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Disrupting Action of Cypermethrin on Thyroid and Cortisol Hormones in The Serum of *Cyprinus carpio*

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Abstract
Through static bioassays, the LC_{50} 96 hr value of cypermethrin to the fishes was found to be 2.0/ppm. Then a sublethal concentration (0.2ppm) was used for assaying chronic toxicity for 4weeks. The blood was collected from the test fishes at intervals (day 4, 7, 14, 21, and 28) for hormonal assays. The pesticide was found to decrease the T3 and T4 levels in the serum of the fishes where as TSH and cortical levels increased. This would affect the regulation of glycogen, cell respiration, antioxidant system, excitability of nervous and muscles and hyperglycemia by the way of breaking down of breaking down of proteins.

Keywords: Cypermethrin, Thyroid hormones, Cortisol and *Cyprinus carpio*.

Introduction
In order to increase the crop production, a huge amount of agro chemicals are being used in agriculture activities. A high temperature and humidity in tropical countries would favour the weeds and insects so that a number of herbicides and insecticides are extensively used as control measures. These chemicals also affect the non target organisms in the aquatic environments [1].

At present, synthetic pyrethroid pesticides are often used to replace organo chloride, organophosphate and carbon pesticides to check the insect pests [2]. The favourable properties of pyrethroids have promoted a widely spread application in all sectors of insect control. Among them, cypermethrin is a widely used synthetic pesticide which is available as emulisifiable concentrate or wettable powder. A tremendous increase in the use of this pesticide would lead to increase flux of this chemical in to the aquatic environment, posing a great threat to the aquatic fauna especially to the fishes.

In vertebrates, thyroid hormones are metabolic regulators and play an important role in growth, differentiation, development and metabolism [3]. Cortisol is one of the most active glucocorticoids secreted from the adrenal cortex and is linked with the mobilization of the energy reserves [4].

Consequent upon, the above available information, the present work has been made to study the action of cypermethrin on thyroid hormones and cortisol in the serum of fresh water fish *C. carpio*.

2. Materials and Methods
The fresh water fishes from the Tamil Nadu Fisheries Department, Aliyar Tamil Nadu, India and cypermethrin from Gharda chemicals, Mumbai, India. were procured and used to determine LC_{50} 96hr value of the pesticide to the fishes. In static bioassays a group of 10 fishes having same average body weight of 18-20gms and average length of 13cms were reared in various concentration of the pesticide(1.2, 1.6, 2.0,2.4, and 2.8ppm) with respective control groups. The test solutions prepared by using dechlorinated tap water were replaced approximately every 24hrs and the test fishes were not fed during experimentation. Then a particular sublethal concentration was selected and the fishes were exposed to this for 4 weeks along with controls.

The blood sample was collected from the fishes through cardiac puncture and serum was obtained and processed for hormonal assays. The determination of T3, T4, TSH and cortisol were based on the principle of direct assay of a limited type following the general antibody-antigen reaction based on enzyme linked immunosorbent assay [5]. The hormonal activity is expressed in ng/dl. The data of results obtained from different studies were tabulated subjected to statistical analyses.

3. Results and Discussion

The LC_{50} 96hr value of cypermethrin to the fishes was found to be 2.0ppm. Then a selected sublethal concentration namely 0.2ppm was used to assess chronic toxicity of the pesticide to the hormonal activity of the fishes. The fishes were exposed to the sublethal concentration of the pesticide for 4weeks and hormonal assays were performed in the fish blood sampled on days 4,7,14,21 and 28.

It is evident that on various exposure cypermethrin causes reduction of T3 and T4 activity and increases the activity levels of TSH and cortisol (Table 1.). The thyroid hormones stimulate all aspects of protein and lipid metabolism in fishes [6]. But a number of environmental pollutant are found to reduce the activity levels of T3 and T4 in fresh water [7, 8, 9, 10]. In the similar manner, cypermethrin also provokes inhibition of thyroid function in *C.carpio* so that the activity levels of T3 and T4 become decreased in the serum. As a consequence, the regulation of liver glycogen, cell respiration, antioxidant system and the excitability of neurons and muscles would also definitely be affected in the fishes. At the event of reduction of thyroid hormones to a certain level, the pituitary secretion more TSH in the blood and this could be reason for the serum for the increased TSH activity in the serum of the species under study.

Cortisol interrelates the metabolism of carbohydrates, proteins and lipids. In the present study, the increased level of serum cortisol would result in the breakdown of tissue proteins causing hyperglycemia through glyconeogenesis. That is, the proteins are promoted to be converted into glucose for increased utilization in the production of energy under stress in *C.carpio*. Similar observations have also noticed that the increased level of cortisol would inhibit protein synthesis and stimulate protein catabolism in extra hepatic tissues of fishes [11].

Table 1: Effect of cypermethrin on various hormones in the serum of *C.carpio.*

Days of Exposure	HORMONES (ng/dl)			
	T_3	T_4	TSH	CORTISOL
Control	**1.93 ± 0.27**	**5.71±0.50**	**1.22±0.12**	**31.99±1.11**
4	1.75±0.24 (- 9.33) r = 0.795	5.43 ± 0.41 Ns (-4.90) r = 0.800	1.36 ± 0.17 (+11.48) r = 0.807	33.62 ± 1.20 Ns (+5.10) r = 0.900
7	1.63 ± 0.20 (-15.54) r = 0.898	5.02 ± 0.30 (-12.08) r = 0.907	1.45 ± 0.20 (+18.85) r = 0.916	35.68 ± 1.38 (+ 11.53) r = 0.803
14	1.50 ± 0.17 (-22.28) r = 0.796	4.54 ± 0.24 (- 20.49) r = 0.802	1.58 ± 0.24 (+ 29.51) r = 0.807	38.24 ± 1.57 (+ 19.54) r = 0.999
21	1.46 ± 0.13 (- 24.35) r = 0.900	4.09 ± 0.19 (- 28.37) r = 0.896	1.64 ± 0.27 (+ 34.43) r = 0.910	41.31 ± 1.74 (+ 29.13) r = 0.900
28	1.37 ± 0.11 (- 29.02) r = 0.696	3.37 ± 0.16 (-34.68) r = 0.802	1.80 ± 0.30 (+ 47.54) r = 0.999	47.33 ± 2.09 (+ 47.95) r = 0.701

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