extensively influenced by the expected toxicity and hence they showed several changes in their behaviour those fishes exhibited restlessness, erratic and darting swimming movements loss of equilibrium, drawing hitting against the wall of Aquaria to avoid the chemical may be related to change in neuro receptors. Hyper excitability and laboured breathing were some of most expressed feature. Mucous secretion from the skin was noticeably increased features of under the exposure. Quite some earlier to then death of the specimens began twisting and spinning their body changing their normal posture of swimming and it come to be shurken down so as the tall kept projected to the surface and thus head side down position could be taken as a sign of loss of balancing functions of central nervous system such changes had been quite common in teleosts exposed to be organo chlorine pesticide as observed in several of the pesticides in this field Holder, (1964), Behaviours changes have been indicator.

Results and Discussion

Exposure of the fish *Heteropneustes fossilis* to the sublethal concentration of Lindane result into mild to few alternations in the histological tissue of the liver and result are presented in the form of photographs.

Fig 1: TS of control fish Liver (100x)

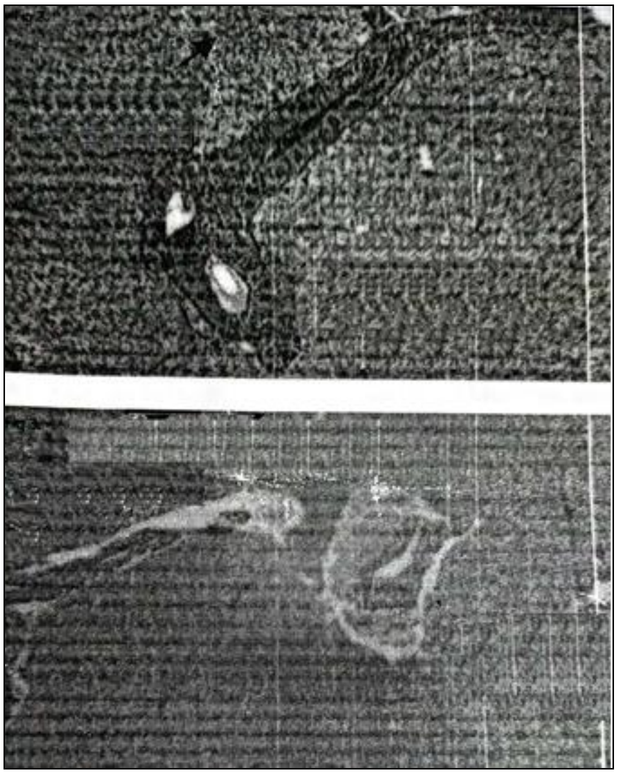

Fig 2: T.S of liver of exposure fish *H. Fossilis* (100X) changes of degeneration tissues of cellular, nuclear structure and hepatocytes cells

The T-S of control fish liver continuous mass of hepatic parenchyma cells arranged in cords around the blood vessel the cells are polygonal in shape with rounded Nucleus and homogenous cytoplasm pancreatic acine of exocrine in the embedded of Capillaries blood vessels. The hepatic cells are said to be hexagonal in shape are compact in their arrangement the ancillary ductile tubules and blood vessels prominent and distinctly formed. But an exposure of Lindane has brought out a number of histologic deviation from the a ford said picture the blood capillaries showed an other criteria of abnormalities the large blood vessels were badly gorged with blood while smaller capillaries showed pressure of but a few R.B.Cs. Thus the capillaries represent a phase that indicate. The lowering of blood pressure while a vessel indicate a rise thereof these are contradictory. Finding these ancillary ducts and bile tubules have lost their normal identify due to massive contraction of general tissue the hepatic cells are enclosed large prominent bile duct stained of nucleus same cellular masses were unstained cytoplasmic part shrinkage of neighbouring cell.

There seem to be noticed correlation between tissue damaged and certain physiological alternation Bainy *et al.*, (1996) [19], B. Ryan, (2004) [20], Saxena *et al.*, (2008) [15], Rama *et al.* (2015) [10].

It is not a surprise that the cells are multi cellular organism might have died irascibly infected in content with the toxicants of pesticides.

The liver play role in accumulation and detoxification of metals, Oxygen requires to support the intense metabolic activity of the liver is supplied in arterial blood via the hepatic artery in effect necrosis of parenchyma cells had taken place, Md. Fazle Rohani (2023) [18].

Conclusion

The toxicity of pesticides found in domestic waste or agricultural run-off many have an adverse effect not only on the body organs which come to direct conduct with the toxic external medium i.e. is skin gill but also in vital organ these pesticides toxicity seemed to get enters in the cells by the cell membranes where they might reached with enzymes and physiological and morphological damaged. Osman *et al.* (2009) [9]. The study suggests to Lindane is toxic to aquatic environment one gene one enzyme Doull (1980) has given brief and coordination discussed on taxonomic aspects of species variation relating to toxicological responses of various animals.

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