Journal of Fisheries International 2 (2): 127-129, 2007
© Medwell Journals, 2007

Sub-Lethal Effect of Monocrotophos on Growth and Food Utilization of the African Cat Fish *Clarias gariepinus* (Teugels)

[1]A.J. Yaji and [2]J. Auta
[1]School of Foundation and General Studies, University of Adamawa State, Mubi, Nigeria
[2]Department of Biological Sciences, University of Ahmadu Bello, Zaria, Nigeria

Abstract: The effect of sub-lethal concentrations 2.51, 5.02 and 10.04 mg L^{-1} of monocrotophos (organophosphorus insecticide) on growth, nutrient and body composition of *Clarias gariepinus* were studied in the laboratory. The growth rates were significantly reduced in fish exposed to the toxicant compared with the control groups. The nutrient utilization showed that, SGR, FCR, FCE, FE, PER and NM were significantly higher ($p<0.05$) in the control fish compared to the exposed groups. Similarly, the percentage crude protein and oil content were significantly higher ($p<0.05$) in the control than the exposed groups. The investigation revealed that, low concentration of monocrotophos causes various physiological effects in this fish. The usage of this insecticide near water bodies for fish production should be monitored and control.

Key words: Monocrotophos, effect, growth, *Clarias gariepinus*

INTRODUCTION

Over the years, the effects of pesticides to aquatic organisms included significant fish kills associated with the accidental release of DDT, toxaphane, dieldrin, aldrin and heptachlor in aquatic environment (Hheydorn, 1970; Elchelberger and Liehleuberg, 1971). The changes in an external environment may affect the physiology of the fish as a result of their relationship with energetics (haemoglobin levels) and defence mechanism (leucocyte levels). These parameters also provide an integrated measure of the health condition of the organism, which overtime may manifest in changes in weight (growth). Water quality attributes are prime factors that influence fish survival, reproduction and growth performance, and over all biological reproduction (Elchelberger and Liehleuberg, 1971). Avoaja and Oti (1997), Aguigwo (2002) reported that, the rate of feeding, food conversion and the efficiency of absorption decrease with increasing concentrations of pesticides. And they further stated that, the growth of *"Hetoroclarias"* (hybrid) were drastically reduced on exposure to thiodon pesticides. In sub-lethal concentrations of cymbush, growth parameters such as specific growth rate, food conversion efficiency and protein efficiency ratio decreased as the concentrations of cymbush increased to *Clarias gariepinus* (Aguigwo, 2002).

Environmental contamination with pesticides is a problem of worldwide importance. Data on their bioaccumulation and excretion by fish are therefore valuable both for the assessment of the safety of pesticides for man and the extend of the contamination of the environment. Few studies exists on the effects of pesticides on Nigerian fishes (Oti, 2003). Therefore, studies need to be carried out to determine the effects of different pesticides on fish in Nigeria. This study investigated the sub-lethal effects of monocrotophos on growth and food utilization of common and important Nigerian fresh water fish *Clarias gariepinus*.

MATERIALS AND METHODS

Experimental fish: Healthy juveniles of *Clarias gariepinus* (average weight 18.5 g and standard length 10.7 cm) of mixed sexes were obtained from river Galma in Zaria, Kaduna State, Nigeria. The fish were transported in cold plastic container to the laboratory in the Department of Biological Sciences, Ahmadu Bello University, Zaria. In the laboratory, the water from the river was gradually replaced with dechlorinated tap water in large baths of 160 L capacity at 24-27.5°C and acclimated for two weeks. During this period, the fish were fed with pelleted feeds containing 35% crude protein twice per day at 5% body.

Sublethal test: Based on the results of the 96 h LC_{50} (Auta, 2001) juveniles of *Clarias gariepinus* were exposed to 2.51, 5.02 and 10.04 mgL^{-1} concentrations of monocrophos for 8 weeks. Each concentration was replicated three times. There was a control for each experiment. A total of 120 specimen were randomly

Corresponding Author: [1]A.J. Yaji, School of Foundation and General Studies, University of Adamawa State, Mubi, Nigeria

assigned to give a loading of 10 fish per tank, and feeding was maintained as at during acclimation. The test solution was renewed at two days intervals to maintain the toxicant concentration and the level of dissolved oxygen as well as to minimize the level of ammonia during experiment (APHA, 1985).

Growth studies: Growth was monitored as described in guideline 210 (OECD, 1992). However, two exceptions were observed. First, instead of exposing 16 fish per tank, 10 fish were exposed to reduce social interactions (Phillips, 1989; Lucas and Priede, 1992) bound to occur during feeding. Secondly, growth measurements were recorded for 56 days and not 28 days so as to observe the long term effects of the toxicant on growth, fish were fed at 5% body weight twice daily i.e morning and evening with pelleted diet containing 35% crude protein. Changes in body weight was measured biweekly.

Statistical analysis: Analysis of Variance (ANOVA) and Duncan Multiple range test were used to test for differences between different levels of treatments and to separate means respectively (Duncan, 1955). Test of significance were at 95% probability.

RESULTS

Growth studies: No mortality was observed in the control tanks. However, mortality was recorded in fish exposed to 10.04 mg L^{-1} concentration of the toxicant (Table 1).

Weight gain, Specific Growth Rate (SGR), Gross Feed Conversion Efficiency (GFCE), Feed Efficiency (FE), Protein Efficiency Ratio (PER) and Nitrogen Metabolism (NM) were significantly higher ($p<0.05$) in the control fish compared to the groups exposed to the toxicant (Table 1), while Feed Conversion Ratio (FCR) increased with increasing concentration of the toxicant.

Table 1: Growth and nutrient utilization of *Clarias gariepinus* exposed to sub-lethal concentration of monocrotophos

	Concentrations (mg L^{-1})			
Parameters	0.00	2.51	5.021	0.04
No. of fish	10	10	10	10
Mortality (%)	0.00	0.00	0.00	0.712
Average initial weight (g)	22.5	18.20	28.12	33.10
Average final weight (g)	38.10	27.5	35.31	39.15
Weight gain (%)	69.30	51.1	25.6	18.3
Weight gain (g)	15.60^{a}	9.30^{b}	7.20^{bc}	6.10^{c}
SGR	0.022^{a}	0.020^{a}	0.020^{ab}	0.010^{b}
FCR	5.47^{c}	6.77^{c}	12.25^{b}	16.75^{a}
GFCE	17.54^{a}	14.77^{a}	8.16^{b}	5.97^{b}
FE	0.18^{a}	0.15^{b}	0.08^{c}	0.06^{c}
PER	0.45^{a}	0.27^{b}	0.21^{b}	0.17^{b}
NM	239.65^{a}	142.96^{b}	110.52^{c}	93^{c}

Means with the same superscript along the row are not significantly different ($p>0.05$)

Table 2: Proximate composition of *Clarias gariepinus* carcass before and after exposure to monocrotophos

		Composition (%)			
		Final/Concentration (mg L^{-1})			
Component	Initial	0.00	2.51	5.02	10.04
Dry Matter (DM)	94.70	93.66^{b}	97.09^{a}	97.20^{a}	97.71^{a}
Crude protein (cp)	53.38	62.69^{a}	62.09^{a}	62.06^{a}	59.56^{b}
Oil	9.45	11.28^{a}	3.84^{b}	5.68^{b}	3.37^{b}
Ash	24.18	22.68^{c}	26.42^{a}	24.23^{b}	27.09^{a}
NFE	5.42	6.48^{c}	7.65^{b}	8.03^{a}	8.04^{a}

Means with the same superscript along the row are not significantly different ($p>0.05$)

Table 2 shows the chemical analysis of *Clarias gariepinus* carcass before and after exposure. The percentage crude protein and oil content in the control fish after the experiment were significantly higher ($p<0.05$) than in the exposed groups. Crude protein and oil composition decreased with increasing concentration of the toxicant, while ash and Nitrogen Free Extract (NFE) increased.

DISCUSSION

This study showed that prolonged exposure of *Clarias gariepinus* to moncrotophos recorded a significant reduction ($p<0.05$) in weight gain, Specific Growth Rate (SGR), Gross Feed Conversion Efficiency (GFCE), Feed Efficiency (FE), Protein Efficiency Ratio (PER) and Nitrogen Metabolism (NM) but however lower Feed Conversion Ratio (FCR) as compared with the control.

The reduction in growth rate and food utilization in *Clarias gariepinus* exposed to sub-lethal concentrations of monocrotophos could be due to suppressive effect on food consumption by the toxicant or increased activity in an attempt to avoid the polluted water. Ponmani and Logaswamy (1997) reported a significant reduction in feeding rate, consumption, absorption, metabolism and growth as well as conversion efficiencies of *cyprinus carpio* exposed to sub-lethal concentration of monocrophos. Avoaja and Oti (1997) observed that *Heteroclarias* (hybrid) exposed to sub-lethal concentrations of thiodon, malathion and carbaryl, decreased the rate of feeding, food conversion ratio and feed efficiency with increasing concentrations of the pesticides, resulting drastically in reduction of growths. Similar observations was made by Aguigwo (2002) that specific growth rate, food conversion efficiency and protein efficiency ratio decreased as the concentration of cymbush pesticide increased.

This investigation revealed a significant decreased in crude protein and oil in the exposed fish compared to the control groups. However, the ash and NFE increased.

This suggest that the fish were stressed and metabolism of protein and fat were impaired. Similar results were obtained by Khattak and Hafeef (1996), Sancho *et al.* (1997) following acute effect on fenthion in eel and malathion on *Cyprinion watsoni*, respectively. Oruc and Uneer 1999 reported that the serum protein levels were lower than the control value in *Cyprinus carpio* exposed to 2, 4-diazinon. This could also be due to the effect of the toxicant on the fish or as a result of utilization of protein and oil for energy due to increased activity to avoid the polluted water. Similar observations was made by Popma (1982) that tilapia can use carbonhydrade, protein and fats for energy.

This study shows that exposure of *Clarias gariepinus* to low concentration of monocrotophos affects the physiology of this fish which over time affected the food acceptability and loss in weight. Therefore it is dangerous to use this pesticide close to body of water use for fish production.

REFERENCES

Aguigwo, J.N., 2002. The toxic effect of cymbush pesticide on growth and survival of the African cat fish *Clarias gariepinus*. J. Aqu. Sci., 17: 81-84.

APHA (American Public Health Association). American Water Works Association and Water Pollution Control Federation, 1985. Standard method for Examination of water and waste water. (16th Edn.), APHA, New York, pp: 1193.

Auta, J. 2001. Toxicity of diamethoate to juveniles of *Oreochromis niloticus* (Trewavas) and *Clarias gariepinus* (Teugels). PhD Thesis, Depertment of Biological Science, Ahmadu Bello University, Zaria.

Avoaja, D.A and E.E. Oti, 1997. Effect of sub-lethal concentrations of some pesticides on growth and survival of fingerlings of the African cat fish *Heteroclarias* (hybrid). Nig. J. Biotech., 8: 40-45.

Duncan, D.B., 1955. Multiple range and multiple F-test. Biometrics, 11: 1-42.

Elchelberger, J.W. and J.J. Lichleuberg, 1971. Persistence of Pesticide in River Water. Environ. Sci. Tech., 6: 1-4.

Heydorn, A.E.F, 1970. The mounting threat to our Estuaries. African Wild, 24:193-200.

Khattak, I.U.D and M.A. Hafeef, 1996. Effect of malathion on blood parameters of the fish *cyprinon watsoni*. Pak. J. Zool., 28: 45-49.

Lucas, M.C. and I.G. Priede, 1992. Utilization of metabolic scope in relation to feeding and activity by individual and grouped Zebrafish, *Brachidonio rerio* (Hamilton-buchanan). J. Fish Biol., 41: 175-190.

OECD, 1992. Draft OECD guidelines 210. Fish earlylife stage toxicity test, fish toxicity on egg and sac-fry stages, fish juvenile growth test.

Oruc, E.O. and Uneer, 1999. Effects of 2,4-Diamin on some parameters of protein and carbohydrate metabolisms in the serum, muscle and liver of *Cyprinus carpio*. Environ. Poll., 105: 267-272.

Oti, E. E. 2003. Acute toxicity of gammalin 20 to *Chrysichthys nigrodigitatus* (leacepede). Science forum. J. Pure and Applied Sci., 6: 219-225.

Phillips, M.J., 1989. The feeding sound of rainbowtrout, *Salmo gairdneri* (Richardson). J. Fish Biol., 35: 589 592.

Ponmani, R.B.D and S. Logaswamy, 1997. Sub-lethal effect of moncrotophos on food utilization of *Cyprinus carpio*. J. Environ. Biol., 18: 321-324.

Popma, T., 1982. Digestibility of selected feedstuff and naturally occurring algae by Tilapia. Ph.D Thesis Auburn University, Auburn.

Sancho, E., M.D. Ferrando and E. Andrev, 1997. Sub-lethal effects of an organophosphate insecticide on the European eel, *anguilla anguilla*, Ecotoxicol. Environ. Saf., pp: 3657-65.