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Imidacloprid Exposure Alters Serum Biochemical Parameters in *Channa Punctuatus* (Bloch)

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Abstract: ***The sublethal effects of imidacloprid the serum biochemical parameters of fish, channa punctuatus could be altered. The levels of Glucose, Lactate, Amino acid nitrogen (AAN), Creatine, Bilirubin, Phospholipids, Triglycerides and Non esterified fatty acids (NEFA) increased with decreased in the level of protein, non-protein nitrogen (NPN), Pyruvate and Albumin during the toxic exposure periods at different time intervals in the serum of the fish. Increase in the level of glucose due to glycogenic activity and decreased in protein level due to enhanced proteolytic activity under stress condition. Low levels of pyruvate and high level of lactic acid indicate fish can shift from aerobic to anaerobic condition. The elevated levels of creatine, bilirubin, urea and decrease in the albumin context under stress condition reveals renal failure and acute hepatic necrosis. The levels of serum phospholipids, Triglycerides, non-esterified fatty acids (NEFA) are increased due to elevation which might be due to increased esterification reactions under stress condition.***

Keywords: Imidacloprid, biochemical parameters, blood, *channa punctatus*

1. Introduction

The pesticides in aquatic ecosystems affect non target organisms such as fishes and prawns. Pesticide hazard on fish mortality, growth and tissue damage has been amply reported by Wildish *et al.,* (1971) and Jackson (1976). These toxic chemicals change the quality of water that affect the fish and other aquatic organisms (Dhasarathan *et al.,* 2000). Among all insecticides the organochloride (OC) are widely used to control pests because of their rapid effectiveness and easy biodegradation (Mahboob and siddiqui, 2002). According to other researches OC cause a number of subsidiary problems like effecting growth and the reproductive and immune systems by causing morphological, pathological and physiological changes and by altering biochemical constituents of fish and other animals. (Singh *et al.,* 2004; setha and saxena, 2003).

A number of recent clinical studies revealed that most of the OC and other toxic chemicals could alter the immune system (Barrcarolli and martinez, 2004; Thangavel, *et al.*, 2004; Chen *et al.*, 2004). Blood being the medium of intercellular transport comes indirect contact with various organs and tissues of the body. The physiological state of an animal at particular time is reflected in its blood. Moreover, pesticides rapidly bind to blood proteins and induce the immune system.

In the present study, the toxic effect of imidacloprid (1-[(6-3-pyridinyl)-methyl] N-Nitroimida-zolidin-2-yliden-Eamine) on kidney and liver function and on serum biochemical parameters of *channa punctatus* was investigated. The effect of a sublethal concentration of imidacloprid in short term experiments is studied to understand the nature of the toxicity exerted by this pesticide on the vital activities of this species.

2. Materials and Methods

Channa punctatus a fresh water edible fish, weighing average of 82-120 gms and 25.5 $\pm$ 1.21 cm in length, were procured from a local market, Warangal (AP). The collected fish were kept in a cement tank (6x3x3 feet) at least for one month for acclimatization under continuous water flow. The average temperature of water was 22-24^{0}C. The fish were fed adlibitum with ground nut cake along with the commercial pellets (1-1.5% body weight). They were starved one day before experiment (Butlerworth, 1972). Without discrimination of sexes, both the sexes of fish were used for the experiment. The physiological parameters of water are given in Table 1. The LC 50 of commercial grade imidacloprid (0.5888 ppm) was determined for 48 hours by the method of Bayna *et al.,* (1977).

Table 1: Physicochemical parameters of Tap Water

S. No.	Parameters	Values
1	Temperature	22 – 24^{0}C
2	P^H Hydrogen ion concentration	7.2 – 7.3
3	Electrical conductivity (milli ohmes/cm)	0.52
4	Calcium (mg/litre)	5
5	Sodium (mg/litre)	2.1
6	Bicarbonates (HCO_3^-) (mg/litre)	142
7	Total alkalinity (mg/litre as Ca_2CO_3)	69
8	Sulphate (mg/litre)	7.1
9	Nitrates (mg/litre)	3.4
10	Iodine (mg/litre)	0.01
11	Chlorides (mg/litre)	37
12	Dissolved Oxygen (mg/litre)	9.2
13	Bilogical Oxygen Demand (BoD)(mg/litre)	1.6
14	Chemical Oxygen Demand (CoD) (mg/litre)	0.008
15	Free Carbondioxide (mg/litre)	10
16	Floride (F^-)(mg/litre)	0.03

Batches of six (6) fish were exposed to 24,48,72 and 96 hours for sublethal concentration (0.19 ppm) along with control fish in separate tanks consisting of six liters of water, at the room temperature. After the stipulated time intervals, the fish were removed and the blood was collected in the tubes by caudal puncture. For further investigations of toxic effects the following methods have been adopted.

Glucose content was determined by the method of Folin and Wu (1920) and pyruvate by the method of Friedmann and Haugen, (1942). The levels of lactic acid were estimated by the method of Barker and summerson (1941). The protein

content was determined by Doomas *et al.,* (1981). The non protein nitrogen was estimated as described by Gupta and Bhargava (1985) and amino acid nitrogen (AAN) according to Good win (1970). Creatine was determined as described by Gupta and Bhargav (1985). The levels of bilirubin were determined by the method of Gupta and Bhargava (1985) and albumin according to Doomas *et al.,* (1981). The levels of Urea were determined by the method of Columb and favpreran (1965) and phospholipids by the method of Connerty *et al.,*(1961). The triglycerides content was determined by Foster and Dunn (1973). The activities of non esterified fatty acids (NEFA) were estimated by the method of Trout *et al.,* (1960).

3. Result and Discussion

It is evident from the data in Table 2. That imidacloprid significantly influenced serum biochemical parameters of channa punctatus. The data reveal and increased in glucose, lactate, aminoacid nitrogen (AAN) and creatine with a decreased in the levels of protein and pyruvate due to pesticide influence. Increase in blood glucose level due to breakdown of stored glycogen. It is clearly indicated that imidacloprid enhanced the rate of oxidative metabolism. The level protein decreased due to increased proteolytic activity which might be increased in amino acid pool during the pesticide exposure period. This amino acid might be utilized for energy production by feeding them as keto acids into the TCA cycle through transferases to contribute energey needs during toxic stress. Increased lactic acid levels and decreased pyruvic acid levels may be due to hypoxic condition under toxicity. It indicates that the fish can shift to an anaerobic metabolism from acrobic. Such a metabolic shift to anerobic glycolysis suggests imidacloprid induced impairment of cell respiration. This effect is mediated via an inhibition of mitochondrial function by the pesticide (Singh *et al.,* 1996).

Table-2: Changes in serum biochemical parameters of the fish *channa punctatus* exposed to Imidacloprid

Parameters +B23: C44G31B23: G44	Control	Imidacloprid treated			
		24 Hrs	48 Hrs	72 Hrs	96 Hrs
GLUCOSE (mg/100ml)	56.43±1.39	63.09±2.83* PC=11.80	67.43±1.89 PC=19.49	70.03±1.79 PC=24.10	75.89±2.04 PC=34.48
PYRUVATE (micrograms/100ml)	15.36±1.09	13.11±0.16* PC=-14.64	11.29±1.84 PC=-26.49	10.13±1.80 PC=-34.04	8.73±0.84 PC=-43.16
LACTATE (micrograms/100ml)	5.03±0.38	6.79±1.02 PC=34.99	8.31±0.89 PC=65.20	9.36±1.32 PC=86.08	10.74±0.89 PC=113.51
PROTEINS (mg/100ml)	308.29±6.82	284.62±4.36* PC=-7.67	267.36±1.89* PC=-13.27	249.83±2.84 PC=-18.96	218.63±2.86 PC=-29.08
NON-PROTEIN-NITROGEN(NPN) (mg/100ml)	16.35±0.89	14.82±0.19* PC=-9.302	10.11±0.34 PC=-38.12	9.36±0.50 PC=-47.71	8.15±0.28 PC=-50.12
AMINO ACID NITROGEN (AAN) (mg/100ml)	0.78±0.02	0.93±0.012 PC=19.23	1.03±0.32 PC=32.05	1.86±0.81 PC=138.48	2.12±0.15 PC=171.89
CREATININE (mg/100ml)	0.24±0.01	0.29±0.013 PC=20.83	0.34±41.66 PC=41.66	0.37±0.015 PC=54.16	0.39±0.018 PC=62.5
UREA (micrograms/100ml)	15.21±1.63	17.82±1.63 PC=17.159	19.39±2.80 PC=27.481	21.66±1.93 PC=42.406	24.39±1.81 PC=60.355
BILIRUBIN (mg/100ml)	0.12±0.001	0.14±0.002 PC=16.66	0.19±0.002 PC=58.33	0.21±0.003 PC=75	0.24±0.013 PC=100
ALBUMIN (micrograms/100ml)	1.98±0.01	1.73±0.17* PC=-12.62	1.50±0.21 PC=-24.24	1.33±0.18 PC=-32.82	1.29±0.14 PC=-34.84
PHOSPHOLIPIDS (mg/100ml)	2.1±0.01	2.62±0.23 PC=24.76	2.91±0.13 PC=38.57	3.16±0.19 PC=50.47	3.79±0.36 PC=80.47
TRIGLYCERIDES (mg/100ml)	1.84±0.06	2.89±0.01 PC=57.06	3.17±0.62 PC=72.28	3.47±0.98 PC=88.58	3.91±0.63 PC=112.5
NON-ESTERIFIED FATTY ACIDS (NEFA) (micromoles/liter)	86.20±3.71	91.68±2.74* PC=6.35	102.63±4.89 PC=19.06	113.82±5.89 PC=32.04	117.38±6.31 PC=36.17

Each value is mean ± S.D of (6) individuals. PC denotes percentage change over control. Means were compared with Mann Whitney u-test at $p<0.05$ for statistical significance. *Not Significant.

High lactic acid content in suggestive of the emphasis laid on glycolysis during pesticide stress. Anitha Kumari and Sree Ramkumar (2006) have reported that the lactic acid acidosis could cause lethality in animals under insecticides toxicity. The levels of non protein nitrogen may be decreased significantly in *Channa Punctatus*. Due to the pathological conditions under toxicity of pesticides NPN levels decreased (Abdul Naveed *et al.,* 2004).

The Amino acid nitrogen (AAN) content is increased due to increase proteolytic activity and also renal failure under toxicity. Harold varley (2005) reported that the liver deamination of amino acids is only impaired when liver damage is severe.

The creatinine content is increased due to creatinine is synthesized in liver from there it enters into the circulation to be taken up by the muscle in which it is converted into creatinine phosphate. It is supported that elevated levels of creatine may be due to hormonal imbalance or change in basic metabolic rate of animal under stress (Nelson and Cox, 2005). The enhanced levels of bilirubin indicate that these insecticides could cause a severe damage to liver. Jain (2006) reported that the PCB metabolites cause necrosis of liver cells. This damaged liver cells are enabled to conjugate

bilirubin and therefore, the levels of serum bilirubin enhanced. The levels of urea may be increased in the serum due to renal failure or kidney necreosis. According to Reena Kumari *et al.,* (2006) that the increase in serum urea levels due to conversion of toxic ammonia into non toxic urea and glutamine. The decrease in albumin indicates fall in osmotic pressure leading to enhanced fluid retension tissue spaces causing edema in animals. According to Sathyanarayana (2004) the major role of albumin in the albumin in the animals is to maintain the osmatic pressure. The levels of phospholipids are increased during prolonged exposure periods in Chenna punctatus. As per Pratap. B. Singh and Vandana Singh (2006) the effect of endosulfan exposure for various phospholipids on hepatic lipogenesis and mobilization to test via plasma during the different phases of its reproductive cycle in a tropical telecast *H. Fossilis*.

Increase in the triglyceride content was consideration of elevation which might be due to increased esterification reactions under stress condition. The raised values in NEFA may be due to starvation or due to emotional stress condition. The levels of NEFA may be enhanced due to hormonal imbalance under toxic stress.

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