1426

THE GROWTH RESPONSE OF FINGERLINGS OF *O. niloticus* in SUBLETHAL TEST TO PARAQUAT

M.M BABATUNDE, BALOGUN, J.K and OLADIMEJI, A.A, AUTA, J, AND ABOLUDE, D.S

ABSTRACT

The initial mean wet weight of the test fish were 7.64 ± 1.3 for the control and 6.33 ± 0.9, 6.88 ± 0.9 and 6.2 ± 0.7 for the fish exposed to 1.02, 1.40 and 2.0mg/l of paraquat in water respectively. Growth was estimated from the sum of the individual wet weights of the fish at 2, 4, 6 and 8 weeks of exposure to the toxicant and expressed as percent Cumulative wet weight gain. The results show that the cumulative percent wet weight gain in the control group increased from 10.34% at 1 week to 36.13% at 8 weeks. The growth of fish that were exposed to 1.02, 1.04 and 2.00 mg/l increased from 3%, 0.44% and 1.55% at 1 week to 30.81%, 9.59% and 19.81% at week 8 respectively. A statistically significant difference in growth rate of the treated and control was observed ($p<0.05$).

Key word: Growth, Paraquat, *O. niloticus*

INTRODUCTION

Final mean length and final mean weight are routinely calculated to assess the effect of test chemicals on the size attained by fry and early juvenile fish. These growth indicators are designated responses in fish chronic toxicity tests. Aquatic toxicologists have defended the utility of fish chronic toxicity tests and in particular the advantages of the fish early life stage test chemicals and effluents (Woltering, 1984). As explained by Woltering (1984), that as more new and expanded use chemicals become candidates for aquatic toxicity screening, scientists and regulators are anxious to complete the test method standardization process for the most time and cost effective and useful test methods. It is appropriate and timely to re evaluate the selection and the utility of the standard toxicity endpoints. The aim of this paper is to evaluate the usefulness of current fish sublethal toxicity endpoints, in particular the growth response to chemical hazard evaluations.

MATERIALS AND METHODS

Four tanks with the appropriate toxicant concentrations of 1.04, 1.40,2.0mg/l were set up separately including the control in duplicate. Ten fish of weight of 5.74 ± 2.69g were assigned to each tank randomly. Fish were fed to satiation once daily. Subsequent Weighing was done once in two weeks for a period of 8 weeks. Constant monitoring of Water parameters (Table 3) and changing of test solutions twice weekly were carried out through-out the test period. Photoperiod of 12hr day and 12hr night was maintained. Wet weight gain and percentage cumulative weight gain were worked out at the end of the test.

]

Preparation of Formulated Diet.

The artificial diet used for this study consisted of a mixture of groundnut cake, corn meal, fish meal and vitamin premix in the proportions shown in Table 2.Ingredients made up of 7kg, 1.5kg and 1.5kg of corn fish meal and groundnut cake respectively were ground finely and mixed together with 2 litres of water into a thick paste. Cooked Starch was added as a binder and all ingredients were cooked at low heat for 20minutes for effective mixing. The paste was then spread into trays, allowed to set and cut into small cubes of uniform size. The cubes were then sun- dried. The dried cubes were put in a water proof container and kept in a dry cool place.

The fish were fed to satiation once daily during the period of acclimation. All data were compared with the control using analysis of variance (ANOVA) and Duncan Multiple Range test (DMRT) at 95% probability level.

RESULTS

Table 1: Physico-chemical parameters of test water.

Parameters	Range	Mean
Temperature (°C)	21.9-24.0	22.7 ± 0.77
Dissolved Oxygen (mg/l)	5.2-6.1	5.7 ± 0.72
Conductivity (umhos)	3.5-5.5 x 10^2	4.5 ± 0.14
Hardness (mg/l)	20-35	28.0 ± 0.83
Alkalinity (mg/l)	14-15	15.0 ± 0.07
pH	6.8-7.8	7.3 ± 0.5

Table 2: Mean Weight (g) of O. niloticus Exposed to Various Paraquat concentrations in sub-lethal toxicity test for a period of 8 weeks. Mean ± S.E 10 Fish are presented

Exposure Levels (mg/l)	Exposure Periods (weeks)				
	0	2	4	6	8
0	7.64 ± 1.3	8.43 ± 2.9	9.48 ± 1.0	10.01± 1.0	10.40±3.2
1.02	6.33 ± 0.9	6.52 ± 0.9	7.34 ± 0.9	8.10 ± 1.0	8.28 ±0.9
1.40	6.88 ± 0.9	6.85 ± 0.9	7.15 ± 0.9	7.33 ± 1.0	7.54 ± 1.0
2.00	3.23 ± 0.7	3.28 ± 0.7	4.24 ± 0.8	3.70 ± 0.7	3.87 ± 0.7

Table 3: Weight gain and % cumulative weight gain in *O. niloticus* during sub-lethal exposure to paraquat Concentrations for a period of 8 weeks

Exposure Levels (mg/l)	Exposure Periods (weeks)			
	2	4	6	8
1.00	0.79	1.84	2.37	2.76
	10.34%	24.04%	31.02%	36.13%
1.02	0.19	0.01	1.77	1.95
	3.0%	15.96%	27.96%	30.81%
1.40	0.03	0.27	0.045	0.66
	0.44%	3.92%	6.54%	9.59%
2.00	0.05	1.01	0.47	0.64
	1.54%	31.27%	14.55%	19.81%

EFFECT OF PARAQUAT ON GROWTH

The initial mean wet weight of the test fish were 7.64 ± 1.3 for the control and 6.33 ± 0.9, 6.88 ± 0.9 and 3.2 ± 0.7 for the fish exposed to 1.02, 1.40 and 2.00mg/l of paraquat in water respectively. Growth was estimated from the sum of the individual wet weights of the fish at 2, 4, 6 and 8 weeks of exposure to the toxicant and expressed as percent cumulative wet weight gain. The physico-chemical parameters of test water were within the range for culturing tropical O. niloticus (Viveen *et al.*, 1977).

The results show that the cumulative percent wet weight gain in the control group increased from 10.34% at 1 week to 36.13% at 8 weeks (Table 3). The growth of fish that were exposed 1.02, 1.04 and 2.00mg/l increased from 3%, 0.44% and 1.55% at 1week to 30.81%, 9.59% and 19.81% at 8weeks respectively. A statistically significant difference in growth rate of the treated and control was observed ($P < 0.05$).

Table 4; Opercular ventilation rate (No/Min) of *O.niloticus* exposed to sublethal concentrations of paraquat for 8 weeks Mean ± S.E of 4 fish are presented

Exposure Levels (mg/l)	Exposure Periods (weeks)				
	0	2	4	6	8
0 .00	110.0 ± 7.0	111.0 ± 2.0	110.0 ± 4.0	110.0± 7.0	102.0±9.0
1.02	115.0 ±7.0	92.0 ± 8.0	78.0 ± 4.0	77.0 ± 3.0	78.0 ±8.0
1.40	116.0 ± 4.0	108.0 ± 8.0	76.0 ± 4.0	68.0 ± 5.0	88.0 ± 5.0
2.00	111.0 ± 4.0	107.0 ± 4.0	85.0 ± 2.0	78.0 ± 7.0	88.0 ± 5.0

EFFECT OF PARAQUAT ON OPERCULAR VENTILATION IN SUB-LETHAL TEST

The results show that there was not much difference throughout the 8 weeks in the ventilation rate of the control fish. However, there was a higher opercular ventilation rate on the first 2 weeks which was subsequently reduced towards the 8weeks in the control (Table 4). Statistically there is significant difference within the treatments in terms of week. With week 1 control showing hyper-ventilation and week 4 fish showing the least value in ventilation rate. The control fish exhibited a significantly higher ($P< 0.05$) mean value for ventilation rate as compared to fish in other test solutions. Toxicant Solutions of 1.02, 1.40 and 2.00mg/l showed decrease in ventilation rate of fish for the 6weeks of exposure period and an increase on the 8th week. However, there was no significant difference in ventilation rate of fish exposed to different concentrations of paraquat ($P> 0.05$)

DISCUSSION

EFFECT OF GROWTH

In this study, the cumulative wet weight gain showed that growth was reduced significantly ($P<0.05$) probably due to the reduction of feeding rate at high concentrations of paraquat. This was very evident from the food always left in the aquaria with the highest toxicant concentration of 2.0mg/l. many authors reported that the growth of fish was reduced by aldrin (0.400 and 0.044ppm). Malathion (0.400 and 1.56ppm, 14-17%) and metasytox (2.0, 1.85 and 0.93ppm, 18-37%) Par and Konarr (1987). It was Woltering (1983) explained that several inherent difficulties are observed in growth responses and these include temporary delay of growth early on, in the exposure periods, but nonetheless, there was equal size attainment by the end of the test. A similar observation was made at highest concentration of exposure (2.00mg/l) in this study, by week 8. Other difficulties come from chemical induced growth stimulation (Mount, 1962, 1968, Pickean,1968) and the influence of density on those fish surviving the exposure (Woltering,1983). Density-dependant competition for food and space often results in aggressive behaviour and can lead to variation in the growth of individual (growth dispensation or size-hierarchy effect).

Ecological reasons for reduction in growth included increase in susceptibility to predation and disease, reduced ability to obtain food and to compete for food and for suitable habitats, delayed maturation and reproduction (Woltering, 1983). Woynarovich and Horvath (1980), Philin (1983) and Banyigyi *et al.*(2001) in their work on feed utilization and growth may be attributed to its source, the wild, and fingerlings obtained from the wild are of unknown parental stock, contaminated by hybridization and, their ages and physiological status are equally unknown. Falayi, *et.al.* (2007) also explained in term of growth that there was no significant growth ($P>0.05$) of *O.niloticus* fingerlings fed with *Lemna pancicostata* of 30% crude protein

despite that they were all in non test solution showing that growth can be subjective since there may be many factors responsible for it. Yisa and Gana (2007) drew a conclusion on their work on effect of fertilizer on growth of Nile Tilapia fingerlings (*O niloticus*) as influence by organic and inorganic fertilizer application that fertilizer application had an effect ($P<0.05$) on the mean live weight gain of the fish at the end of the experiment. However, the treatment did not have an effect on temperature and the pH of the experimental medium ($P>0.05$). Conclusively he said that fertilizer application had a positive effect on Tilapia growth and this growth is enhanced if the water quality is good and maintained.

REFERENCES

Park, A.K. and Konar, S.K (1987): Long- term Effect of Organophosphorus Insecticide, Methyl Parathion on Fish. *Environment and Ecology*. Vol. 5, No 3.

Sprague, J.B. (1971): Measurement of Pollutant Toxicity to Fish Part III. Sublethal Effects and Safe Concentration. Water. Res.5: 245-266.

Woltering, D.M. (1984): The Growth Response of Fish early Life Stage in Chronic Toxicity Test: A Critical Review. Aquatic Toxicol. 5. (1984). 1-21.

Rosenthaland and Alderdice (1976): In: Growth Response of Fish Early Life Stage in Chronic Toxicity Test. A Critical Review. Aquatic Toxicol. 5. (1984). 1-21.

Viveen, W.J.A.R., Richer, C.J., Vanoordt., P.G. W.T, Jansseen., J. A.L., Husman, E.A. (1985): Manual+, for the Culture of the African Cat fish (*Clarias gariepinus)*. Directorate General for International Technical Co-operation. Netherland. 93pp