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ORIGINAL ARTICLE

Effect of Bifenthrin Pesticide on Kidney Protein Content in *Channa Punctatus*

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ABSTRACT

Because the environmental burden of toxic chemicals includes both agriculture and non-agricultural compounds, it is difficult to separate the ecological and human health effects of pesticides from those of industrial compounds that are intentionally or accidentally released into the environment. However, there is overwhelming evidence that agricultural use of pesticides has a major impact on water quality and leads to serious environmental consequences. Although terrestrial impacts by pesticides do occur, the principal pathway that causes ecological impacts is that of water contaminated by pesticide runoff.

Key words: *Bifenthrin Pesticide, Kidney Protein Content, Channa Punctatus*

INTRODUCTION

For the control of pests, the pesticides are used since about 1850. Now-a-days due to advancement of technologies and requirement of huge amount of grains, the use of pesticides increased on large scale. Both types of pesticides are used by the farmers, natural as well as chemical. The natural pesticides are easily used, safe and more biodegradable. But the synthetic pesticides like pyrethroids, polycyclic chlorinated hydrocarbon are less degradable and more dangerous to the environment. These chemicals when enters in food chain then they create most dangerous effects to human beings as well as other animals like fishes, reptiles and aves etc. Oxidative stress and role of reactive oxygen species (ROS) in disease and toxicity have been studied on two major issues in biomedical science in recent times. These aspect have also been studies in the aquatic animals. Fishes constitute one of the major sources of food nutrition for human beings. The nutritional value of different fishes depends upon their biochemical composition like proteins, carbohydrates, vitamins, minerals etc. *Channa punctatus* (Bloch) is selected for present study due to easily availability and handling. The fish "*Channa punctatus* (Bloch)" are the most sensitive of all aquatic animals towards such pollutant while passing through the river receiving wastes from adjoining human settlement and industries. The fish easily gets its tissues, damage due to water pollutants.

Bifenthrin is a pyrethroid insecticide used primarily against the red imported fire ant by influencing its nervous system. It has a high toxicity to aquatic organisms. Although it is listed as a restricted use chemical in the United States, it is allowed to be sold for daily use, provided the product sold has a low concentration of bifenthrin. The chemical was discovered and developed by FMC Corporation. Products containing bifenthrin include Transport, Talstar, Maxxthor, Capture, Brigade, Bifenthrine, Ortho Home Defense Max, Bifen XTS, Bifen IT, Bifen L/P, Torant, Zipak, Scotts LawnPro Step 3, Wisdom TC Flowable, FMC 54800, Allectus, Ortho Max Pro and OMS3024 and mega wash from green planet.

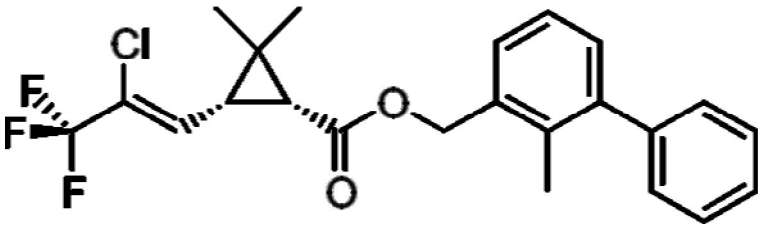
MATERIALS AND METHODS

The live specimen of *Channa punctatus* were brought for the present study from ponds in surrounding vicinity of Agra. For experimental purpose fishes almost of the same size and weight so as to refer to similar age group as constant factor were used for noticing effects of treatments by several insecticides. The fishes were washed in 0.1% $KMnO_4$ solution to smear dermal infection if any. Then they were washed with ordinary water and smeared to aquaria filled with water. The latter was already equipped with sand and *Hydrilla* plants, overcrowding was avoided. The fishes were fed with readymade fish food after every 24 hrs. The water was changed to smear the faecal

matter and excess food after every 24 hrs. Bifenthrin is selected as test compound for the present study.

Test compound: Bifenthrin

CHEMICAL STRUCTURE:



PROPERTIES:

IUPAC name	
2-Methyl-3-phenylphenyl)methyl (1*S*,3*S*)-3- [(*Z*)-2-chloro-3,3,3- trifluoroprop-1-enyl]- 2,2 dimethyl cyclopropane -1-carboxylate	
Identifiers	
CAS Number	82657-04-3
3D model (JSmol)	Interactive image Interactive image
ChEMBL	ChEMBL44019
ChemSpider	9114004
ECHA InfoCard	100.120.070
KEGG	C10980
PubChem CID	10938769

Bifenthrin is poorly soluble in water and often remains in soil. Its residual half-life in soil is between 7 days and 8 months, depending on the soil type, with a low mobility in most soil types. Bifenthrin has the longest known residual time in soil of insecticides currently on the market. It is a white, waxy solid with a faint sweet smell. It is chemically synthesized in various forms, including powder, granules and pellets. However, it is not naturally occurring. Like other pyrethroids, bifenthrin is chiral; it has different enantiomers which can have different effects. Bifenthrin is found in two enantiomers: 1S-cis-bifenthrin and 1R-cis-bifenthrin. 1S-cis-Bifenthrin is 3-4 times more toxic to humans than 1R-cis-bifenthrin, while the latter is more than 300 times more effective as a pesticide.

BIOCHEMICAL ESTIMATION OF TOTAL PROTEIN:

Total protein was estimated by Biuret method described by Henry *et al*. (1974).

Principle: Proteins react with cupric ions of biuret in an alkaline medium to form a violet blue coloured complex which appears as a result of the reaction between –CO and $-NH_2$ groups of protein cupric ions. The intensity of the coloured complex so developed is proportional to the total protein concentration in the sample.

Reagents:

(I) Biuret reagent

(II) Protein standard

Calculations:

$$\text{Total protein (mg/dl)} = \frac{\text{O.D. of Test}}{\text{O.D. of standard}} \times 5.7$$

Statistical Calculations: In the present investigation, the formulae were used for different statistical calculations after Fischer and Yates (1950) using statistical software.

Table 1: Kidney total proteins in *Channa punctatus* after bifenthrin intoxication

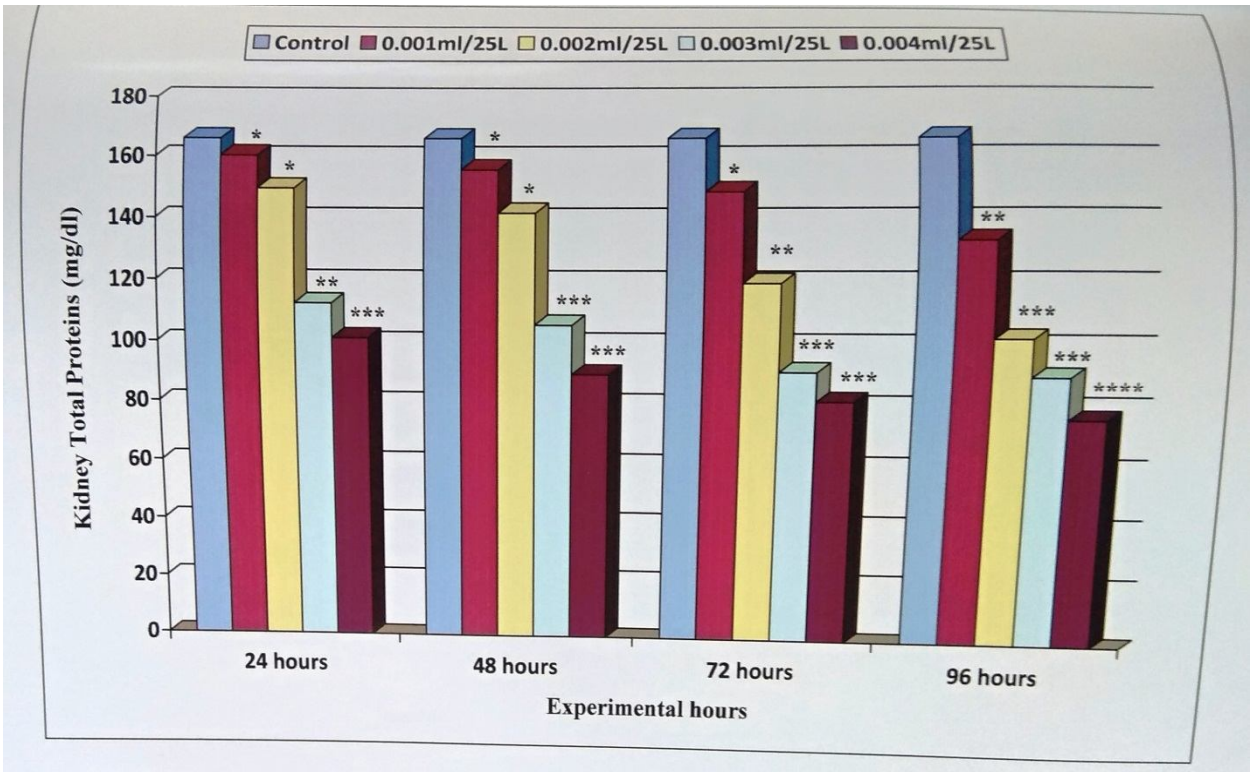
Experimental Sets	24 hrs	48 hrs	72 hrs	96 hrs
	Mean ± S.Em.	Mean ± S.Em.	Mean ± S.Em.	Mean ± S.Em.
Control set	166.31 ± 0.72	166.31 ± 0.72	166.31 ± 0.72	166.31 ± 0.72
0.001 ml/25L	160.33 ± 0.53*	155.64 ± 0.88*	148.50 ± 0.67*	133.00 ± 0.70**
0.002 ml/25L	149.60 ± 0.30*	141.66 ± 0.99*	119.33 ± 0.66**	101.88 ± 0.50***
0.003 ml/25L	112.50 ± 0.40**	105.70 ± 0.33***	90.88 ± 0.50***	89.66 ± 0.33***
0.004 ml/25L	101.20 ± 0.80***	89.67 ± 0.38***	81.00 ± 0.20***	75.64 ± 0.67****

*Non-significant (P > 0.02)

**Significant (P < 0.05)

***Highly-significant (P < 0.01)

****Very highly significant (P<0.001)



Graph 1: Kidney total proteins in *Channa punctatus* after bifenthrin intoxication

RESULTS AND DISCUSSION

Pesticides are material used to control pest. Pesticides are used for crop protection, control of disease causing organisms, prevention of insects transmitting diseases, preservation of food and other materials. During the application of pesticides on the target organisms, they pose public health risk especially to the sprayer. This is because pesticides are toxic to human, animals, plants and non-target organisms. When pesticides are applied into the environment to control a particular pests, they can miss their target and affect other organisms in the environment i.e. air, surface water and sediment, groundwater, soil. The biota in each of the environmental component (i.e. soil, water and air) could be affected depending on the type of pesticides, concentration and mode of application.

The level of total protein in the kidney of *Channa punctatus* exposed to bifenthrin is presented in Table 1 and Fig. 1. Significant variation ($P < 0.05$) exist between the various concentration of the toxicant as compared to control.. This could be associated to the role of the various organs in metabolism of toxicants. Total protein is an essential constitutes of cells and tissues which aid in the physiological functions of the cells (Adamu et al., 2013). Due to the fact that fish has low carbohydrates, protein which is architecture of the cell and main source of nitrogenous metabolism is used to enhance the energy demand (Adamu and Kori-Siakpere, 2011). The protein is the energy sources of spores during stress period. The reduction of tissue proteinpesticides stress impacts in the conversion of tissue protein into soluble fraction (Olusegun and Adedayo, 2014).

The two types of pyrethroids are the ones with an α-cyanogroup and the ones without an α-cyanogroup. The neurotoxicity of bifenthrin is based on the affinity to the voltage-gated sodium channels (both in insects, as well as in mammals). The pyrethroids with an α-cyanogroup block the closing of the sodium-channel permanently, causing the membrane to be permanently depolarized. The resting potential will not be restored, and no further action potential can be generated. The pyrethroids without an α-cyanogroup, to which bifenthrin belongs, are only able to bind to the sodium channel transiently. This will result in after potentials and eventual continuous firing of axons. The resting potential is not affected by these pyrethroids. Bifenthrin will open the sodium channel for a shorter period than other pyrethroids. The mechanism in mammals and invertebrates is not different, but the effect on mammals is much less due to higher body temperature, higher body volume, and lower affinity of bifenthrin to sodium channels

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