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RESEARCH ARTICLE

BEHAVIORAL ALTERATION IN *LABEO ROHITA* EXPOSED TO LETHAL CONCENTRATION OF CYPERMETHRIN (SYNTHETIC PYRETHROID)

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ABSTRACT

Static renewal bioassay test conducted to determine the toxicity of technical grade (10% EC) insecticide Cypermethrin on the fresh water fish *Labeo rohita*. Fishes were exposed to lethal concentration of pyrethroid insecticide Cypermethrin for 24 hours which was found to be 2µl/L was selected as lethal concentration for behavioural studies. *L. rohita* in toxic media exhibited erratic and darting movements with imbalanced swimming activity which might be due to the malfunctioning of neurotransmitters, followed by hyper and hypo activity of operculum, loss of equilibrium and mucus secretion all over the body were observed.

INTRODUCTION

Due to increasing industrialization and urbanization, application of synthetic fertilizers and use of various insecticides and pesticides, the natural resources are fast degrading in the water quality. Aquatic ecosystems that run through agricultural or industrial areas have high liability of being contaminated by runoff and ground water leading by a variety of chemicals (Todd and Leuwen 2002).

Cypermethrin is a highly potent synthetic pyrethroid insecticide that used to control many pests such as moth pests of cotton, fruit and vegetable crops including structural pest control, landscape maintenance for residential and garden use. This has resulted in its discharge into the aquatic environment and consequently several laboratory studies have been performed which evidenced that Cypermethrin is extremely toxic to fish at very low concentration (Sarkar *et al.* 2005). The hypersensitivity of fish to pyrethroid toxicity is due to the low availability of fish to hydrolyze these compounds (Haya K 1989). *Labeo rohita* is one of the prime cultured fresh water fish and having great economic importance. Hence, present study is behavioural impact of Cypermethrin based pesticide to fresh water fish *Labeo rohita* exposed to lethal concentration of Cypermethrin.

MATERIALS AND METHODS

Experimental animals: Live specimens of Labeo rohita (11.0±1.5cm in total length, 20.0±2.0gm in weight) brought from Bhadaran fish farm, Bhadarania, Borsad, Anand, Gujarat, India. Fishes were transferred to aquarium of zoology Department of Sir P. P. Institute of Science of Bhavnagar University. Fishes were acclimatized to laboratory condition for 15 days in aquarium previously washed with potassium permanganate to free the walls from any microbial growth. Fishes were feed with commercial fish food. The water in the aquarium was aerated continuously with aerators.

Water: Water was renewed every two days. Physico chemical parameters of water was measured according to methods in APHA and found as follows:

Table Physical and chemical characteristic of the water used for the study

Physical and Chemical Parameters of the water used for the study		
1	Temperature	29±1.2
2	pH	7.4±0.75
3	Dissolved Oxygen (ppm)	4.40±1.08
4	Alkalinity (ppm)	50±1.80

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Toxicant: Technical grade cypermethrin (10% EC) manufactured by United Phosphorous Limited (UPL) purchased from local market of Bhavnagar, Gujarat, India was used for evaluation of its toxicity to fish.

Acute lethal toxicity and Behavioral studies: The concentration of Cypermethrin at which 100% mortality occurred taken as lethal concentration which was found to be 2µl/L. 10 fishes were transferred in two 50 L aquarium. Control and exposed fishes were aerated frequently to prevent hypoxic condition of the medium. The control fish and Cypermethrin exposed fish were keep under continuous observation during the experiment period 24 hours for lethal concentration. During this experiment behavioural changes were observed.

RESULTS

Behavioural changes: Behavioural changes are physiological responses shown by the animal which are often used as the sensitive measure of stress syndrome in the organism experiencing it consequently the behavioural changes were observed in control and exposed fish.

Control fish: Control fish behaved in a natural manner. They were sensitive to light and slightest disturbance. They moved to bottom of the aquarium when light was passed in the aquarium. No any other extra ordinary behaviour was observed.

Exposed fish: When the fish were exposed to the lethal concentration of Cypermethrin they migrated immediately to the bottom of the aquarium. After half an hour of exposure swimming movement has became slower. After one hour irregular, erratic and darting movements followed this with imbalanced swimming activity.

After two hours fishes were hyperactive and highly jumping and trying to come out from the insecticide medium which is known as escaping phenomenon.

After three hours of exposure swimming behaviour was in a corkscrew pattern rotating along horizontal axis and followed by ‘s’ jerk, partial jerk, sudden, rapid, non-directed spurt of forward movement (burst swimming). The fish progressively show loss of balance.

After five hours of exposure fishes lost their equilibrium and response to external stimuli such as touch and light followed by drowning to the bottom.

After six hours of exposure eyes became reddish and opening and closing their mouth rapidly due to respiratory disruption.

After seven hours of exposure fishes are stable at one place of aquarium and only movements in fins were seen. Fins became reddish may be due to breaking of capillaries in it.

After eight hours fishes eventually died with their mouth and operculum wide opened.

DISCUSSION

Cypermethrin is very toxic even at lower concentration (2µl/L) for 24 hour LC50. Behavioural characteristics are obviously sensitive indicators of toxicants effect. It is necessary however to select behavioural indices of monitoring that relate to the organisms behaviour in the field in order to derive a more accurate assessment of hazards that a contaminant may pose in natural system.

The migration of fish to the bottom of the tank following the addition of Cypermethrin clearly indicates the avoidance behaviour of fish which was earlier reported by Murthy in trout. The erratic swimming in fish results due to obstruction in acetyl cholinesterase activity.

Aggressive behaviour such as nudge and nip were increased following exposure to toxic material orientation and locomotors patterns were found to be involved in most aspects of fish behaviour such as migration., mating, courtship and feeding which were altered under Cypermethrin stress and observations in the present investigations are consistent with the earlier reports (Sarkar at al., 2005, Murthy *et al*., 1987, Sabita *et al*., 1995, Madhab *et al*., 2002).

Animal behaviour is usually regulated by neurosecretion such as AchE at the synapse. Cypermethrin inhibits activity of enzyme AchE. This AchE enzyme is present in synaptic region and mediates transmission of impulses by breaking acetyl choline into acetic acid and choline. The acetyl choline at neural and neuromotor regions upon accumulation causes “hyperexcitability” which in turn might also influence behavioural pattern and may lead to death of fish. (Mushigeri and David 2005).

Cypermethrin act as nerve poison interfering with the nerve impulse conduction and changes the nerve membrane permeability.

Cypermethrin induce stress condition result in less availability of oxygen in turn less ATP production in tissues and thus adversely affecting oxidative metabolism. During stress condition fishes needed more energy to detoxify the toxicants and to overcome stress and by this they try to minimize the toxic effect of Cypermethrin. There is a tendency to shift the aerobic pathway to anaerobic pathway of fish respiration to meet energy demands for the physiological and metabolic activities augmented by stress induced by Cypermethrin.

Leanness in fish indicates a decreasedced amount of dietary protein consumed by the fish under pesticide stress which is immediately utilized and not stored as body mass.

Increasing ventilation rate by accelerated, repeated opening and closing of the mouth and opercular coverings accompanied by partially extended fins was observed. This could be due to margin of the accumulated mucus debris in the gill region for proper breathing.

The fish behaviour indicates that the fish has adapted to a compensatory mechanism to derive energy during pyrethroid toxicosis as suggested by Philip *et al*., 1988. Hence this type of study can be useful to compare the sensitivity of the various species of aquatic animals and potency of chemicals using LC50 values and to derive safe environmental concentration, due to this there is no lethality and stress to the animals. (Marigoudar *et al*., 2009).

References

1. David M., S. B. Mushigeri and M. S. Prasanth, 2002. Toxicity of fenvalerate to the freshwater fish *Labeo rohita (Hamilton).* Geobios., 29:25-28.
2. Madhab, P., Bandopadhyay and Ajit Kumar Adithya, 2002. Xenobiotic impact on sensitivity in *Anabus testudineus* (both). J. Ecobiol, 14(2):117-124.
3. Marigoudar S. R., R. Nazeer Ahmed and M. David, 2009. Cypermethrin induced respiratory and behavioural responses of the in fresh water Teleost, *Labeo rohita (Hamilton).* Vet. Arhiv 79 (6): 583-590.
4. Marigoudar S. R., R. Nazeer Ahmed and M. David, 2009. Impact of Cypermethrin on Behavioural responses in fresh water Teleost, *Labeo rohita (Hamilton).* World J. of Zoo. 4(1):19-23
5. Murthy, A. S., 1987. Sub lethal effect of pesticides on fish. Toxicity of pesticides to fish, 2:55-100.
6. Philip G. H., P. M. Reddy and Ramamurthi, 1988. Changes in protein metabolism in liver and kidney of *Mus Boodurga* Gray after BHC feeding. Bull. Environ. Contam Toxicol., 41: 822-827.
7. Radhaiah, V. And R. K. Jayantha, 1988. Behavioural response of fish, *Tilapia mossambica* exposed to fenvalerate. Environ. Ecol,. 6(2):2-23.
8. Sabita, B. And R. N. S. Yadav, 1995. Static Bioassay and toxicity of two pesticides, rogor and endosulfan to the air breathing fish, *Heteropneustes fossilis* with special reference to behaviour. Poll. Res., 14(4):435-438.
9. Santhakumar, M., M. Balaji, K. R. Saravanan, D. Soumady and K. Ramdu, 2000. Effect of monocotrophos on the optomoter behaviour of an air breathing fish, *Anabas testudinius* (Bloch). J. Environ. Biol., 21(!):65-68.
10. Sarkar B. A. Chatterjee, S. Adhikari and S. Ayappan, 2005. Carbofuran and Cypermethrin induced histopathological alterations in the liver of *Labeo rohita (Hamilton)* and its recovery. J. Applied Ichthyol., 21:131-135.

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