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ACUTE TOXICITIES OF BASUDINE AND GAMMALIN 20 TO *APHYOSEMIN GAIRDNERI*

BY

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ABSTRACT:

Effects of Basildon and Gammalin 20 on the fingerlings of A. gairdneri were investigated using static bioassays and continuous aeration over a period of 48 hours. The 48 hours LC50 of the exposed fish to basudine and gammalin 20 were determined to be 194.99 ugdm3 and 95.50 ug dm -3 respectively. Gammalin 20 was more toxic than Basildon. The behavioural responses observed include agitation, erratic swimming, loss of equilibrium, period of quiescence and death. it is concluded that repeated applications of these herbicides should be avoided before stocking ponds with fish.

Key words: Fingerlings, LC50 Herbicides
Running headline: Toxicities of herbicides to A. gairdneri
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INTRODUCTION:

Pecticides which are to be used in or near water are given special attention, usually with comprehensive field experiments and trials, before approval for their uses is given. This applies particularly to aquatic herbicides which although, may have a low toxicity to fish, could cause secondary effects by the removal of plants which act as a necessary habitat for juvenile life stages (Lloyd 1992). Although aquatic herbicides are cleared for human and environmental safety there are evidence that local fishermen still use them for fish poaching (Mason 1993). There are also indication that some of these herbicides are often used repeatedly and in conjunction with grass carp for controlling water weeds (Cross 1969, Tooby *et al.* 1980). Two of such herbicides that are in common use are basudine and gammalin 20. Basudine is an organophosphate with diazonon as the active ingredient. Goodman *et al.* (1979) reported that the 96 - hours LC50 of diazonon using juveniles of sheephead minnows was 1.4 mg *dm3*. Gammalin 20 is an organochloride whose active ingredient is lindane. Obande (1984) reported that "Otapiapia", a locally formulated pesticide with gammalin 20 as its major

active ingredient has a 96 - hour LC50 of less than 26ug dm^3 on A gairdneri. This work was conducted to establish the acute toxicities of basudine and gammalin 20 to a larvivorous annual cypridont, A gairdneri, a common member of the tropical freshwater fauna (Anthony 1982).

Materials and Methods:

Fingerlings of A gairdneri with mean weight of 0.037 + 0.006g were collected from the Delimi river in Jos, Nigeria. the fish were transported in plastic buckets (20 dm^{-3} capacity) to the laboratory. They were stocked 10 fish per tank in 32 dechlorinate aerated municipal ap water. The fish were acclimated to laboratory conditions for 2 weeks prior to the exposure period. During the acclimation period the fish were fed twice daily (0800h and 1600h) at 4% of their body weight with laboratory formulated fish feed. the holding tanks were cleaned daily and the water changed during cleaning. Mortality was less than 3% during acclimation period. Fish were not fed for 48 hours prior to and during the exposure period which lasted 48 hours. Basildon was obtained as 600g per cubic decilitre of diazonon. 0.005cl of the stock solution was diluted in 1 cubic decilitre of distilled water from which the following serial dilution were made 468.7, 234.35, 117.18, 58.59, 29.30, 14.65, 7 .32 and 0.00ug dm^{-3}. These were delivered into the first set of eight plastic tanks. The 0.00ug dm^{-3} served as the control experiment. The second set of eight plastic tanks served as replicates. Gammalin 20 was obtained as 200g per cubic decilitre lindane. It was dissolved using distilled water and delivered into each of the third set of eight tanks at the following concentrations: 312.5, 156.25, 78.13, 19.53, 9.77, 4.88 and 0.00ug dm^{-3}. The 0.00ug dm^{-3} served as the control while the fourth set of eight plastic tanks served as replicates. Water quality parameters were monitored every 23 hours in each tank for temperature, dissolved oxygen, total alkalinity, total hardness and pH according to APHA (1985). Dead fish was removed immediately to prevent polluting the experimental set up. The 48 hours LC50 was determined as a probit analysis using the arithmetic method of the percentage mortality rate. The lower and upper confidence limits of the LC50 were determined as described by UNEP (1989). Result obtained from this investigation were subjected to statistical analysis using the analysis of variance (ANOVA) method to test for significance at 0.05 probability level.

RESULT

Table 1: Water quality parameters obtained during exposure of A. gairdneri to acute concentrations of basudine.

Parameters	Basudine concentration (ug dm^{-3})							
	468.70	234.35	117.20	58.59	29.30	14.65	7.31	0.00 (control)
Temperature (0C)	18	18	18	18	18	18	18	18
Dissolved Oxygen (mg dm-3)	8.18	8.20	8.22	8.25	8.20	8.15	8.20	8.20
Total Alklinity (mg dm-3)	155	154	154	154	154	154	154	154
Total Hardness (mg dm-3)	77	76	76	75	76	76	76	76
pH	6.75	6.70	6.70	6.65	6.70	6.70	6.70	6.70

Table II Mortality rate of A gairdneri fingerlings to various consentrations of basudine.

Basudine concentrations (ug dm-3)	Time for 50% Mortality (Hr)	Total mortality %	Probit value
468.70	24	55	5.13
234.30	48	50	5.00
117.20	-	25	4.33
58.59	-	20	4.33
29.30	-	20	4.16
14.65	-	5	3.16
7.32	-	-	-
0.00	-	-	-

Table III. Water quality parameters obtained during exposure of A.gairdneri to acute concentrations of gammalin 20.

Parameters	Gammalin 20concentrations (ug dm-3) 312.5	156.5	78.13	39.06	19.53	9.93	4.88	0.00
Temperature (oC)	18	18	18	18	18	18	18	18
Dissovled Oxygen (mg dm-3)	8.15	8.20	8.25	8.10	8.25	8.20	8.25	8.20
Total Alkalinity (mg dm-3)	154	154	153	154	154	153	154	154
Total Hardness (mg dm-	76	75	75	76	76	75	76	76
pH	6.70	6.65	6.60	6.65	6.70	6.60	6.70	6.70

Table iv: Mortality rate of A gairdneri fingerlings to various concentrations of gammalin 20 for 48 hours

Gammalin 20 concentrations (mg dm-3)	Time for 50% Mortality (Hr)	Total Mortality (%)	Probit Value
312.5	12	75	5.67
156.25	24	60	5.25
78.12	48	60	5.25
39.06	-	45	4.87
19.53	-	20	4.16
9.77	-	-	-
4.88	-	-	-
0.00	-	-	-

The mean water quality parameters of the various concentrations of basudine did not vary significantly (p 0.05) from those of the control (Table 1). At basudine concentration of 468.70ug dm-^{3}, 55% mortality was recorded within 24 hours of the experiment while at concentration of 7.32ug dm-^{3} and the control group no mortality was recorded throughout the 48 hour exposure period as shown in Table 2. The 48-h LC50 was determined to be 194.99ug dm-^{3} with lower and upper confidence limits being 7.86ug dm-^{3} and 954.99ug dm^3 respectively. The water quality parameters in the treatment tanks with gammalin 20 did not vary significantly (P 0.05) with those of the control (Table 3). Mortality was observed to be highest, (75%) in the group of fish exposed to 312.5ug dm-^{3} of gammalin 20, while at concentration of 19.53ugl-1, 9.77ug dm-^{3}, 4.88ug *dm-3* and 0.00ug dm-^{3} no morality was recorded throughout the period of exposure (table 4) The 48 - h LC50 for gammalin 20 was determined to be 95.5ug dm-^{3} with the lower and upper confidence limits to be 14.13ug dm-^{3} and 501.87ug dm-^{3} respectively, the 48 hours LC50 of basudine was higher than that of gammalin 20. the 48-h LC50 is the concentration at which 50% mortality occurs within a 48hour (or 2 day) exposure. The higher the value of the 48 - h LC50 and the threshold concentration the less toxic the pesticide. This shows that basudine was less toxic than gammalin 20. The *following into the* experimental tanks containing acute consentrations of both herbicides: the fish became agitated and swan rapidly around the test tank but eventually lost equiluibrium and lack of response to gently prodding before death. these responses were not observed in the control groups.

DISCUSSION

Results of the water quality parameters including those of control for both basudine and gammalin 20 were within suggested tolerance range (mackereth 1963). This research revealed that the 48-hour LC50 for basudine was 194.99ug dm-^{3}, *Goodman et al.* (1979) reported that 96 - hour Lc50 for sheep head minnow, *Cyprinodon variegatus* exposed to basudine was 1400ug dm-^{3}. The differences in the result of this study from

those of Goodman *et al.* (1879) may be attributed to differences in fish species, age and experimental condition. The 48 - hour LC50 of gammalin 20 determined in this research was 95.50ug dm^{-3}, while Moss (1979) observed that 6.25mg dm^{-3} concentration of gammalin 20 was toxic to fingerlings of bluegill. Mason (1993) reported that gammalin 20 is hydrophobic, fat soluble and biologically stable so that it can accumulate in body fats. The observed abnormal behaviour of A. gairdneri was characterized by agitation and rapid swimming around the test tank with eventual loss equilibrium before death. A comparable behaviour of respiratory distress to acute concentration of toxicants (Wise *et al.* 1987, Ufodike and Omoregie, 1990, Omoregie *et al.* 1998). In fish farms herbicidies are applied once a year to eradicate weeds before stocking. Such applications are not harmful since the dose applied have enough time to be regarded by the microform. However repeated application should build up the LC50 values obtained in this research. It is recommended that in cases of subsequent application that enough time should be allowed for the degradation of the herbicides before fish stocking.

Acknowledgment
The authors are grateful to PADP (Plateau Agricultural Development Programme) for providing the herbicides used for this investigation

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