Biospectra : ISSN: 0973-7057, Vol. 18(1), March, 2023, pp. 119-122 **Animal Science**
An International Biannual Refereed Journal of Life Sciences

ISSN : 0973-7057

Study on the impact of deltamethrin on a few hematopoietic variables in freshwater fish *Heteropneustes fossilis* (Bloch)

Ragini Ranu*
University Department of Zoology, B.N.M. University, Madhepura, Bihar, India

Received : 05th January, 2023 ; Revised : 05th February, 2023

Abstract- In the agricultural area (Paddy), it has been discovered that many pests have developed resistance to the usual pesticides, such as deltamethrin (a pyrethroid), which are typically used to treat the crops to make them insect-free. However, the pond also serves as an excellent refuge for fish that live at the bottom of the water column, Heteropneustes fossilis (Bloch), which are frequently subjected to chemicals used to eradicate insects. After 30 and 40 days of exposure, there was a dramatic peak in opercular beat as well as a gradual increasing trend of 20 to 30%, all of which contributed to a significant mortality rate. Using accepted techniques, the current experiment was conducted to determine how deltamethrin affected the hematopoietic variables in the Asian stinging catfish *Heteropneustes fossilis*. Fish were treated for 96 hours to a sub-lethal dose of deltamethrin. The blood was drawn from both control and experimental fish, and the haematological parameters total leucocyte count, total erythrocyte count and haemoglobin percentage was measured. The findings showed that while total leucocyte count somewhat increased in experimental fish, total erythrocyte count, haemoglobin percentage, dramatically dropped. As a result of exposure to deltamethrin, the study found that Asian stinging catfish *Heteropneustes fossilis* blood underwent noticeable modifications.

Key words: Deltamethrin, *Heteropneustes fossilis*, hematopoietic variables, chemicals

INTRODUCTION

Heteropneustes fossilis, also known as the Asian stinging catfish or fossil cat, is a type of airsac catfish that can be found in India, Pakistan, Bangladesh, Bhutan, Nepal, Sri Lanka, Myanmar and Thailand. Additionally, it has been introduced to Iran's Tigris River Basin.[1] Air breathing fictitiously, Adults are typically found in ponds, ditches, swamps, and marshes, though they can occasionally be seen in murky rivers. Known to have been or be grown in rice fields. Capable of enduring slightly brackish water, it is omnivorous. When enough rainwater collects, they can spawn in ponds, abandoned ponds, and ditches but only during the monsoon season. Like other members of the same family, oviparous, unique pairing is possible. Due to its therapeutic properties, it is in high demand. *H. fossilis* is primarily found in ponds, ditches, swamps, and marshes, while it can also be found in murky rivers. It can stand water that is a little bit brackish. It eats everything. This species can spawn in ponds, abandoned ponds, and ditches when enough rainwater collects, but it only does so during the monsoon season. It is highly sought after because of its purported medical benefits.[2]

A typical synthetic pyrethroid pesticide used in agricultural and pest management is deltamethrin. Aquatic habitats, especially freshwater species like *Heteropneustes fossilis* (sometimes called the stinging catfish or sting fish), may suffer as a result of its use.[3] Because of the chemical's extreme toxicity to aquatic life, deltamethrin exposure can

*Corresponding author :
Phone : 6204682505
E-mail : raginiranu@gmail.com

have a variety of physiological and biochemical effects, including changes to haematological markers. The current study discusses a few hematopoietic variables that deltamethrin may affect in *Heteropneustes fossilis*.

MATERIALS & METHODS

Without regard to gender, 30 adults live *Heteropneustes fossilis* fish weighing 150–220 g were procured from the neighbourhood market of Madhepura and placed in the control tank in the lab, given a thorough wash using tap water, and then allowed to acclimatise for 20-40 days. They were given a typical fish diet. 25 fish were distributed in the group of 5, which were then moved to six separate tanks having 20 litre capacities for the experimental treatment and exposed to 1/4th sub lethal concentration of deltamethrin, with 5 fish remaining in the reserve tank as the control. A drug called ethylenediamine tetraacetic acid (EDTA) is used to manage and treat heavy metal poisoning. It belongs to the chelating drug subclass. The benefits of using EDTA as an effective treatment for lead toxicity are discussed in this activity, along with its side effects and indications. By severing the caudal peduncle and using EDTA as an anticoagulant, blood was collected in a glass tube at the conclusion of the exposure period. Only 2 ml blood samples for hematopoietic variables were taken. Total leucocyte count, total erythrocyte count and haemoglobin percentage were calculated as hematopoietic variables.

Table 1- Effect of deltamethrin on total leucocytes count (× 10^3/mm^3) in *Heteropneustes fossilis*

Group	Body weight (gm)	20 days	30 days	40 days
Control	200 ± 1.23	4.16 ± 0.25	4.16 ± 0.25	4.16 ± 0.25
Group 1	187 ± 0.18	5.01 ± 0.46	4.87 ± 0.21	5.11 ± 0.10
Group 2	199 ± 0.11	4.99 ± 0.52	4.82 ± 0.12	4.81 ± 0.08
Group 3	202 ± 0.16	5.81 ± 0.12	4.96 ± 0.34	5.26 ± 0.09
Group 4	218 ± 0.08	5.42 ± 0.11	4.67 ± 0.45	4.87 ± 0.08
Group 5	150 ± 0.09	4.45 ± 0.20	4.50 ± 0.11	5.69 ± 0.07

Table 2- Effect of deltamethrin on total erythrocytes count (× 10^6/mm^3) in *Heteropneustes fossilis*

Group	Body weight (gm)	20 days	30 days	40 days
Control	200 ± 1.23	2.61 ± 0.4	2.61 ± 0.4	2.61 ± 0.4
Group 1	167 ± 0.16	0.98 ± 0.52	1.69 ± 0.45	1.11 ± 0.09
Group 2	193 ± 0.17	1.12 ± 0.49	1.58 ± 0.15	0.99 ± 0.05
Group 3	203 ± 0.09	1.67 ± 0.84	1.23 ± 0.63	1.87 ± 0.09
Group 4	198 ± 0.14	1.36 ± 0.36	1.78 ± 0.17	1.78 ± 0.07
Group 5	213 ± 0.09	1.17 ± 0.45	1.16 ± 0.12	1.58 ± 0.06

Table 3- Effect of deltamethrin on haemoglobin percentage (g%) in *Heteropneustes fossilis*

Group	Body weight (gm)	20 days	30 days	40 days
Control	200 ± 1.23	10.56 ± 0.97	10.56 ± 0.97	10.56 ± 0.97
Group 1	205 ± 0.11	9.1 ± 1.7	8.54 ± 0.67	6.42 ± 0.42
Group 2	197 ± 0.13	8.9 ± 1.2	7.42 ± 0.59	5.23 ± 0.63
Group 3	152 ± 0.18	6.2 ± 1.8	5.31 ± 0.74	3.62 ± 0.48
Group 4	159 ± 0.19	9.9 ± 1.4	8.33 ± 0.82	7.99 ± 0.85
Group 5	220 ± 0.02	8.8 ± 1.1	7.41 ± 0.69	6.09 ± 0.28

RESULTS & DISCUSION

Effect of deltamethrin on total leucocytes count :-

Fish subjected to sub-lethal concentrations of 1/4th of deltamethrin for 20 days, 30 days and 40 days in group 1 were found to have total leucocytes count of 5.01 ± 0.46, 4.87 ± 0.21 and 5.11 ± 0.10, respectively, in group 2 were found to have total leucocytes count of 4.99 ± 0.52, 4.87 ± 0.21 and 4.81 ± 0.08, respectively, in group 3 were found to have total leucocytes count of 5.81 ± 0.12, 4.96 ± 0.34 and 5.26 ± 0.09, respectively, in group 4 were found to have total leucocytes count of 5.42 ± 0.11, 4.67 ± 0.45 and 4.87 ± 0.08, respectively, in group 5 were found to have total leucocytes count of 4.45 ± 0.20, 4.50

± 0.11 and 5.69 ± 0.07, respectively, while the mean control was 4.16 ± 0.25g/dl. Over the control, the haemoglobin level was considerably higher for all exposure times.

Effect of deltamethrin on total erythrocytes count :-

Fish subjected to sub-lethal concentrations of 1/4th of deltamethrin for 20 days, 30 days and 40 days in group 1 were found to have total erythrocytes count of 0.98 ± 0.52, 1.69 ± 0.45 and 1.11 ± 0.09, respectively, in group 2 were found to have total erythrocytes count of 1.12 ± 0.49, 1.58 ± 0.15 and 0.99 ± 0.05, respectively, in group 3 were found to have total erythrocytes count of 1.67 ± 0.84, 1.23 ± 0.63 and 1.87 ± 0.09, respectively, in group 4 were found to have total erythrocytes count of 1.36 ± 0.36, 1.78 ± 0.17 and 1.78 ± 0.07, respectively, in group 5 were found to have total erythrocytes count of 1.17 ± 0.45, 1.16 ± 0.12 and 1.58 ± 0.06, respectively, while the mean control was 2.61 ± 0.4 g/dl. Over the control, the haemoglobin level was drastically lower for all exposure times.

Effect of deltamethrin on haemoglobin percentage :-

Fish subjected to sub-lethal concentrations of 1/4th of deltamethrin for 20 days, 30 days and 40 days in group 1 were found to have haemoglobin contents of 9.1 ± 1.7, 8.54 ± 0.67 and 6.42 ± 0.42, respectively, in group 2 were found to have haemoglobin contents of 8.9 ± 1.2, 7.42 ± 0.59 and 5.23 ± 0.63, respectively, in group 3 were found to have haemoglobin contents of 6.2 ± 1.8, 7.42 ± 0.59 and 3.62 ± 0.48, respectively, in group 4 were found to have haemoglobin contents of 9.9 ± 1.4, 8.33 ± 0.82 and 7.99 ± 0.85, respectively, in group 5 were found to have haemoglobin contents of 8.8 ± 1.1, 7.41 ± 0.69 and 6.09 ± 0.28, respectively, while the mean control was 10.56 ± 0.97g/dl. Over the control, the haemoglobin level was considerably lower for all exposure times.

Anaemia: Fish exposed to deltamethrin may become anaemic. A reduction in the quantity of red blood cells (erythrocytes) or a drop in haemoglobin concentration, are two symptoms of anaemia. The blood's ability to carry oxygen may be diminished as a result, depriving tissues of oxygen.[4]

Hematocrit is the proportion of red blood cells to total blood volume. Hematocrit levels can change after exposure to deltamethrin. A higher hematocrit may be a sign of stress or dehydration, whereas a lower value may be indicative of anaemia. Leukocyte count in fish can change as a result of exposure to delamethrin. It may cause white blood cell counts to either rise (leukocytosis) or fall (leukopenia). These variations in leukocyte count may be a sign of inflammatory or stress-related immune system reactions. Hemolysis, or the rupture or destruction of red blood cells, is a potential side effect of deltamethrin. Serum haemoglobin levels may rise as a result of hemolysis, which releases haemoglobin into the blood.[5]

Thrombocytopenia: Thrombocytopenia is a condition in which there is a reduction in the number of platelets (thrombocytes) in the blood as a result of exposure to deltamethrin. A decrease in platelets can make it more difficult for the fish to control bleeding because platelets are essential for blood clotting. Changes in Differential Blood Cell Counts: Exposure to deltamethrin may also alter the proportions of certain white blood cells, such as neutrophils, lymphocytes, and monocytes. Changes in these differential counts can reveal information about the immune system and general health of the fish.[6,7]

The specific effects of deltamethrin on haematological markers in *Heteropneustes fossilis* can differ based on a number of variables, including the concentration and length of exposure, the age and health of the fish, and environmental circumstances.[8,9] Studies on the effects of deltamethrin on this species may also offer more thorough and data particular to this species. In conclusion, exposure to deltamethrin can significantly harm freshwater fish like *Heteropneustes fossilis'* haematological characteristics. In regions where deltamethrin is used or where pesticide runoff is a possibility, monitoring these metrics is crucial for determining the health and wellbeing of fish populations. The main hematopoietic reactions of rainbow trout in the study were somewhat different from the results of some other authors who examined the reactions of rainbow trout and common carp to exposure to synthetic pyrethroid.[10] After acute exposure to deltamethrin, carp showed significantly decreased RBC, Hb, and PVC values (P 0.01) due to probable haematopoiesis disruption, although there were no changes in the white blood cell profiles.[11] PVC, Hb, LEU, and RBC levels were found to be lower in carp after cypermethrin poisoning,[10] and total leucocyte count and neutrophil granulocyte count were shown to be lower in carp after acute permethrin poisoning.[12]

CONCLUSION

The results of the current study indicate that deltamethrin decreased the haematological parameters in

Heteropneustes fossilis, which suggests that the synthetic deltamethrin (pyrethroids) may impair immunological function and cause serious physiological issues that finally lead to fish mortality. Farmers who come into direct touch with deltamethrin, a synthetic pyrethroid used to protect many fruits, vegetables, and field crops from disease, could suffer health effects.

REFERENCES

1. **COAD, Brian W. 2015.** Review of the Freshwater Catfishes of Iran (Order Siluriformes). *Iranian Journal of Ichthyology*. **1(4):** 218–257.
2. **Froese Rainer & Pauly Daniel (eds.) 2011.** *Heteropneustes fossilis* in Fish Base. December 2011 version.
3. **Ragini Ranu & Arun Kumar. 2019.** Studies on the effect of deltamethrin on the respiratory rate and some blood parameters of *Heteropneustes fossilis* (Bloch). *Biospectra*. **14(1):**27-30
4. **Atamanalp M., Keles M. S., Haliloglu H. I., Aras M. S. 2002.** The effects of cypermethrin (a synthetic pyrethroid) on some biochemical parameters (Ca, P, Na and TP) of rainbow trout (*Oncorhynchus mykiss*). *Turkish Journal of Veterinary Animal Sciences*. **26:**1157–1160.
5. **Jee L. H., Masroor F., Kang J. C. 2005.** Responses of cypermethrin-induced stress in haematological parameters of Korean rockfish, *Sebastes schlegeli* (Hilgendorf). *Aquaculture Research*. **36:** 898–905.
6. **Prashanth M. S., David M., Mathed S. G. 2005.** Behavioural changes in freshwater fish, *Cirrhinus mrigala* (Hamilton) exposed to cypermethrin. *Journal of Environmental Biology*. **26:** 141–144.
7. **Adhikari S. & Sarkar B. 2004.** Effect of Cypermethrin and Carbonfluron on certain haematological parameters and prediction of their recovery in a freshwater teleost, *Labeo rohita* (Ham) *Ecotoxicol. Environ. Safe.* **58:**220-226.
8. **Tyagi M., Agrawal V. P. and Nandini S. 1989.** Haematological abnormalities induced in *Ophiocephalus puntatus* by Endosulfan; *Environ. Ser. Recent. Trends. Toxicol*. **1:**81-84.
9. **Svobodova Z., Pravda D., Palackova J. 1991.** Unified methods of haematological examination of fish. *Research Institute of Fish Culture and Hydrobiology, Vodnany, Methods.* **20:** 31 pp.
10. **Dorucu M. & Girgin A. 2001.** The effects of cypermethrin on some haematological parameters of *Cyprinus carpio*. *Aquaculture International*. **9:** 183–187.
11. **Svobodova Z., Luskova V., Drastichova J., Svoboda M., Zlabek V. 2003.** Effect of deltamethrin on haematological indices of common carp (*Cyprinus carpio* L.). *Acta Veterinaria Brno*. **72:** 79–85.
12. **Sopinska A. & Guz L. 1998.** Influence of permethrin on phagocytic activity of carp. *Medycyna Weterynaryjna*. **54:**126–128.

***