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TOXIC IMPACT OF CYFLUTHRIN ON HAEMATOLOGICAL PARAMETERS OF SPOTTED SNAKEHEAD, *CHANNA PUNCTATUS* (BLOCH)

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Abstract

Synthetic pyrethroids, such as cyfluthrin, are frequently included in pesticides because of their effectiveness in controlling pests. In spite of the fact that it has a negligible impact on mammals, the substance is extremely poisonous, which indicates that it poses a significant risk to aquatic species that are not the intended targets, particularly fish. Examination of haematological parameters was carried out after 15 and 30 days of exposure to cyfluthrin at a dose that was 10% of the lethal limit (LC_{50}). There was a significant decrease in TEC, Hb concentration, haematocrit percentage, and MCV along with an increase in TLC and MCHC in the groups that were treated to the substance, as demonstrated by the findings. Cyfluthrin has been shown to have a considerable toxicological effect on *Channa punctatus*, which results in significant changes in haematological indicators, as demonstrated by the findings of this study.

Keywords : Pyrethroid, Cyfluthrin, Haematological, Parameters, *Channa punctatus*.

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Introduction

To put an end to an infestation, pyrethroid pesticides are highly effective and powerful instruments. In recent years, the production of these more current forms of pesticides has surged, in contrast to the decline in the usage of conventional pesticides such as carbamates, organochlorines, and phosphates. Chrysanthemum cinerariaefolium blooms contain natural pyrethrins, which are the basis for the production of synthetic compounds known as pyrethroids. The danger they present to mammals and birds is significantly reduced according to Goulding *et al*., (2013). In the manufacture of pesticides, cyfluthrin, which is a synthetic pyrethroid of class II, is frequently involved. You can use it both inside and outside, and it is excellent against a wide variety of pests. In the year 2013, researchers Bhushan and their colleagues carried out a study jointly. Pyrethroids have been discovered to pose a significant threat to fish and other aquatic species that are not the intended targets of the treatment. Research on this topic was conducted by Pimpao *et al.*, (2007) and Sepici-Dincel *et al.*, (2009). Both of these groups of researchers published their findings. The physicochemical qualities of aquatic ecosystems are altered when these pesticides make their way into waterways as a result of carelessness, which poses a threat to the ecosystems of aquatic streams. The biochemical and physiological impacts of these pesticides cause the important organs of fish to be susceptible to damage. Banaee et al. were the ones who came up with the idea for the study in 2011. There is potential for the outcomes of a haematological test to provide insight into the general health of a patient. Through the examination of the components of fish blood, it is possible to observe the impact of every chemical or physical change that occurs in the water. In accordance with the findings of Blaxhalet *et al.*, (1973). It is harmful substances in the water that are the source of problems with normal blood cell counts and other hemodynamic parameters. Therefore, haematological examinations are extremely important to the process of toxicological studies. The counts of erythrocytes and leucocytes, the concentration of hemoglobin, the haematocrit, the mean corpuscular volume, and the mean corpuscular haemoglobin concentration are all important haematological indicators that are used in the diagnostic process, in accordance with the findings of Blaxhalet *et al.*, (1973). The spotted snakehead, also known as *Channa punctatus* in the scientific community, is a very common species of freshwater fish that may be found throughout India. This fish is a steel because it is carnivorous, difficult to kill, and affordable. For toxicological investigations, it is quite useful because it is simple to maintain in controlled laboratory environments and it is also useful.

Materials and Methods

A neighboring water reservoir provided us with the opportunity to gather *Channa punctatus* specimens that were free of contamination. A medication consisting of 1% KMnO4 was delivered to the fish in order to protect their skin against infectious diseases. Ten days were allotted to the fish so that they could become accustomed to the conditions of the laboratory before the experiment. The pellets that were supplied to the fish were manufactured from commercial fish feeding formula. Throughout the course of the experiment, it was necessary to keep a close eye on a number of important water parameters, including temperature, pH, dissolved oxygen, and hardness. Cyfluthrin of a technical grade was utilized in the research project, which was obtained from Bayer Vapi Ltd., which is situated in Gujrat. The chemical

cyfluthrin was first dissolved in acetone to produce a concentrated solution, which was then used to obtain the concentrations that were required for the testing. During the process of conducting haematological investigations, we divided the fish into three distinct groups. A group known as Group I served as the control. Those who were exposed were members of Groups II and III. When fish were exposed to cyfluthrin, a sublethal dose of 0.3 µg/L was administered to groups of fish for a period of 15 and 30 days. After being exposed to the cyfluthrin concentration for 96 hours, which was 10% of the lethal dosage, fifty percent of the organisms that were tested passed away with death. Before having their blood drawn, the subjects were told to completely abstain from eating for a period of at least twenty-four hours. The examination of haematological markers requires blood samples to be taken at two different time points: fifteen days and thirty days after the initial sample was taken. The hemodynamic parameters were estimated by employing procedures that are considered to be standard. Utilizing the improved hemocytometer, an estimation of the total amount of white blood cells and red blood cells was made. A hemoglobinometer belonging to Sahli was utilized in order to determine the concentration of hemoglobin. For the purpose of determining the haematocrit, the approach that was described in the study that Wintrobe and colleagues conducted in 1981 was followed. For the purpose of analyzing the data, we utilized the statistical application known as SPSS.

Results and Discussion

The results of haematological studies are presented in table-I

Table-I Haematological parameters of *Channa punctatus* after sublethal treatment of cyfluthrin (0.3 µg/L) for 15 and 30 days

Parameter	Group I (Control)	Cyfluthrin exposed Groups		Significance level
		Group II (15 Days exposure)	Group III (30 Days exposure)	
TEC	3.69±0.03	2.66±0.08	2.30±0.11	P<0.001
TLC	8850±28.86	9550±28.86	10520±15.27	P<0.001
HbC	12.76±0.14	09.66±0.08	08.43±0.12	P<0.001
HCT	47.66±1.45	35.33±1.45	30.00±0.57	P<0.001
MCV	129.14±3.24	119.24±5.90	112.79±4.84	P>0.05
MCHC	26.81±0.50	27.43±0.98	28.13±0.76	P>0.05

Values are mean+SEM for three replicates.

As can be seen in the data, the numbers of total red blood cells, hemoglobin concentrations, percentages of haematocrit, and mean corpuscular volumes were significantly lower in both of the exposed groups (Groups II and III) as compared to the control group (Group I). A considerable rise in total leucocyte count and mean corpuscular haemoglobin concentration was observed in the fish that were exposed to the substance, in comparison to the control group. In order to answer the question of how cyfluthrin affects Channa punctatus, the purpose of this study was to investigate the most important haematological parameters. It was discovered in this study that pyrethroid pesticides were present in the fish samples that were examined, which is in line with the findings of prior studies. The findings of other researchers have also been reported, and they are highly comparable to one another, with some slight differences. Following exposure to cypermethrin, the following parameters in Cyprinus carpio were found to be altered: total erythrocyte count (TEC), hemoglobin (Hb), haematocrit (HCT), total leukocyte count (TLC), mean corpuscular volume (MCV), and mean corpuscular hemoglobin concentration (MCHC). These findings were reported by Dorucu and Girgin (2001). Girgin and Cakmak (2003) observed decrease in TEC, TLC, Hb and MCHC while MCV went up throughout the study after cypermethrin overdose. A decrease in packed cell volume (PCV), mean corpuscular volume (MCV), and total leukocyte count (TLC) was observed in rainbow trout (Oncorhynchus mykiss) when cypermethrin was administered. However, the total erythrocyte count (TEC), haemoglobin (Hb), and mean corpuscular hemoglobin concentration (MCHC) were all increased as a result of the treatment. These alterations were observed by Atamanalp and colleagues in the year 2002. A rise in the total leucocyte count was observed in Schizothorax esocinus after exposure to cypermethrin, but a drop in the erythrocyte count, hemoglobin concentration, and haematocrit was observed in a study by researchers Akhtar *et al.,* (2021). The results of a study that was carried out by Vani and colleagues (2011) on young Catla catla fish that were subjected to deltamethrin showed that there was a significant reduction in the levels of TEC, TLC, and Hb conc. blood counts. The total erythrocyte count (TEC), hemoglobin (Hb), packed cell volume (PCV), mean corpuscular hemoglobin concentration (MCHC), total leukocyte count (TLC), and mean corpuscular volume (MCV) were all the parameters that were found to be affected by deltamethrin exposure in Channa punctatus, according to the findings of a study that was carried out by Jayaprakash and Shettu (2013). In the study conducted by Ullah et al. (2014), it was discovered that the levels of total erythrocyte count (TEC), haemoglobin (Hb), and haematocrit (HCT) decreased in Tor putitora following exposure to cypermethrin. Furthermore, Uddin *et al.,* (2022) discovered that Mystus cavasius that had been poisoned with cypermethrin had a significantly greater total leukocyte count (TLC), as well as lower levels of TEC and hemoglobin. There was a drop in the number of white blood cells, red blood cells, and haemoglobin levels in Oriochromis niloticus when they were exposed to deltamethrin, according to the findings of Dawood *et al.* (2020). Patole *et al.,* (2016) achieved equivalent results for fenvalerate in C. punctatus, while Khan *et al.,* (2018) discovered comparable results for cypermethrin in Labeo rohita. Both scientist's findings were similar. Bhushan *et al.,* (2013), Jayaprakash and Shettu (2013), and Selvi *et al.,* (2008) discovered that various fish species that were subjected to cypermethrin, deltamethrin, and fenvalerate had significantly higher white blood cell counts and significantly lower red blood cell counts, haemoglobin concentrations, and packed red blood cell volumes.

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