EFFECT OF SUBLETHAL CONCENTRATIONS OF SOME PESTICIDES ON THE GROWTH AND SURVIVAL OF THE FINGERLINGS OF THE AFRICAN CATFISH - *HETEROCLARIAS"* (HYBRID)

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ABSTRACT

Fingerlings of *"Heteroclarias"* (hybrid) were exposed to sublethal concentrations of thiodon (Organophosphate), Malathion (Organophosphate), and carbaryl (organo-carbamide) for a period of 21 days in a static bioassay. The rate of feeding, food conversion and the efficiency of absorption and conversion decreased with increasing concentrations of the pesticides. Protein, carbohydrate and lipid contents of muscle, liver, gill and intestine in *"Heteroclarias"* also decreased when the fish were exposed to maximum sublethal concentrations of the pesticides. A comparative analysis of the efficacy of the three pesticides reveals that the growth rate of *"Heteroclariase"* was drastically reduced on exposure to thiodon Pesticides.

Key Words: *"Hateroclarrias"* Pesticides, sublethal Growth and survival.

INTRODUCTION

Pesticides occupy rather a unique position amongst many chemicals that man encounter daily, in that they are deliberately added to the environment for the purposes of killing, injuring or even enhancing some forms of life. Indeed pesticides in general represent one group of agro-chemicals that are used in larger quantities and have a history of causing toxic effect in fish and other forms of aquatic life. They represent one of the most popularly used compounds which are xenobiotic in nature.

However, water pollution by pesticides is a serious problem to all forms of aquatic fauna and flora and to a considerable extent, man. Pesticides in the aquatic environment cause several effects on the physiological and biochemical aspects of fishes, (Vasanth, *et al.,* 1989a). Several reports have been documented on the effects of pesticides and herbicides on temperate species (Alabaster, 1980). The information on toxic effects of organophosphate, organochlorine or carbamide groups of pesticides on the physiology and the biochemistry of tropical fishes is scanty. In fact there has not been any comparative study on the effect of these pesticides on the physiology and biochemistry of this hybrid of African fresh water catfish species - *Heteroclarias".*

Of the rationales behind this study is to provide a baseline information on the effect of selected pesticides on the growth and survival of this hybrid of African fresh water Catfish species (*Heteroclarias*). The parameters monitored include, feeding rate, metabolic rate, absorption rate, absorption efficiency and growth rate. More information regarding pesticides effect on this species "*Heteroclarias* is needed with specific reference to our local conditions.

MATERIALS AND METHODS

The African Catfish "*Heteroclarias*" fingerlings (3.4 + 13g) were collected from local freshwater pond, Jay-ess Consultant fish farm limited, Port Harcourt, Rivers State - Nigeria. They were acclimated to laboratory conditions of 25° + 2°C and at a definite feeding schedule throughout the acclimation period of one month. In this study the three pesticides used were procured from Agricultural Development Project (ADP) of Abia State, Headquarters located at Umuahia. They were thiodon (35 EC, Organochlorine), Malathion (50 EC, Organophosphate and Carbanyl 50 EC), Carbamide.

The sublethal levels of thiodon, malathion and carbonyl for 96-hours exposure were found to be 0.0002, 0.6 and 1.2 ppm, respectively. For the growth experiment, different Sublethal concentrations of Malathion (0.15, .0.3, 045 and 0.6ppm), thiodon (0.0005, 0.0001, 0.00015, and 0.003ppm) and Carbanyl (0.3, 0.6, 0.9 and 1.2ppm) were prepared and each concentration was placed in a plastic cylindrical aquarium (20 x 13cm). In each concentration of selected pesticides, three fish were reared individually. The control experiment was conducted in pesticide - free environment. The test individuals were fed on *ad libitum* diet of live earthworm and commercial meal (59% protein) once a day (8 - 9am). The unfed remains of the diet were carefully removed using a siphon tube. The test water was changed once in three days.

The method of calculation and expression of food utilization parameters and the scheme of energy balance used in this study were those described by Arunachalam and Palanichany (1982).

In another separate experiment, a group of ten fishes were stocked at maximum sublethal concentrations pesticides (Malathion, 0.6ppm; thiodon, 0.0003ppm and carbanyl, 1.2ppm) for a period of 21 - days of exposure in order to monitor the protein, carbohydrate and lipid contents. Biochemical estimations or proximate analysis of protein, carbohydrate and lipid contents of muscle, liver, gill and intestine were estimated by the method of Lowry *et al.,* (1951), Roe, (1955) and Folch *et al.,* (1957), respectively. The results are expressed as percentages.

RESULTS AND DISCUSSION

From the data collected, it was clear that the rate of feeding in "*Heteroclarias*" was reduced considerably. The condition indices indicates that the feeding rate decreased with increasing concentration of pesticides (Table 1). Such a decrease in the feeding rate has been reported of *Clarias gariepinus* and *Heterobranchus bidorsalis* exposed to Lindane (OYIM and OTI 1993). Similar results were also obtained when *M. vittatus* were exposed to Malathion, Thiodon and Carbonyl (Arunachalam *et al.*, 1990). *Oreochromis N. niloticus* and *Tilapia Zilli* exposed to Lindane and Thiodon showed that Thiodon was

about 50 times more toxic than Lindane to *O. n. niloticus* and about 6 times more toxic than Lindane to *Tilapia zill*i urure, 1987).

The shortfall reported in the feeding regime may have been a consequence of pesticidal intoxication. Sequel to the reduced feeding rate observed, a downward trend was also noticed in the rate of absorption. However, there was no significant difference in the absorption efficiency (Table 1). From the result of the experiment, it was plausible to conclude, that the offered sublethal concentrations of malathion, thiodon and carbonyl had a definite inhibitory effect on growth and conversion efficiency (Table 1). This may be due to reduction in the food energy channelled to the fish for growth. Similar results have also been reported by Oti and Okoti (1992) when they exposed *Chrysichthys nigrodigitatus* to sublethal concentrations of Thiodon and Malathion. The calculated metabolic rate decreased with increasing concentration of pesticides (Table 1). It indicates that the chemicals in the pesticides act as metabolic inhibitors and lipid contents of muscle, liver, gill, and intestine of *Heteroclarias* decreased when fish were exposed to pesticides (Rath and Mishra 1980). Because of the depletion in protein, carbohydrate and lipid contents, it is pertinent to assume that the decrease in the utilization of stored substances was a natural response to meet the energy requirement during the stress. This doe not mean that the decrease in carbohydrate, protein and lipid contents is simultaneous,. As a result of the depletion of the major energy yielding source, other sources of body enrichment therefore exhibit a proportional depletion as the metabolism of these substances are interlinked through a common pathway of organic synthesis i.e. the TCA. Throughout the duration of the experiment there is depletion in all these components of fish tissues.

Table 1: Sublethal effects of Pesticides on food utilization Parameters of *"Heteroclarias"* hybrid.

Concentration					Conversion efficiency (%)		
(ppm)	Fr	Ar	Gr	Mr	Ae%	Ko	Ki
Malathion							
0	20.0+ 0.80−	19.0+ 1.0 −	4.0+ 0.15	15.0+ 0.60−	90+ 1.50	18+ 0.60	20.0+ 0.30−
0.15	19.00+ 0.90 −	18.0+ 1.00−	3.0+ 0.30	14.60+ 1.50 −	89.0+ 2.30−	16.0+ 1.60−	16.0+ 3.10−
0.30	15.0+ 2.6 −	14.80+ 1.80 −	2.0+ 0.21	13.50+ 1.56 −	86.0+ 2.57−	13.0+ 2.10−	14.0+ 2.00−
0.45	14.0+ 0.60−	10.0+ 1.00−	1.90+1 .10 −	8.6+ 1.00	82.0+ 2.00−	9.1+ 1.80	10.0+ 1.50−
0.60	9.00+ 0.13−	9.00+ 0.01−	0.80+ 0.03−	80.00+ 1.00 −	8.00+ 1.00−	5.00+ 0.40−	5.00+ 0.41−
Thiodon							
0.00005	18.00+ 0.70 −	16.00+ 0.90 −	3.00+ 0.15−	13.60+ 1.00 −	82.00+ 2.00 −	14.0+ 0.80−	15.0+ 1.00−
0.00010	14.00+ 0.30 −	13.00+ 0.18 −	1.20+ 0.26−	8.00+ 0.90−	80.00+ 1.00 −	9.60+ 0.76−	10.0+ 0.50−
0.00015	9.00+ 1.20−	8.00+ 1.00−	0.70+ 0.30−	7.20+ 0.40−	76.00+ 0.607−	5.00+ 5.00−	30.+ 0.60
0.00020	8.00+ 2.20−	6.90+ 1.80−	0.33+ 0.02−	7.20+ 0.11−	70.0+ 1.00−	2.80+ 0.20−	3.20+ 0.12−
Carbanyl							
0.3	18.96+ 0.33 −	17.40+ 0.52 −	2.90+ 0.21−	16.00+ 0.52 −	92.00+ 0.11 −	16.00+ 1.20 −	19.00+ 1.30 −
0.6	16.33+ 0.80 −	15.42+ 1.00 −	2.00+ 2.26−	14.72+ 1.03 −	90.66+ 1.42 −	14.08+ 1.31 −	17.0+ 1.00−
0.90	15.21+ 1.50 −	14.00+ 1.18 −	1.89+ 0.21−	11.96+ 1.00 −	86.00+ 2.40 −	10.60+ 1.31 −	14.0+ 1.02−
1.2	10.00+ 0.92 −	9.67+ 0.42−	0.81+ 0.06−	7.21+ 0.34−	83.00+ 3.86 −	8.29+ 0.52−	10.00+ 0.41 −

Fr - Feeding rate Gr - Growth, Ae - Absorption efficiency,
Ar - Absorption rate, Mr - Metabolic rate,

The figures below are mean (± S.D.) of three individuals.
The efficiencies and the rate are expressed in percentages and in mg/d//g fish respectively

Table 2: Sublethal effects on Protein, Carbohydrate and lipid in different tissues of *Heteroclarias*

Organic Compound	Tissue							
	Muscele		Liver		Gill		Intestine	
	Control	Treated	Control	Treated	Control	Treated	Control	Treated
Thiodon								
Protein	25.0± 1.20	14.00± 1.00	16.00± 0.96	14.00± 0.50	18.00± 1.00	15.00± 1.76	18.00± 1.52	13.90± 1.11
Carbohydrate	2.60± 0.11	0.80± 0.06	9.0± 0.70	3.0± 0.14	4.0± 0.80	1.7± 0.08	3.0± 0.01	0.8± 0.02
Lipid	7.0± 0.70	2.0± 0.08	4.0± 0.16	1.0± 0.03	6.0± 0.40	3.0± 0.50	10.0±0. 18	3.6± 0.26
Malathion								
Protein	23.0± 1.10	15.0± 0.80	17.0± 1.00	13.0± 0.60	18.0±1. 02	14.0±0. 65	17.0±1. 24	12.0± 0.58
Carbohydrate	2.30± 0.11	0.90±0.0 3	7.90± 0.50	2.96± 0.09	4.0± 0.60	1.5± 0.13	2.3± 0.03	1.2± 0.09
Lipid	6.00± 0.52	2.00± 0.09	4.00± 0.13	2.00± 0.25	6.0± 0.72	3.00±0. 81	8.1±0.1 8	4.0±0. 51
Carbanyl								
Protein	20.1± 1.10	16.3± 0.90	17.0±1.0 0	14.0±0. 60	18.0±1. 02	15.0±0. 65	17.0±1. 24	13.0±(.58
Carbohydrate	2.30± 0.11	0.90± 0.03	7.90± 0.50	2.96± 0.09	4.0± 0.60	1.5± 0.13	2.3± 0.03	1.2± 0.09
Lipid	6.00± 0.52	2.00± 0.09	4.00± 0.13	2.00± 0.25	6.0± 0.72	3.00±0. 81	8.1± 0.18	4.0± 0.51

The figures above represents the mean (±S.D) of four estimations. The results are expressed in percentages.

The present result shows that the pesticides affected all parameters of food utilization and body composition of *"Heteroclarias"* negatively. the results also proved that Thiodon is more toxic than malathion and carbanyl to *Heteroclarias*.

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