



EFFECTS OF CHRONIC CONCENTRATIONS OF SHARPSHOOTER (PROFENOFOS 40% AND CYPERMETHRIN) ON THE HAEMATOLOGICAL PROFILE AND OVERT DISTRESS BEHAVIOUR OF SUB-ADULT *CLARIAS GARIEPINUS*-(BURCHELL, 1822)

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ABSTRACT

Pollution in aquatic environment is one of the major environmental threats in the world and pesticides are among the leading polluting agents that affect aquatic organisms. This study has investigated the behavioural effect and haematological profile of chronic concentrations of sharpshooter (Profenofos 40% and Cypermethrin) on *Clarias gariepinus* over 28 days of exposure. Sub-adult *C. gariepinus* (150-200g and 25-30cm) were exposed to 0.00ppm, 0.12ppm, 0.24ppm, 0.48ppm, 0.96ppm concentrations of sharpshooter for 28 days. Blood samples were collected at day 7, 14, 21 and 28 and analyzed. Descriptive statistics and one-way ANOVA was used to analyze data. Overt distress behavioural responses like erratic movement, frequent surfacing, copious mucus secretion and grouping together were observed among the treatment groups. Significant changes ($p < 0.05$) were induced on haematological parameters of *C. gariepinus* by Sharpshooter (Profenofos 40% and Cypermethrin). We observed that changes in behaviour and haematological profile were concentration and time-dependent. Our findings suggest that chronic exposure of *Clarias gariepinus* to sharpshooter can lead to abnormal behaviour and significant alterations in the haematological profile (WBC, LYMP, RBC, HGB, MCH, MCHC, PLT, HCT, MCV and MPV) which in turn can lead to; compromised immunity, poor nutrient circulation, slow growth and threat to survival of *Clarias gariepinus*. Caution and concrete policies should be put in place to ensure safety of the environment and aquatic organisms.

KEYWORDS: Pesticides, Sharpshooter, *Clarias gariepinus*, Haematological profile and behaviour

INTRODUCTION

Sharpshooter is an organophosphorus and synthetic pyrethroid combination insecticide that contains profenofos (40 %) and cypermethrin (4%) as active ingredients. It is a broad-spectrum insecticide that has fast onset of action in the control and total annihilation of insect pests. Application of insecticides on crops and agricultural products has rapidly increased in recent years in low and middle-income countries. This is partly because of increased availability of these chemicals in the market pest (Srivastava, 2016) and its efficacy in controlling insect. Sharpshooter is found to be active in the control of insect pests such as aphids, whiteflies, leaf hoppers, cabbage moth, caterpillars, ants etc.

It is commonly used by farmers on cotton, citrus, rice, vegetable, trees, shrubs and ornamentals flowers, including indoor and outdoor pests. Linstrom and Mullard (2015) reported that profenofos acts on acetyl cholinesterase enzyme while cypermethrin which is systemic pyrethroid behaves like a neurotoxin. It is marketed with different trade names such as "Impact, Prime-plus" and Prowin 404 depending on the manufacturing company. Chronic concentrations of sharpshooter as well as other insecticides which are of domestic and agricultural use are known to induce no apparent mortality in an experimental condition; this is because the concentrations are not strong enough to kill the organisms exposed to it.

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However, these long-term exposures which may or may not be noticed can trigger a wide variety of physiological and biochemical changes. The blood and other body fluids are the foremost transport system of the animal and any modification resulting from organic or inorganic toxicants, pathogens, pressure or stress are shown in the quantity and morphology of all the blood types (Nshabum *et al.*, 2025). Haematological indices had been widely studied and there is usually a link between them and the general health indices of an individual (Nshabum *et al.*, 2025).

Properly applied chemicals can be effective in managing harmful insects, fungi and weeds which can help farmers by increasing productivity and income. Nevertheless, hazardous insecticides in combination with climate change can pose significant risk to the survival of species and integrity of the ecosystem (Job and Nshabum, 2024). Worldwide deaths and chronic diseases due to pesticide poisoning number at about one million (The Environment forum, 1999) while long-term-low doses of exposure is increasingly linked to human deaths with effects such as immune suppression, hormone disruption, reproductive abnormalities and cancer (Akter, *et al.*, (2009). According to reports by WHO (2017), about one in every three-person in the globe's suicide cases are accounted for by self-poisoning with pesticides.

Generally, pesticides must be lethal to the target species and not to the non-target pests. However, Maharajan *et al.*, (2016) stated that over 98 % of sprayed insecticides and 95 % of herbicides reach destinations outside the target species. Hodgson (2010) asserted that human exposure to pesticides can occur directly especially for agricultural workers and their families. Individuals residing in areas that are close to farms where pesticides are heavily applied may also be directly exposed. Indirect exposures can also occur when pesticide residues on food or contaminated fish are ingested by man and other predators. Environmental modeling indicates that, over sixty percent of the world is at danger of insecticide contamination with more than one active ingredient while thirty percent is at high danger (Tang *et al.*, 2021). Some synthetic organic pesticides are not easily degraded and can persist in the body tissues or the environment for years. Bio accumulation of these insecticides in human tissues can therefore occur and result in human health problems. Hodgson (2010) stated that chronic intoxications are more common than acute poisoning. Long term exposures to relatively low concentrations of pollutants such as SO₂, smoke and heavy metals (e.g. cadmium, lead and mercury) may eventually lead to injuries in plants, animals and humans. Class, *et al.*, (1991) argues that insecticides use remains controversial and is giving rise to increasing environmental and health concerns.

Pollution in aquatic environment is one of the major environmental threats in the world. Aquatic pollution reduce the quality of the environment by rendering water bodies unsuitable for aquatic life (Ama *et al.*, 2025). Pesticides are among the leading polluting agents that affect aquatic organisms and humans (Achikanu and Nwanba, 2020). Fish is a good indicator of aquatic contamination because its biochemical stress response is like those found in mammals (Maharajan and Rusha, 2013). *Clarias gariepinus* (African catfish) is locally called mud catfish and is of the family Claridae (The air breeding cat fish). The adults are found mainly in quiet waters (lakes and ponds) but can also be found in flowing rivers. They prefer shallow and swampy areas with muddy substrates and are tolerant to extreme environmental conditions. They are common in natural water bodies and man-made reservoirs where they are cultured for food and income generation. With the world population increasing yearly and with a corresponding increase in demand for food, agricultural practices have moved from subsistence to commercial levels. Urban and rural farmers are now engaging modern farm technologies especially in the use of pesticides for pest and weed control. However, the incidence of poor use practices is widespread while quality control in manufacture, handling, labeling and packaging is often poor. Chronic doses of insecticides are common though often ignored or not easily noticed. This study examined the effects of chronic exposure of "Sharpshooter" insecticide on the overt distress behavior and blood parameters of *Clarias gariepinus*.

MATERIALS AND METHODS

Collection and transportation of test fish

Sub-adult *Clarias gariepinus* weighing between 150-200 g and measuring 25-30 cm in length were procured from the Fish Farm in the University of Calabar and transported in well aerated plastic tanks of 160 liters capacity containing water to Zoology and Environmental Biology Department's Laboratory, University of Calabar.

Acclimatization of test fish

In the laboratory, the fish were transferred into transparent aquaria of 30x30x60cm containing de-chlorinated water; fed commercial fish feed of Copen Brand and left to acclimatize under laboratory conditions for three (3) weeks. The fish tanks were washed thoroughly with potassium permanganate to avoid fungal infection before introducing the fish (Ogueji *et al.*, 2017).

Test chemical

Sharpshooter insecticide (produced by WACOT limited) was procured from Cross River State Agricultural Development Programme (CRADP), Ministry of Agriculture, Calabar, Cross River State, Nigeria.

Preparation of stock solution

Stock solution of Sharpshooter was prepared by diluting 2.5 ml of the liquid in 997.5mls of distilled water to make 1000ml of the solution in line with standard procedures for preparing stock solutions (Reish and Oshida, 1987). The serial test concentrations were derived from the stock solution. Four concentrations (0.12, 0.24, 0.48 and 0.96ppm) and a control were prepared in three replicates.

Sample size and test procedure

A sample size of one hundred and fifty (150) sub-adults *Clarias gariepinus* was used as test organism to conduct the experiment. Fifteen (15) transparent tanks of size 30x30x60cm were provided in three replicates. Each tank hosted ten fishes. The fishes were randomly assigned to these tanks and fed with commercial fish feed of Copen Brand at 2.5 % body weight daily. Water was changed daily to remove remnants of feeds and maintain the strength or concentration of sharp shooter in water (Avoajah, *et al.*, 1997). Oxygen was kept at saturation level using mechanical air pump. The duration of the experiment was 28 days.

Sampling procedure

Two (2) fish samples were collected randomly from each concentration (2 fishes per tank) after every 7 days. Four sampling sessions were involved i.e. day 7, 14, 21 and 28. Fish samples were weighed with a digital weighing balance and length measured respectively. Blood was drawn from the posterior caudal vein with the help of disposable 2 ml plastic syringes fitted with pediatric needles (Ajang *et al.*, 2024). Sterile sample bottles were used to store the blood. Ethylenediaminetetraacetic acid (EDTA) sample bottles were used to store un-clotted blood and the bottles were properly labeled. Blood samples collected were stored in iced containers and taken for analyses at the Department of Medical Laboratory Science, University of Calabar, Nigeria.

Analysis of haematological profile

EDTA and plain bottles were used to store collected blood from the test organisms. Haematological parameters of White Blood Cells (WBC), haematocrit, Platelets (PLT), Mean Corpuscular Volume (MCV), Mean corpuscular haemoglobin (MCH), Haemoglobin (Hgb), Red blood cells (RBC), Mean Corpuscular Haemoglobin Concentration (MCHC), and Lymphocytes (LYMP) were measured with the use of Sysmex model XS1000i haemolyzer at intervals of 7, 14, 21 and 28days. Blood counting was done using flow cytometry, which utilizes flow cells, photometer and apertures to analyze different elements in the blood. A small amount of sample (blood) was aspirated and diluted according to the method of Dacie and Lewis (1968). It was then passed through an aperture and a lesser flow cell. Various indices were reported on the parameters under examination.

Ethical approval

This study was approved by the Research Ethics Committee of the Faculty of Biological Sciences, University of Calabar, Calabar, Nigeria.

Statistical analysis

Data obtained for haematological parameters were subjected to descriptive statistics (mean and standard deviation). One-way Analysis of Variance (ANOVA) was used to test the significant difference for each group after 7, 14, 21 and 28 days of exposure compared to control. Duncan multiple post hoc test was used for between duration analysis. All analyses were performed using Graph Pad Prism version- 5 at 0.05 levels of significance and the relevant degree of freedom.

RESULTS

Behavioural responses of *Clarias gariepinus* to chronic concentration of sharpshooter

During the period of exposure to sharpshooter *Clarias gariepinus* showed distress behavioural responses such as erratic swimming, gasping for breath, piping and frequent surfacing. As the test progressed, the test organisms became weaker and those that could not tolerate the concentration any longer went into lethargy. The experiment was conducted in replicates of three treatments per concentration.

Behavioral changes in fish exposed to different concentration of sharpshooter insecticides ranged from grouping together, darting movement to mucous secretion. Agitated movement was observed in higher concentrations (exposures) of 0.48ppm and 0.96ppm. Copious mucus secretions were also visible on days 21 and 28 in concentration 0.24, 0.48 and 0.96ppm.

Effect of sharpshooter on haematological parameters in *Clarias gariepinus*

Total White Blood Cell Count (TWBC)

Results of the study shows significant changes in the white blood cells (WBC) count of *Clarias gariepinus* after 28 days of exposure to sharpshooter (Table 1). The white blood cells (WBC) counts reduced significantly ($p < 0.05$) when compared with the control in concentration 0.24mg/l, 0.48mg/l and 0.96mg/l in all the treatment durations. There was however, no significant reduction in the white blood cells (WBC) count of *Clarias gariepinus* treated with 0.12mg/l concentration of sharpshooter on day 7, day 14 and day 28 (Table1).

Lymphocytes count (%) (LYM)

Sharpshooter induced changes in the lymphocytes of *Clarias gariepinus* after 28 days of exposure. There was a significant ($p < 0.05$) reduction in the lymphocytes count of *Clarias gariepinus* in all the treatments and all durations except 0.12mg/L at day 7 of the treatment (Table 1).

Red blood cell (RBC)

Toxicological changes were equally observed in the Red blood cells of *Clarias gariepinus* after 28 days of exposure. There was a significant ($p < 0.05$) reduction in the red blood cell count of all the treated experiment, at all durations except 0.12mg/L at day 28 of the treatment (Table1)

Haemoglobin count

At day 7 of the exposure, there were significant ($p < 0.05$) decreases in HgB count across the different concentrations used compared with control (Table 1). After 14 days of exposure, no significant reduction was observed with 0.12 mg/L treatment compared with control. At day 21, significant reduction in the haemoglobin count of *Clarias gariepinus* were recorded only in 0.48mg/l and 0.96mg/l concentration of sharpshooter. However, at day 28, only 0.96mg/l concentration showed significant change when compared with the control. (Table1).

Mean cell haemoglobin (MCH)

Significant changes on the mean corpuscular haemoglobin of *Clarias gariepinus* were observed in all concentrations (0.12mg/l, 0.24mg/l, 0.48mg/l and 0.96mg/l) on day 14, day 21 and day 28, whereas the changes observed after 7 days of exposure time were not significant when compared with the control experiment. (Table 1).

Mean cell haemoglobin concentration (MCHC)

Significant changes were observed in 0.24mg/l, 0.48mg/l and 0.96mg/l after 14, 21 and 28 days of exposure time. However, 0.12mg/l concentration of sharpshooter recorded significant changes in the mean cell haemoglobin only on day 7 and day 28 of exposure to sharpshooter when compare with control. (Table1).

Platelets (PLT)

Sharpshooter toxicity induced changes in the platelet count of *Clarias gariepinus* after 28 days of exposure. There was a significant ($p < 0.05$) reduction in the platelet count of *Clarias gariepinus* in all the concentrations (0.12mg/l, 0.24mg/l, 0.48mg/l and 0.96mg/l) of sharpshooter. The reduction was concentration dependent. (Table1).

Hematocrit (HCT)

Hematocrit count of *Clarias gariepinus* decreased with increase concentration of sharpshooter. However the decrease in 0.12mg/l and 0.24mg/l concentration of sharpshooter were not significant when compared with the control experiment. Whereas 0.48mg/l and 0.96mg/l concentration of sharpshooter recorded a significant ($p < 0.05$) decrease in hematocrit count of *Clarias gariepinus* when compared with the control. (Table 1).

Mean Corpuscular volume (MCV)

A significant ($p < 0.05$) reduction in the Mean Corpuscular volume of *Clarias gariepinus* exposed to 0.12mg/l, 0.24mg/l, 0.48mg/l and 0.96mg/l after 7, 14, 21 and 28 days of exposure time was observed when compared with the control (Table 1).

Mean platelet volume (MPV)

This study recorded a significant ($p < 0.05$) reduction in the Mean platelet volume of *Clarias gariepinus* in all the treatments (0.12mg/l, 0.24mg/l, 0.48mg/l and 0.96mg/l) after 7 days and 28 days of exposure period. The decrease in Mean platelet volume of *Clarias gariepinus* in 0.12mg/l treatment was insignificant on day 14 and 21 when compared to the control (Table 1).

S/N	Haematological parameters	Exposure duration	Chronic Concentration of sharpshooter				
			Control (0.00mg/l)	0.12mg/l	0.24mg/l	0.48mg/l	0.96mg/l
1	TWBC($\times 10^3$ /NL)	7 Days	57.49 \pm 1.36 ^a	55.92 \pm 0.12 ^a	54.82 \pm 0.17 ^b	50.86 \pm 0.26 ^b	41.77 \pm 0.43 ^b
		14 Days	59.96 \pm 0.09 ^a	58.40 \pm 0.47 ^a	57.94 \pm 0.06 ^b	55.21 \pm 0.26 ^b	54.63 \pm 0.31 ^b
		21 Days	63.96 \pm 0.46 ^a	60.74 \pm 0.01 ^b	56.54 \pm 0.04 ^b	51.49 \pm 0.06 ^b	51.09 \pm 0.46 ^b
		28 Days	91.56 \pm 0.04 ^a	89.03 \pm 0.07 ^a	59.19 \pm 0.58 ^b	57.42 \pm 0.13 ^b	55.23 \pm 2.98 ^b
2	LYM (%)	7 Days	43.28 \pm 0.02 ^a	42.71 \pm 0.09 ^a	31.48 \pm 0.02 ^b	31.03 \pm 0.02 ^b	19.32 \pm 0.03 ^b
		14 Days	58.63 \pm 0.03 ^a	43.00 \pm 0.18 ^b	42.35 \pm 0.15 ^b	38.96 \pm 0.35 ^b	32.58 \pm 0.07 ^b
		21 Days	51.27 \pm 0.99 ^a	41.27 \pm 0.99 ^b	32.37 \pm 0.04 ^b	30.77 \pm 0.05 ^b	29.91 \pm 0.11 ^b
		28 Days	59.43 \pm 0.49 ^a	54.94 \pm 0.06 ^b	44.51 \pm 0.49 ^b	40.66 \pm 0.14 ^b	33.28 \pm 0.06 ^b
3	RBC ($\times 10^3$ /NL)	7 Days	3.52 \pm 0.04 ^a	2.21 \pm 0.01 ^b	1.97 \pm 0.02 ^b	1.78 \pm 0.02 ^b	1.57 \pm 0.02 ^b
		14 Days	3.39 \pm 0.19 ^a	2.20 \pm 0.01 ^b	1.87 \pm 0.07 ^b	1.76 \pm 0.01 ^b	1.54 \pm 0.01 ^b
		21 Days	2.05 \pm 0.03 ^a	1.89 \pm 0.03 ^b	1.55 \pm 0.05 ^b	1.49 \pm 0.01 ^b	1.10 \pm 0.10 ^b
		28 Days	10.23 \pm 0.07 ^a	9.85 \pm 0.09 ^a	7.60 \pm 0.40 ^b	4.56 \pm 0.03 ^b	4.41 \pm 0.32 ^b
4	HgB(g/dL)	7 Days	21.20 \pm 0.40 ^a	14.00 \pm 0.00 ^b	12.26 \pm 0.04 ^b	11.20 \pm 0.36 ^b	9.90 \pm 0.10 ^b
		14 Days	16.70 \pm 0.30 ^a	15.20 \pm 0.20 ^a	14.85 \pm 0.15 ^b	3.60 \pm 0.20 ^b	3.50 \pm 0.10 ^b
		21 Days	12.10 \pm 0.00 ^a	12.07 \pm 0.05 ^a	11.90 \pm 0.10 ^a	10.17 \pm 0.15 ^b	9.40 \pm 0.00 ^b
		28 Days	2.47 \pm 0.02 ^a	2.26 \pm 0.19 ^a	2.13 \pm 0.01 ^a	2.10 \pm 0.02 ^a	2.07 \pm 0.03 ^b
5	MCH (Pg)	7 Days	64.73 \pm 1.24 ^a	64.57 \pm 0.25 ^a	64.20 \pm 0.10 ^a	63.23 \pm 0.05 ^a	63.20 \pm 0.40 ^a
		14 Days	76.70 \pm 0.10 ^a	63.20 \pm 0.40 ^b	60.60 \pm 0.20 ^b	58.05 \pm 0.45 ^b	55.45 \pm 0.05 ^b
		21 Days	63.50 \pm 0.50 ^a	62.30 \pm 0.30 ^b	61.43 \pm 0.05 ^b	58.15 \pm 0.05 ^b	54.95 \pm 0.05 ^b
		28 Days	156.00 \pm 1.00 ^a	146.70 \pm 0.57 ^b	144.70 \pm 0.57 ^b	58.15 \pm 0.05 ^b	57.17 \pm 0.05 ^b
6	MCHC (g/dL)	7 days	49.55 \pm 0.15 ^a	47.32 \pm 0.08 ^b	45.20 \pm 0.60 ^b	43.11 \pm 0.11 ^b	41.37 \pm 0.05 ^b
		14 days	53.33 \pm 11.58 ^a	53.03 \pm 1.79 ^a	43.30 \pm 0.10 ^b	42.55 \pm 1.25 ^b	40.80 \pm 0.60 ^b
		21 days	48.50 \pm 0.10 ^a	48.47 \pm 0.23 ^a	45.91 \pm 0.11 ^b	43.60 \pm 0.52 ^b	40.70 \pm 0.30 ^b
		28 days	58.60 \pm 0.10 ^a	44.70 \pm 0.30 ^b	41.77 \pm 0.05 ^b	39.37 \pm 0.35 ^b	38.90 \pm 0.70 ^b
7	PLT (mcL)	7 days	49.95 \pm 0.15 ^a	47.32 \pm 0.08 ^b	45.20 \pm 0.60 ^b	43.11 \pm 0.11 ^b	41.37 \pm 0.05 ^b
		14 days	57.00 \pm 1.00 ^a	15.67 \pm 0.57 ^b	13.67 \pm 0.57 ^b	11.67 \pm 0.57 ^b	10.67 \pm 0.05 ^b
		21 days	41.67 \pm 0.57 ^a	23.67 \pm 0.57 ^b	19.00 \pm 1.00 ^b	16.67 \pm 0.57 ^b	11.00 \pm 0.00 ^b
		28 days	57.00 \pm 0.100 ^a	26.67 \pm 0.57 ^b	16.67 \pm 0.57 ^b	14.67 \pm 0.57 ^b	12.67 \pm 0.57 ^b
8	HCT (%)	7 days	0.43 \pm 0.01 ^a	0.34 \pm 0.01 ^a	0.31 \pm 0.01 ^a	0.24 \pm 0.01 ^b	0.23 \pm 0.01 ^b
		14 days	0.43 \pm 0.03 ^a	0.40 \pm 0.01 ^a	0.36 \pm 0.01 ^a	0.21 \pm 0.01 ^b	0.20 \pm 0.01 ^b
		21 days	0.31 \pm 0.01 ^a	0.30 \pm 0.01 ^a	0.25 \pm 0.01 ^a	0.22 \pm 0.01 ^b	0.20 \pm 0.00 ^b
		28 days	0.20 \pm 0.00 ^a	0.14 \pm 0.00 ^a	0.13 \pm 0.00 ^a	0.12 \pm 0.00 ^b	0.12 \pm 0.00 ^b
9	MCV (fL)	7 days	153.00 \pm 0.00 ^a	150.30 \pm 0.5 ^b	145.50 \pm 0.50 ^b	135.70 \pm 0.57 ^b	127.30 \pm 0.57 ^b
		14 days	150.70 \pm 0.57 ^a	146.30 \pm 0.57 ^b	145.00 \pm 0.00 ^b	143.70 \pm 0.57 ^b	124.70 \pm 0.57 ^b
		21 days	143.70 \pm 0.57 ^a	142.00 \pm 0.00 ^b	141.70 \pm 1.52 ^b	131.00 \pm 0.00 ^b	120.70 \pm 0.57 ^b
		28 days	137.30 \pm 0.57 ^a	128.70 \pm 1.52 ^b	36.20 \pm 0.42 ^b	31.57 \pm 0.04 ^b	30.39 \pm 0.59 ^b
10	MPV (fL)	7 days	10.77 \pm 0.05 ^a	10.15 \pm 0.05 ^b	9.80 \pm 0.00 ^b	9.16 \pm 0.05 ^b	8.70 \pm 0.57 ^b
		14 days	9.86 \pm 0.05 ^a	9.80 \pm 0.00 ^a	9.63 \pm 0.05 ^b	9.40 \pm 0.10 ^b	8.20 \pm 0.10 ^b
		21 days	9.76 \pm 0.05 ^a	9.66 \pm 0.15 ^a	9.60 \pm 0.20 ^b	9.16 \pm 0.20 ^b	8.16 \pm 0.15 ^b
		28 days	10.30 \pm 0.00 ^a	10.10 \pm 0.10 ^b	9.86 \pm 0.35 ^b	9.16 \pm 0.63 ^b	9.06 \pm 0.05 ^b

Values are in Mean \pm standard deviation, Values with different superscript compared to the control are significantly different (p<0.05)

TWBC- White Blood Cell Count

LYM - Lymphocytes count

RBC-Red blood cell

HgB-Haemoglobin count

MCH-Mean cell haemoglobin

MCHC-Mean cell haemoglobin concentration

PLT-Platelets

HCT-Hematocrit

MCV-Mean Corpuscular volume

MPV-Mean platelet volume

DISCUSSION

The unregulated discharge of agricultural chemicals such as pesticides and other toxicants into water bodies have caused ecological problems to all classes of aquatic organisms including fish (Adewunmi, *et al.*, 2018). The use of modern organic synthetic pesticides has increased in agricultural sector to promote crop yield with low labour and effort. Various types of pesticides are employed intensively in agricultural fields and domestic homes for the control of certain pest species of agricultural and domestic importance. The consequences of the widespread and indiscriminate application of these chemicals have manifested in numerous health-related challenges around the world. The environment, especially the aquatic ecosystem is mostly affected with resultant high risk to the flora and fauna (Srivastava, 2016). Environmental pollution poses a serious threat, to aquatic animals and the plants that constitute the primary producers in the ecosystem (Nwani, *et al.*, 2013). Micro-aquatic fauna and flora (planktons) which form an important trophic level in the food chain of an aquatic ecosystem are also affected by pesticide pollution and other toxicants. This study has examined the effects of sharpshooter (an organophosphate and synthetic pyrethroid insecticide) on the overt distress behaviour and haematological parameters in *Clarias gariepinus*. The impact of profenofos on the neural transmissions and coordination was reflected on the behavioural patterns observed. *Clarias gariepinus* showed rapid swimming and hyper excitability/agitation immediately they were introduced into the toxicant. Frequent surfacing, grouping together and lethargy were observed with increase time of exposure and concentration. Copious mucus secretions and decrease mobility was visible in the groups treated 0.48mg/l and 0.96mg/l. Similar observations were reported by Chandra, *et al.*, (2017) where they reviewed the toxicity and other effects of Dichlorvos on fresh water fish and Betraud, *et al.*, (2000) who reported the effects of carbofuran, diuron and nicosulfuran on acetylcholinesterase activity on gold fish (*Carassius auratus*).

Blood plays crucial role as a pathological reflector of the status of an exposed organism to a toxicant or stressor. Changes in haematological profile are often used to ascertain stress due to environmental, nutritional and pathological factors. This study revealed a decrease ($p < 0.05$) in TWBC, LYMP, RBC, HgB, MCH, MCHC, PLT, HCT, MCV and MPV levels compared to the controls. All the parameters showed significant decrease ($p < 0.05$) in concentrations 0.48mg/l and 0.96mg/l compared with the control while others showed significant decrease in lower concentration of the toxicant. The changes observed in the blood parameters were time and concentration dependent. Similar findings have been reported by Ajang *et al.*, (2024), Eni, *et al.*, (2019), Ani *et al.*, (2018) and Ogueji *et al.*, (2017). The

significant decrease ($p < 0.05$) in the Red Blood Cell (RBC) concentration may be associated with poor digestive process due to the presence of Profenofos in sharpshooter that may have caused bone marrow inhibition of erythropoiesis or direct haemotoxicity which could cause release of free radicals and hemolysis of blood cells as reported by Ugwuene, 2011., Soetan, *et al.*, 2013, Isaac *et al.*, 2013 and Abbes *et al.*, 2006. The White Blood Cell (WBC) decrease may have led to a compromised immunity. This may have exposed the fish to high risk of disease infection because of low antibody production and poor resistance to diseases as reported by Soetan, *et al.*, 2013 and Etim, *et al.*, 2014.

This study revealed significant decrease ($p < 0.05$) in level of blood platelets across days of exposure when compared to control. The blood platelets showed significant decrease ($p < 0.05$) in all exposures across all days compared to control. This may arise from the reactions between the secondary metabolites of the pesticides with oxygen in water as suggested by Srivastava *et al.*, (2016) in their work on "Pesticides toxicity in fishes: Biochemical, physiological and genotoxic aspects"

Low levels of MCH and MCHC at high concentrations of sharpshooter and longer duration may lead to anemic condition and impaired hemostasis in the fish. Chineke, *et al.*, (2006) reported that low levels of MCH and MCHC are indicators of anemia indices of evaluating circulatory erythrocytes and are important in diagnose of anemia. This was evident in the difficulty in extracting blood from the fish at day 21 and 28. Agbon *et al.*, (2013) also reported probability of anemia and lymphopenia in Tilapia when exposed to low doses of atrazine.

CONCLUSION

Results of the study have shown that sharpshooter (profenofos 40% and cypermethrin) is toxic to *Clarias gariepinus* and toxicity of the chemical is dependent on concentration and duration of exposure. Distress behavioural responses in *Clarias gariepinus* (African Catfish) were found to increase with increase in concentrations and duration of exposure

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