

HAEMATOLOGICAL AND BIOCHEMICAL ALTERATIONS OF *CATLA CATLA* FINGERLINGS FOLLOWING SUBLETHAL EXPOSURE TO NUVAN

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ABSTRACT

The sublethal exposure (0.24 ppm) of Nuvan on some biochemical compositions such as serum protein, blood glucose, glutamate oxaloacetate transaminase (AST) and glutamate pyruvate transaminase (ALT) and on some haematological parameters such as red blood corpuscles (RBC), white blood corpuscles (WBC), haemoglobin content (Hb), mean corpuscular concentration (MCV), mean corpuscular haemoglobin concentration (MCHC) of *Catla catla* fingerlings were studied. The haematological and biochemical parameters evoked a significant reduction (excepting MCV, ALT and AST which is significantly increased) with increasing days of Nuvan exposure.

In the modern world, the total aquatic ecosystem is highly affected due to the industrial modernization and side by side the agricultural development. Most of the insecticides used by farmers are discharged consequently into the aquatic system through agricultural run-off and found to be highly toxic to many non-target organisms (Bostrom and Johansson, 1972). This is a serious menace to pisciculture, since both the fish and their food are equally affected. Several workers have studied the deleterious effect of insecticides on haematological alterations on fishes. Rao *et al.* 1985, Subramanian *et al.* 1988, Varadaraj *et al.* 1993 and Narendra *et al.* 1993). Among the organic pesticides organophosphorus compounds are extensively used because of their high activity, variety of action and less persistence in nature. The present study is undertaken to observe the effect of a sublethal concentration of Nuvan, a commonly used organophosphorus compound on red blood corpuscles (RBC), white blood corpuscles (WBC), haemoglobin content (Hb), mean haemoglobin corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC) and also on some biochemical composition such as blood glucose, serum protein, glutamate oxaloacetate transaminase (AST), and glutamate pyruvate transaminase (ALT) of *Catla catla* fingerlings over different exposure periods.

The samples (av. wt 10.21 ± 0.78 g and av. length 8.84 ± 0.64 cm) were collected from a local freshwater pond and acclimatized in the tap water for 15 days under natural photo period. They were fed with tubifex worm *ad libitum*. Healthy fingerlings of *C. catla* were kept @ 10/ aquaria in 3 glass aquaria each containing 20 litres of tap water. The water was changed daily and the water quality parameters analysed following standard methods (APHA, 1980). The average values of physico-chemical parameter of water were: temperature, $28 \pm 1^\circ\text{C}$; salinity 3.6 to 4.4‰. pH 7.4 ± 0.2 ; and dissolved oxygen 8.3 ± 1.0 ppm. Nuvan was applied to the glass aquaria so that the final concentration of the pesticide was 0.24 ppm., a concentration selected after determination of the LC_{50} value of the samples under study according to Litchfield and Wilcoxon, (1949).

A concurrent control was maintained in an identical condition without the application of Nuvan. No mortality was observed throughout the experimental period. Both normal and experimental fishes were fed tubifex worm *ad libitum* once daily and aeration was provided throughout the experimental period. On the third day of exposure the blood was collected and the haematological and biochemical parameters analysed following the methods of Dacie and Lewis (1984), Lowry *et al.* (1951),

and Reitman and Frankel, (1957). After 7th and 15th days of exposure the fishes were sacrificed and the haematological and biochemical parameters analysed as before. Statistical significance was estimated by student's 't' test.

It was observed that all the haematological and biochemical parameters under study were significantly affected by exposure to sublethal concentration of Nuvan during the experimental period, the red blood corpuscles (RBC), white

blood corpuscles (WBC) counts, haemoglobin content (Hb) and mean corpuscular haemoglobin concentration (MCHC) were significantly reduced and mean corpuscular volume (MCV) significantly increased during exposure (Table I.). There was also a significant hypoglycemic and hypoproteinemic response and the glutamate oxaloacetate transaminase (AST) and glutamate pyruvate transaminase (ALT) concentrations were significantly increased (Table 2.)

Table 1 : *Effect of sublethal concentration of Nuvan on some haematological parameters of the blood of Catla catla fingerlings.*

Parameters	Control fish	3 days exposure	7 days exposure	15 days exposure
RBC (million/cmm)	5.54±0.19	4.12±0.17 ^{****}	3.91±0.16 ^{****}	2.23±0.11 ^{****}
WBC (thousand/cmm)	29.85±1.82	21.24±1.74 ^{***}	18.35±1.66 ^{***}	16.25±1.62 ^{****}
Hb (Gm%)	6.28±0.40	4.16±0.33 ^{***}	4.02±0.36 ^{***}	3.77±0.31 ^{****}
MCV (M ³)	166.05±7.22	192.21±8.06 ^{**}	208.44±8.23 ^{***}	219.20±8.44 ^{****}
MCHC (%)	24.76±1.56	19.25±1.26 [*]	18.15±1.22 ^{***}	14.54±1.08 ^{****}

Table 2 : *Effect of sublethal concentration of Nuvan on some biochemical constituents of the blood of Catla catla fingerlings.*

Parameters	Control fish	3 days exposure	7 days exposure	15 days exposure
Serum protein (g/100ml)	42.24±1.22	34.26±1.18 ^{***}	33.20±1.09 ^{****}	30.51±1.11 ^{****}
Blood glucose (mg/100ml)	110.28±1.54	94.06±1.47 ^{****}	81.25±1.44 ^{****}	72.57±1.49 ^{****}
ALT (u/l)	52.50±1.23	74.71±2.77 ^{****}	84.90±3.35 ^{****}	87.12±3.45 ^{****}
AST (u/l)	66.28±2.72	78.54±2.98 ^{**}	2.40±3.01 ^{***}	88.40±3.06 ^{****}

**** Significant at 0.001 level
 *** Significant at 0.01 level
 ** Significant at 0.025 level
 * Significant at 0.05 level

The reduction in RBC, Hb, MCHC concentration with a concomitant increase of MCV could be due to macrocytic anaemia (Rao *et al.* 1985). The fall in WBC count could be due to loss of efficiency in the defence mechanism against the Nuvan treatment, as observed elsewhere by Subramanian *et al.* (1988). But a significant increase of mean corpuscular volume (MCV) of blood due to macrocytic anaemia has also been observed. Decreased blood glucose levels were noticed and this hypoglycemic condition appeared to be due to the rapid utilization of glucose during hyperexcitability (Narendra *et al.* 1993). The suppression of protein level of the blood of treated fishes was comparable to those reported by Jha (1991) and Khanee (1992). This may be attributed to spontaneous utilization of aminoacids in various catabolic reactions that arise to combat the pesticide stress. The hypoproteinemic response was also observed in fingerling of *Labeo rohita* and *Cirrhina mrigala* exposed to different sublethal concentrations of Nuvan and phosphamidon (Medda *et al.* 1992, 1993). The increased activities of AST and ALT during Nuvan treatment may be due to the rapid turnover of enzymes activities following increased supply of substrates. Usha and Rai (1993) used the increase in the levels of these enzymes as a specific indication of hepatic cell damage and found them to be time and dose dependant.

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Errata

Volume 22, 1992. Distribution of decapod larvae in the Bombay harbour - Thana - Bassein creek regions. Page 25 Table II
After Penaeidea incorporate

Caridea

Families : Pasiphaeidae
Palaemonidae
Alpheidae
Hippolytidae
Processidae
Crangonidae