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IMPACT OF PESTICIDE CHLORPYRIFOS ON THE FRESH WATER FISH, OREOCHROMIS SPP.

Research

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CONFLICTS OF INTEREST
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ABSTRACT
The stress of pesticides is a very common factor today in human and animal health. Fishes can serve as bio indicators of environmental pollution, since they are directly exposed to chemicals resulting from agricultural production via surface run off or directly through the food chain of the ecosystem. Haematological parameters, protein levels etc , are considered as the index of the total body and therefore they are important in diagnosing structural and functional strategy of fish. Two different stages of fishes (juveniles and adults) were chosen for experimenting and a narrow range of pesticide chlorpyrifos was used in juvenile fishes(ranging from 10ppm to 30ppm) and in adults two different concentrations(both narrow and broad) range of pesticide were used The broad range concentration is 1000ppm or 1ml. And in narrow range in adults, three different concentrations were used (10ppm,20ppm, and 30ppm). Various biochemical and histological parameters of the pesticide treated fishes were tested and compared with that of the control. This proved the toxic effect of the pesticide in the aquatic habitat.

INTRODUCTION
Water pollution problems related to agrochemicals have been taken into consideration and it has been found that use of agrochemicals in the crop fields is liable to change the abiotic and biotic characters of the aquatic media leading hazards to the aquatic flora and fauna. Generally, the biochemical parameters serve as indicators for monitoring the pathological status of the treated fish. These variations were tissue specific and species specific, but it can be used as an indicator for pesticide pollution. Such differential behaviour with regard to tissue damage will be markers to characterize the particular pollutant and its potential toxicity to fish. Fishes are rich in proteins, lipids, vitamins etc., and form valuable food for the people throughout the world and especially for the people suffering from malnutrition. Fishes are aquatic and poikilothermic animals and perform best under narrow range of optimum environmental conditions. Pesticides are used to control pests of food crop, livestock and human health. Due to the use of pesticides, water bodies like ponds, lakes and low lying water filled areas are continuously polluted. The pesticides are used in the agricultural fields for the eradication of the insects,

pests, weeds etc., for increased crop yield, but on the other hand, this lead to large scale mortality of most of the important aquatic organisms. Fishes are one among them. However, if toxic substances are encountered in higher concentration, they are bound to bring severe adverse effects. Such effects may be at cellular or even at molecular level. But ultimately it leads to behavioural, pathological and biochemical disorders that may prove fatal conditions to aquatic life. The number of changes in the biochemistry of the fish was reported as a result of an exposure to the pesticides.

OTHER NAMES OF CHLORPYRIFOS:-

Brodan, chlorpyrifos, organophosphate, chlorpyrifos-ethyl, detmol, dursban, empire, eradex, lorsban, piridane, stip & tricel.
IUPAC NAME- o,o- diethyl 0-3-5-6-trichloropyridin 2-phosphorothioate.
CHEMICAL FORMULA- C9H11Cl13No3PS
MOLAR MASS-350.59g/mol.
DENSITY-1.398g/cm3
SOLUBILITY IN WATER-2mg/l.
Introduced in 1965 by dow chemical company.

Chlorpyrifos is moderately toxic to humans and exposure has been linked to neurological effects, persistent development disorders and autoimmune disorders. Exposure during pregnancy retards the mental development of children and most use in homes has been banned since 2001in U.S. In agriculture, it remains one of the most widely used organophosphate insecticide.

Chlorpyrifos is used around the world to control pest insects in agricultural, residential and commercial settings, although its use in certain residential applications has been restricted in several countries. According to the dow chemical company, chlorpyrifos is registered for use in nearly 100 countries and is applied to approximately 8.5 million crop acres each year. Some of the crops with the most intense chlorpyrifos use are cotton, corn, almonds, and fruit trees including oranges, bananas and apples.

When this pesticide is used in agricultural crops, it is transferred to the water bodies in nearby areas and so the fishes like organisms surviving in the water bodies take up this toxic or treated Water and this pesticide has the capacity to get accumulated in the body of the aquatic organisms and this process of accumulation of a toxic substance in living organisms posing a threat to health, life and to environment is called as “bioaccumulation”. And when the accumulated toxic substances are transferred to the next energy level, it causes “biomagnification”.

MATERIALS AND METHODS;-

1. JUVENILES- NARROW RANGE

Tilapia fingerlings weighing about 5/0.5g and average length of about 5-7cm, were collected from Himalaya (a private fish farm) at Thittai, Tanjore and was acclimatized to laboratory conditions for about two weeks (14 days) in large plastic tubs previously washed with potassium permanganate, to free walls from any microbial growth. The food bought from the farm was supplied regularly. The fishes were aerated well and non-chlorinated tap water was used. Four tubs were used one for control which contained 6 fishes and three different series of concentrations of the pesticides were used in the remaining three tubs. One with concentration of 20ppm, the others with 50ppm and 100ppm. And 7 fishes were introduced in each tubs. By converting the ppm to ml- 20ppm =0.1 ml in 5000ml water, 50ppm=0.25ml in 5000ml water and 100ppm=0.5ml in 5000ml water. Thus the pesticide chlorpyrifos was introduced in each tub. The fishes were then observed and after one hour, the fishes in the highest concentration(100ppm), began to die on one by one. The dead fishes were counted and removed immediately from the test container. Later by one and a half hour, the fishes in the 50ppm concentration began to die. By two hours the fishes in the 20ppm concentration were also dead. 100% mortality was observed.

ADULT FISHES(BROAD RANGE)

Adult tilapia fishes weighing about 80-90 gms and average length of 15-19cms were collected from the Allithurai Fish farm.

It was then kept for acclimatization to laboratory conditions for about 7 days in large plastic tubs. Similarly, the tubs were washed with potassium permanganate to avoid microbial growth. The fishes were well aerated and was supplied with dechlorinated water. Broad range concentration of pesticide(1000 ppm=1ml) and three fishes were introduced and for control 5 fishes were kept. After the pesticides were introduced, the mortality of fishes

were observed within half an hour.

ADULT FISHES(NARROW RANGE)
Three sets of concentration of pesticides chlorpyrifos were used for the narrow range in adult tilapia fishes.
1)10ppm=0.2ml in 10,000ml water
2)20ppm=0.4ml in 10,000ml water
3)30ppm=0.6ml in 10,000ml water.

Thus, the pesticides in ppm were converted to ml and introduced in water. In each concentration, 7 fishes were introduced and observed for mortality. The fishes survived upto 4hours in 30ppm, then upto 5-5and a half hours in 20ppm and 6-7 hours in 10ppm. Then the fishes were scarified immediately and the isolated organs such as liver, muscle, heart, kidney were tested for haematological and biochemical analysis. The blood was also drawn immediately for testing the haematological parameters.

RESULTS AND DISSCUSSION:-
The results are summarized in the following tables.
1.BIOCHEMICAL ANALYSIS
Thus, the results summarized in the tables 2.1to 2.3 indicates the amount of proteins present in the fishes treated with various pesticide concentrations. And this indicates that the level of protein present in the lowest concentration (10ppm) is higher than the other concentrations. From this it is assured that the pesticide concentration affects the amount or level of protein synthesis. Those in turn lead to other disorders and retarded activity of the fishes was observed.

From the tables (3.1 and 3.2), it is proved that the higher concentration of pesticides are more toxic to the fishes and causes death in few hours thus in the highest concentration(30ppm) , the time taken(in hours) for mortality is less. Whereas in lowest concentration(10ppm) the time taken(in hours) is more. From the tables given, it is assured that due to the pesticidal effect the total metabolism of the fishes are affected and this in turn leads to "BIOACCUMULATION" and "BIOMAGNIFICATION".

When these treated fishes are intaken by humans and other animals, birds etc., it leads to severe toxic effects. These pollutants are known to alter the physiological and biochemical states of the animals by inducing marked changes in the activities of several enzymes. In the present study, the mitochondrial oxidative enzymes were found to be altered or inhibited after organophosphate exposure. Various studies reported similar decrease in oxidative enzymes of fishes on the pesticide treatment. The reduced level of protein synthesis in fishes after pesticide treatment is due to the "LIVER CIRRHOSIS" which signifies the effects of toxicants or pollutants on the organism(FAO). The gradual decrease in the protein content of treated fishes suggests the disruption of carbohydrate metabolism, destruction of proteins and protein synthesis machinery and inhibition of ATP synthesis. As these are edible fishes, and if humans are exposed to the toxic effect of this pesticide, it may lead to several neurological effects, developmental disorders and autoimmune diseases. Continuous inhalation of the pesticide by humans causes severe respiratory disorders. Eventhough the symptoms and effects are slow in humans, it may be fatal (Gupta,1986).

Fig 1.1: Fish death due to induction of Chlorpyrifos

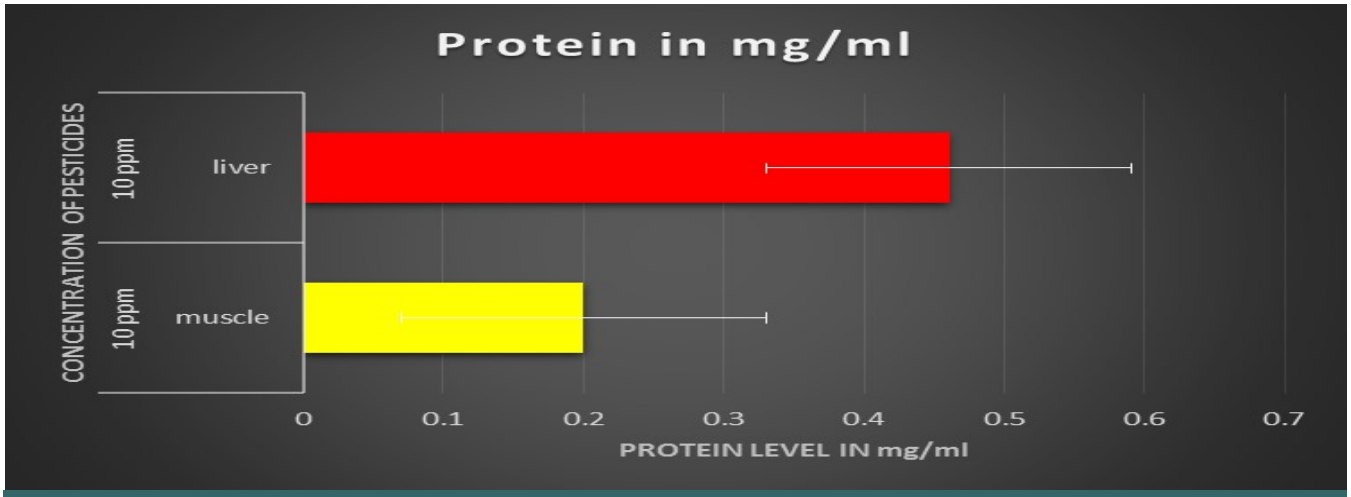

Fig 2.1 Amount of proteins observed in 10ppm

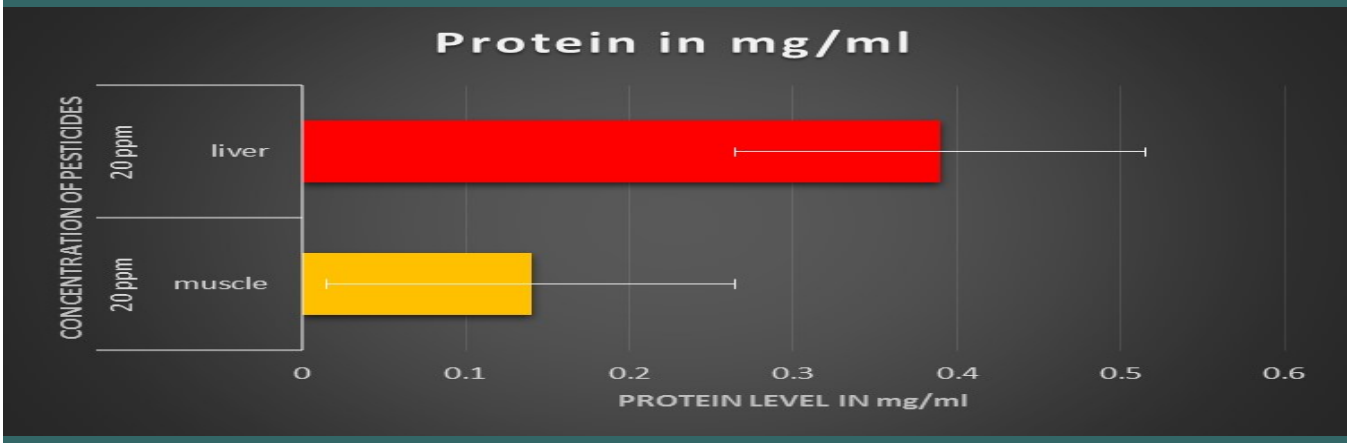

Fig 2.2. Amount of proteins observed in 20ppm

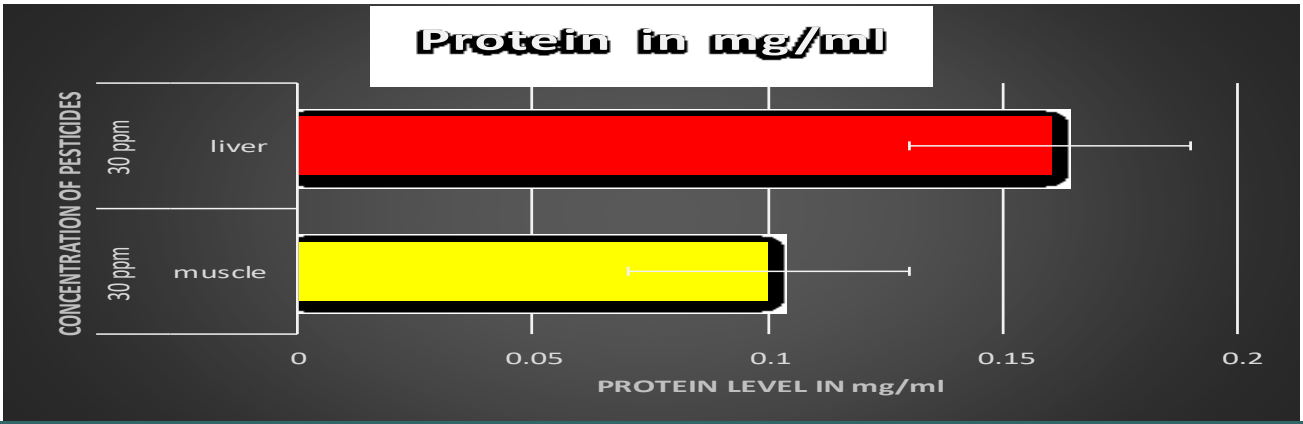

Fig 3.3 Amount of proteins observed in 30ppm

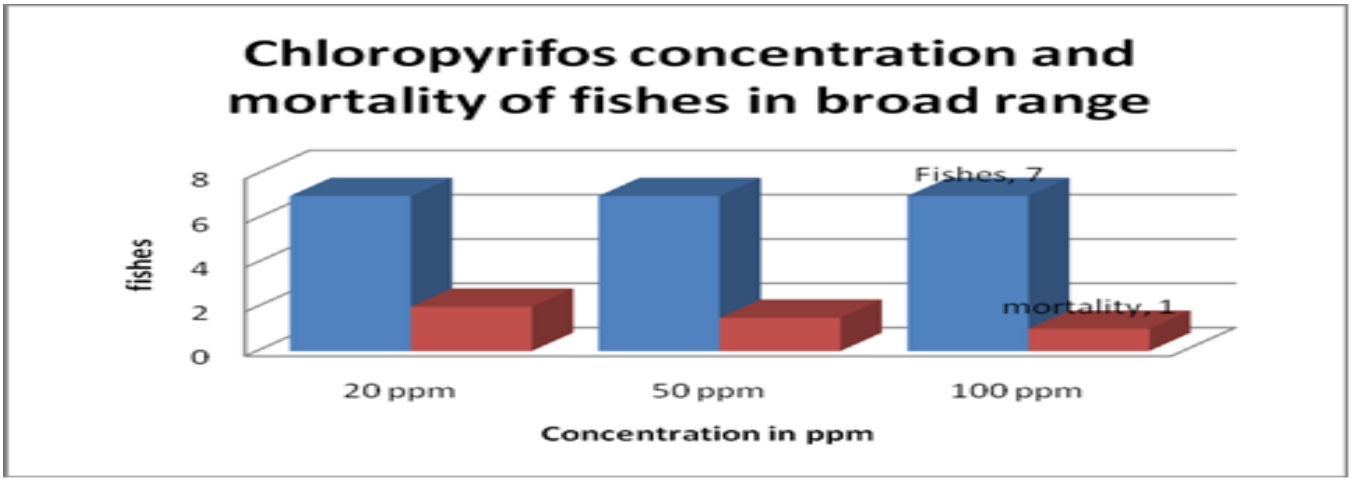

Fig 3.1 Mortality of fishes in broad range

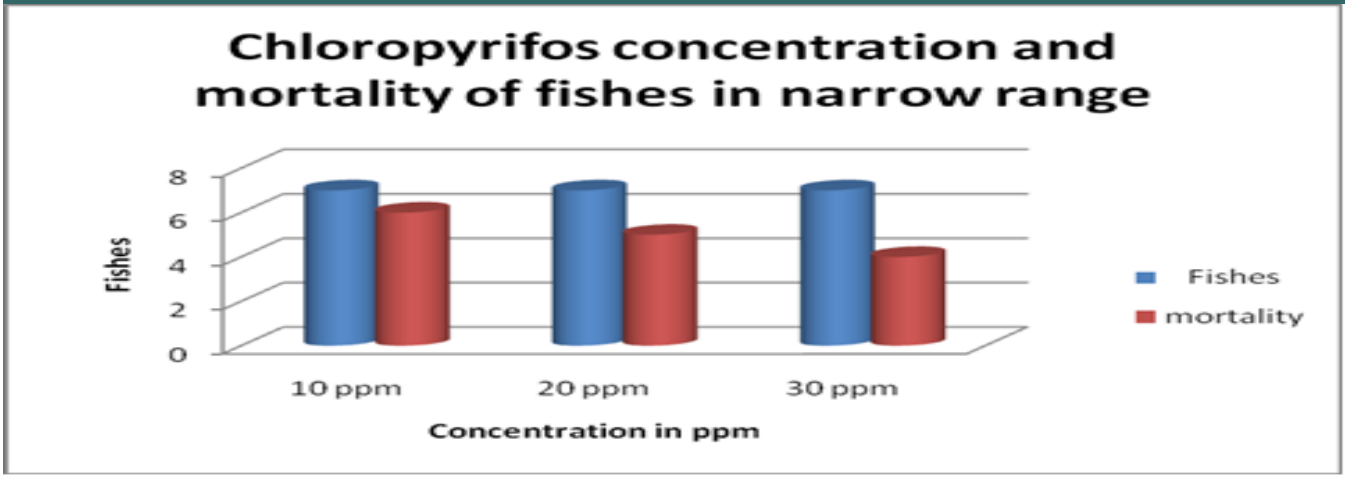

Fig 3.2 Mortality of fishes in narrow range

Concentration of pesti-cides	No of fishes treated with pesticides	control	Mortality rate
20ppm /in 500ml water	7	6	2 hrs
50ppm in 500ml water	7	6	1 1/2 hrs
100ppm in 5000ml wa-ter	7	6	1 hr

Mortality of Juveniles at 24 hrs. (TABLE2.1)

CONCLUSION:-

Based on the results and observations made throughout the course of this investigation,it was concluded that the use of the pesticide chlorpyrifos in agricultural fields to control pests cannot be completely eradicated instead it can be controlled or minimized and the appropriate toxicity levels of knowledge with reference to several pesti-cides and insecticides should be explained to the farmers and alternatives such as IPM(INTEGRATED PEST MANAGEMENT) should be suggested so that they can be cautious in preventing the water to be polluted with toxicants thus saving the life of aquatic organisms as well as humans.

Mean ±sd%

Concentration of pesticides	No of fishes treated with pesticides.	Mortality rate
1000ppm or 1mg/10000ml water	3 fishes	Observed within half an hour

Broad range of pesticides using 1000ppm

Concentration of pesticides	No. of fishes treated with pesticides	Mortality
10ppm	7 fishes	6-7 hours
20ppm	7 fishes	5-5 1/2hrs
30ppm	7 fishes	4 hrs

Narrow range of pesticides

parameters	Control	Fishes treated with pesticides
Wbc	4300±133.99	13,069
NE%	5.0±1.2	5.7
LY%	29±1.594	2.5
MO%	1.0±1.7	1.1
EO%	4.0±0.158	90.7
BA%	2.0±0.6	0.0

Haematological parameters [broad range] 1000 PPM

Parameters	Control	Fishes treated with pesticides
RBC	1.89±0.015	0.73
HGB	3.2±0.160	5.0
HCT	11±0.2	12.1
MCV	40.5±0.158a	165.8
MCH	20.1 ± 0.162b	69.0
MCHC	20.8 ± 0.163b	41.6
RDW	20±0.24	50.9

HAEMATOLOGICAL PARAMETERS BROAD RANGE 1000PPM

REFERENCES

1) International journal of current microbiology and applied sciences (http://www.ijcmas.com) sahli T. 1962(in textbook of clinical, pathological seward. muller,E.,(Ed.). William and williams ,Baltimore.
2.) Venkataraman G.V, P.N. Sandhya rani and P.S Murthy,2006. impact of pesticides in the biochemical parameters of gobies fish. journal environmental biology.
3)T.K.Ghosh(in Toxic impact of the organophosphate pesticide on fresh water fishes. 4)Gupta P.K. 1986 Environmental pollution by pesticides in PESTICIDES IN THE INDIAN ENVIRONMENT.
5) Food and agricultural organisation of United States(FAO) Fisheries Department Review of the state of world aquaculture health management.(http://FAO/newsroom.com)

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