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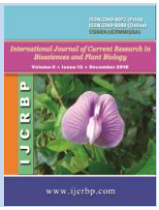

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Evaluation of Toxic Effects of Some Pesticides on Cat Fish (*Clarias gariepinus*)

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ABSTRACT

The present study was carried out to investigate the LC_{50} of four commonly used pesticides (DDT, Carbofuran, Endosulfan, Gramaxone) on the fresh water *Clarias gariepinus* and also examine the effect on its nutritive value. The LC_{50} values of pesticides at different period (24hrs-96hrs) ranges from DDT (0.0094-0.004ppm) Endosufan (0.4100-0.1800ppm), Carbofuran (0.1600-0.0800ppm) Gramaxone (0.1400-0.0700ppm) and the nutritive value of the cat fish decreased tremendously on the addition of toxicants which indicated biochemical alteration. The organophosphate, Endolsufan, was found least toxic: (96 h LC 500.118 ppm) EHK1 the Gramoxone, bipyridilium compound (Paraquat Dichloride) recorded an intermediate'96 h LC 50 value of 0.07 ppm. It was noticed that lethal concentrations of pesticides reduced as a function of time.The changes in nutritional quality and toxicity effect of the pesticides will pose a greater danger to humans upon continuous consumption of such fish. This study focuses on toxic effects of some pesticides on cat fish.

Introduction

With Nigeria's burgeoning population, there is an ever-increasing need to step-up agricultural productivity. There has been an overzealous application of scientific techniques, such as chemical pesticides and herbicides, bringing its own set of problems, ranging from pollution of water resources to destruction of wildlife. In a bid to maximize high yield from available arable land, many old, non-patented, more toxic, environmentally persistent and inexpensive pesticides are used extensively in Nigeria.Fish farming is the principal form of aquaculture which involves raising fish commercially in ponds or tanks or enclosures, usually for food. There is an increasing demand for fish and fish protein, which has resulted in widespread overfishing in wild fisheries hence fish farming has offered fish marketers another source (Hastein et al., 2006). Fishes are of the: most important members of the aquatic food chain, and through them some

toxicants may reach human beings as well. The selection of organisms for toxicity test is mainly based on certain criteria like its ecological status, position within the food chain, suitability for laboratory studies, genetically stable and uniform populations and adequate background data on the organism (Buikema et al., 1982). Agrochemicals are used extensively in Nigeria, but without much regulation. Monitoring and evaluation remains a challenge even when there is some form of regulation. With growing interest in environmental protection, earnest efforts are being made in laying down sound policy guidelines. The tripartite bond between agriculture, environment and food security is on the front burner in Nigerian policy enactments (FEPA, 1998; The New Nigerian Agricultural Policy, 2001).

The effects, including acute toxicity, of pesticide-contaminated water on non-target organisms (NTOs) should be determined using biological methods. The concept of *in situ* bioassays is based on exposure of test animals at field sites without disturbing contaminated sediment, and the determination of percentage survival. The process of exposing fish to test the toxicity of water is relatively simple: cages containing fish are hung in the water column or anchored at the bottom, and mortality is measured after exposure for 96 h or longer. The problem of pesticidal impact on the ecosystem has assumed considerable proportions owing to the modernisation of agricultural operations and the consequent widespread and indiscriminate permeation of the ecosystem with these pesticides (Bretaud et al., 2000). The effects of pesticides on aquatic fauna, particularly fishes, may be exhibited in a variety of ways, since the majority of them are non-selective and produce detrimental and sometimes fatal side effects (N1 non-target species (Bretaud et al., 2000). Histopathological effects of pesticides in fishes have been studied intensively. Pathological changes occur mainly in the liver, blood vessels, kidneys, and gills. Liver cells exhibit cytoplasmic granularity, partial loss of liver plate radial orientation, and shrinkage of some liver cell mass. The effects of pesticides on aquatic fauna, particularly fishes, may be exhibited in a variety of ways, since the majority are non-selective and produce detrimental and sometimes fatal side effects on non-target species (Fisher et al.,1984).

There are various ways of investigating sublethal effects, and each technique provides an insight into the physiology or behaviour of the organism (Polder et al., 2014). Efforts were made to evaluate the lethal and sublethal effects of commercial grade pesticides individually on a selected non-target vertebrate. The present study involved investigation of the lethal and sublethal effects of four pesticides. The pesticides selected are the commercial formulations of Endosulfan, DDT, Gramaxone and Carbonfuran.

Materials and methods

Experimental design

Cat fish were reared in five different water quality, stocked at a rate of five fish/m^2 of water for 90 days and screened for any pathogenic infections. The cat fish were acclimated to laboratory for 10 days prior to experimentation in a large fibre glass of 250litres capacity containing well with dechlorinated water and aerated to full saturation before use, and the pH of the water was maintain at 7.5, and at normal laboratory temperature of 30 ± 1.5^0C

Materials used

Toxicant (Endosulfan, DDT, Gramaxone, Carbonfuran), and other chemicals are all of high Analytical grade.

Preparation of toxicants (pesticides)

The toxicity tests were carried out in accordance with standard methods (APHA, 1992). The pesticides (toxicants) were prepared separately and added to the test media to get the desired concentrations. The two toxicants concentrations were prepared in distilled water because it is soluble and the DDT concentrations were prepared by mixing formulation with acetone in ratio 1:1 ration.

Acute toxicity test

The experiments were carried out to assess the individual lethal toxic response of catfish to the four different toxicants (pesticides), DDT, Carbofuran, Endosulfan, Gramaxone. Fifteen fish samples were used for each test concentration of the toxicant. The fish were not fed for 24 hrs prior to the test period as recommended in order to prevent interference in the toxicity of pesticides by excretory products. The toxicants was added into 25 litres of water containing the fish and percentage mortality was recorded at every 12 hrs interval and the LC_{50} Values with 95% confidence limits were calculated (ASTM. 1980).

Results and discussion

Analysis of four different commonly used pesticides (DDT, Carbofuran, Endosulfan, Gramaxone) as shown in Table 1 and Fig. 1 provide the information regarding the mode of action of toxicants on nutritive value and acute toxicity of pesticide on cat fish. The LC_{50} values of pesticides at different period (24hrs-96hrs) ranges from DDT (0.0094-0.004ppm) Endosulfan (0.4100-0.1800ppm), Carbofuran (0.1600-0.0800ppm) Gramaxone (0.1400-0.0700ppm), Mortality was observed in all toxicants used at various time interval). Among the pesticides used DDT, an organochlorine was the most toxic for Catfish giving 96 hrs, LC 50 value of 0.004 ppm. The organophosphate, Endolsufan, was found least toxic: (96 h LC 500.118 ppm) EHK1 the Gramoxone, bipyridilium compound (Paraquat Dichloride) recorded an intermediate'96 h LC 50 value of 0.07 ppm. It was noticed that lethal concentrations of pesticides reduced as a function of time. Thus, a group of effects that affect the growth, rate, metabolism, reproductive potential behaviour or which impair the defense mechanism of an organism are referred to as pesticides, especially organochlorines and organophosphates have become increasingly important additions to chemical wastes polluting natural aquatic communities and many of these are considered hazardous because of their ability to kill or immobilize organisms even at very low concentrations (Miles and Pfeuffer, 1997).

The proximate analysis of catfish before and after treated with toxicants at 24hrs interval is shown in Table 2 and Fig. 2. The nutritive values of *Clarias gariepinus* before and after treatment with toxicants shows a highly significant different. The highest reduction of nutrients was observed in toxicants carbofuran. The pesticides under study showed a deleterious effect on nutritional status of the catfish which may pose a serious health effect for human upon consumption of the fish.

Table 1. Percent mortality of *Clarias gariepinus* exposed to four different toxicants (pesticides) for different periods.

Pesticides	24hrs LC 50ppm (95%CL)	48hrs LC_{50} (95% CL)	72hrs LC50 ppm (95% CL)	96hrs LC50 ppm (95% CL)
DDT	0.0094	0.0087	0.0060	0.0040
Endosufan	0.4100	0.3100	0.2400	0.1800
Carbofuran	0.1600	0.1400	0.0900	0.0800
Gramaxone	0.1400	0.1200	0.0800	0.0700

Table 2. Proximate Analysis of Catfish before and after treated with toxicants at 24hrs interval.

Treatments	Moisture (%)	Carbohydrate (%)	Protein (%)	Fat (%)	Ash (%)
Before treatment	82.10	40.8	17.01	11.76	1.33
DDT	61.18	23.04	15.04	8.74	1.04
Endosufan	58.74	21.01	11.06	6.38	1.05
Carbofuran	59.12	22.07	11.64	7.12	1.14
Gramaxone	61.41	23.7	12.36	8.11	1.08

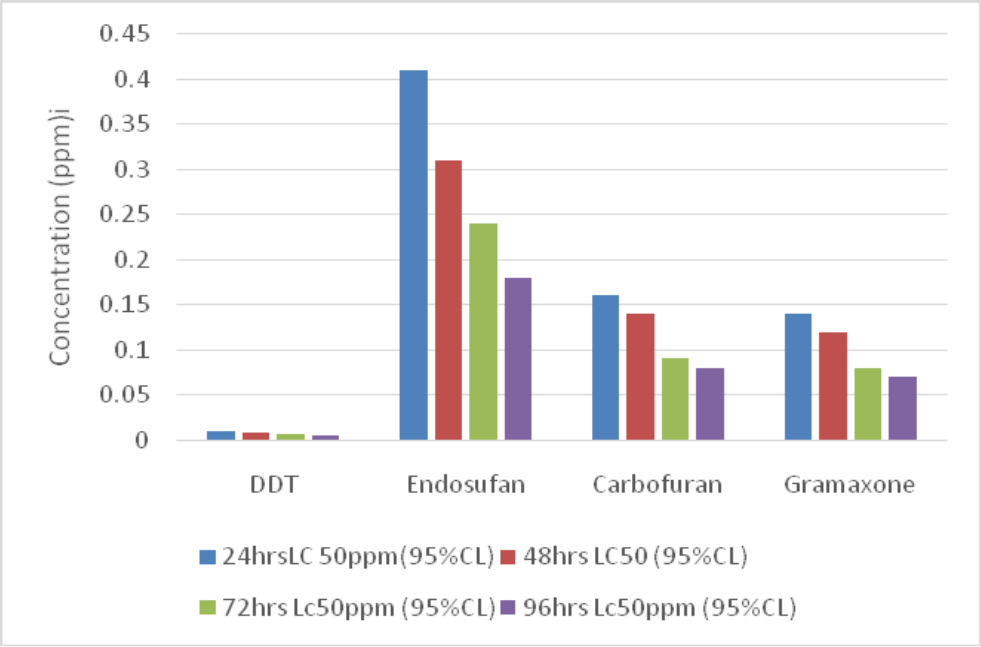

Fig.1: Percent mortality of *Clarias gariepinus* exposed to four different toxicants (pesticides) for different periods.

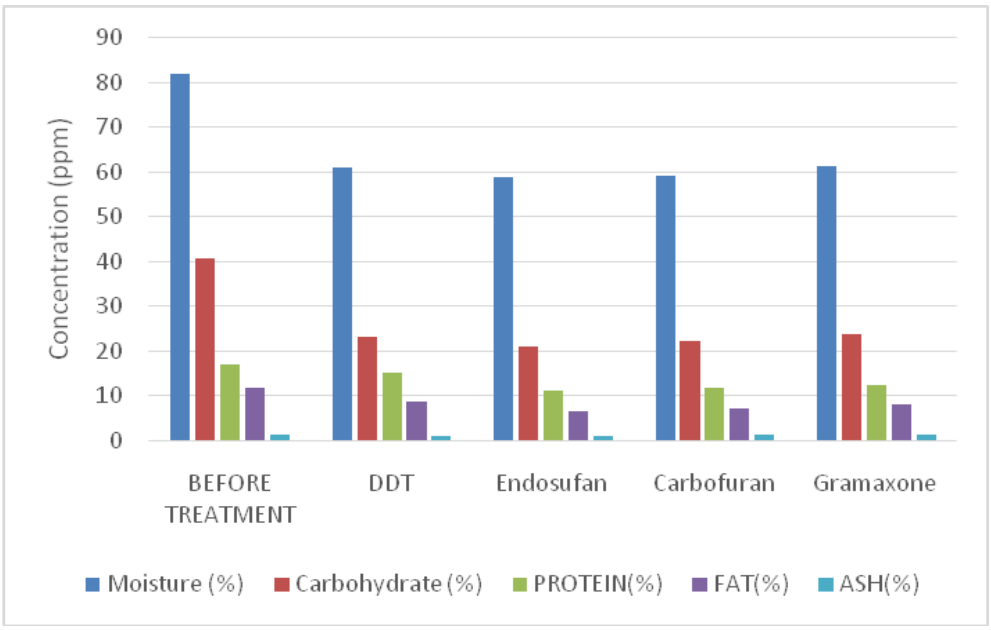

Fig. 2: Proximate analysis of catfish before and after treated with toxicants at 24 hrs interval.

Conclusion

Pesticides by design are meant to be toxic. Although a major goal of the discipline of modern pesticide: chemistry is to develop pesticides and consequent use patterns that confine pesticide toxicity to pest organisms, such goal is seldom attained easily. All living organisms have much in common biochemically, and successful exploitation, often relatively biochemical difference between pest and non-pest species, is almost always difficult and is, in fact, sometimes impossible. The interactions of these chemicals or their transformation products with non-target species will result some unforeseen toxic consequences.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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