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SHORT COMMUNICATION

Investigation of Hematological Parameters Following Monocrotophos Intoxication in *Channa punctatus* (Bloch.)

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ABSTRACT
This study utilized monocrotophos, an organophosphate pesticide, to assess its toxicity on the fish species Channa punctatus. The toxicity assay revealed that the median lethal concentration (LC50) at 96 hours was determined to be 3.27 µL/L. The hematological characteristics of the fish indicated a considerable reduction in total erythrocyte count, hemoglobin concentration, and packed cell volume as a result of monocrotophos exposure. An elevated total leukocyte count and erythrocyte sedimentation rate were observed. The toxic impact of monocrotophos on fish, along with the effects of its sublethal concentrations in fish blood, indicates that the indiscriminate discharge of monocrotophos into aquatic ecosystems poses a significant risk to the survival of fish and other aquatic creatures.
***Keywords**: Monocrotophos, hematological profile, LC_{50}*

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INTRODUCTION

Agricultural pesticides utilized in integrated pest management systems and associated industrial effluents are a significant cause of environmental pollution. Monocrotophos is a widely utilized organophosphate insecticide for managing agricultural pests in India. The toxicity of monocrotophos in *Channa punctatus* [3, 4], *Labio rohita* [5], *Heteropneustus fossilis* [6, 7], *Anabas testudineus* [2], and *Batasiotengana* [9] led to alterations in behavior, hematology, and biochemistry.

Blood is a crucial element for examining the impact of toxicants. Hematological measures can offer significant insights into the physiological responses of fish as indicators in toxicological research. Changes in erythrocyte parameters have been documented in fish exposed to environmental stress [3]. The sublethal effects of monocrotophos on hematology were investigated in the African catfish *Clarias gariepinus* by Yazi and Auta [6]. This study examined the toxicological effects of monocrotophos on the locally accessible fish *Channa punctatus*, focusing on its behavior, LC_{50}, and hematological.

MATERIAL AND METHODS

The *Channa punctatus* specimens, measuring 8 to 15 cm in length and weighing 20 to 65 grams, utilized in this study were sourced from the Yamuna River in Agra. The fish were transported to the laboratory, cleaned with 1% KMnO4 for several minutes to eliminate any skin infections, and housed in big tanks (75 cm x 37.5 cm x 37.5 cm) filled with well-aerated dechlorinated water. The fish were acclimated in the laboratory.

Assessment of LC_{50} values

To assess the Lc50 value of *Channa punctatus*, various experimental groups of fish were subjected to varied concentrations of the test substance. Various concentrations of monocrotophos, specifically 2.0, 4.0, 6.0, and 8.0 µl/L, have been designated as the test substance. The mortality of fish was recorded at various time intervals: 24 hours, 48 hours, 72 hours, and 96 hours (Table 1), and the LC_{50} was computed according to international criteria for fish. Mortality exhibited a proportional rise with escalating concentrations of the test substance. LC50 values were determined using the log-dose/probit regression line approach [1]. The LC50 value of 96-hour monocrotophos exposure was 3.27 µl/L, with a variation of

0.06, and fiducial limits of +2.5227 and -2.4992. The regression equation is y = 5.39 + 3.16 (x - 2.63) for the fish species *Channa punctatus*. The sublethal dose constituted one-fifth of the LC_{50}.

Hematological Methods

Following acclimatization, thirty fish of almost identical size and weight were allocated into four groups, with each group consisting of six fish in five distinct tanks, each comprising 100 liters. In one tank (Tank 1), fish were maintained in regular dechlorinated water as the control group, while the fish in the other four tanks were exposed to sublethal doses of monocrotophos. Every other day, the control group tanks were replenished with normal water, whereas the experimental group tanks received water mixed with pesticide. Fish were subjected to monocrotophos for four days. To investigate the impact of monocrotophos, fish from both control and experimental groups were randomly selected, anesthetized, and blood was individually collected from the caudal peduncle using EDTA (ethylenediaminetetraacetic acid) as an anticoagulant for hematological analysis. The total erythrocyte count, total leucocyte count, hemoglobin concentration, erythrocyte sedimentation rate, and packed cell volume were assessed with an autoanalyzer [10].

Statistical analysis

Data acquired from replicates were utilized for statistical analysis to compute mean values. The LC_{50} results and hematological parameters were analyzed using variance analysis and significance testing.

RESULTS AND DISCUSSION

Fish behavior

Exposure of the fish *Channa punctatus* to varying concentrations of monocrotophos resulted in observable stress effects. The fish exhibited restlessness and demonstrated backward movement. When subjected to high concentrations, the fish exhibited significant respiratory distress, reduced swimming activity, and attempted to settle at the bottom of the aquarium. The fish in the experimental group exposed to 8 µg/L perished within 96 hours.

LC_{50} Analysis

LC50 analysis mentioned in table 1 and table 2.

Table 1: Survival number and percentage mortality of *Channapunctatus* (Bloch.) due to the exposure of monocrotophos at 96 hours.

Concentration (µl/L)	No. of Individual (treated)	Survival No.	% mortality
0.0	6	6	0.00
2.0	6	5	16.66
4.0	6	3	50.00
6.0	6	2	66.66
8.0	6	0	100.00

Table 2: Toxicity evaluation of monocrotophos on *Channa punctatus* (Bloch.) specifying fiducial limits

Experimental fish	Compound	Regression equation	LC_{50} µl/L	Variance	Fiducial limits
Channa punctatus	**Monocrotophos**	**Y=5.39+ 3.16 (x-2.63)**	**3.27**	**o.oo6**	m_1= (+) 2.5227 m_2 = (-)2.4992

Table 3: Effect of sublethal concentration monocrotophos on Total erythrocyte count (10^{12}/ l) of *Channa punctatus* (Bloch.)

TEC (10^{12} /l)	Control	24 hrs exposure	48 hrs exposure	72 hrs exposure	96 hrs exposure
Range	2.30-2.90	2.20- 2.70	2.20- 2.69	1.50- 1.90	1.20-1.70
Mean	2.59	2.46	2.40	1.79	1.37
±S.Em	±0.09	±0.02	±0.03	± 0.14	± 0.08

Table 4: Effect of sublethal concentration of monocrotophos on the Total leucocyte count (10^{9}/ l) of *Channa punctatus* (Bloch.)

TLC (10^{9} /l)	Control	24 hrs exposure	48 hrs exposure	72 hrs exposure	96 hrs exposure
Range	1.90- 2.81	2.20- 2.80	2.30- 2.90	2.40- 2.90	2.60- 3.10
Mean	2.33	2.39	2.45	2.75	2.92
±S.Em	±0.52	± 0.09	± 0.07	±0.01	± 0.03

Table 5: Effect of sublethal concentration of monocrotophos on Heamogloblin concentration conc. of *Channa punctatus*(Bloch.)

Hb Conc.	Control	24 hrs exposure	48 hrs exposure	72 hrs exposure	96 hrs exposure
Range	13.0- 14.0	13.0- 13.5	12-0- 13.0	9.5- 11.0	5.8- 7.2
Mean	13.5	13.0	12.3	10.3	6.7
±S.Em	±0.30	±0.09	± 0.02	±0.24	±0.12

Table 6: Effect of monocrotophos on Erythrocyte sedimentation rate in *Channa punctatus* (Bloch.)

ESR	Control	24 hrs exposure	48 hrs exposure	72 hrs exposure	96 hrs exposure
Range	2.30- 2.60	2.40- 2.80	2.70- 3.10	3.20- 3.60	3.50-3.80
Mean	2.54	2.77	2.91	3.41	3.77
±S.Em	± 0.08	±0.04	± 0.03	±0.03	± 0.05

Table 7: **Effect of monocrotophos on Packed cell volume in *Channa punctatus* (Bloch.)**

PCV	Control	24 hrs exposure	48 hrs exposure	72 hrs exposure	96 hrs exposure
Range	40.00-49.00	39.00-48.00	38.00- 44.00	34-00- 39.00	25.00- 33.00
Mean	46.02	44.49	42.71	37.42	29.61
±S.Em	±1.92	±1.03	±1.22	±1.11	±0.09

Toxicity of monocrotophos on several hematological parameters Total erythrocyte count, total leucocyte count, hemoglobin concentration, erythrocyte sedimentation rate, and packed cell volume of *Channa punctatus* [Table 3-7]. Fishes treated to pesticides for 24, 48, 72, and 96 hours exhibited a substantial ($P < 0.01$) rising trend in pesticide exposure over these time intervals.

The exposure to monocrotophos impacts fish within the aquatic habitat, and its toxicity is contingent upon dosage. The 96-hour LC_{50} of monocrotophos for the test fish *Channa punctatus* was 3.27 µl/L. In *Labio rohita,* the 96-hour LC_{50} was 0.036 ppm [7], but in *Heteropneustes fossilis*, it was 20 ppm [8]. The fatal and sublethal doses of monocrotophos on *Channa punctatus* indicate its toxicity to fish.

Hematological variables serve as significant indicators for detecting the toxicological impacts of contaminants and environmental stress in fish. This investigation demonstrated that exposure to sublethal concentrations of monocrotophos in *Channa punctatus* during various time intervals (24, 48, 72, and 96 hours) resulted in a declining trend in Total Erythrocyte Count (Table 3). Tamizhazhagan [4] observed a reduction in total erythrocyte count in *Labio rohita* as a result of monocrotophos exposure. A diminished total erythrocyte count is significant and may arise from decreased erythropoiesis, potentially leading to anemia.

The total leukocyte count exhibited an upward trend upon exposure to monocrotophos at various time intervals (24, 48, 72, and 96 hours) at sublethal concentrations (Table 4). Abdul Kareem et al. [2] and Anusiya Devi et al. [3] observed an elevation in total leukocyte count in *Heteroclarias gariapinus, Mystus vittatus*, and *Labeo rohita*, respectively, following exposure to sublethal concentrations of monocrotophos. An elevated total leukocyte count can lead to leukocytosis and leukemia.

The hemoglobin concentration exhibited a declining trend upon exposure to monocrotophos at various time intervals (24, 48, 72, and 96 hours) at sublethal concentrations (Table 5). Anusiya Devi et al. [3] observed a reduction in hemoglobin concentration in *Labio rohita* as a result of monocrotophos exposure. Decrease hemoglobin concentration leads to hypohemoglobinemia, which can impair the oxygen-carrying ability of blood.

The erythrocyte sedimentation rate exhibited an increasing trend upon exposure to monocrotophos at various time intervals (24, 48, 72, and 96 hours) at sublethal concentrations (Table 6). An elevation in erythrocyte sedimentation rate indicates anemia.

The packed cell volume exhibited a decreasing trend upon exposure to monocrotophos at various time intervals (24, 48, 72, and 96 hours) at sublethal concentrations (Table 7). Abdul Kareem [2] observed a reduction in packed cell volume in *Heteroclarias*, whereas Vaiyanan *et al.* [5] reported a similar drop in *Cyprinus carpio*, attributable to the influence of sublethal concentrations of monocrotophos. A reduction in packed cell volume indicates induced anemia.

CONCLUSION

The LC_{50} investigation indicates that Monochrotophos exposure is harmful to the fish *Channa punctatus* in aquatic habitats. It impacts the fish's blood at sublethal quantities. Careless application of this insecticide poses a threat to aquatic animals. This pesticide must be utilized judiciously under integrated pest management practices.

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