JSIANE : Vol. 1, Issue 4, 2021, Page 09–11 ISSN (Online) 2583-2093

Journal of Science Innovations and Nature of Earth

Journal homepage : www.jsiane.com

EFFECTS OF BETA-CYFLUTHRIN ON SOME BIOCHEMICAL PARAMETERS OF *CHANNA PUNCTATUS* (BLOCH)

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https://doi.org/10.59436/jsiane.134.2583-2093

Abstract

Beta-cyfluthrin, a type II synthetic pyrethroid, based pesticides are routinely used to manage a large variety of unwanted insects in both agriculture and household. It has very moderate toxicity for mammals, but significant toxicity for fish and other non-target species. Effect of this toxicant was observed regarding a few biochemical markers of *Channa punctatus*. Alterations in biochemical parameters were recorded after exposure to a sublethal concentration of beta-cyfluthrin for a period of 15 and 30 days. The results showed a significant decrease in total proteins and alkaline phosphatase and increase in total lipids in exposed groups. The results indicated that beta-cyfluthrin caused significant changes in biochemical parameters of fish.

Keywords: Beta-cyfluthrin, *Channa punctatus*, Total proteins, Total lipids and Alkaline phosphatase.

Received 08.10.2021 **Revised 25.10.2021** **Accepted 05.11.2021**

Introduction

In recent years, the use of pesticides has been increased several folds. Extensive use of pesticides resulted in contamination of aquatic ecosystem. Nowadays, pesticides are considered as one of the main sources of aquatic pollution in India. Pesticides used in agriculture are posing a great toxic hazard to aquatic organisms especially to fishes (Sharma and Singh, 2007). Pesticides induced toxicity cause significant damage to the health of fishes. Fishes are a good source of proteins and lipids and to be fit for human consumption, fishes must be healthy. It is well known that the majority of pesticides are extremely hazardous to organisms that are not intended to be killed by them, such as fish that live in aquatic environment close to farmlands. These pesticides frequently enter into aquatic environment by surface runoff, flooding and direct spraying (Banaee *et al*., 2011). Pyrethroids are a novel class of highly effective insecticides that have a broad spectrum of insecticidal activity while exhibiting little toxicity to mammals. (Verma *et. al*., 2001). These are pyrethrin derivatives that have been synthesised, and pyrethrin itself originates from the flowers of Chrysanthemum cinerariaefolium. The insecticide known as beta-cyfluthrin is classified as a type II pyrethroid. Its toxicity surpasses that of the cyfluthrin that it derives from. It is currently utilised as an ingredient in a wide variety of formulations for the control of a wide variety of pests both indoors and outdoors. (Bhushan *et al*.,2013). It blocks sodium channels and keep them open to prolonged periods, causing a rapid knockdown effect on target insects. It is relatively safer to mammals but extremely toxic to fish and aquatic invertebrates. Fishes and other non-target organisms are affected by pyrethroid pesticides present in water (Joshi *et. al*., 2007). Acute toxicity of cyfluthrin in fishes has been reported by many workers (Bradbury and Coats, 1989; Benli, 2005; Sepici-Dincel et al., 2009). Fishes are very sensitive to any changes in the aquatic environment and serve as bioindicators of aquatic pollution. Any physical or chemical changes in the aquatic environment may affect the physiological status of fishes. The presence of toxicants in the water may cause toxic stress in tissues and organs of fish resulting in alterations in biochemical parameters. Biochemical studies are important tools to know about a toxicant mode of action. It is possible to identify biochemical markers quickly and utilise them to anticipate and diagnose pesticide damage. Toxic stress in exposed animals' organs is demonstrated by changes in these measures. Alterations in biochemical parameters can be used for the detection of abnormalities in the organs of fish such as liver and other tissues (Banaee *et al*., 2011). *Channa punctatus* (Bloch) is a common airbreathing, edible freshwater fish found in India and neighbouring countries. It is hardy, easily rearable and economical fish. It can be easily maintained under laboratory conditions and hence suitable for toxicological studies.

Materials and Methods

Healthy specimens of *Channa punctatus* (Bloch) weighing 25+3 gm, were procured from a local water reservoir. The fish were treated with 1% KMnO4 to avoid any dermal infections. The fish were acclimated to laboratory conditions for ten days before the start of experiment. Fish were fed commercial fish food. Water parameters like water temperature, pH, dissolved oxygen and hardness were constantly monitored during the experiment. Technical grade beta-cyfluthrin (>95% purity) used in this study, was procured from Bayer Vapi Ltd., Gujarat, India. For Biochemical studies, Fish were divided into three groups, one control group and two experimental groups. Fish in experimental groups were exposed to one sublethal concentration of beta-cyfluthrin (0.154µg/L) for 15 and 30 days. This concentration of beta-cyfluthrin was 5% of the 96 h LC_{50}, determined in a previous study. Feeding was stopped 24 hours prior to blood collection. For the study of biochemical parameters, blood was collected after 15 days and 30 days. Biochemical parameters were estimated by standard methods. Total proteins were estimated by the method of Dumas (1971), total lipids were estimated by the method of Frings and Dunn (1970) and alkaline phosphatase

was estimated by Kind and King Method (1954). The data was analyzed with the help of SPSS statistical software.

Results

The results of biochemical studies are presented in table 1. Beta-cyfluthrin exposure of *Channa punctatus* for 15 and 30 days resulted in a significant decrease in total proteins and alkaline phosphatase, while total lipids showed a significant increase. There was a significant decrease of 6.73% and 11.48% in total proteins after exposure to sublethal concentration (0.154µg/L) of beta-cyfluthrin for a period of 15 days and 30 days, respectively when compared to control. A significant reduction of 7.55% and 15.09% in alkaline phosphatase was observed after exposure to same sublethal concentration of beta-cyfluthrin for same period when compared to control. Total lipids showed a significant increase of 6.33% and 8.91% after exposure to sublethal concentration (0.154µg/L) of beta-cyfluthrin for a period of 15 and 30 days when compared to control. The effect of beta-cyfluthrin was more pronounced in 30 days group as compared to 15 days group.

Table-1 Effect of sub-lethal concentration (0.154µg/L) of beta-cyfluthrin on some biochemical parameters of *Channa punctatus* (Bloch) for 15 and 30 days

Parameters	Control	Experimental Groups		Significance level
		15 days	30 days	
Total Proteins (mg/dl)	336.66±2.60	314.0±3.05	298.0±1.52	P<0.001
Total Lipids (mg/dl)	400.33±2.90	425.66±3.45	436.0±4.16	P<0.01
Alkaline phosphatase (U/L)	0.53±0.008	0.49±0.006	0.45±0.008	P<0.01

Values are Mean ± SEM of three replicates.

Discussion

Utilizing a number of different biochemical parameters, this research was carried out with the purpose of determining the consequences of a sublethal exposure to beta-cyfluthrin in *Channa punctatus*. These results are in accordance with previously reported studies for beta-cyfluthrin and other type II pyrethroids in fishes and other animals. Several workers reported similar changes in these biochemical parameters after exposure to type II pyrethroids and other pesticides. Akhtar et al. (2021); Bhanu & Deepak (2015); Yadav N.K. (2020) reported a significant reduction in total proteins after exposure to cypermethrin in snow trout, *Cyprinus carpio* and *C. punctatus*, respectively. Decrease in total proteins were reported by Dawood et al. (2020); Ullah et al. (2019); Vani et al. (2011) after exposure to deltamethrin in Nile tilapia, silver carp and *Catla catla*, respectively. Al-Ghamin et al. (2020) observed decrease in alkaline phosphatase in zebra fish after fenvalerate exposure. Montanha et al. (2014); Saha & Kaviraj (2009) reported decline in alkaline phosphatase after cypermethrin exposure in *Rhamdia quelen* and *Heteropneustes fossillis*, respectively. Mahmood et al. (2020) reported significant decline in total lipids in bighead carp after exposure to acetochlor, while Parmar et al. (2019) after being exposed to beta-cyfluthrin, rats exhibited a decrease in the total amount of lipids in their bodies. According to Bhushan and colleagues (2013), there was a significant drop in the levels of both total proteins and alkaline phosphatase, although there was an increase in total lipids in rats after exposure to cypermethrin and beta-cyfluthrin.

Acknowledgements:

The author is thankful to the Principal, D.S. College Aligarh for providing necessary laboratory facilities. The author is also thankful to Dr. B.R. Ambedkar University, Agra for facilitating this study and for providing necessary guidance.

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