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RESEARCH ARTICLE

Changes in the Hematology Parameters of Freshwater Fish *Channa striatus* Exposed to the Pesticide of Propargite

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ABSTRACT

In the present study was sublethal concentrations of propargite pesticide administered to freshwater fish *C. striatus* for 96 hours propargite exposure is 0.34 parts per million (ppm) based on the period of (0.034ppm), (1.02ppm), 15 and 30 days about significantly ($P > 0.05$) in hematological parameters alterations was recorded. The hematological analysis showed significant ($P > 0.05$) reduction in red blood cell count, hemoglobin value, packed cell volume, mean corpuscular hemoglobin (MCH), MCH concentration, and mean corpuscular volume. The parameters such as total white blood cells increased when induced toxic content. The present study indicated marked changes in the blood of *C. striatus* after exposure to propargite pesticide.

Keywords: Propargite, *Channa striatus*, sublethal toxicity, hematology.

INTRODUCTION

Propargite is a highly toxic organo sulfuric pesticide which is being widely used in agriculture as well as in integrated aquaculture farming systems to product important food crops.[1] Elevated residue levels of propagate in plant ingredients have also been reported,[2] and many of these plant ingredients are now increasingly used in aqua-feeds for sustainable aquaculture, thus exposing the aquatic animals to pesticide. It has been reported that exposure to propargite, even at sublethal doses, induces white blood cells (WBCs) and biochemical changes in common carp.[2] Paradoxically, they are considering highly vulnerable to toxic chemicals because first their large surface area facilitates greater toxicant interaction and absorption, and second, their detoxification system is not as robust as that of the liver. In addition, absorption of toxic chemicals through gills is rapid, and therefore, toxic response in gills is also rapid.[3] Pesticides such as herbicides, insecticides, and their mixtures in agriculture often lead to alterations in the chemical composition of natural aquatic systems, causing chronic toxicity to the freshwater fauna, particularly fish.[4,5] These pesticides can reach natural waters either through transfer of the chemicals from the soil or by direct spraying on the target organisms. The environmental monitoring plays a major role which provides a framework for the controlled usage of chemical pesticides for agriculture, household, and veterinary uses. Fishes are one of the economically important natural resources which are known to play a crucial role in ecological sustenance.[6] Aquatic ecosystems that run through agricultural areas have high probability of being contaminated by runoff and groundwater leaching by a variety of chemicals. The environment is the sum total of water, air, and land interrelationships among themselves and also with the human being, other living organisms, and other property.[7]

The blood is the most important and abundant body fluid. Its composition often reflects the total physiological condition and widely used in ichthyology research, aquaculture research as well as toxicology and biological monitoring.[8] The blood parameters have been considered as diagnostic indices of pathological condition and are important for the assessment of systemic functions and overall health of animals. Furthermore, the alterations in hematology also help in diagnosing the structural and functional status of animals exposed to the toxicants.[9-11] Anemia caused on account of lead acetate poisoning can be of two types: Hemolytic anemia, which is associated with

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acute high-level lead acetate exposure, and frank anemia, which is caused only when the blood lead acetanilide is significantly elevated for prolonged periods.[12]

There have also been instances where *Channa striatus* has been used for medicinal purposes.[13] The extinction of the snakehead fish is caused by the overfishing, habitat disruption.[2] The pesticides pollution, soaps and organic matter, gradual repair of damaged muscles necrosis, macrophage infiltration, fibrosis and mycotic granulomas. [14] and also[15] reported, that the causes death in C. striatus to solve the problem is prevent the extinction through basic research to discover the theories and methods of fish farming to improve of snake heads fish[16] and environmentally ecofriendly to increase the production of *C. striatus*.[17]

Hematological characteristics are an important tool that can be used to understand as an effective and sensitive index to monitor physiological and pathological changes in fishes. Changes in hematological parameters depend on the aquatic biotope, fish species, age, and sexual maturity and health status.[18,19] Various blood parameters in fish have been established by different investigators in fish physiology and pathology.[20,21] Significant reported that the assessment of the ecotoxicological risks caused by pesticides to ecosystems based on toxicity data and the effects of pesticide preparations on non-target organisms. Fish are among the group of non-target aquatic organisms. Blood parameters are considered pathological indicators of the whole body and, therefore, are important in diagnosing the structural and functional status of fish exposed to toxicants.[22]

The fishes are best indicator of water body pollution and are the most sensitive of all the aquatic animals, toward the pollutant poisoning through the river water from adjoining settlement and industries. The accumulation of effluents becomes hazardous to the aquatic organisms and to surrounding human population because the fishes are the most important factors of the food chain which has great nutritive value in the environment. The present investigation was to assess the hematology contents of exposed to sublethal concentration. The use of pesticide propargite should be regulated, especially, in farmlands along the coast and riversides to avoid the influx of pesticides into the aquatic ecosystems.

MATERIALS AND METHODS

Fish collection and laboratory conditions

The freshwater healthy fish *C. striatus* of the weight (22.34 ± 0.79 g) and length (17–20 cm) was selected for the experiment and was collected from ponds in around Thanjavur. Fish was screened for any pathogenic infections. A glass aquarium was washed with 1% KMnO4 to avoid fungal contamination and then sun-dried. The fishes were maintained in 300 L tank containing dechlorinated tap water (temperature 26°C; total hardness516 ± 22 mg/L; Do - 5.7 ± 70.2 mg/L; salinity - 1.3 ± 0.13 parts per million [ppm], and pH - 7.8 ± 0.03). Fish was acclimated to laboratory conditions for 15–30 days before experimentation. They were regularly fed with commercial food, and the medium (tap water) was changed daily to remove fasces and food remnants.

Toxicant

Propargite is one of the organosulfuric insecticides extensively used in agriculture. Chronic and sublethal level 2-(4-tert-butyl phenoxy) cyclohexyl prop-2-ynyl sulfite is a non-systemic insecticide. The sublethal concentrations of propargite were applied exposure duration of 15–30 days; the water and propargite were completely replenished each day during experimental period.

Experimental design of sublethal concentration

The experimental group was vulnerable to a sublethal concentration of the insecticide (0.34 ppm/L) during 15 and 30 days. Toxicity tests were carried out in accordance within standard methods (APHA, 1800). Based on acute toxicity test (96-h lethal concentration 50), sublethal concentrations (10%and 30% of 15 and 30 days) were derived for arsenic which served as the experimental concentration of the arsenic in the subsequent experiments. Ten fishes were exposed to each concentration for 15 and 30 days. Control batch was maintained simultaneously.

Fish dissection and preservation

The fishes were divided into a four groups, each group of ten healthy fishes was transferred

to plastic tab having a capacity of 10 L and they exposed to 10% and 30% sublethal concentration of propargite (0.034 ppm and 0.02 ppm of 15 and 30 days). One group was kept as control. At the end of the exposure period, the blood was collected in glass tube by cutting the caudal peduncle, using EDTA as anticoagulant. Maximum 2 ml blood was taken for hematological studies.

Mean corpuscular hemoglobin (MCH)

This indicates the weight of Hb in a single RBC and is expressed in pictograms (pg) (1 pg = 10–12 g).
MCH=Hemoglobin (g/100 ml)
RBC count million per cu. mm×10
Values were expressed as pg

MCH concentration (MCHC)

This denotes the Hb concentration per 100 mi of packed RBCs and is related to the color of the red cells. This is expressed as percentage of packed cells.
MCHC=Hemoglobin (g/d1)×100 values were expressed as %
Packed cell volume (PCV)%.

The MCV

This is expressed as the volume in cubic microns or femtoliters of an average RBC.
MCV=PCV%×10
RBCs in millions per cu.
The mm values were expressed as femtoliters.

Statistical analysis

All the data were subjected to one-way ANOVA using statistical software of SPSS version 16.0. Duncan's Multiple Range test was used to determine the difference among treatment means at 5% level of significance.

RESULTS AND DISCUSSION

The Effect of propargite exposure on hematology parameters of *Channa striatus* like RBC, WBC, Hb, PCV, MCV, MCH, MCHC and the many pathological changes of the blood cells in the fish *C. striatus* both in control and sublethal concentration of propargite 15 and 30 days exposed given in Table 1 in present study the alterations in hematology parameter such as WBC increased significantly and RBC, Hb, PCV, MCV, MCHC values decreased significantly after 15, and 30 days of exposure periods, respectively, in comparison with control. Residual of this pesticide alteration in to the ecosystem and trouble the healthy environment and aquatic forms. Aquatic farm contains fish and other organism. However, the fish is mostly affected by pesticide residuals.[7] Hematological parameters have significantly reported to be affected by a range of factors which include size, age, physiological status, environmental conditions, and species.[23] After treatment periods, suddenly increase of WBC may be due to the activation of the animal's defense mechanism and the immune system. Several chemical compounds including insecticides generate antibodies due to their interference with immune system which could be the reason for increase in WBC.[24] Reported that increase in WBC count

Table 1: Hematological parameters of freshwater fish *Channa striatus* exposed to sublethal concentrations of (10% and 30% of 96-h LC50) propargite pesticide

Hematological					
Treatment	**Control**	**Propargite 0.034 ppm 15 days**	**Propargite 0.034 ppm 30 days**	**Propargite 1.02 ppm 15 days**	**Propargite 1.02 ppm 30 days**
RBC	5.84±0.99^{a}	3.30±0.69^{b}	2.18±0.23^{bc}	1.60±0.36^{c}	1.32±0.25^{c}
WBC	4.53±0.52^{c}	6.15±0.56^{c}	8.48±0.52^{b}	10.22±0.56^{b}	14.21±0.99^{a}
Hb	9.37±0.84^{a}	5.30±0.69^{b}	2.54±0.39c	3.58±0.64b^{c}	2.16±0.24^{c}
PCV	34.42±0.94^{a}	30.23±0.59^{b}	16.12±0.73^{d}	22.34±0.93^{c}	13.18±0.57^{e}
MCV	371.12±0.64^{a}	216.12±0.56^{d}	219.21±0.94^{c}	365.22±0.94^{b}	104.63±0.98^{e}
MCH	50.27±0.79^{a}	31.22±0.89^{d}	36.13±0.57^{c}	45.21±0.83^{b}	28.48±0.94^{e}
MCHC	76.23±0.81^{a}	43.22±0.92^{c}	73.21±0.87^{a}	65.15±0.71^{b}	27.23±0.94^{d}

Values are given as±SE. Values not sharing a common marking (a, b, c, d, e) different alphabets in columns differ significant at $P< 0.05$ (Duncan's multiple range test).
SE: Standard error, RBC: Red blood cell, WBCs: White blood cells, Hb: Hemoglobin, PCV: Packed cell volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration, MCV: Mean corpuscular volume, PPM: Parts per million, LC50: Lethal concentration 50

monocrotophos and these changes may be due to immunological reactions to produce antibodies to cope up with stress induced by monocrotophos.[25,26] According to dicofol, increased WBC count established leukocytosis, which is considered to be of an adaptive value for the tissue under chemical stress.[27] In the present study in RBC, Hb, PCV, MCV, MCHC values decreased. Fount that the decrease in other haematological variables PCV, Hb and RBC of the exposed fish may be due to haemolysis of RBCs by both pesticides leading to significant decrease in haematocrit value which results in fish anaemi.[28] Similar observations were reported for juvenile *Clarias gariepinus* separately treated with endosulfan and with other pesticides separately.[28] May be due to the disruptive action on the erythropoietic tissue, which is turning affect all of the cell viability.[29] Changes in hematological parameters might have been brought about by cypermethrin as an anemic condition due to decreased synthesis of Hb and RBC number in hemopoietic organs. The reduction of RBC is mainly due to the development of hypoxic condition during the treatment which intern leads to increase in the destruction of RBC or decrease in the rate of formation of RBC due to non-availability of Hb content in cellular medium. The reduction in Hb and several other blood components might be due to the inhibition of RBC and heme synthesis, osmoregulatory dysfunction, and destruction of RBCs in hematopoietic organs as reported earlier in *Catla catla.*[30] In the present study, Hb level was connected with number of RBC, and when the number of RBC decreased, Hb level decreased. When temperature decreased, the number of WBC increased. A decreasing trend of Hb during the cold temperature has been reported in many. The random use of different pesticides often causes a lot of damage on non-target organism. Organophosphate pesticides constitute a large proportion of the total synthetic chemicals employed for the control of pests in the field of agriculture, veterinary practices, and public health.[31] Reduction in Hb level, hematocrit, and number of RBCs might be due to erythroblastosis causing anemia.[32]

Thus, the present study of propargite the significantly MCV, MCH, and MCHC decrease values compared to the control group. Reported that acute exposure of diazinon pesticide in fingerlings European catfish caused a significant decrease of MCV, MCH, and MCHC values compared to the control group.[33] Similarly, in the current acute study, the hematological indices were significantly decreased. The high percentage of immature RBCs in the circulation might be the reason for MCV and MCH decrease in the present investigation. Moreover, an increase in the erythrocyte volume during stress condition may be another possible reason.[13]

CONCLUSION

The hematological parameters are the most sensitive indices in the toxicity of propargite at sublethal concentration. These pesticides result in significant changes in hematological alterations and behavioral changes may be potentially disruptive for the survivability of the fish in their natural environment. This fact should be taken into consideration when it is used for pest control in the agricultural fields surrounding their natural freshwater reservoirs. The analysis can be converted into decisions in risk management and decisions to minimize the toxic impacts.

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