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ACUTE TOXICITY OF LIQUID ORGANIC FERTILIZER TO JUVENILES OF *CLARIAS GARIEPINUS*

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ABSTRACT

The study was carried out to determine the acute toxicity of liquid organic fertilizer to juveniles of Clarias gariepinus. Clarias gariepinus juveniles were exposed to different concentrations of liquid organic fertilizer for 96 hours under static conditions. The LC_{50} was calculated to be 328.10ml/L with Lower and upper confident limits of 275.02 ml/L and 391.42 ml/L respectively. At the contact phase there was a brief period of high excitability, visible avoidance characterized by fast swimming, leaping and attempts to jump out of the test medium, loss of equilibrium, followed by lethal (death) phase. There was no significant difference between the various mean values of temperature and pH ($P > 0.05$). The study revealed that acute concentrations of the liquid organic fertilizer were harmful to Clarias gariepinus juveniles. Liquid organic fertilizers could be applied in fresh water fish ponds and allowed for a period of time to break down through natural processes before stocking. Indiscriminate use of liquid organic fertilizer could also be avoided.

Key words: Organic fertilizer, *Clarias garipinus*, Acute toxicity.

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INTRODUCTION

Human activities in one way or the other affect the aquatic environment. Some of these activities include indiscriminate use of pesticides, herbicides and fertilizers from farm lands; these are capable of polluting the water bodies (Osibajo, 2022). Indiscriminate use of fertilizers can affect the immediate environment, thus changing the aquatic ecosystem. Chemical fertilizers such as NPK 15:15:15 have been shown to have devastating effects on aquatic biota when used excessively (Adakole, 2005). Fertilizer is any material, organic or inorganic, natural or synthetic, that supplies plants with the necessary nutrients for growth and optimum yield (Addiscott *et al*.,1991) or a substance added to water to increase the production of natural fish food organisms (Nwadukwe, 1995). Fertilizer in fish fry ponds thus stimulates the production of organisms that may serve as the first food for many species of fish and increase fry survival and growth (Odiete, 1999). Several biochemical and physiological changes occur when fish absorb fertilizer (Auta, *et.al*. 2004). Accumulation of fertilizer depends on the concentration of the fertilizer, duration of exposure and environmental conditions (Auta *et al*., 2004). Fertilizers may enter into the aquatic environment through surface run-off from cultivated agricultural farm lands in either soluble or particulate forms and consequently, deliver soluble phosphorus, nitrogen and carbon for uptake and growth of plants (Ufodike and Onusiriuka, 1990).

Acute toxicity describes the adverse effect of a substance that result either from a single exposure or from multiple exposures in a short space of time (usually less than 96 hours). The LC_{50} (lethal concentration, 50%) of a toxin, radiation or pathogen is the concentration required to kill half the members of a tested population after specified test duration. Liquid organic fertilizer is used for stimulating better rooting and development for early and mature growth. It is a compound chemical in suspension with dark brown colouration, sweet chocolate like odour and pH 4.5 as provided by the manufacturers. The African catfish, *Clarias gariepinus* is a native tropical freshwater and aquaculture species (Hetch *et al*., 1996) to Africa but now has a wide range of distribution geographically (Teugels, 1984). They are hardy and adaptable due the presence of accessory breathing organs; they thrive well in a variety of climatic conditions in Nigeria (Verreth, 1993). Hence it is important to determine the 96 hr. LC_{50} of liquid organic fertilizer to *Clarias gariepinus* juveniles.

MATERIALS AND METHODS

Liquid organic fertilizer is produced by white fog environmental services limited; and was obtained from a retail shop. *Clarias gaiepinus* juveniles were obtained from Ochepson fish farm around Makurdi International market and transported in plastic bowls to the laboratory at Joseph Sarwuan Tarka University, Makurdi. The fish was acclimatized for 72 hours and fed with vital feeds at 5% body weight. Feeding was stopped 24 hours before the start of the experiment. Twenty liters of water was introduced into a 50-liter capacity tank. Five treatments were used at concentrations of 5, 7.5, 10, 12.5 and 15.5 in ml/l respectively, each treatment with a replicate and a control. Ten fish were introduced into the experimental tanks before the liquid fertilizer was introduced. The control tank was without the liquid fertilizer. The experiment was carried out for 96hours under static water conditions. Water quality parameters tested include temperature, total dissolved solids (TDS), pH, and electrical conductivity (EC) which was measured using Hanna multi parameter water quality tester model HI98129. While dissolve oxygen (DO) was measured using a VWR DO meter model L933246. Statistical analyses were performed using one-way analysis of variance (ANOVA) for water quality while the mean separation was done using LSD method. The mortality record was subjected to descriptive (percentage) and regression as well as probit analysis. Statistics packages used were Microsoft excel and SPSS 21.0.

RESULTS

The 96 hr. LC_{50} after exposure was determined to be 328.10ml/L with upper and lower confidence limits 391.42ml/L and 275.02ml/L respectively. There was no mortality in the control. The probit kill in the treatment increased as the concentration of the organic fertilizer was increasing. The R^2 value of the regression model (0. 9869) indicates a strong relationship between the two parameters (Figure 1). Other behavioural responses observed include swimming in an upright position with snouts above the water surface gasping for air, uncoordinated swimming, restlessness, frequent attempts at jumping out of the test medium and quietness. The water was observed to deteriorate in quality as the concentration of white fog liquid fertilizer was increased (Table 1) There was no significant difference in water quality parameters across the treatments (p>0.05).

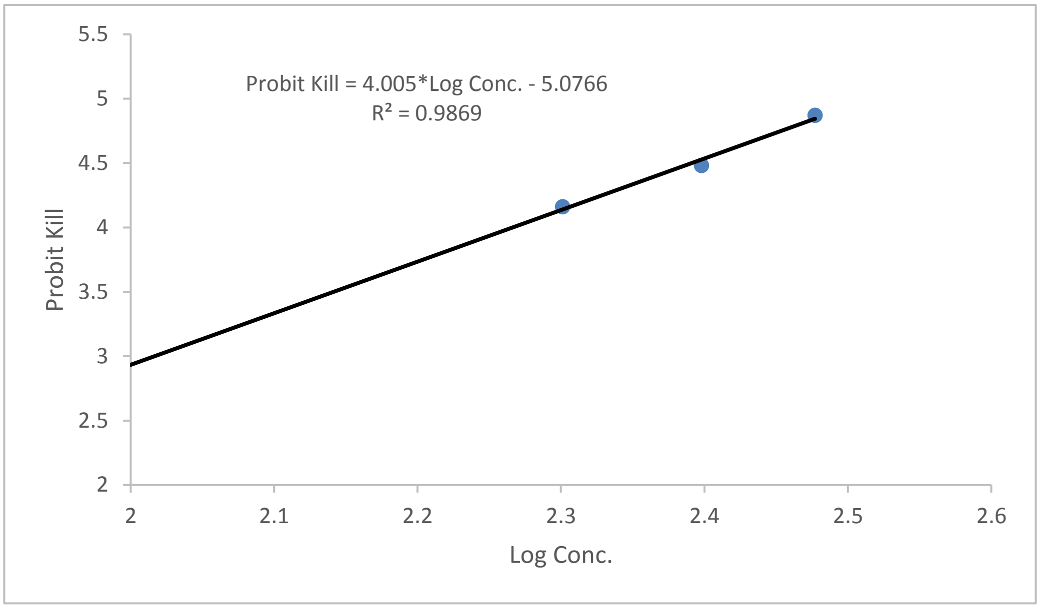

Figure 1: Regression Relationship between probit kill of *Clarias gariepinus and* liquid organic fertilizer

Table 1: Mean Water Quality Parameters of the Bioassay water for acute toxicity experiment with liquid organic fertilizers on *Clarias gariepinus* juveniles

Concentration (ml/L)	Temperature	DO	TDS	pH	EC
Control	26.50±0.42[a]	2.53±0.28[a]	310.50±2.78[a]	7.41±0.14[a]	621.25±5.86[a]
Treatment 1	26.53±0.43[a]	3.28±0.45[a]	327.50±8.78[a]	7.43±0.15[a]	655.25±18.14[a]
Treatment 2	26.60±0.44[a]	2.55±0.26[a]	324.75±7.11[a]	7.43±0.15[a]	648.75±14.67[a]
Treatment 3	26.53±0.46[a]	2.63±0.19[a]	322.50±6.70[a]	7.43±0.15[a]	644.50±13.76[a]
Treatment 4	26.58±0.45[a]	2.40±0.22[a]	314.50±3.88[a]	7.43±0.15[a]	627.50±7.27[a]
Treatment 5	26.53±0.46[a]	2.43±0.19[a]	310.00±2.71[a]	7.43±0.14[a]	620.00±5.43[a]
P-Value	**1.00**	**0.28**	**0.18**	**1.00**	**0.20**

**means in the same column with different superscripts differ significantly ($P < 0.05$)*

DISCUSSION

The 96 hours LC_{50} was 328.10ml/L and the 95% confidence limit of LC_{50} was calculated to range from 275.02ml/L to 391.42ml/L. As the concentration of organic fertilizer increases, the probit kill of *Clarias gariepinus* increases. The regression model shows a strong relationship between liquid organic fertilizer concentration and fish mortality. The behavioural changes at the contact phase which was characterized by a brief period of high excitability, visible avoidance characterized by fast swimming, leaping and attempts to jump out of the test medium, loss of equilibrium, followed by lethal (death) phase (when opercula movement and responses to tactile stimuli cease completely) is an indication that the fish was sensitive to the fertilizer. This has also been earlier documented by Okwuosa and Omoregie, 1995; Ayuba and Ofujekwu, 2005, when they exposed fish fingerlings to acute concentrations of different types of organic fertilizers. The water in the control set up was in good condition with optimum dissolved oxygen (2.52mg/L) and adequate pH (7.41). The absence of mortality in the control suggests that water quality may not have contributed to fish mortality during the exposure. There was no significant difference ($p>0.05$) in the mean values of the physico-chemical parameters measured as it was within the suggested tolerance ranges for warm water fish species.

CONCLUSION

The study reveals that acute concentrations of liquid organic fertilizers are harmful to *Clarias gariepinus* juveniles. Application of these fertilizers in aquatic ecosystems either in ponds, irrigations or farms should be carefully controlled or monitored, such that lethal concentrations (LC_{50} 328.10ml/L) could be avoided

RECOMMENDATION

Liquid organic fertilizers could be applied in fresh water fish ponds and allowed for a period of time for breakdown of the fertilizer through natural processes before stocking. Indiscriminate use of liquid organic fertilizer could also be avoided.

REFERENCES

Adakole J.A (2005). Acute toxicity of metal-finishing company wastewater to *Clarias gariepinus* fingerlings. *Journal of Aquatic Sciences* 20(2): 69-73.

Addiscott T. M., Whitmore A. P.andPowison D.S.(1991).Farming fertilizer and the nitrate problem C. A. B. International, Willingford. 28 pp.

Auta J, Balogun JK, Lawal FA, Ipinijolu JK (2004) Acute toxicity of the insecticide, Dimethoate on juveniles of Oreochromis niloticus (Trewavas) and Clarias gariepinus (Teugels). Journal of Aquatic Sciences 19(1): 5-8.

Ayuba V.O, Ofojekwu P.C (2005) Effects of sublethal concentrations of *Datura innoxia* leaf on weight gain in the African catfish, *Clarias gariepinus. Journal of Aquatic Sciences* 20(2): 113-116.

Hetch T., Odlemann L., Verheust L. (1996). Perspective on Clarid catfish culture in Africa. In: L. Marc, J. P. Pierre (eds). The Biology and Culture of Catfishes. Geneva, Swaziland: Aquatic Living Resources, 121-145pp.

Nwadukwe F. O. (1995). Analysis of production, early growth and survival of *Clarias gariepinus, Heterobranchus longifilis* and their F1 hybrids in ponds. *Netherlands Journal of aquatic Ecology*, 29 (20): 222– 227.

Odiete W. O. (1999). Environmental physiology of animals and pollution. Diversified ResourcesLtd., Lagos, Nigeria. 315 pp.

Okwuosa VA, Omoregie E (1995) Acute toxicity of Alkyl benzene sulphate (ABS) detergent to the tooth carp, Aphyosemion gaidneri (L). *Aquaculture Research* 3(10): 755-758.

Osibajo O. (2002), Perspective on pollution and waste management for sustainable development. Paper developed at Federal Environmental Protection Agency, Abuja, Nigeria. 47 pp

Teugels, G.G., (1984). The nomenclature of African catfish *Clarias* species used in aquaculture. Aquaculture, 38: 373-374.

Ufodike E.B.C, Onusiriuka BC (1990). Acute toxicity of inorganic fertilizers to African catfish, *Clarias gariepinus. Aquaculture research* 21(2): 181-186.

Verreth, J. (1993). A review of feeding practices, growth and nutritional physiology in larvae of the catfishes *Clarias gariepinus* and *Clarias batracus*. *Journal World Aquaculture. Society*., 24: 135-144.