TOXICITY OF GRAMOXONE^{R} AND DETERGENT TO NILE TILAPIA (Oreochromis niloticus L.) FINGERLINGS

BY

Amos B. KAYODE, Adekunle A. SALAMI, Oyedapo A. FAGBENRO and Lawrence C. NWANNA

Department of Fisheries and Wildlife, Federal University of Technology, Akure, Nigeria.

ABSTRACT

Acute toxicity tests on the effects of Gramoxone and detergent (both applied as a single dose) to Nile tilapia, *Oreochromis niloticus,* fingerlings (mean weight 2.7±1g) were conducted using static bioassay. The 96-h LC_{50} of Gramoxone and detergent applied were 0.08ml/l and 0.004 g/l, respectively. The fingerlings showed increased hyperactivities exemplified by erratic movement, loss of reflex, and hyperventillation during thye period of exposure. These effects increased with increasing concentrations of Gramoxone or detergent throughout the duration of exposure. Tilapia fingerlings of the same size showed different levels of tolerance to the same concentration of both pollutants.

Key Words: toxicity, Gramoxone, detergent, Nile tilapia, *Oreochromis niloticus.*

INTRODUCTION

Concerted efforts are currently being made to increase fish production just as attempts are also made to increase crop production through intensive agricultural practices. The latter has resulted in a large-scale use of herbicides/pesticides such as Gramoxone which is increasing daily (Mason, 1983). Although there are definite advantages in the use of pesticides for increased of crop yield, their indiscriminate use has been identified as a cause for many previously unexplained fish kills as a result of run-off effluents diverted into fish habitats (Oloruntuyi *et al.*, 1992; Palanichamy *et al.*, 1989). Pesticides usually find ways into the aquatic environment either by accident or by delebrate application into water bodies. Accidental introduction include the run-off in water from treated land, spray drift during treatment, washing of spraying equipments in waterways and from the air. The delibrate application may be used to control weeds, intermediate host of human and animal diseases, protect aquatic crops and the elimination of unwanted fish (Nair *et al.*, 1985).

Various pesticides are used in Nigeria and while information is available on their impact on rats and man, little information exists on their effects on fishes. Hence there is a need to evaluate the significance of such pesticides in order to understand the potential havoc of this pesticide if used persistently. Other sources of aquatic pollution are effluents from laundries and garages which are regularly discharged into inland water bodies; often resulting in mass mortality, inability to reproduce in polluted environment and migration to safe areas. The objectives of this study are to determine the effects and safe limit of Gramoxone or detergent on Nile tilapia (*Oreochromis niloticus*) fingerlings.

Materials and Methods

Healthy unsexed *O. niloticus* fingerlings (2.7±1g) were collected from the Federal University of Technology Akure fish farm and acclimated for two weeks and fed with a 40% protein diet prior to commencement of toxicity tests. They were later stocked into 28 rectangular glass tanks (75x40x40cm) filled with 45 litres of spring water (pH, 7.2+0.1; temperature, 27.5°C; total hardness and alkalinity, 168-213mg/l) and starved for two days. Fish were randomly distributed at 10 fish/tank in duplicated treatments. *O. niloticus* fingerlings were exposed to graded Gramoxone

or detergent concentrations (range 1.0 - 5.1ml/l and 0.40-0.25g/l, respectively) each treatment having a control. High dissolved oxygen level was maintained by continous aeration and the tests were conducted under static toxicity testing conditions (FAO, 1977). Observations of the effects of Gramoxone or detergent on fish behaviour were made every six hours. The range of concentrations used in the tests was predicted to give a mortality range of 0-100% (no mortality - total fish kills), and the lethal concentration that will kill half of the test population (LC_{50}) was determined graphically. The data obtained were subjected to the student t-test to determine the significant differences among means.

Results

The 96-h LC_{50} of Gramoxone and detergent to *O. niloticus* were 0.08ml/l and 0.004g/l, respectively (Fig 1a & 1b). Mortality was 85% and 100% with 4.5ml and 4.8ml of Gramoxone while 50% and 75% mortality were recorded with 0.2g and 0.25 g of detergent, respectively. No mortality was recorded at 0.1g of detergent to the fish. The fish species showed differences in tolerance to the same concentration of toxicant. Mortality at 4.5ml of Gramoxone at 96-h was 80% and 90% while the mortality at 0.25g of detergent at 96-h was 70% and 80%. The fingerlings showed initial disturbed swimming behaviours such as erratic movement, rapid opercula movement and gasping at the surface. This was followed by blackening of the whole body, unusual lethargy and tendency of the fish to settle at the bottom, motionless with slow opercular movement.

Discussion

The 96-h LC_{50} of Gramoxone and detergent to *O. niloticus* (0.08ml/L and 0.004g/L, respectively) were different (lower or higher) than toxicity levels for other fishes. For example, Oloruntuyi *et al.* (1992) reported 96-h LC_{50} of 99ppm and 90ppm for "round up" and Gramoxone exposed to catfish, *Clarias gariepinus* (mean weight 30g) while Cruz *et al.* (1988) reported 2.58ppm and 0.092ppm for the molluscides, aquation and brestan respectively on *O. mossambicus* (mean weight 30g). Organisms exposed to chemicals usually exhibited changes in opercular rate which demonstrated to be a sensitive indicator of physiological stress in fish subjected to sublethal concentrations of pollutants (David, 1973).

It was observed in this study that *O. niloticus* fingerlings showed variations in their tolerance of same Gramoxone and detergent concentrations at a given period particularly as the replicates giave different mortality. Chen and Lei (1990) reported that juveniles of shrimp, *Penaeus monodon* showed differences in tolerance to ammonia and nitrate solutions. Heit and Fingermann (1977) noted that females of the cray fishes, *Procambarus clarki* and *Faxonella clypeata* were much more tolerant of mercury than the males, thus the differences in tolerance of *O. niloticus* to the same concentration of Gramoxone and detergent may be attributed to the male female composition of the test fishes.

Stress and hyperactivities of the *O. niloticus* fingerlings observed in this study, was similarly reported in the brook stout, *Salvelinus fontinalis* (Drummond *et al.*, 1973). Ajao (1985) found that as the concentrations of the textile mill waste water effluent and detergent wash increased, some of the hermit crab (*Clibinarium africanus*) abandoned their shells while some exhausted crabs had half of their body passively outstretched outside the shell with the antenna lazily probing the test solution. The effects of these pollutants may be less pronounced if effective screening is made of various chemicals in use, particularly in areas where fish farms are located.

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