Zoological and Entomological Letters

E-ISSN: 2788-8428
P-ISSN: 2788-8436
ZEL 2023; 3(2): 17-19
Received: 23-04-2023
Accepted: 28-05-2023

Sunita Arya
Department of Zoology, DG PG College, Kanpur, Uttar Pradesh, India

Renu Goel
Department of Zoology, PPN PG College, Kanpur, Uttar Pradesh, India

Girijesh Shukla
Department of Zoology, DDU Govt. PG College, Saidabad, Prayagraj, Uttar Pradesh, India

Correspondence Author:
Sunita Arya
Department of Zoology, DG PG College, Kanpur, Uttar Pradesh, India

Impact of chlorpyrifos insecticides on the Haematology of *Clarias gariepinus*

Sunita Arya, Renu Goel and Girijesh Shukla

DOI: https://doi.org/10.22271/letters.2023.v3.i2a.64

Abstract
Insecticides' toxic effects on edible fish are an issue of concern on a global scale. The purpose of the current study was to track the toxicity caused by Pyrethroid pesticides. Haematological analysis of blood was done to assess the degree of Pyrethroid toxicity in the exposed *Clarias gariepinus*. Chlorpyrifos trioxide was administered at a sublethal dose for 30 days. Fish were fed a specific diet at 2% body weight each day. In chlorpyrifos-exposed fish, haematological indices including TEC, Hb, and PCV dramatically rose, but ESR, WBC, MCV, MCH, and MCHC values significantly reduced. However, after 20 days (p=0.01) and 30 days (p=0.001) of exposure durations, substantial alterations were only seen.

Keywords: Chlorpyrifos, insecticides, haematology, *Clarias gariepinus*

Introduction
Insecticides are biologically toxic substances used by humans to kill pests to increase the yield of many crops and to control the spread of insects. The use of pesticides has caused serious environmental and health risks to living things, including humans (Prakash and Verma, 2014) [9]. In many countries, large scale mortality of fishes has been recorded due to pesticides in water bodies as pollutants (Nikam, 2011) [7].

The diverse effects of insecticides and their range of concentrations that activate toxic adverse effects in aquatic life forms make them a particular source of worry. According to Jayaprakash and Shettu (2013) [6], nearly 30% of all pesticides used worldwide are chlorpyrifos and its derivatives, which are often employed to control insect pests. Their average time in water is two weeks, however aquatic creatures quickly absorb them and they are very poisonous (Rand and Petrocelli, 1995) [11].

Chlorpyrifos, a broad-spectrum organophosphorus insecticide used on fire, fruit, stems, leaf mines, for defoliating larvae, sucking pests, termites etc. and in other situations to kill several pests including insects and worms. Chlorpyrifos is considered moderately hazardous to humans by the World Health Organization. Even at extremely low concentrations in water, chlorpyrifos may be absorbed by gills (Clark *et al*., 1985) [4]. Freshwater fishes could be used as potential biomarkers of Chlorpyrifos insecticides (Krishna and Prakash, 20015) [7], and they also pose a threat to human health and the environment (Damien *et al*., 2004) [5]. On exposure to cypermethrin, a significant alteration in the haematological parameters of the edible freshwater snake-headed fish was observed.

In many fish species, haematology serves as a gauge of overall health. Fish haematological characteristics offer important information on how fish react physiologically to changes in their environment. The clinical relevance of hemological parameters in prognosis and diagnosis as well as the relative ease of sampling they provide are well documented. Mean Corpuscular Volume (MCV), Mean Courpuscular Haemoglobin (MCH), and Mean Corpuscular Haemoglobin Concentration (MCHC) are three haematological parameters that have received little attention. Only a small number of species from diverse regions of the world have normal values for these criteria available.

These values offer a rather accurate indicator of the physio-pathological and eco-biological state of the blood. Haemoglobin, a pigment found in erythrocytes that serves as a respiratory carrier, transports oxygen in fish blood. Therefore, fish haematology is employed to show how fish physiological mechanisms work abnormally (Adakole, 2012) [1]. The purpose of the current study was to show how exposure to a sublethal dose of chlorpyrifos caused

haematological alterations in the fish *Clarias gariepinus*.

Materials and Methods

Clarias gariepinus, a freshwater catfish, was taken from nearby freshwater bodies and kept in aquaria for 10 days to acclimatise it to lab settings. The same food and habitat as the experimental fish were provided to the fish housed in one tank as control specimens, with the exception that they did not receive the same dosage of the insecticide chlorpyrifos. For 7, 14, and 21days, the test fish were exposed to sublethal levels of chlorpyrifos. There were six sets of tests put up. Fish were fed a specific diet at 2% body weight each day.

To estimate the total RBC count, haemoglobin (Hb%), packed cell volume (PCV), erythrocyte sedimentation rate (ESR), total leukocyte count (TLC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC), blood was drawn from the caudal vein of control and experimental test fish using heparinized needles. The data were analysed statistically according to accepted practises. The results are expressed as the mean standard deviation of the mean (SD) of n = 5.

Results and Observation:

The present focus of ichthyologists and aquaculture managers is fish haematology. Clinical fish haematology has just recently begun to be used, and even then, primarily in western nations. Despite being a useful analytical technique, fish haematology is still not widely utilised in India and is only applied when there is a serious epidemiological problem affecting fish or their environment that causes mass death (Chadha and Sharma, 2015) [2].

In the current study, the blood of a freshwater teleost, *Clarias gariepinus*, was used to examine the effects of chlorpyrifos on a number of blood parameters, including haemoglobin percent (Hb%), clotting time (CT), packed cell volume (PCV), erythrocytes sedimentation rate (ESR), total erythrocyte count (TEC), total leukocyte count (TLC), mean corpuscular haemoglobin (MCH), After 10, 20, and 30 days of exposure, respectively, changes were seen in haematological parameters such TEC, Hb, and PCV, whereas ESR, WBC, MCV, MCH, and MCHC levels dramatically reduced when compared to controls.

The value of the total erythrocyte count determines the values of haemoglobin and PCV%. In the current investigation, numerical values for RBC increased as haemoglobin percentage increased, and PCV percentage was higher than it was for the control group. Following exposure to sublethal levels of chlorpyrifos, erythrocyte counts increased with increasing the concentration and duration of exposure, along with increases in Hb% and PCV% age, when compared to controls. *Clarias gariepinus* was exposed to sub-lethal levels of chlorpyrifos, which resulted in anaemia, as seen by the considerable decline in Hb, RBC, and PCV values.

The RBC count, haemoglobin concentration, and haematocrit volume may have decreased as a result of the anaemia. Fish with anaemia have either an abnormally low amount of red blood cells or red blood cells with insufficient haemoglobin. According to Jayaprakash and Shettu (2013), the pesticide-induced anaemia in fish may be brought on by the hazardous inhibitory impact of substances on the enzyme system in charge of producing haemoglobin. In the current study, fish exposed to chlorpyrifos had considerably lower leucocyte counts and haematological incidences such MCH, MCV, and MCHC than control fish. The substantial rise, however, wasn't seen until 14 days (p=0.01) and (p=0.001) following the exposure periods. It was discovered that all of the reading was statistically significant.

Table 1: Changes in haematological parameters of *clarias gariepinus* exposed to sublethal concentration of chlorpyrifos pesticides for the period of 7, 14 & 21 days

Parameters	Exposure Periods of Chlorpyrifos			
	Control	7 days	14 days	21 days
RBC	3.05±0.11	3.22±0.21	3.80±0.04*	4.72±0.12**
Hb%	9.30±0.13	10.22±0.11	10.67±0.13*	11.82±0.12**
PCV%	22.43±0.11	26.35±0.13	32.12±0.12*	40.13±0.08**
ESR	8.02±0.12	7.33±0.09	6.04±0.10*	5.02±0.11**
WBC	54.24±0.11	48.16±0.09	42.52±0.07*	40.47±0.11**
MCH	30.40±0.12	26.30±0.11	17.05±0.12*	12.50±0.13**
MCV	78.30±0.06	70.22±0.14	62.70±0.08*	52.10±0.11**
MCHC	38.02±0.07	34.70±0.11	30.70±0.09*	26.60±0.12**

*p< at 0.01 and **p<0.001

For the assessment of the fish's physiological condition, haematological measures are crucial. The modifications depend on the type of fish, its age, the stage at which spawners reach sexual maturity and illnesses (Pandey *et al*., 1080) [9]. Fish blood properties typically alter in response to pollutants quite quickly (Verma and Prakash, 2019 & 2023; Chakraborty *et al.*, 2021) [12, 13, 3]. According to Jayaprakash and Shettu (2013) [6], a fish's nutritional state, food, strain, temperature, season of the year, and haemoglobin concentration all affect its red blood cell count, PCV, and haemoglobin concentration.

Conclusion

The most sensitive indicators of Chlorpyrifos poisoning at sublethal dosages are the haematological markers. The most sensitive aquatic fauna are the fish, and any small modification to an aquatic waterbody may have an instantaneous impact on their health. *Clarias gariepinus*is very poisonous to chlorpyrifos, even at very low concentrations. It is advised that Chlorpyrifos insecticide be used sparingly and under strict management to manage agricultural pests. This study also clearly indicates that the presence of chlorpyrifos in fresh water bodies, even in small concentration, could cause deleterious effects on fish physiology and may potentially disturb their survivability in the natural environment. Therefore, controlling measures should be taken to prevent the possible contamination of the aquatic environment by such toxic pesticides.

References

1. Adakole JA. Changes in some haematological parameters of the African catfish (*Clarias gariepinus*) exposed to a metal finishing company effluent. Ind. J Sci. Technol. 2012;4(5):2510-2514.
2. Chadha P, Sharma M. Acute toxicity of 4-nonylphenol on haematological profile of fresh water fish *Channa punctatus*. Res. J Recent. Sci. 2015;4:25-31.
3. Chakraborty BK, Verma AK, Muniya S. Present Status of Aquatic Resource and Its Catch of Mogra River in Bangladesh. Sustainable Marine Structures. 2021;3(2):26-38.
4. Clark JR, Patrick Jr JM, Middaugh DP, Moore JC. Relative sensitivity of six estuarine fishes to carbophenothion, chlorpyrifos, and fenvalerate. Ecotoxicology and environmental safety. 1985 Dec 1;10(3):382-90.
5. Cuny D, Van Haluwyn C, Shirali P, Zerimech F, Jérôme L, Haguenoer JM. Cellular impact of metal trace elements in terricolous lichen Diploschistes muscorum (Scop.) R. Sant.–identification of oxidative stress biomarkers. Water, Air, and Soil Pollution. 2004 Feb;152:55-69.
6. Jayaprakash C, Shettu N. Changes in the hematology of the freshwater fish, Channa punctatus (Bloch) exposed to the toxicity of deltamethrin. Journal of Chemical and Pharmaceutical Research. 2013;5(6):178-83.
7. Krishna R, Prakash S. Acute toxicity of Cypermethrin against fresh water fish, *Mystus vittatus*. International Journal of Applied Research. 2015;1(2):286-288.
8. Nikam S, Shejule KB, Patil RB. Study of acute toxicity of Metasystox on the freshwater fish, Nemacheilus botia, from Kedrai dam in Maharashtra, India. Biology and Medicine. 2011;3(4):13-7.
9. Pandey PK, Singh NK, Chaudhary BP. Effect of organophosphrous insecticide, Malathion on the haematology of Channa punctatus. In Proceedings of Sixth Indian Science Congress. 1980;11:213.
10. Prakash S, Verma AK. Effect of Orgnophosphorus pesticides (Chlorpyrifos) on the hematology of *Heteropneustes fossilis* (Bloch). International Journal of Fauna and Biological Studies. 2014;1(5):95-98.
11. Rand GM, Petrocelli SR. Fundamentals of aquatic toxicology. Hemisphere Publishing Corporation, 1995, 666.
12. Verma AK, Prakash S. Impact of arsenic on haematology, condition factor, hepatosomatic and gastrosomatic index of a fresh water cat fish, Mystus vittatus. International Journal on Biological Sciences. 2019;10(2):49-54.
13. Verma AK, Prakash S. Effect of copper on haematological indices of freshwater catfish, *Mystus vittatus* (Bloch). J Exp. Zool. India. 2023;26(1):371-375.