



Review Article

## Effect of Paraquat – A weedicide on the Haematological Parameters of a Common Indian Catfish, *Heteropneustes fossilis*

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### Abstract

This study was undertaken to investigate the toxic effect of sub-lethal concentrations of Paraquat on some of the haematological parameters in Indian cat-fish, *Heteropneustes fossilis* during different time periods i.e., 24 hrs., 48 hrs., 72 hrs., and 96 hrs at different concentrations i.e., 0.5 ppm, 1.0 ppm, 1.5 ppm and 2.0 ppm. Paraquat caused a significant decrease in the total count of RBC, haemoglobin content and percentage PCV.

**Keywords :** Paraquat, *Heteropneustes fossilis*, RBC, Haemoglobin, PCV, Haematological parameters.

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### INTRODUCTION

One of the crucial problems confronted by pisciculturists globally is the control of aquatic weeds. Aquatic weeds are unwanted and undesirable vegetation which reproduce and grow in water and, if left unchecked may choke the water body posing a serious menace to pisciculture (Jhingran, 1983). Different measures such as manual, mechanical, biological and chemical have been devised for the eradication of weeds. Among all these methods, the chemical method has been proved very much instrumental in weed control.

Most of the weedicides have proved very effective in weed control. However, the weedicides having positive effects on the aquatic weeds may have adverse effect on the non- target species like fish either directly or indirectly (Boyle, 1980, Folmar, 1980 ;George and Hingo Rani, 1982).

Ventura et al. (2008) reported that pesticides presents in aquatic environments can affect aquatic organisms in different ways.

Paraquat (1,1' dimethyl- 4,4'-bipyridylum dichloride) a weedicide has been in common use for the control of eradication of aquatic weeds. It kills all green tissues of the weeds. However, exposure to high dose of paraquat has been reported to cause toxic effect in organs like liver, kidney, lungs, nervous cardio-vascular, blood, adrenal and male reproductive system of mammals such as mouse, rat, dog and monkey. Very scanty literature is available as to the effect of weedicides especially Paraquat on the fish. Hence, the present investigation has been undertaken to assess the impact of this weedicide on the haematological parameters of a common Indian catfish, *Heteropneustes fossilis*. Fishes act as the ideal sentinels and

susceptible to any alteration in the physico-chemical characteristics of the habitat (Sadiq Bukhari et al., 2012) . Blood indices are

### COLLECTION OF BLOOD

The fish was taken out of the aquarium with the help of small net and was caught gently with a piece of wet cloth. The needles of 2 ml plastic syringe rinsed with the 3.8% Sodium citrate solution (anti coagulant) was introduced into the lumen of cauda – dorsalis which runs just below the vertebral column. The syringe was kept ventrally at an angle of 45% for an easy collection of blood. The collected blood was kept in a dry vial for various investigations.

### MATERIAL & METHODS

Live specimens of *Heteropneustes fossilis* were procured from local ponds and local market of Chapra. They were kept in glass aquaria with tap-water and were acclimatized under laboratory conditions for two weeks. The fishes were fed daily with

greatly used to evaluate the toxic stress of the fishes (Kavitha et al., 2010).

pellets of wheat and ground dried shrimps. Aquaria were cleaned and the water was changed every-day to eliminate contamination caused by faecal matter. The fish specimens selected for experimental purposes were healthy and their weight varied from 50-60 g.

Total count of RBC was done with the help of Thoma-zeiss Haemocytometer with improved Neubauer-Ruling as described by Darmady and Davenport (1954).

Haemoglobin content (in g %) was estimated by cynamet method using a photoelectric colorimeter as described by Van Kampen & Zijlstra (1961).

Packed cell volume (in %) was determined by micro-haematocrit method.

**Table 1 :** Showing impact of various concentrations of Paraquat (0.5ppm,1.0ppm,1.5ppm and 2.0ppm) on Total Erythrocyte Count of *Heteropneustes fossilis* at different hours of exposure (n=10 animals in each group; ± SE)

Parameters	Treatment Group (ppm)	Duration of Exposure (in hrs)			
		24	48	72	96
TEC (million /c.mm)	Control 0.000	2.227±0.019	2.237±0.022	2.227±0.221	2.210±0.019
	0.5	2.200±0.018	2.175±0.020	2.148±0.019	2.109±0.022
	1.0	2.150±0.017	2.085±0.021	2.007±0.019	1.874±0.021
	1.5	2.077±0.021	1.944±0.022	1.775±0.017	1.529±0.018
	2.0	2.051±0.021	1.882±0.019	1.671±0.022	1.411±0.018

### Analysis of variance for Total Count of RBC of *Heteropneustes fossilis*

Source of Variation	of	d.f.	Sum of Square	Mean sum of square	F-value
Factor A	3		3.327577	1.109192	178.797878 sig 5%
Factor B	4		5.916967	1.479242	238.448498 sig 5%
Factor A X B	12		1.821445	0.151787	24.467537 sig 5%
Error	180		1.116650	0.0006204	

**Table 2 :** Showing impact of various concentrations of Paraquat (0.5ppm,1.0ppm,1.5ppm and 2.0ppm) on Haemoglobin Content (in gm%) of *Heteropneustes fossilis* at different hours of exposure (n=10 animals in each group; ± SE)

Parameters	Treatment Group (ppm)	Duration of Exposure (in hrs)			
		24	48	72	96
Hb (gm%)	Control 0.00	13.810 ± 0.290	13.890± 0.312	13.820± 0.330	13.810± 0.325
	0.5	13.580± 0.300	13.390± 0.315	13.150± 0.320	12.760± 0.316
	1.0	13.170± 0.310	12.550± 0.305	11.770± 0.310	10.440± 0.309
	1.5	12.490± 0.306	11.140± 0.329	9.450± 0.302	6.840± 0.316
	2.0	11.980± 0.324	9.590± 0.316	6.790± 0.317	5.710± 0.307

### Analysis of variance for Hemoglobin content of *Heteropneustes fossilis*

Source of Variation	d.f.	Sum of Square	Mean sum of square	F-value
Factor A	3	420.325750	140.108583	629.780122 sig 5%
Factor B	4	607.050500	151.762625	682.167378 sig 5%
Factor A X B	12	229.897500	19.1581215	86.114683 sig 5%
Error	180	40.045000	0.222472	

**Table 3 :** Showing impact of various concentrations of Paraquat (0.5 ppm,1.0 ppm,1.5 ppm and 2.0 ppm) on Packed Cell Volume (%) of *Heteropneustes fossilis* at different hours of exposure (n=10 animals in each group; ± SE)

Parameters	Treatment Group (ppm)	Duration of Exposure (in hrs)			
		24	48	72	96
PCV (%)	Control	29.159 ± 0.351	29.307± 0.551	29.224± 0.451	29.152± 0.451
	0.5	28.905± 0.351	28.427± 0.362	28.142± 0.359	27.508± 0.360
	1.0	28.103± 0.362	27.470± 0.365	26.000± 0.549	24.180± 0.548
	1.5	27.085± 0.440	25.180± 0.442	24.836± 0.369	21.694± 0.462
	2.0	26.200± 0.463	24.670± 0.462	20.985± 0.483	17.030± 0.489

### Analysis of variance for Packed Cells volume of *Heteropneustes fossilis*

Source of Variation	d.f.	Sum of Square	Mean sum of square	F-value
Factor A	3	630.198737	210.066246	369.996813 sig 5%
Factor B	4	1018.505733	254.626433	448.482185 sig 5%
Factor A X B	12	361.120155	30.093346	53.0004433 sig 5%
Error	180	102.195270	0.567752	

### RESULTS :

**RBC :** It was observed that the paraquat at different concentrations caused marked effect on the total count of RBC of *Heteropneustes fossilis* as note below

- (i) At 0.5 ppm a marked and gradual decline in the value of RBC from the controlled condition to 96 hrs of the treatment of paraquat occurred. The marked fall in the count of RBC 96 hrs. was statistically significant from

the value of controlled condition and 96 hrs of treatment.

- (ii) At 1.0 ppm again a marked decrease in the count of RBC was observed from the controlled condition to successive hours of treatment upto to 96 hrs. The decline in the value at 72 and 96 hrs of treatment was also statistically significant from the preceding hrs of treatment.
- (iii) At 1.5 ppm a sharp decline in the count of RBC was observed from the controlled condition to the succeeding hours of treatment upto 96 hrs. Moreover, the decreases in the value of RBC at different concentrations were statistically significant among one another.
- (iv) At 2 ppm also a marked decline in the count of RBC was observed from the controlled condition to the succeeding hrs of treatment i.e. upto 96 hrs. The decline in the value was statistically highly significant at all the stages of treatment.

The analysis of variance showed significant variability at different time intervals of observations. The F ratio was highly significant at 0.05 level of P (F = 24.467537)

It appears that with increasing concentrations of paraquat from 0.5 ppm to 2 ppm caused a marked decline in the values of R.B.C. from the controlled condition of fish to the successive durations of treatment of this weedicide upto 96 hrs.

#### **Hb Content :**

Table 2 showed the haemoglobin content (in gm%) of *Heteropneustes fossilis* at controlled condition and at different

concentrations and different hrs. of treatment of paraquat.

It appears that with the increasing concentrations of paraquat and increasing durations of treatment, the haemoglobin content of the fish sharply falls down ultimately leading to the anaemic condition of the fish.

The analysis of variance showed significant variability in the haemoglobin content of blood at different concentrations and different time intervals of observation.

The F-ratio was highly significant at  $P < 0.05$  level (F value- 86.114)

#### **PCV :** Table 3 showed PCV (in %)

1. At 0.5 ppm a gradual decline in the level of PCV was observed at successive hrs. of treatment.
2. At 1 ppm also a decrease in the level of % PCV was marked at successive stages of duration of the treatment. The fall in the value at 24 hrs. was statistically significant from the value of controlled condition but a decline in its level at 48 hrs. was statistically non-significant from the value at 24 hrs. Again decrease in the value at 72 hrs and 96 hrs was statistically significant from all the preceding stages of observation.
3. At 1.5 ppm a sharp decline in the value of % PCV was observed from controlled condition to successive duration of treatment upto 96 hrs. However, the fall in its value between 48 hrs and 72 hrs was statistically non-significant but a sharp fall in its value at 96 hrs of treatment was found to be highly

significant from the value of controlled condition as well as from the preceding duration of treatment.

4. At 2 ppm a very marked effect was observed in the value of % PCV in which a sharp decline in its level was observed at all the successive durations of treatment from controlled condition upto 96 hrs. Moreover, the decreases in the value were highly significant at 0.05 level of P ( $F = 53.004433$ ).

## DISCUSSION

Changes in the haematological parameters like RBC count, haemoglobin content, haematocrit (PVC) etc. have been widely reported in fishes under toxicity stress. Koundinya and Ramamurthi (1979), Allin & Wilson (2000) and Chowdhary et. al. (2004) reported significant reductions in erythrocyte count and haemoglobin concentrations to about 17 percent and 8 percent respectively under lethal Sumithion exposure. Mishra and Srivastava (1983) observed decrease in the haemoglobin values of *Heteropneustes fossilis* exposed to sublethal concentration of Malathion. Mishra and Srivastava (1983) also reported decreased haematocrit value of *Heteropneustes fossilis* exposed to malathion. Malathion was found to induce

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similar changes in juveniles of *Claris batrachus* (Mukhopadhyay and Dehadrai, 1980). On the other hand Dhillon and Gupta (1983) reported an increase in the RBC count, Hb content and packed cell volume in *Clarias batrachus* with the increase in concentration of pollutant and time exposure. Susanthi, et al. (2015) also shared the same view.

In the present investigation, the cause behind a decrease in the RBC count of the fish exposed to paraquat treatment at different concentrations may be attributed primarily to the damaging effect of weedicide on the erythropoietic tissues thereby interfering with the formation of erythrocytes and secondarily, to its destructive action on peripheral red cells, as a result of which, the viability of the red cells is affected (Verma et. al., 1982; Gill & Pant, 1985)

## CONCLUSION :

It is thus evident that the paraquat at four different concentrations viz., 0.5 ppm, 1.0 ppm, 1.5 ppm and 2.0 ppm, each for four successive time intervals of exposure, i.e. 24 hrs, 48 hrs, 72 hrs and 96 hrs causes a gradual decrease in the total count of RBC, haemoglobin content and percentage PCV and is to be used prudently.

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