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Effect of an organophosphate pesticide, monocrotophos on the biochemical parameters of an air breathing fish, *Anabas testudineus* (Bloch, 1792)

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Abstract : The experimental fish, *Anabas testudineus* was exposed to sub-lethal concentrations of an organophosphate pesticide, monocrotophos. The fish was exposed to acute toxicity of monocrotophos for 16, 24 and 48 hours while for chronic toxicity it was exposed for 15, 30 and 45 days. The monocrotophos was found to be toxic to the fish, which was found to be increasing with the increase of its concentration. Significant changes were observed in various biochemical parameters of 0.072 ppm treated fishes like increase in the cholesterol, plasma alkaline phosphatase, plasma triglyceride, serum bilirubin, serum creatinine while decrease in plasma glucose and total protein.

Key words: Biochemical parameters, monocrotophos, *Anabas testudineus*.

INTRODUCTION

One of the most common organophosphate pesticides used to kill the insect pest in the agriculture field along with NUVAN is monocrotophos. The later is a broadspectrum organophosphate pesticide which has a collateral impact on other aquatic organisms existing on higher tropic level such as fishes. The present investigation is related with studies on the effect of different concentrations of monocrotophos on the selected biochemical parameters of breathing climbing perch, *Anabas testudineus* which is found in both fresh water and brackish water bodies. The fish has also edible value for the human being. The pesticide is one of the highly toxic agricultural chemicals with wide variation in toxicity amongst different species of fishes.[1] The widespread use of monocrotophos results in extensive aquatic contamination by its application intentionally for control of insects and unintentionally by drift of aerial spray, watershed drainage or accidental spillage. Although, monocrotophos is being used extensively in India, studies on its toxicity to aquatic life are relatively rare. Biochemical heterogenicity of different organs are well established in different species of fishes, but the investigation on the sublethal effect of organo-phosphates on various biochemical parameters are not sufficiently studied. Therefore, in the present study efforts has been made to investigate the impact of monocrotophos on various biochemical parameters of *Anabas testudineus.*

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MATERIALS AND METHODS

Collection of experimental fishes

Disease free and active freshwater fish *Anabas testudineus* having the body length 12-18 cm and weight

15-20 gm were collected from the local fish market, Madhepura and brought to the laboratory for its further study. All the fishes were kept in aquarium of about 50L containing filtered tap water & fed with meat according to their body weight.

Procurement of monocrotophos & its treatment dose, the pesticide monocrotophos 28% which is available in the commercial name of AIMOCRON 28 SL was obtained from the local market. LC_{50} concentration of the pesticide was determined as per APHA standard 1992 (Renewal toxic test method).[2] Fishes were exposed to 0.072 ppm sub-lethal concentrations for 16, 24 and 48 hours in acute studies and 15, 30 and 45 days in chronic studies. Control fish were maintained under identical conditions without the pesticide in the medium.

Collection of blood

Blood sample from the treated fishes was drawn from the dorsal aorta after each exposure period & preserved in anti-coagulant (0.1ml EDTA) coated plastic vials for biochemical tests. Merc'k biochemical test kits were used for different biochemical analysis.

Statistical analysis of the data

The data obtained from the biochemical test were subjected to students "t" test in order to determine the significance of the difference between control and treated values at two levels of significance-2% & 5%.

RESULTS & DISCUSSIONS

In the present study, attempts have been made to investigate the effect of sub-lethal concentrations of monocrotophos on various biochemical parameters. The exposure of 0.072 ppm concentration of monocrotophos led to the addition in cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, serum bilirubin, serum creatinine, while reduction in plasma glucose, total protein in both acute and chronic studies.

Acute effect

In 16 hr exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin & serum creatinine were 64.738 + 0.570 mg/dl, 157.5 + 0.957 mg/dl, 143.833 + 1.343 mg/dl, 299.833 + 1.343 mg/dl, 4.417 + 0.177 mg/dl, 2.777 + 0.087 mg/dl & 1.338 + 0.024 mg/dl, respectively (Table -1). In case of 24 hr exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin & serum creatinine, were 58.376 + 0.839 mg/dl, 167.167 + 1.343mg/dl, 146.833 + 1.343 mg/dl, 279.333 + 2.285 mg/dl, 4.80 + 0.081 mg/dl, 2.645 + 0.106 mg/dl & 1.80 + 0.012 mg/dl respectively (Table -1). In case of 48 hr exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin & serum creatinine were 46.201 + 1.109 mg/dl, 172.00 + 1.29 mg/dl, 161.33 + 1.374 mg/dl, 260.5 + 1.707 mg/dl, 4.717 + 0.106 mg/dl, 1.855 + 0.017 mg/dl & 2.05 + 0.170 mg/dl, respectively (Table -1).

Chronic effect

In 15 days exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin & serum creatinine were 52.286 + 1.374 mg/dl, 161.5 + 0.957 mg/dl, 146.65 + 0.150 mg/dl, 230.0 + 1.29 mg/dl, 4.733 + 0.110 mg/dl, 1.307 + 0.098 mg/dl & 1.117 + 0.1067 mg/dl respectively (Table - 2). In case of 30 days exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin & serum creatinine were 48.576 + 0.956 mg/dl, 178.517 + 0.106 mg/dl, 158.567 + 0.110 mg/dl, 241.33 + 1.105 mg/dl, 4.60 + 0.129 mg/dl, 1.503 + 0.105 mg/ dl & 1.15 + 0.095 mg/dl respectively (Table - 2).

In case of 45 days exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin & serum creatinine were 41.493+ 0.936 mg/dl, 192.517 + 0.134 mg/dl, 167.567 + 0.110 mg/dl, 247.0 + 1.29 mg/dl, 4.40 + 0.163 mg/dl, 2.022 + 0.163 mg/dl & 1.467 + 0.2808 mg/dl respectively (Table - 2). It is evident from the results that the sub-lethal concentrations of monocrotophos have influence on various biochemical parameters in exposed fishes.

DISCUSSION

Organophosphate pesticides are generally much more acute toxic to vertebrates and other aquatic animals. Pesticides containing chlorinated hydrocarbons persist in the environment and are known to have drifted over thousands of kilometers in the water from Antarctic snow. Traces of chlorinated hydrocarbon pesticides in water may be accumulated in fishes up to the levels of more than 10,000 times, the concentration present in the surrounding water. Several pesticides including some, those were

washed extensively in agriculture in the past and some, those are still used for the purpose of disease control, have been shown to produce tumors in animals.

Similar studies have been carried out by different authors in different fishes with respect to other insecticides such as- Tilak *et al.*, (2001)[3] studied endosulphan induced hyperglycemia in the catfish, *Clarias batrachus*. Ram and Sathyanesn (1985)[4] observed a marked decline in liver glycogen and protein contents in the catfish with sublethal concentration of malathion. Sastry and Sharma (1981)[5], and Singh and Shrivastava (1982)[6] studied variations in various carbohydrate metabolites in *Ophiocephalus punctatus* and *Heteropneustes fossilis* treated to toxicants and a mixture of aldrin and formathion, respectively.

As regards to specific findings on the changes in the biochemical profile of fishes exposed to different, notworthy results have been obtained by- Sastry and Dasgupta (1991)[7] and Sastry *et al.*, (1984)[8] noticed significant alterations in blood glucose, lactic acid and protein in *Clarias batrachus, Anguilla anguilla* and *Channa punctatus* acutely or chronically exposed to aldrin, lindane and nuvacron. Shrivastava *et al.*, (1984)[9] noticed heptachlor induced changes in protein, glycogen and lactic acid contents in functionally different muscles of *Channa punctatus*. Singh and Shrivastava (1982)[6] have noticed hyperglycemia in *H. fossilis* treated with sub-lethal concentrations of organochlorine and organophosphate insecticides.

SUMMARY

In the present study, it has been observed that the exposure of monocrotophos led to the decrease in the level of plasma glucose & total protein while significant increase was observed in the levels of cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, serum bilirubin, serum creatinine. Identical findings were also noticed by Murthy and Devi (1982)[10], Borah and Yadav (1995)[11], Katty and Sathyanesan (1984)[12], Ram and Sathyanesan (1984)[13], Dalela *et al.*, (1978)[14], Shweta Agrahari (2004)[15], Santhakumar and Balagi (2000)[16], Singh *et al.*, (2003)[17], Tilak *et al.*, (2003)[18] and Sharad Srivastava (1990)[19].

Table 1: Sublethal effect of Monocrotophos on certain biochemical parameters of *Anabas testudineus*: Acute studies (0.072ppm/L)

Sl. No.	Parameters	Treated fishes	Tested fishes	After 16 hrs	After 24 hrs	After 48 hrs	Control
1	Plasma glucose	20	6	64.738±0.570	58.376±0.839	46.201±1.109	71.601±0.958
2	Cholesterol	20	6	157.5±0.957	167.167±1.343	172.00±1.29	125.6±0.129
3	Alkaline phosphatase	20	6	143.833±1.343	146.833±1.343	161.33±1.374	130.798±0.0106
4	Triglyceride	20	6	299.833±1.343	279.333±2.285	260.5±1.707	119.5±0.957
5	Total protein	20	6	4.417±0.177	4.80±0.081	4.717±0.106	5.783±0.106
6	Serum bilirubin	20	6	2.777±0.087	2.645±0.106	1.855±0.017	0.913±0.011
7	Serum creatinine	20	6	1.338±0.024	1.80±0.012	2.05±0.170	0.817±0.014

Table 2: Sublethal effect of Monocrotophos on certain biochemical parameters of *Anabas testudineus*: Chronic studies (0.072ppm/L)

Sl. no	parameters	Treated fishes	Tested fishes	After 16 hrs	After 24 hrs	After 48 hrs	Control
1	Plasma glucose	20	6	52.286±1.374	48.576±0.956	41.493±0.936	72.451±0.867
2	Cholesterol	20	6	161.5±0.957	178.517±0.106	192.517±0.134	125.483±0.106
3	Alkaline phosphatase	20	6	146.65±0.150	158.567±0.110	167.567±0.110	132.1±0.081
4	Triglyceride	20	6	230.0±129	241.33±1.105	247.0±1.29	121.833±1.067
5	Total protein	20	6	4.733±0.110	4.60±0.129	4.40±0.163	5.133±0.1105
6	Serum bilirubin	20	6	1.307±0.098	1.503±0.105	2.022±0.163	0.760±0.096
7	Serum creatinine	20	6	1.117±0.1067	1.15±0.095	1.467±0.28	0.718±0.1304

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