



ORIGINAL RESEARCH PAPER

Zoology

Acute Exposure of Melathion on Heteropneustes fossilis with Ethological Response

KEY WORDS: Melathion chloride, *Heteropneustes fossilis*, behaviour, skin, coloration.

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ABSTRACT

Behavioural reactions are one of the most sensitive reactions of an organism to toxic materials. Heavy metals are among the most resistant pollutants having poor biodegradability. Melathion is a black listed heavy metal that affects normal vital activities of fish including behaviour, colouration, physiology and *haematology* etc. Freshwater catfish, *Heteropneustes fossilis* were subjected to 96 hour LC50 dose (392.92 mg/l) and 25% of 96 hour LC50 dose (98.23mg/l) to evaluate toxic impact of melathion on fish behaviour. The exposed animals showed avoidance, increased irritation, frequent surfacing, restlessness, fast opercular beat, irregular movement, loss of balance, poor food detection and consumption with increased air gulping. Peeling of skin, rashes, heavy mucus deposition, ulceration, haemorrhages on caudal and pectoral fins and colour fading was also noticed in exposed fishes. Possible underlying mechanisms of melathion toxicity have been discussed.

1. Introduction

Chemicals can cause deleterious effects at one or more levels of biological organization, from biochemical, physiological, individual, population and through to the ecosystem levels. The behavioural variables can be employed as useful and reliable biomarkers of environmental contamination. The use of animal behaviour in applied science is a quite modern approach that requires an extensive knowledge of animal behaviour theory. Behavioural variables will give an early warning to pollution and that behaviour is a comprehensive variable in the detection of effects of pollution since alterations in behaviour is the consequence of several biochemical and physiological alterations. Behavior provides a unique perspective linking the physiology and ecology of an organism and its environment: [1] Behavior is both a sequence of quantifiable actions, operating through the central and peripheral nervous systems [2], and the cumulative manifestation of genetic, biochemical, and physiologic processes essential to life, such as feeding, reproduction and predator avoidance. Behaviour is a study of all the activity of an organism interacting with the environment. Behavioural toxicology is a tool for hazard assessment of water pollution [3, 4]. The toxic potential of Melathion is enormous even in low concentrations. It is a common aquatic pollutant and can bio-accumulate in mussels, oysters, prawns, shrimps, lobsters and fish as they are not able to successfully regulate metal uptake. Its susceptibility can vary greatly between aquatic organisms. Marine organisms are known to be more resistant to Melathion poisoning than freshwater organisms that are quite sensitive to heavy metals. Present work has been taken into account to evaluate toxic effect of melathion on *Heteropneustes fossilis*, an economically important as well as rich protein source of poor people of India.

2. Material and Methods

The catfishes *Heteropneustes fossilis* (Bloch.) were collected from river and other water Reservoirs in and around Lucknow, with the help of local fisherman and brought to the laboratory (N-26°; 49°55'E-80°55'58" in plastic containers under controlled temperature condition. The mature healthy fishes (average length 15±1.5 cm and average weight 26.5 ± 2.0 gm) were selected and sorted out for experimental purposes. The studies were carried out on both freshly collected as well as laboratory acclimated animals as per experimental requirements.

The freshly collected animals were brought to laboratory and maintained in glass aquaria of 50 liter capacity at normal photoperiod. Prior to maintenance and acclimation, animals were treated with 0.2% KMnO₄ solution for 2-3 minute to avoid the microbial infections and acclimatized to

laboratory conditions according APHA et al. (1998)[5], for 15-20 days before commencement of experiment until fish start normal feeding. Air pumps and stone diffusers were used in aquaria to maintain proper dissolve oxygen level of water.

Acute and sub acute studies were performed on 96 hour LC50 dose (392.92 mg/l) and 25% of 96 hour LC50 dose (98.23mg/l) respectively. Observation were taken at 24, 48, 72, 96 hours and 10, 20, 30 days after exposure respectively on live animal only. Short term (acute exposure) experiment were carried out on 96 hour LC50 dose (392.92 mg/l) of Melathion for *Heteropneustes fossilis* and all the observation were taken after 24, 48, 72 and 96 hours duration.

Long term (sub acute exposure) experiment were carried out on 25% of 96 hour LC50 dose (98.23mg/l) of Melathion for *Heteropneustes fossilis* and all the observation taken after 10 days, 20 days and 30 days on live animals only. General behavioural alteration of exposed fishes observed by naked eye comparing with control fishes and photographed.

3. Results Acute exposure

After 24 hour of CdCl₂ exposure, the exposed animal showed restlessness, irregular & erratic swimming, loss of balance, increased surfacing & fast opercular beats. Initial peeling and colour fading was also noticed at this stage. After 48 hr of exposure fish became hyperactive and irresponsive to gentle tapping, light, sound and food. They completely lost their compact schooling behaviour and showed increased surfacing and air gulping in comparison to control fish. The major behavioural changes after 72 hour of exposure were sluggishness, surfacing, fast opercular beats, loss of schooling and loss of schooling. Thin colouration became faded with rashes and peeling of skin. Ulcerative tubercles were observed on dorsal and caudal region. After 96 hr of exposure fish became inactive, reside at the bottom of the aquaria and showed very less or almost no swimming movement. Fish completely lost their balance and became irresponsive to stimuli of light, sound and gentle tapping. School formation was completely disturbed and fish were found scattered at bottom in unbalanced body posture. Ulcer formation become more prominent, haemorrhages appeared near caudal and pectoral fin. The colour fading was more prominent with much skin peeling off and endoskeleton was found visible in caudal region of most of the fishes. After sub acute exposure of melathion induced remarkable changes in behavior which are summarize. After 10 day of exposure fish showed more surfacing, air gulping, restlessness, escaping movement, erratic swimming and loose schooling. Sudden irregular swimming, increased mucus secretion and high rate of opercular beat rate was

also noticed. Responsiveness to stimuli and food consumption became less the control fish. Ulcerative tubercles, haemorrhages and skin rashes were also start to appear on caudal and abdominal region. After 20 day of exposure increased surfacing, fast swimming, jerky movement, restlessness, loss of balance, loose schooling and erratic swimming was observed in exposed fishes. Fish became less active and less responsiveness to external stimuli and food. The skin was found peeling off more with increased haemorrhages and skin rashes on body surface particular in opercular and caudal region along skin colour fading in exposed animals.

After 30 day of exposure fish became lethargic, less active, irresponsive which resided at the bottom of aquaria. Schooling was found completely disturbed and fish were scattered. Fish showed very less response for food and became very weak. Haemorrhage, colour fading, peeling of skin and rashes were also observed.

4. Discussion

In present study, various behavioural alterations were observed. After acute exposure of melathion, initial hyperactivity, restlessness, fast opercular beats, increased surfacing, loss of balance, loose schooling, colour fading, skin peeling off, jerky movement, erratic swimming, formation of ulcerative tubercles, haemorrhages on caudal and pectoral fins with heavy deposition of mucus on gill region and whole body surface were noticed. In sub acute exposure abdominal swelling, loss of food detection capacity, feeble response on gentle paddling, high rate of gulping air were noticed in addition to acute toxicity. Almost similar alterations in fish behavior after exposure of various metal compounds were observed by several workers [5, 7-9]. The initial hyperactivity and restlessness of the fish invariably in the lethal and sub lethal exposure may be probably due to hindrance in the functioning of enzyme AChE in relation to nervous system as suggested by many authors [10,11]. It leads to accumulation of acetyl choline, which is likely to cause prolonged excited postsynaptic potential. These may first leads to stimulation and later cause a block in the cholinergic system [12]. The erratic swimming in melathion exposed fish in the present study indicates loss of equilibrium. It is likely that the area in the brain associated with the maintenance of equilibrium is affected by melathion [13]. Loss of balance also due to change in blood cortisol and glucose level [14].

5. References

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