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TOXICITY OF COPPER SULPHATE ON BEHAVIOURAL CHANGES TO FRESH WATER FISH, CYPRINUS CARPIO

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ABSTRACT Behavioral changes were recorded in the freshwater fish, *Cyprinus carpio* when exposed in copper sulphate for lethal and sub lethal concentration for different exposure periods. Various physiological, behavioral and morphologically changes were observed in both concentrations. It includes protective response, behavioral disruptions and adverse effects on the behavior have been reported during the present investigation

KEYWORDS : *Cyprinus carpio* Copper sulphate, & behavior.

Introduction

Copper is highly toxic in aquatic environments and has effects in fish, invertebrates, and amphibians, with all three groups equally sensitive to chronic toxicity (U.S EPA, 1993; Horne and Dunson, 1995). Copper will bio concentrate in many different organs in fish and mollusks. While mammals are not as sensitive to copper toxicity as aquatic organisms, biomagnifications play critical role in their toxicity. Toxicity in mammals include a wide range of animals and effects such as liver cirrhosis, necrosis in kidneys and the brain, gastrointestinal distress, lesions, low blood pressure and fetal mortality (ATSDR, 1990; Kabata-Pendias and Pendias, 1992; Ware, 1983; Vymazal, 1995). According to Rostein (1959), heavy metals directly affected to the tissue and may interact with cell membrane. Higher concentration of toxic metals, in aquatic environment can cause adverse effects on aquatic organism at cellular or molecular level and ultimately leads to disorder in biochemical composition of organism. The behavior of an organism is defined as an act or conducts in particular way or exact way an organism responses to stimulation of environment especially those responses that can be observed (Webster's, 2002). The behavioral modification in animals can be taken as the most sensitive indicators of environmental stress (Eisler, 1979). Nimgnare (1992), Shaikh, (1999) and Sarojini *et al.,* (1990), Aluminium and salicylic acid in the environment have changed the behavior of *Lymnaea stagnalis* (Compbell *et al.,* 2000). Khunyakari *et al.* (2001) investigated toxicity of nickel, copper, and zinc in *Poecilia reticulata*. Heavy metal exposure caused increased mucus like secretion over gills, excessive excretion, anorexia and increased fin movement. Copper was found to be the most toxic followed by zinc and nickel. Gokhale and Mane (1990), studied the toxicity of molluscicide in bivalves *Lamellidens marginalis*, where they documented that, after intoxication, bivalve closed their valves, immediately after exposure to molluscicide and showed diapedesis in all exposed animals after 12h with white coagulated matter of mucus. These effects can potentially gives out structural and functional changes in freshwater ecosystems (Camargo, 2003).Present study is designed to investigate toxicity of copper sulphate on behavioral responses of freshwater fish *Cyprinus carpio*

MATERIALS AND METHODS

Experimental Design:

Fresh water fish *Cyprinus carpio*, weighing 120-180 gm and measuring 7-8 cm were collected from nearby nersary pond at umri tahsil, Dist- Nanded. They were safely brought to the laboratory. Fish were acclimatized for about 5 to 6 days before the commencement of the experiment. During acclimatization period, fish were fed with rice bran and ground nut oil cake in the form of dough once in daily. Water replaced every 24h after feeding in order to maintain a healthy environment for the fish. 10 healthy fishes were introduced into each tub. The mortality of fish in control and copper treated tubs was recorded after each 24h and the concentration at which 50% mortality of fish occurred was taken as the median lethal concentration (LC_{50}) the median lethal concentration (LC_{50}) of copper sulphate for 96h was found to be 0.12 ppm. Fish were considered dead when there was no visible movement and touching the caudal peduncle produced no reaction. The dead fish were removed from the aquaria as and when noticed, after the 96hr study period, food to observe the feeding response. Behavioral toxicity effects were recorded when they exceeded the normal range of variability.

RESULTS AND DISCUSSION

Fishes was exposed in copper sulphate showed anomalous behavior like surfacing phenomenon, irregular, erratic and darting swimming movements, hyper excitability, loss of equilibrium and hitting to the walls of the test tank before finally sinking to the bottom just before death. Oxygen consumption studies for a period of each 24h, in both lethal and sublethal concentrations indicated that lethal concentrations had profound effect than sublethal concentrations. During experimentation, severe respiratory distress, rapid opercular movements leading to the higher amount of toxicant uptake, increased mucus secretion, higher ventilation volume, and decrease in the oxygen uptake efficiency, labored breathing and gulping of air at the surface were observed. in the present investigation several behavioural changes were observed which include swimming at the surface of water. This surfacing phenomenon was more in fish exposed to lethal concentration over the control. Hyperexcitation, loss of equilibrium, increased cough rate, flaring of gills, increase in production of mucus from the gills, body surface acquired dark colour before their death which is one of the symptoms of toxicity. A film of mucus was observed all over the body and also on the gill. similar changes observed in other study, Patil and David (2008) in their study on behavioural and respiratory dysfunction as an index of malathion toxicity in *Labeo rohita* clearly reported that while the control fish were active with controlled and co-ordinated movements, the toxicant exposed fish exhibited irregular, erratic and darting movements and loss of equilibrium due to inhibition of AChE activity leading to accumulation of acetylcholine in cholinergic synapses ending up with hyper stimulation. These findings are in corroboration with those of Murshigeri and David, (2005), Rao *et al.,* (2003) and Parma de Croux *et al.,* (2002). Recent studies on acute toxicity and behavioural responses of common carp, *Cyprinus carpio* (Linn.) to an organophosphate, The various behavioral anomalies in fish exposed to different toxicants in general include initial increase in opercular movements followed by steady decrease with increased duration of exposure (Shiva kumar and David, 2004), gulping air at the surface, swimming at the water surface, disrupted shoaling behaviour and easy predation (Ural and Simsek, 2006). Gulping of air may help to avoid contact of toxic medium. Surfacing phenomenon might be a demand of higher oxygen level during the exposure

period (Katja *et al.,* 2005). Finally, fish sunk to the bottom with the least opercular movements and die with their mouth opened similarly when in sublethal exposures, the fish body becomes lean towards abdomen position as compared to control owing to reduced amount of dietary protein consumed by the fish at pesticide stress, which was immediately utilized and was not stored in the body weight (Kalavathy *et al.,* 2001). Effects of fluoride on animal behaviour have been found in aquatic animals as apathetic behavior, loss of equilibrium and altered migratory movements (Damkaer and Dey, 1989). Nagarajah *et al.,* (1985) noticed the behavioural changes in same intertidal molluscs after exposure to water soluble fraction of diesel.

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