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# EFFECT OF PESTICIDES ON BIOLOGICAL AND HAEMATOLOGICAL PARAMETERS IN THE FISH, *CHANNA STRIATUS*

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## ABSTRACT

Blood is a good bioindicator to determine the health of organisms. In the present investigation, a study was carried out to assess the effect of sublethal concentration (0.002 mg/L) of endosulfan and 2.0 mg/L of diazinon on biology and haematology of the fish, *Channa striatus* for 30 days. The toxic nature of these pesticides produced ill effects on the biology and haematology of the fish. A significant decrease in the body weight was observed. In blood of the exposed fish, there was a gradual decrease in TEC, Hb, PCV and oxygen carrying capacity. TLC showed gradual increase in number and ESR value showed increase with the duration of exposure.

## INTRODUCTION

The pesticides in aquatic ecosystems affect nontarget organisms such as fishes and prawns. Pesticide hazard on fish mortality, growth and tissue damage has been amply reported by Wildish et al. (1971) and Jackson (1976). Many reports have been published on the toxic effects of pesticides on haematology of fishes (Koundinya & Ramamurthi 1979, Sharma & Gupta 1984, Thakur & Pandey 1990). However, there is paucity of information on biology and haematology of the fishes after exposure to pesticides. Present study, deals with the toxic effect of two commonly used pesticides, endosulfan and diazinon on the biology and haematology of fish, *Channa striatus*.

## MATERIALS AND METHODS

The air-breathing fish *Channa striatus* was selected for the present study. Live specimens of *Channa striatus* (measuring 17-19 cm and 50-55 g of body weight) were procured from the local market and acclimatised at laboratory conditions in aquarium for a week by alternate day feeding with live pieces of earthworms. The quality of test aquaria water was monitored as recommended by APHA (1998). After acclimatisation, the fish were divided into three groups. The first group served as control and maintained in identical laboratory conditions. The second group was kept on endosulfan solution of 0.002 mg/L and the third group was kept in 2.0 mg/L of diazinon. The treatments were given to the fishes for one month. After one month, each group was further divided in two subgroups i.e., A and B. The subgroup A from each group was kept for biological observations, and B for haematological observations.

For biological observations, the body weight of fish was recorded daily for one month. For haematological observations the blood samples were collected from fishes of subgroup B. Total RBC and WBC counts were recorded using Hyem's and Turk's fluid (Brown 1976) respectively. Oxygen carrying capacity of the fish blood was calculated by multiplying the haemoglobin content with 1.25, oxygen combining power of Hb per g (Johansen 1970). Haematocrit value (PCV) and erythrocyte sedimentation rate (ESR) were estimated by Wintrob's method. Estimation of haemoglobin was made by cyanmethaemoglobin method (Dacie & Lewis 1997).

## RESULTS

Present study was an attempt to establish the effects of pesticides on health and certain blood parameters of the fish, *Channa striatus*. So far as biological parameters are concerned, it was found that endosulfan is more toxic than diazinon. An increase in the body weight of control fishes was noted, while the other group showed a decrease in the body weight. Endosulfan predominantly showed its toxic effect on the fish (Table 1 and Fig. 1).

Animals exposed to sublethal levels of endosulfan (0.002 mg/L) and diazinon (2.0 mg/L) elicited a significant decrease in RBC count, Hb, PCV content and oxygen carrying capacity of blood, while TLC and ESR showed the opposite trend (Table 2 and Fig. 2). Exposure of fish to endosulfan and diazinon for 30 days caused alteration in the haematological parameters. Alterations in the haematological parameters were predominant in endosulfan treated fish.

## DISCUSSION

Blood is a patho-physiological reflector of whole body and, therefore, blood parameters are useful in

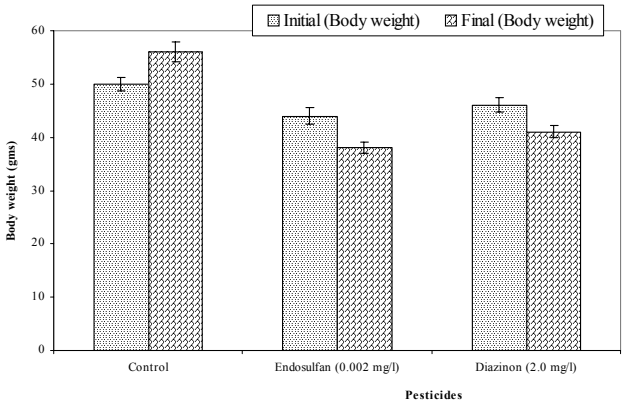


Fig. 1: Graphical representation of variation in the body weight (g) of *Channa striatus* after treatment of endosulfan and diazinon.

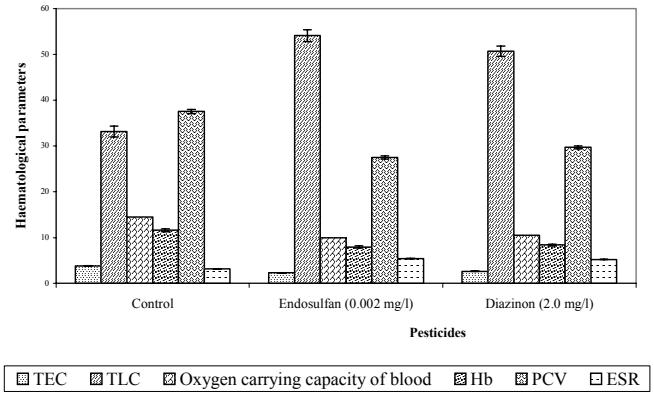


Fig. 2: Graphical representation of variation in haematological parameters of *Channa striatus* after treatment of endosulfan and diazinon.

Table 1: Summary of body weight (g) of *Channa striatus* after treatment of endosulfan and diazinon.

| Body weight (g) | Control | Endosulfan (0.002 mg/L) | Diazinon (2.0 mg/L) |
|---|---|---|---|
| Initial | 50 ± 1.30 | 44 ± 1.52 | 46 ± 1.36 |
| Final | 56 ± 1.84 | 38 ± 1.00 | 41 ± 1.15 |
| Variation | + 10.0% | - 14.0% | - 11.0% |

Values are expressed as mean ± SEM (n = 5)

Table 2: Variation in the haematological parameters of *Channa striatus* exposed to sublethal concentration of endosulfan and diazinon.

| Haematological parameters | Control | Endosulfan (0.002 mg/L) | Diazinon (0.002 mg/L) |
|---|---|---|---|
| TEC ($\times 10^6$/mm$^3$) | 3.81 ± 0.05 | 2.30 ± 0.04 (- 39.63) | 2.61 ± 0.04 (- 31.50) |
| TLC ($\times 10^3$/mm$^3$) | 33.16 ± 1.20 | 54.10 ± 1.28 (+ 63.15) | 50.71±1.12 (+ 52.93) |
| Oxygen carrying capacity of blood ($mLO_2.g^{-1}Hb$) | 14.50 | 9.96 (- 39.63) | 10.50 (- 27.59) |
| Hb (g/dL) | 11.60 ± 0.32 | 7.97 ± 0.25 (-31.29) | 8.40 ± 0.20 (-27.59) |
| PCV (%) | 37.53 ± 0.46 | 27.50 ± 0.38 (- 26.72) | 29.70 ± 0.33 (- 20.86) |
| ESR (mm/h) | 3.15 ± 0.05 | 5.40 ± 0.06 (+71.43) | 5.21 ± 0.05 (+65.40) |

Values are expressed as mean ± SEM (n = 5); Values in parenthesis are percent change over control.

diagnosing the structural and functional status of body organs exposed to toxicants. The toxic chemicals inhibited the protein synthesis in fish which resulted in the fall of total body weight. Bhattacharya (1996) has observed decrease in health conditions of the fish *Oreochromis mossambicus*, when exposed to endosulfan, hence the present investigation emphasize the ill effects of pollutants on the biology of fishes. Gautam & Gautam (2002) have also reported the decrease in the body weight of fishes treated with endosulfan and diazinon.

The significant reduction of RBC, Hb and PCV values in *Channa striatus*, exposed to sublethal levels of endosulfan and diazinon, resulted in anaemia. Anaemic state of fish under toxic stress of pesticides may be due to inhibition of erythropoiesis coupled with enhanced rate of destruction of erythrocytes in haemopoietic tissue (Gardner & Yevich 1970) and haemodilution (Johansen-Sjobeck & Larsson 1978). Koundinya & Ramamurthy (1979) have also observed a significant decrease in RBC and related parameters leading to anaemia in *Sarotherodon mossambicus*, when exposed to lethal concentrations of sumithion and sevin. James & Sampath (1995) have found that oxygen carrying capacity of blood of *Heteropneustis fossilis* declined due to reduction of RBC and Hb values which is reflected by the tissue respiration. Gill et al. (1990) have also recorded a decrease in erythrocyte count in the blood of *Punctius conchonius* after exposure to pollutants. Gautam & Gautam (2002) have also observed decrease in RBC and Hb content while increase in WBC of blood in *Channa striatus* treated with endosulfan and diazinon.

Bell et al. (1972) have reported that greater ESR may be associated with lower RBC count in

fishes exposed to heavy metals. Increase in the number of leucocytes occurs due to the immunological responses. Time and dose dependent increase of TLC was reported in *Channa punctatus*, exposed to 2', 4'-diamine, 3'-aminoazobenzene (Garg 1982) and *Clarias batrachus* exposed to BHC (Thakur & Pandey 1990). In the present study, an increase in the population of basophils, neutrophils and lymphocytes has been observed. The increase in lymphocytes suggests that the immune mechanism of fish gets stimulated and becomes adapted under pesticide stress to fight against the pollutants in the environment. The neutrophil increase in fish exposed to pesticides, seems to be caused by tissue damage. Chronic exposure of fishes to sublethal levels of pesticides caused damage to various tissues (Asztalos et al. 1990).

On the basis of the present observations, it can be concluded that moderate exposure to these pesticides may be tolerable but repeated exposure eventually leads to worst health hazards.

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