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Study on the effect of lindane on some hematological parameters of Indian fresh water cat fish, *Clarias batrachus* (L.)

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Abstract

The acute toxicity of an organochloride pesticide is characterized by their persistence and ability to accumulate in aquatic organisms. Present work tries to investigate the toxicity of an organochlorine, lindane on some hematological parameters in the blood plasma of *Clarias batrachus.*

Keywords : *Clarias batrachus,* lindane (hexachlorocyclohexane), RBC, WBC, Hb.

1. Introduction

Since a major part of world's food is being supplied from fish source, so it is essential to secure the health of fishes for sustainable food source in terms of protein (Tripathy and Harsh, 2002). In India 70% of chemical formulation employed in agricultural practices are believed to effect the non target organisms and to find their way to fresh water fish and ultimately polluting them (Bhatnagar and Bana, 1992).

Modern agricultural practices result in indiscriminate use of various agrochemicals which usually enter in to the aquatic environment. These agrochemicals affect the non target organisms, specially plankton and fish (Omitoyin *et al.,* 2006). In vivo study of lihocin activity on Channa sp. results on lowering of total serum protein (Naveed *et al.,* 2010). Present study reveals the toxicity of lindane (gamma-hexachlorocyclohexane, Y-HCH) an agro based insecticide which is used as an agricultural insecticide and as pharmaceutical treatment for lice and scabies. Lindane is considered as persistent organic pollutant (POP) because of its ability to resist degradation and to remain in the environment for years.

Since blood parameters are considered as pathophysiological indicators of the whole body and diagnostic tool for the structural and functional status of fish exposed to toxicants (Adhikari *et al.,* 2004). The present study investigates the impact of sub lethal concentration of lindane on hematological changes on Indian fresh water cat fish, *Clarias batrachus.*

2. Materials and Method

Healthy fresh water cat fish, *C. batrachus* with 15-25 cm in length and 80-120 gms in body wt. were collected locally from Ambagan of Nagaon district and acclimatized to lab condition for 7 days in plastic tubs (tarsons), previously washed with KMnO4 to free walls from any microbial growth. Physicochemical properties of water was followed after APHA (1989) method (temp. 27±1^{0}C, pH 6.8±0.05 at 27 C and DO 6.9-7.4 mg /L). The tub water was aerated continuously and food was provided in the form of chopped small fish, chopped chicken intestine *ad libitum* as in the controlled (Arockiaraj *et al.,* 2004).

Stock solution of lindane was prepared by dissolving analytical grade of lindane (Himedia) in double distilled water. Acute toxicity of lindane to

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C. batrachus was determined using a standard static renewal technique (APHA, 1989).

After determining the Lc 96 hr value by following the method described by Finney, 1971, the required quantity of lindane to constitute Lc 50 dose for 24 hr, 48hr and 72 hr exposure was found to be 10.50, 8.50 and 7.50 mg /L respectively. The safe concentration of lindane is 5.00 mg /L.

The fishes were kept in a plastic tubs containing 6L tap water. Each tub contains five experimental animals. Fishes were exposed for 24 hr, 48 hr ad 72 hr exposure period to sub lethal concentration of lindane as stated above. Controlled animals were kept in similar conditions without any treatment. After 35 days the blood from the controlled and treated were obtained by severance of caudal peduncle and collected in Eppendorf tubes containing EDTA (Mgbenka *et al.,* 2003).These treated and controlled blood samples were used to estimate the hematological and cytological parameters.

2.1 Total RBC Count

Total RBC count were done by using an improved Neubaur haemocytometer (Shah and Altindag, 2004). Blood was diluted 1:200 with hayem's diluting fluid (Mishra and *et al.,* 1973). Erythrocytes are counted in the loaded haemocytometer chamber and total no were reported as 10^6 / mm^3 (Wintrobe, 1967)

2.2 Total WBC Count

Total WBC cell's are counted using an improved Neubaur Haemocytometer (Shah and Altindag, 2004). Blood was diluted to 1:20 with turks diluting fluid and placed in haemocytometer. The total no of WBC is reported as $10^3/mm^3$ (Wintrobe, 1967)

2.3 Estimation of Hemoglobin

Amount of haemoglobin was determined Sahli's haemoglobinometer.Values of treated groups were compared statistically with controlled one by student's t-test. Significance was established at $P<0.05$ using the Microsoft Excel 2000 programmed. Significance of data was further checked with the percent change (+ increase and – decrease) in blood parameters of *C. batrachus.*

3. Results

3.1 Total RBC Count

The erythrocyte counts of healthy controlled fish showed a mean value of $1.75\times10^6/mm^3$. On the other hand fishes exposed to sub lethal concentrations of lindane showed mean values of RBC's as 1.65×10^6, 1.60×10^6 and $1.50\times10^6/mm^3$ for 7.5 mg/L, 8.5 mg/L and 10.5 mg /L of diferential concentrations of lindane respectively. The reduction was dose dependent. The treatment was found to inflict a drastic reduction in the total RBC count.

3.2 Total WBC Count

The mean values of total WBC count in the blood of controlled fishes were found to be $6.5\times10^3/mm^3$. The fishes exposed to sub lethal concentration showed the mean values of WBC as 11.5×10^3, 12.0×10^3 and $12.5\times10^3/mm^3$ for 7.5 mg, 8.5 mg and 10.5mg /L of differential concentrations of lindane respectively. The values of treated showed a significant increase as compared to control.

3.3 Estimation of Hemoglobin

The mean value of hemoglobin was found to be 7.5g/dL in the controlled fishes. But the fishes exposed to sub lethal concentration of lindane showed a significant decrease as compared to control. It was found to be 65.2g/dL, 60.0g/dL and 57.5g/dL hemoglobin at 7.5mg/L, 8.5mg/L and 10.5 mg/L of differential concentrations of lindane treatment respectively.

4. Discussion

Blood is highly susceptible to internal and external environmental fluctuations as it is acted as vehicle for the transport of pollutant (Blaxhall, 1972) .The fish serves as bio indicator of water quality and the impact of pesticide can well be understood by analyzing either blood or serum. The toxic effect of pesticides to the blood of fishes has been studied by many researchers (Dawson, 1935).

The result of the present study shows that the treatment of lindane inflicted a drastic reduction in the total RBC count and which was dose dependent (Panigrahi and Mishra, 1978). They observed reduction in the Hb% and RBC count in the fish, Anabus, when treated with mercury.

Decrease in hemoglobin, RBC count was observed in the fish *Tinca tinca* exposed to mercuric chloride and lead (Shah and Altindag, 2004). Lowering of Hb percentage might cause anaemia. This may be due to the decreased rate of production of red blood cells or increased loss of these cells.

White blood cells play a major role in the bodily defense of fishes and consist of granulocyte, monocyte, lymphocyte and thrombocytes. Granulocyte and monocytes function as phagocytes to salvage the debris from injured tissues and lymphocytes produce antibodies (Wedemeyer and Mcleay, 1981).

An increase in WBC count may be compensatory response of lymphoid tissues to the destruction of circulating lymphocyte (Shah and Altindag, 2005)

The study in the rivers, Gomti (Jaunpur) and Ganga (Varanasi) polluted with HCHs, DDTs were reported to affect the reproductive physiology of some edible catfishes and carps during the pre monsoon season by lowering the levels of estradiol-17 in plasma (Singh, P. B. and Singh, V., 2008)

In conclusion, present investigation reveals that the differential toxicity of lindane to *C. batrachus* can be attributed to the differences in susceptibility and tolerance resulted to its accumulation, biotransfor-mation and excretion. Present results suggest that the pesticide may weaken the immune system resulting severe physiological problems and ultimately leading to the death of fishes. Long term exposure of organisms to pesticide means a continous health hazard for the population. Therefore the amount of such pesticides in the aquatic systems should be monitored to prevent the decreasing nutritive value of fish and fish mortality in particular and risk of human population in general.

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