EFFECTS OF DIELDRIN TOXICITY ON THE HAEMATOLOGY OF THE AFRICAN CATFISH, *Clarias garipinus* (Burchell, 1822)

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ABSTRACT

The effect of chronic dieldrin toxicity on the blood parameters of the African catfish, *Clarias gariepinus* exposed at three different water concentrations (0.7ug l^{-1}, 1.5ug l^{-1} and 2.4ug l^{-1}) for 30 days was determined. Results however, indicated that both haemotocrit and haemoglobin levels were not significantly (P>0.05) affected by these concentrations. The organochlorine toxicity however, affected the behaviour pattern of the fish at the initial stages by lost of equilibrium resulting in erratic movements though there were no mortalities.

It was concluded that the effects of the three concentrations organochlorine (dieldrin) on the blood parameters of this fish were temporary as fish were able to recover quickly from the toxicity effects.

Keywords: Haemotology, haemotocrit, haemoglobin and behaviour

INTRODUCTION

Fish haematology is an effective aid in the diagnosis of fish stress and disease. In addition, blood is the most accessible part of the teleostean body fluid system (Culloty, *et al.*, 1991). As a result, blood variables are commonly used as direct or inferential indicators of functional state. Blaxhall & Daisley, (1973) used measurement of haematological status to evaluate dietary adequacy. Common haematological parameters used are haemoglobin and haematocrit levels because they are simple to measure and are also sensitive to stress (Matthiessen, 1981; Crusco *et al.,* 1991). In 1981, Matthiessen reported on the haematological changes in *Tilapia* spp. and *Clarias* spp. following aeries spraying with endosulfan insecticide in Zimbabwe. His studies indicated that endosulfan elevated the blood cell count by a factor of four in cases of fish sampled during spraying, and plasma protein levels were also affect. Still, little attention has been paid to determining the blood - pesticide relationship in African fishes in spite of the information it might provide. It was with this in mind that work on this aspect was initiated. The objective of this work was to establish the effects of the dieldrin an organochlorine pesticide (OCP), on the blood parameters of adult *Clarias gariepinus.*

MATERIAL AND METHODS

4O adult *Clarias gariepinus* fish of mixed sexes weighing between 243-250g were obtained from the same stock in the hatchery where they had been bread and reared for seven months. The 40 fish were acclimatized for about two weeks before commencement of experiments. They were checked for their state of health weighed and measured to 0.01g using a Mettler top loading electronic balance. The experimental design was such that four treatments were replicated in eight glass acquria. After weighing, five fish were placed into

each of the eight glass weighing, five fish were placed into each of the eight glass weighing, five fish were placed into each of the eight glass acquaria of 23 litre capacity containing diedldrin treated water at three different concentrations (0.7ug l^{-1}, 1.5ug l^{-1} and 2.4ug l^{-1}) and controls without diedrin all in replicates. The fish were exposed for a period of 30 days with water changes every 96 hours.

The water quality parameters of pH, dissolved oxygen, temperature and ammonia levels were monitored throughout the period of the experiment before and immediately after every water change.

Blood sampling:

Blood was sampled according to the method described by Blaxhall and Daisely, (1973). After every six days a single fish was taken from each aquarium by handnetting and immediately anaesthetized in 1 ppt benzocaine. When fish were confirmed anaesthetized, that is no response at the touch of confirmed anaesthetized (that is no response at the touch of the caudal peduncle), the fish's head was destroyed by crushing. Blood was then taken by cadiac pucture using a 2ml plastic syringe containing heparin.

Microheamatocrit (packed cells volume).

The well mixed blood from cadiac puncture sampling was drawn into a microhaematocrit tube (Hawsley, Ltd) 75 mm long 1.1-1.2mm internal diameter and one end was sealed with a "critasseal", however, where blood had to be taken from caudal peduncle, the blood was drawn directly into the microhaematocrit tube from the severed peduncle. This slight alteration in procedure did not produce any variation in readings. The tubes were then centrifuged in a microhaematocrit centrifuged for five minutes. The readings were made with the aid of a Hawsley microhaematocrit reader and expressed as the volume of the erythrocytes per $100cm^3$.

Haemoglobin.

Replicates of 20 microliter of blood samples were taken in tests-tubes and 10ml of 0.1 M HCI was added to each. Each of the tubes was stirred gently by swirling to ensure complete mixing. The samples were then put into cuvettes and were read on the Spectrophotometer (SHIMAZU UV-120) at 540nm wavelength, between 3-5 minutes after mixing according to Blaxhall and Daisely (1973). The values were then read out on a standard scale giving results in g/100ml.

Statistical analysis:

Data obtained were subjected to analysis of variance (ANOVA) procedure by Wardlaw, (1989). Significant differences were determined at $P< 0.05$.

RESULTS.

Behavioral effects.

Following exposure to dieldrin some of the fish showed hyperactivity characterized by rapid and erratic swimming or darting, partial loss of equilibrium and rapid pectoral and opercular movements. After about 2-3min. However, they recovered and settled down. Similar

observations were made by Holden, (1973) and Matthiessen, (1981).

Hematocrit count:

The exposure to these sublethal concentrations of 0.7ug l^{-1}, 1.5ug l^{-1}, and 2 .4ug l^{-1}, did not result in any significant effect on the blood parameters investigated. Table 1 shows the changes in the Hematocrit counts in comparison to the controls. They did not differ significantly.

Haemoglobin:

Similarly, there was no significant difference between the haemoglobin levels of the controls and treated fish (Table 1). The findings did not suggest any relationship between sampling time and effect.

Table 1 **Hematocrit values (v/100cm^3) of *C. gariepinus exposed* to 0.7ug l^{-1}, 1.5ug l^{-1} and 2.ug l^{-1} of dieldrin for 30 days. Values are means ±SD of three readings taken from the same fish.**

Con. ugl^{-1}	Days				
	6	12	18	24	30
Control I	36.5±2.0	31.83±1.25	30.67±0.76	31.83±0.29	33.5±0.5
Control II	28.14±4.9	28.0±0.1	31.33±0.29	33.0±0.1	34.0±1.7
0.7 I	30±0.87	31.5±0.87	26.17±0.76	28.5±0.5	35.5±0.5
0.7 II	31.5±1.8	28.0±1	28.0±1	33.33±0.76	30.0±0
1.5 I	28.83±2.36	31.17±0.57	30.33±1.15	33.5±1.32	25.33±0.57
1.5 II	22.67±0.83	34.67±0.38	30.5±0.5	32.0±1	30.33±0.57
2.4 I	28.83±0.76	29.0±5.2	27.67±0.58	32.33±0.58	31.5±0.87
2.4 II	31.5±2.18	27.33±3.75	33.5±0.5	35.5±1.32	28.8±1.04

Table 2: Haemoglobin content (g/100 cm^3) in *C. gariepinus* exposed to 0.7ug l^{-1} 1.5ug l^{-1} and 2.4ug l^{-1} of dieldrin for a period of 30 days. Values are means ±SD of three readings taken from the same fish, - Blood sample in these replicates had clotted before reading.

Con. ug l^{-1}	Days				
	6	12	18	24	30
Control I	-	18.6±1.41	19.73±0.25	15.97±0.59	11.8±1.21
Control II	18.4±1.15	11.9±0.17	8.87±1.32	10.77±0.12	23.67±5.92
0.7 I	14.67±0.59	19.67±0.76	17.53±0.83	7.97±0.12	16.37±0.59
0.7 II	21.6±1.39	15.4±4.19	18.93±0.67	25.0±0.0	8.6±5.37
1.5 I	6.87±2.65	12.0±4.16	16.17±3.45	3.23±0.4	-
1.5 II	14.17±1.47	11.7±0.52	8.06±0.47	18.2±0.35	16.8±0.85
2.4 I	±2.04	8.67±1	18.23±0.55	±5.9±0.0	±8.03±0.26
2.4 II	15.33	-	9.67	17.93	14.63

DISCUSSION

Dieldrin has been found to be toxic to fish (Holden, 1972). One of the immediate observable effects is a behavioral response. When conducting these tests, a realization of sudden change in behaviour from the time of introduction of fish to the treated water was observed. This was characterized by rapid, erratic swimming or drafting, a partial loss of equilibrium and rapid pectoral and opercular movements. This behaviours lasted for only 2-3 minutes, as the fish recovered quickly and settled down.

This observation is consistent with those of other scientists mentioned earlier. Holden, (1972), for example, observed similar effects of lethal aqueous concentrations of pesticides. prior to death. In field studies, Matthiessen, (1981), observed abnormal fish behaviour during spraying of endosulfan.

The results of the present study are in distinct disagreement with most of previous findings on hematological responses to insecticides. For example Matthiessen, (1981) observed that in all cases of fish tested with endsulfan, blood cell counts were significantly elevated, but he also observed a significant decline in mean weight of hb in *Tilapia* spp.

The relatively constant values noted in the hematocrit level of *C. gariepinus* are close to normal values found in other catfishes e.g. *Italurus nebulizes* and channel catfish *Italurus punctatus*.

The fact that values were near normal suggests that dieldrin did not cause serious physiological or hematological stress. However, it is likely that this fish is relatively tolerant, as observed earlier in other dieldrin related tests. Matthiessan, (1981), observed in his field studies, that hematological characteristics in *Tilapia* began returning to pre spray values within a month after spraying stopped. This, he suggested, was possibly due to enzymatic detoxification.

It is reasonable to suggest that similar internal response occur in *C. gariepinus,* but they do not appear to involve the blood cell count.

The sahli-Hellige technique used to determine the Hb levels was found to be satisfactory since all results were consistent with those of others, (Mcnight, 1966).

Dieldrin effect was not significant on the Hb levels (Table 2) because the whole blood

Hb was not elevated. Similar studies carried out on *Tilapia* and *Hepsetus*, showed that in the former whole-blood Hb did not change significantly, while in the latter it was unaffected by endosulfan (Matthiessen, 1981).

REFERENCES,

Blaxhall, P.V. and Daisely, K.W., (1973). Routine hematological methods for use with fish blood. *J. Fish Biol.*, 5, 771-781.

Carusco, C., Rutigliano, B., Romano, M., and Prisco, G., (1991). The haemoglobin of the cold-adapted Antarctic teleost, *Cynodraco mamsoni., Biochim. biophys. ACTA.*, 1078, 273-282.

Holden, A.V., (1972). The effects of pesticides on life in freshwaters. *Pro. Roy. Sco. Series* B, 180, 383-394.

Matthiessen, P., (1981). Hematological changes in fish following aerial spraying with endosulfan insecticide for tsetse fly control in Botswana. *J. Fish Biol.*, 18, 461-469.

Mcknight, I.M., (1966). Hematological study on the mountain Whitefish. *Prosopium williamson J. Fish. Res. Bd Can., 23, 45-63.*

Wardlaw. A.C., (1989). Practical statistics for experimental biologist. John Wiley & Sons, Chichester.