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ORIGINAL ARTICLE

Studies on Effect of Bifenthrin on Kidney Glycogen Content in *Channa Punctatus*

Prem Sagar, Surendra Singh and Anand Pratap Singh
Department of Zoology, School of Life Sciences, Dr. B.R. Ambedkar University, Agra
Email: premlovesagar@gmail.com

ABSTRACT

Use of pesticides can have unintended effects on the environment. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, including nontarget species, air, water, bottom sediments, and food. In addition, when run off field, at disposal, being sprayed aerially as well as in water bodies to kill insects and algae. The amount of pesticide that migrates from the intended application area is influenced by the particular chemical's properties: its propensity for binding to soil, its vapour pressure, its water solubility and its resistance to being broken down over time. While agricultural use of chemicals is restricted to a limited number of compounds, agriculture is one of the few activities where chemicals are intentionally released into the environment because they kill pests. Agricultural use of pesticides is a subset of the larger spectrum of industrial chemicals used in modern society.

Key words: *Bifenthrin, Kidney Glycogen Content, Channa Punctatus*

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INTRODUCTION

Recently a great deals of attention has been paid to evaluate hazardous effect of organophosphorus compound on physiology of many non – target organisms particularly fish. The symptoms of organophosphorus compound toxicity generally involve respiratory distress, increase glycolytic rate, decreased oxidative metabolism protein and RNA synthesis. (Srivastava and Singh, 1981; Shastry, 1984) though a lot of work has been done on the pollutional characters and determinate effect of the organophosphorus compound, their indiscriminate use has increased the pollutional hazards, posing much danger to fish and other aquatic life. The two principal mechanisms are bioconcentration and biomagnification. Biomagnification term describes the increasing concentration of a chemical as food energy is transformed within the food chain. As smaller organisms are eaten by larger organisms, the concentration of pesticides and other chemicals are increasingly magnified in tissue and other organs. Very high concentrations can be observed in top predators, including man. Different pesticides have markedly different effects on aquatic life which makes generalization very difficult. The important point is that many of these effects are chronic (not lethal), are often not noticed by casual observers, yet have consequences for the entire food chain.

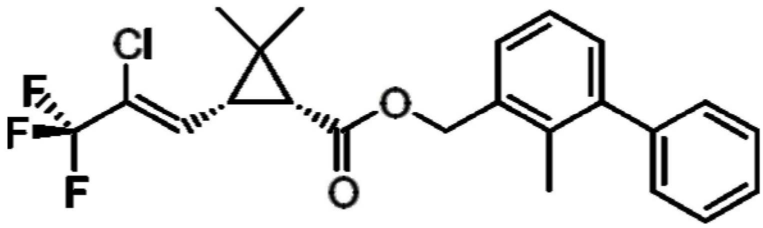
Bifenthrin is a pyrethroid insecticide. Pyrethroids are synthetic compounds made to mimic the pyrethrins that are refined from chemicals found in chrysanthemum flowers. Bifenthrin is a broad-spectrum insecticide that works by interfering with a nerve cell's ability to send a normal signal by jamming open tiny gates on the cell that need to open and close rapidly to carry the message. Bifenthrin is used in agriculture and residential settings, both indoors and outdoors. *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.

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-dimethylcyclopropane-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 GLYCOGEN:

ESTIMATION OF GLYCOGEN

The glycogen was estimated by the method of Rex-Montgommery (1957).

Principle:

When the tissue was digested in potassium hydroxide solution, a precipitate of glycogen was produced which was estimated with the help of anthrone reagent.

Reagents:

(i) Anthrone reagent:

200 mg of anthrone powder was dissolved in 5.0 ml distilled water in a 100 ml volumetric flask, and then concentrated nitric acid was added upto 100 ml mark.

(ii) Standard glucose solution:

The standard glucose solution was prepared by dissolving 1.0 gm crystalline glucose in 100 ml distilled water.

(iii) Working glucose solution:

The working glucose solution was prepared by diluting 0.04 ml of the standard glucose solution with 100 ml distilled water.

(iv) 30 % potassium hydroxide solution:

30 % potassium hydroxide solution was prepared by dissolving 30 gm potassium hydroxide in 100 ml distilled water.

(v) 90 % Ethanol

PROCEDURE

250 mg of the tissue was taken in a test tube and digested with 2.0 ml of 30 % potassium hydroxide solution in a boiling water bath for about twenty minutes, and after cooling 2 ml of 90 % ethanol was added to it. The content of the test tube was again boiled and cooled, and centrifuged at 2000 rpm for about ten minutes. The supernatant was discarded and the precipitate dissolved in 2 ml of 90 % ethanol, boiled, cooled and again centrifuged at 2000 rpm for about ten minutes to precipitate glycogen. Now the supernatent was again discarded and the precipitate dissolved in 5.0 ml distilled water.

Two test tubes were marked as Test 'T', and Blank 'B'.

Test:

1.0 ml of alignote (*vide supra*) and 4.0 ml of anthrone reagent was taken in test tube marked Test 'T', and kept in an ice bath for about three minutes. After cooling the test tube was boiled for about five minutes and again cooled in an ice bath.

Blank:

4.0 ml of anthrone reagent and 1.0 ml of distilled water were taken in a test tube marked Blank 'B', boiled and cooled in an ice bath.

The optical density of the 'Test' was measured colorimetrically at 620 nm (red filter) against the blank.

Calculation:

The glycogen was calculated by the following formula

$$\text{Kidney glycogen (mg/gm)} = \frac{\text{O. D. of Test}}{\text{Wt. of tissue}} \times \frac{4}{2} \times 10$$

RESULTS AND DISCUSSION

In biodiversity including humans, pesticides have the tendency to alter normal metabolism and physiology and under prolong exposure could cause death. Pesticides could cause poisoning, birth and neurological deformity, disruption of several systems including endocrine, nervous, cardiovascular, digestive, etc. Typically, there are different types of pesticides and their use depends on the target pest. As such they can be classified according to pest they are used to eradicate i.e. insecticides, acaricides, herbicides, fungicides, rodenticides, fumigants. They can also be classified based on formulation (soluble in solvent especially, dust), origin (synthetic or organic) and mode of action (contact, systemic etc). Pesticides may end up in surface water through runoff and affect aquatic organisms [2-5] such as zooplankton, phytoplankton, and fisheries abundance. Fish is a major source of animal protein especially in communities aligning water way in coastal region of the Niger Delta. Again, fisheries are obtained from their natural stock (wild) and pond. Irrespectively of the sources, they require water to thrive/ survive. When pesticides enter the water, they induce metabolic, enzymatic, electrolytes, behavioral, physiological, histological, hematological and biochemical changes.

Table 1: Kidney glycogen content in *Channa punctatus* after bifenthrin intoxication

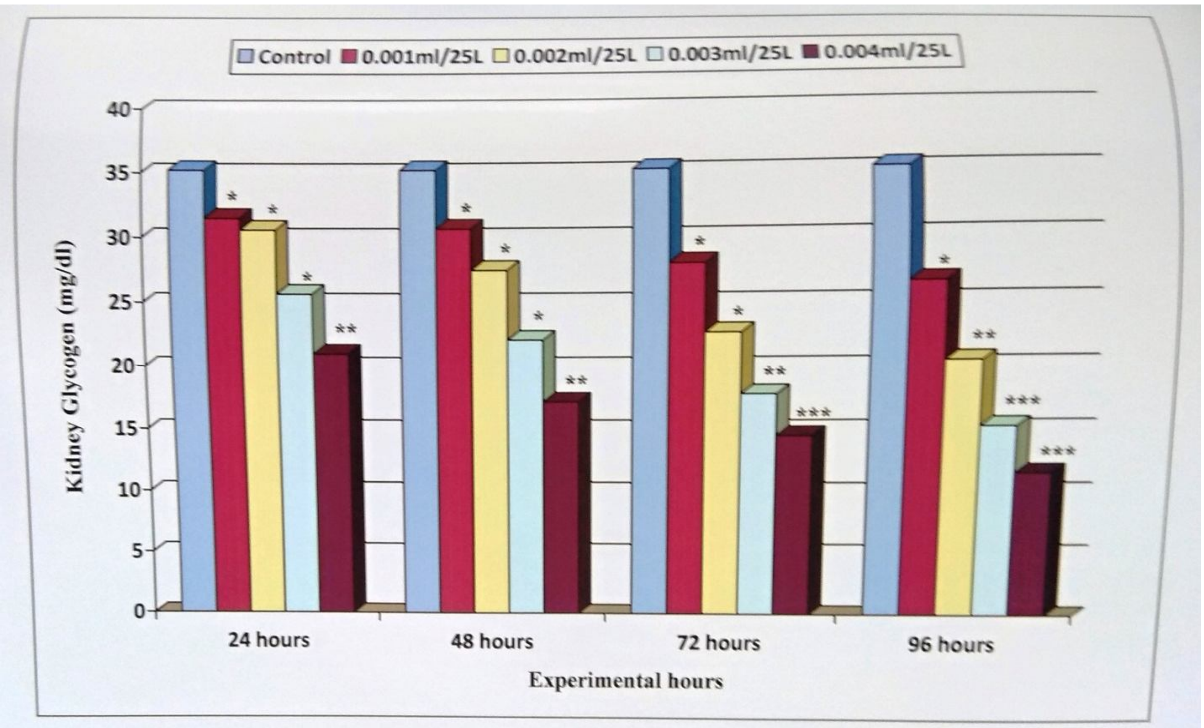
Experimental Sets	24 hrs	48 hrs	72 hrs	96 hrs
	Mean ± S.Em.	Mean ± S.Em.	Mean ± S.Em.	Mean ± S.Em.
Control set	35.20 ± 0.33	35.20 ± 0.33	25.20 ± 0.33	35.20 ± 0.72
0.001 ml/25L	31.50 ± 0.50*	30.67 ± 0.33*	28.00 ± 0.22*	26.50 ± 0.12*
0.002 ml/25L	30.60 ± 0.33*	27.50 ± 0.38*	22.66 ± 0.20*	20.40 ± 0.67**
0.003 ml/25L	25.67 ± 0.20*	22.10 ± 0.15*	17.80 ± 0.25**	15.23 ± 0.33***
0.004 ml/25L	21.00 ± 0.50**	17.20 ± 0.39**	14.50 ± 0.40***	1150 ± 0.15***

*Non-significant (P > 0.02)

**Significant (P < 0.05)

***Highly-significant (P < 0.01)

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



Graph 1: Kidney glycogen content in *Channa punctatus* after bifenthrin intoxication

The pesticidal effect on the kidney of experimental fish, Channa punctatus to various periods revealed a significant decrease in glycogen content. The changes in biochemical parameters are important to indicate the susceptibility of organ system to pollutants (Barnes. and Blackstock, 1973). In an organism toxic substances brings about a kind of stress and an organism responds to that by developing necessary potential (Hyalij, 2013). During stress, organism needs sufficient energy which is supplied from reserve food material i.e. glycogen.

Carbohydrate typically contribute to structural support, protection and serves as nutrient and stored energy which increase or decrease according to organismal need (Yerragi et al., 2000). Carbohydrates are stored as glycogen in fish tissue and organ like liver in order to supply the energy needs when there are hypoxic condition and lack of food (Olangnathan and Patterson, 2013). Depletion of glycogen level in the tissue indicates that glycogen acts as major source of energy in fishes exposed to pesticide overcome the toxicity stress. Due to these reasons glycogen content might be decreased in present study.

Numerous studies have been conducted on the half life of bifenthrin in soil, water, and air under different conditions, such as aerobic or anaerobic, and at different temperatures and pH. It is more likely to remain in the soil and not so much in water (it is hydrophobic), nor in the air (it is unlikely to volatize because of its physical properties). Because of the water-insolubility of bifenthrin, it will not rapidly cause contamination of ground water. However, some contamination might occur by soil-bound bifenthrin to surface water through runoff. For an overview of the environmental degradation of bifenthrin, see figure below. The main path of degradation results in 4'-hydroxy bifenthrin. Pyrethroids are much less toxic in mammals than they are in insects and fish, because mammals have the ability to rapidly break the ester bond in bifenthrin and break the substance into its inactive acid and alcohol components: In humans and rats, bifenthrin is degraded by the cytochrome p450-family.

REFERENCES

1. Barnes H. and Blackstock Z.J. (1973): Estimation of lipids in marine and tissue. Detailed investigation of the phosphovanilline method for total lipids. Journal of Experimental Marine Biology and Ecology, 12, pp. 103-118.
2. Ganeshwade R.M. (2011): Biochemical changes induced by dimethote in the liver of of fresh water fish Punctius ticto (Ham).Biological forum an Int. J., 3(2): 65-68.
3. Hyalij M.T. (2013): Effect of sugar factory effluent on glycogen, protein and free amino acid content in tissue of the fish Lepidocephalus thermalis., Journal of Environmental Research and Development., 7(3), 1228-1230.
4. Ingham P.E., McNeil S.J. and Sunderland M.R. (2012): Functional finishes for wool – Eco considerations. Advanced Materials Research. 441: 33–43.
5. Lund Albert E. and Narahashi Toshio (1983). Kinetics of sodium channel modification as the basis for the variation in the nerve membrane effects of pyrethroids and DDT analogs. Pesticide Biochemistry and Physiology. 20(2): 203–216.
6. Olangnathan R. and Patterson J. (2013): Effect of anthroquinone dyes on the carbohydrates, protein and lipid content in the muscle of Channa punctatus and Cyprinus carpio. Int. J. Pharma. Appli. 4(1): 11-18.
7. Yerragi S.G., Koli V.A. and Yerag S. (2000): Effect of pesticide malathion on protein metabolism of the marine crab Ucamarionis. J. Ecotoxicol. Environ. Monit, 10(1): 59-62.