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Lambda-Cyhalothrin Induced Protein Alternations in *Etroplus suratensis* (Bloch)

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ABSTRACT

Lambda-cyhalothrin (trade name Karate) is a pyrethroid insecticide, widely used to control insect pests in agriculture, public health, and homes and gardens. In the present study, an attempt has been made to study the effect of lambda-cyhalothrin on protein content of different tissues like liver, muscle and brain of the edible fish *Etroplus suratensis* (Bloch). The *E. suratensis* fishes were exposed to different sub-lethal concentrations of lambda-cyhalothrin for a period of 60 days. From the result, the protein content in the tested tissues of *E. suratensis* was found to decline with increasing sub-lethal concentrations of lambda-cyhalothrin. It is concluded that, lambda-cyhalothrin induced deleterious effect on *E. suratensis*. Therefore, the use of lambda-cyhalothrin in the field may be a threat to fish population and also other organisms including human beings through food chain.

Keywords: Different tissues, *E. suratensis*, Lambda-cyhalothrin, Deleterious effect, Protein

1. Introduction

Environmental pollution caused by pesticides, especially in aquatic ecosystems, has become a serious problem. Pyrethroids insecticides, including lambda-cyhalothrin are widely used for the control of insect pests all over the world to increase the production of food grain and other agricultural products. It may also be used in public health applications to control insects such as cockroaches, mosquitoes, ticks and flies which may act as a disease vector [6]. Pollutants such as insecticides may significantly damage certain physiological and biochemical processes when they enter into the organs of fishes [7]. The intake of insecticide affects the biochemical composition of fishes has been reported previously by many workers [10, 17]. Insecticides can cause serious impairment to physiological and health status of fish. Insecticides have also proved to be detrimental to human beings, fish, and domestic animals by altering various metabolic activities [1, 3]. Biochemical indices of stress have been proposed to assess the health of non-target organisms exposed to toxic chemical in aquatic ecosystem [15].

Protein constitutes the building block and the basic molecule for any biochemical reaction. They are intimately related with almost physiological processes, which maintain a simple biochemical system in living condition. The physiological and biochemical alterations observed in an animal under any physiological stress can be correlated with the structural and functional changes of cellular proteins. Proteins occupy a unique position in the metabolism of cell because of the proteinaceous nature of all the enzymes which mediate at various metabolic pathways [12]. Reports on variations of qualitative tissue proteins are very few and is much wanting, especially with reference to pesticide toxicity [4]. Therefore, the present study an attempt has been made to study the effect of multipurpose pyrethroid insecticide, lambda-cyhalothrin on protein content of different tissues like liver, muscle and brain of the edible fish *Etroplus suratensis* (Bloch).

2. Materials and Methods

Well acclimated *E. suratensis* (6-7 g) of uniform size grouped into sets of 10, and each set was introduced into different sub-lethal concentrations 0.005 ppm, 0.006 ppm, 0.008 ppm, 0.013 ppm and 0.026 ppm of lambda-cyhalothrin respectively. The fishes were fed with standard food pellets throughout the experimental period for 60 days. After their respective exposure period, tissues like liver, muscle and brain were removed and used for the analysis of protein by the method of Lowry *et al.* [11]. The significance difference of protein values in control and experimental animals were analyzed by two-way ANOVA.

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3. Results and Discussion

Protein metabolism is considered the most sensitive physiological responding to environmental stress. The alternations of protein content in the treatments and control group are presented in Table 1. The protein content in the tested tissues of *E. suratensis* was found to decline with increasing sub-lethal concentrations of lambda-cyhalothrin (Fig 1). The maximum protein content of 16.92 ± 0.62 mg/ 100 mg wet tissue (control) and minimum of 5.12 ± 0.77 mg/ 100 mg wet tissue (0.026 ppm) were recorded in liver and brain tissues respectively. From the two-way ANOVA that there was significant difference ($P < 0.0001$) between the different tissues and variations due to concentrations were statistically significant ($P < 0.001$) compared with control group. The decrease in protein

content in different tissues of *E. suratensis* indicated that the active degradation of protein under lambda-cyhalothrin stress. The present observation is in agreement with the investigations of Radhakrishnan Nair [18] and revealed a significant decrease in protein content in liver, kidney, stomach, intestine and muscle *O. mossambicus* and *C. carpio* exposed to different pesticides. Ogueji and Auta (2007) observed depletion of protein content in the blood of *C. gariepinus* with increasing sub-lethal concentration of lambda-cyhalothrin. Ahmad *et al.* [2] studied decreased protein content in different tissues of *D. rerio* exposure to lambda-cyhalothrin and neemgold. Protein depletion in tissues constitutes a physiological mechanism with an important role in providing energy to cope with the stress situation.

Table 1: Variations of lambda-cyhalothrin on protein content in different tissues of *E. suratensis* for 60 days

Tissues	Control	Concentrations of lambda-cyhalothrin (ppm)				
		0.005	0.006	0.008	0.013	0.026
Liver	16.92± 0.62	16.24± 0.71	15.78± 1.14	14.76± 0.54	13.87± 0.55	10.04± 0.58
Muscle	15.65± 0.24	14.9± 0.58	13.93± 1.09	12.49± 0.97	11.64± 0.69	10.69± 0.36
Brain	11.93± 0.45	11.03± 0.48	10.19± 0.73	9.26± 0.19	6.83± 0.45	5.12± 0.77

Values are expressed as mean ± SD

Values are expressed as mg/ 100 mg wet tissue

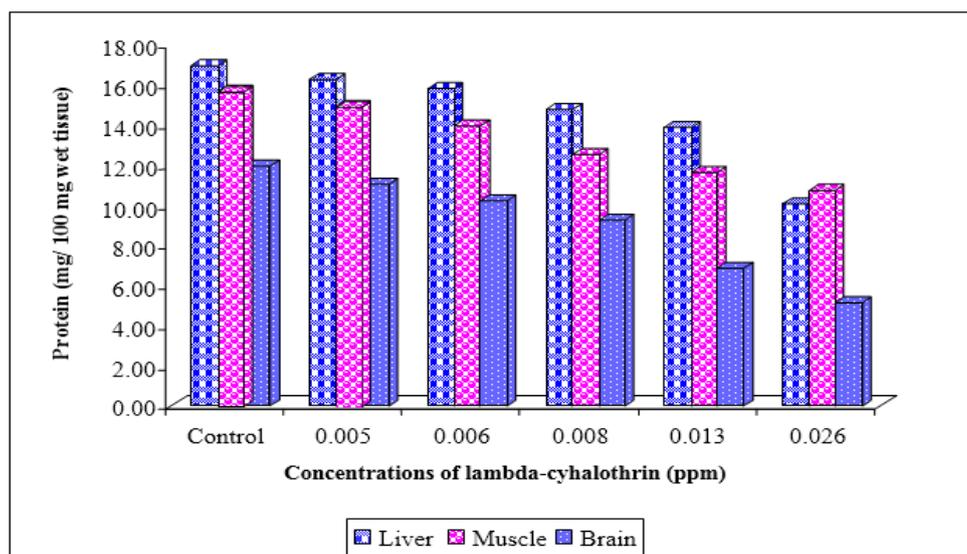


Fig 1: Effect of lambda-cyhalothrin on protein content in different tissues of *E. suratensis* exposed for 60 days

According to Nelson and Cox [14] and Sathyanarayana [22], the physiological activity of animal was indicated by the metabolic status of proteins. Jrueger *et al.* [8] reported that the fish can get its energy through the catabolism of proteins. Proteins are mainly involved in the architecture of the cell, which is the chief source of nitrogenous metabolism. Thus the depletion of protein fraction in liver, muscle and brain tissues may have been due to their degradation and possible utilization for metabolic purposes. Increases in free amino acid levels were the result of breakdown of protein for energy and impaired incorporation of amino acids in protein synthesis. The toxicants may affect the hormonal balance

which could directly or indirectly affect the tissue protein levels [9, 24].

These findings also support the concept of reduction in protein content was also observed in *C. carpio* and *L. rohita* exposed to cypermethrin [12]. Decrease in protein content of *Clarias batrachus* exposed to fenvalerate was reported by Tripathi *et al.* [25]. These results are in agreement with report of Ravinder *et al.* [20] had demonstrated a similar situation in *C. batrachus* exposed to deltamethrin. The variation in distribution suggests difference in metabolic calibers of various tissues. Remia *et al.* [21] demonstrated depletion of protein in gill, muscle and kidney of *T. mossambica*

exposed to insecticide, monocrotophos. Sharma Dilip and Ansari Badre ^[23] recorded the reduction of protein content in zebra fish, *D. rerio* exposed to deltamethrin and achook.

A defect in protein synthesis by the action of toxicants can also decrease the protein content in different tissues. An altered relationship between the ribosomes and the membranes of the endoplasmic reticulum may also produce a defect in protein synthesis. Rath and Misra ^[19] examined the changes in nucleic acids and protein content in liver, muscle and brain of *T. mossambica* exposed to the insecticide, dichlorovos. Rath and Misra ^[19] also found that the RNA/DNA ratio decreased in exposed fish and it showed a positive correlation with protein. Usually RNA and RNA/DNA ratio of a tissue are considered to indicate the intensity of protein synthesis ^[13]. Depletion of proteins might also be attributed to the destruction or necrosis of cellular function and consequent impairment in protein synthetic machinery as suggested by David *et al.* ^[5] Under the light of this study, it is concluded that lambda-cyhalothrin induced deleterious effect on *E. suratensis*. Therefore, the use of lambda-cyhalothrin in the field may be a threat to fish population and also other organisms including human beings through food chain.

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