ORIGINAL RESEARCH PAPER

Zoology

EFFECT OF CYTHION ON BEHAVIOURAL PATTERN OF SOME AQUATIC ORGANISMS

KEY WORDS:
Organophosphate, Toxicity, Lethal, Behavioural change

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ABSTRACT

Different types of pesticides like organophosphate,organochlorine are known to produce several behavioural changes in aquatic organisms. Exposure to pesticide is known to affect both the central and peripheral nervous system.Pollution stresses on behavioral pattern includes a wide range of effects an predator avoidance, migratory behaviour, learning ability habitat selection, feeding behaviour, changed movements and attitude loss of sensation .Study showed that the crab, fish and snail were more sensitive to cythion .The 24 h LC50 values obtained were the highest in all cases followed by 48, 72 and lowest for 96 h among all exposure periods. It showed that the toxicity of pesticide is directly proportional to exposure time. The LC50 values decreased as the exposure period increased and mortality rate increased with increasing concentrations.These toxicity studies are important because of their economic importance and vital position in the food chain and food web of the aquatic ecosystem.

INTRODUCTION

Exposure of large quantities of pollutants might be an immediate effect as measured by mortality suddenly in larges scale aquaculture, for example, fish mortality caused by pollution of waterways with agricultural insecticides. A small quantity of pollution discharge may result in the accumulation of pollutants in fish species and also by aquatic organisms. Furthermore pesticides carried through food chains are very harmful to the aquatic animals and a potential danger to man when he consumes. herbicides can also trim down the reproductive success of fish species and other aquatic flora and fauna [1],[2],[3] The inhibitory effect was observed in Lepomis macrochirus, Labeo rohita, Danio rerio, *and* Jenynsia multidentata exposed to endosulfan [4] .Entry of these pesticides into water bodies through industrial effluents, run off of direct applications affects many aquatic organisms [5],[6] Pesticides not only affect the farmer health but can also affect on consumer's health through residues of pesticide present in the food [7].

The pest controllers and weed-killers are moderately to highly toxic to aquatic invertebrates such as crab, shellfish and fish species[8] .The aquatic environment has become a store house for chemical pollutants which Infiltrate in to aquatic environment by several ways .Behavioural pattern includes a wide range of effects an predator avoidance, migratory behaviour, learning ability habitat selection, feeding behaviour, changed movements and attitude loss of sensation and other behavioural responses may easily be up set, if altered by environmental stresses associated with pollution.

The crab P. jacquemontii, fish C. orientalis, B. bengalensis are exposed to lethal and sublethal concentrations of organophosphate cythion at 24, 48, 72 and 96 h treatment period and are observed for the behavioural changes. Pollutant affects behaviour of organisms.

The behaviour of animal has been correlated to the metabolic changes in different crustaceans, [9],[10].

The toxic effects begins with the change of behaviour followed by the death of organisms. Physiological and behavioural effects of sublethal exposures to pesticides has been closely studied.Experimental animals when exposed to lethal concentrations of organophosphate cythion resulted in severe behavioural lesions and at last resulted in death. Excitability, irritability and restless movements were the prominent features of cythion exposed animals. In sub lethal exposures the behavioural changes were same but with lesser intensity. The high excitability shown by vigorous movements, cleaning movements. Loss of equilibrium and co-ordination was observed.

MATERIAL AND METHODS

The species which has been selected for the present study are of economic value and readily available through out the year and it stands captivity well.

The species represents the natural population i the river or water bodies of the Amravati (Lattitude 20- N, Longitude 77-45 E) and are resistant to handling a transportation.

Procurement And Maintenance

ALL the animals used were of same size and weight. Crab of size 6.5x5.3 and weight 55-65 g; Fishes of size 13-15 cm and weight 20-32 g and Snails of size 3-5 cm with weight 5-6 g. The animals were purchased from the market as well as collected at spot. The animals were brought in to the laboratory, transferred to the glass aquarium and were inspected for any possible injury or infection Only the healthy animals were selected and washed with dilute solution of potassium permangnate ($KMnO_4$ 1.0 mg/1) t remove dermal infection if any.

The animals were acclimatized for 10 days according to APHA/AWWA/WPCE (1975) standard methods [11]. The mortality was less than 5 per cent within 4 days of preceding test. The Test animals were fed adlibitum diet of boiled eggs,dried prawn, fish food and goat liver. Excess food ant faecal matter were removed from aquaria once in a day or twice at least in a week .The renewal technique bioassay method (Committee on methods for toxicity test with aquatic organisms, 1975) was used. It is an Improved static test in the sense that an attempt was made to maintain the water quality. The test solutions were periodically (usually once every 24 h) replaced with fresh test solution of the same composition. This was achieved by transferring the test organisms from one test chamber to another or some time by replacing the test solution in the same chamber periodically. The animals were starved for 24 hours before using for experimentation: The quality of water used in terms of physical and chemical characters is given in **Table 1.1** For toxicity evaluation organophosphate cythion pesticides was selected. Dilution medium was well water.

Procedure For Toxicity Evaluation Experiment The toxicity evaluation of cythion to the crab, fish and snail was conducted in static aquatic medium as per the method of Doudoroff et al, (1955)[12].

Exploratory Tests

i Different concentrations of cythion (organophosphate) were prepared from stock solutions.

ii The crab, fish and snail in batches of 10 were taken in six plastic troughs. The five troughs as experimental and the

sixth one as a control.

iii. The crabs, fishes and snails in the 6 troughs were exposed to the above selected pesticide concentration for 48 hours.

iv. The animals were exposed to pesticide at 8 O'clock in the morning to avoid chronotoxicological alterations in the toxicity evaluation as per the method of Utham et al, (1979).[13]

v. After 48 hours of exposure, the number animals killed in each concentration were recorded.

vi. To reach precise value in each concentration,the experiment was repeated and concurrent values obtained.

vii. To determine the precise dosage level of LC_{50} value, the probit method was followed (Finney, 1964) [14].

Table 1.1 Means and ranges of various physio chemical characteristics of dilution water.

Characteristics*	Mean	Range
Temperature (%)	28.3 _+2.3	25.30-30.50
pH	7.30	6-80-7,50
Total solids	13.60	12.50-18.25
Dissolved solid	4.38	3.23.5.80
Suspended solids	9.45	9.23-11.20
Alkalinity as CO3	55.00	37.00-88.00
Alkalinity as OH7	5.22	3.50 8.22
Dissolved oxygen (D.0.)	4.42	3.56- 6 80
Biochemical oxygen demand	1.70	0.83 3.53
Phosphate as C	0.82	0.22 1.61

*Values except pH and temperature have been expressed in mg/1.

Cythion was found to be a toxic pesticide. The LC_{50} values (lethal concentration) at which 50 percent mortality occurred in test animals were calculated by Finny et. al; (1981) method,

Paratelphusa Jacquemontii

The values of probit analysis of LC_{50} for Cythion were 3.981 at 24 h, 3.467 at 48 h, 3,888 at 72 h and 3.235 at 96 h (Table 1.9.).

Channa Orientalis

LC_{50} values were 1.941, 1.819, 1 737 and 1.513 at 24, 48, 72 and 96 hours respectively (Table 1.9)

Bellamya Bengalensis

Respective values of LC_{50} at 24, 48 72 and 96 h. were 0.930,0.870.0.800,0.790 **(Table 1.4)**

Probit analysis LC50 values for the crab P. Jacquemontii fish C. orientalis and snail B.begalensis F.typica exposed to Cythion at different time intervals (ml/1).

Treatment periodh	Paratelphusa Jacquemonti	Channa orientalis	Bellamya bengalens
24	3.981	1.949	0.930
48	3.467	1.819	0.870
72	3.888	1.737	0.800
96	3.235	1.513	0.790

OBSERVATION

The freshwater crab P. jacquemontii is an important common member of freshwater ecosystem, The maladaptive behaviour of this crab following exposure to pollutants would increase in it's predation which might enhance the changes of bio accumulation in the food chain.

Paratelphusa Jacquemontii

The crab P. jacquemontii a fresh water crab showed little different organophosphate. behaviour when exposed to organophosphate.The crabs showed no notable response, normally calm and quite. Little movements of mouth parts and chlae in normal position, preferred to sit at bottom. Locomotion unaffected. After 48 hour became sluggish, and sat at one place. If touch by rod reacted quickly in attacking way. Loss of balance was prominent and crab did not turn or ventral side immediately after keeping on glass.

In sublethal concentration crab were, calm and quite indifferent for short and long span exposure. No observable changes in mouth parts and chelae during experimental period were observed with slowed movements. Crabs preferred to remain at one place and became sluggished or rather slow in action if touched by rod. Non-responsive to predatory action.

Channa Orientalis

Fish is very sensitive indicator to pollutants The behavioural responses of the fish C. orientalis varied in accordance to the test concentrations.Decreased opercular movement during early exposure period was noticed. It showed excitability, restless movements and Irritability, but the intensity was less than the organo chlorine insecticide. Increased erratic movement,. Jerky body and opercular movements, There was balance impairment in exposed fishes, Overall fish movements were slowed down as compared to the fish introduced in higher pesticide, Mucus secretion was found directly proportional to the concentration of pesticide, Secretion Increases with increase in pesticide concentration

Bellanya Bengalensis F.Typica

In toxicological experiments carriedout on B. bengalensis F. typica; disturbed behaviour prior to death was observed, After cythion exposure body retracted within shell and operculum was closed. The operculum was opened slowly with little foot protruded. Adherence to substratum (Wall of bowl) with partially protruded proboscis, epipodial lobe and tentacles was recorded.

The body remain outside and snails did not respond to stimulus, foot margin and other parts were seen swollen. The snail appeared to edematous with their swollen body outside the shell and flattened foot. Large secretion of mucus was noticed in early hours of treatment but the quantity of mucus secretion decreased with exposure period

RESULT AND DISCUSSION

Now a days due to tremendous development in chemicals for crop production and pest control, the problem of aquatic pollution is increased. The pollutants used in agriculture and industry dump in aquatic medium, ultimately affects the organisms of aquatic medium.

Singh and Srivastava (1982) [15] worked out the toxic concentrations of various insecticides on air breathing fish, Heteropneuses fossilis. Results exhibited the LC_{50} concentrations for malathion 9.9-7.0 mg/l, aldrin 0.242-0.175 mg/1 and mixture of aldrin and for malthion 0.198-0.142 mg/1 to this fish.

Abidi. (1983)[16] recorded the relative toxicity of 8 popular insecticides to carp fingerlings and found organochlorine more toxic than other types. Sharma et al., (1983)[17] observed the effect of malathion on the mortality of Clarias batrachus at 0.25, 0.5, 0.75, 1.0, 1.25, 1.5, 1.75 and 2.00 ppm. Singh and Sahai, (1984a) tested the malathion toxicity on two freshwater species. Rasbora daniconius (6 ppm) and Puntius ficto (4 ppm).

Ruperelia et al (1984)[18] recorded LC50 of thiodon for Cyprinus carpio as 0.00092 mg/1 of chlorodane to be 0.0029 mg/1 and 0.0031 g/1 of aldrin and the value of dieldrin was 0.60 mg/1. di-eldrin was 0.60 mg/1. Rao et al (1981) [19] reported 96 h LC_{50} values as 3.5 0.2 ppb.

In Oziotelphusa senex senex 3 mg/1 BHC was found to be the LC_{50} 24 h while in case of P. Jacquemontii LC_{50} was found to be 84.1 mg/1 [20].. Rao (1984)[21] suggested that the marine edible crab, Scylla serrata were most sensitive to DDT, less sensitive to malathion and least sensitive to sevimol.

Molluscs have received less attention of researchers to carryout toxicity studies, using different pollutants even in India, several references may mentioned that deal with the study of cytochemistry, biochemical composition, physiology, ecology, growth and reproduction of molluscs by[22],[23],[24],[25],[26].

The organophosphate (cythion) exposed animals showed prominent loss of balance in all organisms with erratic movements and irritability. Mucus secretion was observed in snails after cythion exposure. In present study the initial reaction to pesticide exposure might be disturbing some enzyme system and acetylcholinesterase metabolism. The action of low concentration of pesticides might be at a sensory cell, then stimulate the C.N. synapse and finally influence the motor neurons, while in high concentration of pesticide must have acted on directly on motor neurons or motor nerves. In fishes anti acetylcholinestesase activity of pesticides was studied with reference to the inhibition of brain and serum choline-esterase activity[27]and suggested the paralytic action. Similar might be true in all above tested animal of present study.

SUMMARY AND CONCLUSION

In nature, pesticides like organochlorine and organophosphate compounds were reported to be toxic to several non target organisms like fish, crab, snail and aquatic fauna. These pesticides enter the aquatic ecosystem through various routes and cause much disaster. The animals fish crab and snail are important as they are sensitive to a wide variety of toxicants in water and hence were profitably used as pollution Indicators in water quality management.

In the present research work the efforts were made to investigate the effect of pesticides Cythion (organophosphate) behavioural aspects in the crab Paratelphusa jacquesonti fish C. orientalis, snail B. bengalensis f. typlea at different time intervals. on

The LC50 values of cythion for crab were 0.34 at 24 0.25 at 48 h, 0.17 at 72 h and 0.12 at 96. For fish LC, 50 values were 0.16, 0.15, 0.14 and 0.13 and for snail 0.112. 0.06, 0.06, 0.04 at 24, 48, 72 and 96 h respectively.

Above data showed that the toxicity of pesticide is directly proportional to exposure time. The LC50 values decreased as the exposure period increased and mortality rate increased with increasing concentrations.

The freshwater crab P. Jacquemontii is an important common member of fresh water ecosystem. The maladaptive behaviour of the crab following exposure to pollutants would increase it's predation which might enhance the death rate with increasing pesticide deposition in the body tissues.

The crab P. jacquemontii exposed to cythion exposure showed prominent loss of balance, did not turn on vertical side, became sluggish and sat at one place.

Fish C. orientalis after the treatment of Cythion showed loss of co-ordination and nervous balance. Increased erratic movements and pescular movements were observed. Overall movements were slowed down.

After cythion treatment bengalensis did not respond to stimulus, foot margin and other parts were seen swollen and appeared to edematose.

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