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Behavioural studies of Lead nitrate impact on crab *Barytelphusa guerini*

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Abstract: *Heavy metals have a capacity to damage the natural ecosystem. There impact is often found to be magnified on biological systems. The present study had been carried out by considering the impact of Lead nitrate on behavioural patterns of crab Barytelphusa guerini. Crabs were exposed to increasing concentrations of Lead nitrate were kept in separate groups. The time period was taken as 24, 48, 72 and 96 hours. Both their physical and physiological behaviour were recorded and compared against the control group. It was found that the increasing concentrations of Lead nitrate showed a deviant behaviour than normal in feeding, excretion and overall body movements.*

Keywords*: Lead nitrate, behavioural pattern, Barytelphusa guerini.*

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I. Introduction

Water bodies are found contaminated water with a wide variety of heavy metals. Heavy metals as a result of anthropological pursuits result in aquatic pollution. (Ozturk M.et al., 2008). Environmental contamination poses a threat to aquatic species worldwide (Fingerman et al. 1998,Vutukuru, 2005 Smirjakova, 2005).

Common pollutants which adversely affect freshwater ecosystems include physical inorganic constituents like pH, temperature, hardness, inorganic salts etc. (Diwan, 1971). The heavy metals can enter water and food cycles through geochemical processes as they are the natural components of Earth's crust (Tinsley, 1979). The environment pollution has the influence on human health as its effects are wide ranging (Khan and Ghouri, 2011).

Lead is a toxic metal which lurks in a wide variety of products. The use of lead had been increasing and in recent times has risen from five million tons per annum in 1970 to approximately 11 million tons in 2016 (ILZSG, 2017). Lead particles can move from one place to another in waterways as soluble complexes and in the form of ions. In waters bodies, average residence time is about two to five years of biological particles containing lead (UNEP, 2010). Lead has the damaging effects on human health (Tiwari and Tripathi, 2012).

Repeated exposures over time from multiple sources could create health problems especially to young children and to pregnant and nursing women. Lead is a metal that exists naturally in the Earth's crust and is ubiquitous in the environment. It is being used in many industries such as paints, batteries, petrol, electrical components and plastic chemicals (Hodgson et al.1984). Lead present in soil may be taken up into plants or leach out in aquatic systems consequently leading its way into food animals, like crustaceans, shellfish etc. Even the pipes and plumbing fixtures in our home could be soldered with Lead and that can release Lead into tap water and then to aquatic water bodies. However, biomagnifications of lead is not found in higher concentration in edible tissues of aquatic animals moving up the food chain (Thornton et al., 2001).

Crustaceans are important members in all aquatic ecosystems. It is a group of aquatic organisms that has received relatively less attention on impact of anthropogenic stressors on its behaviour. Pollution can be caused by industrial discharges, acid rain, climate change, agriculture, and aquaculture (behavioral consequences for crustaceans) (Zala and Penn. 2004).

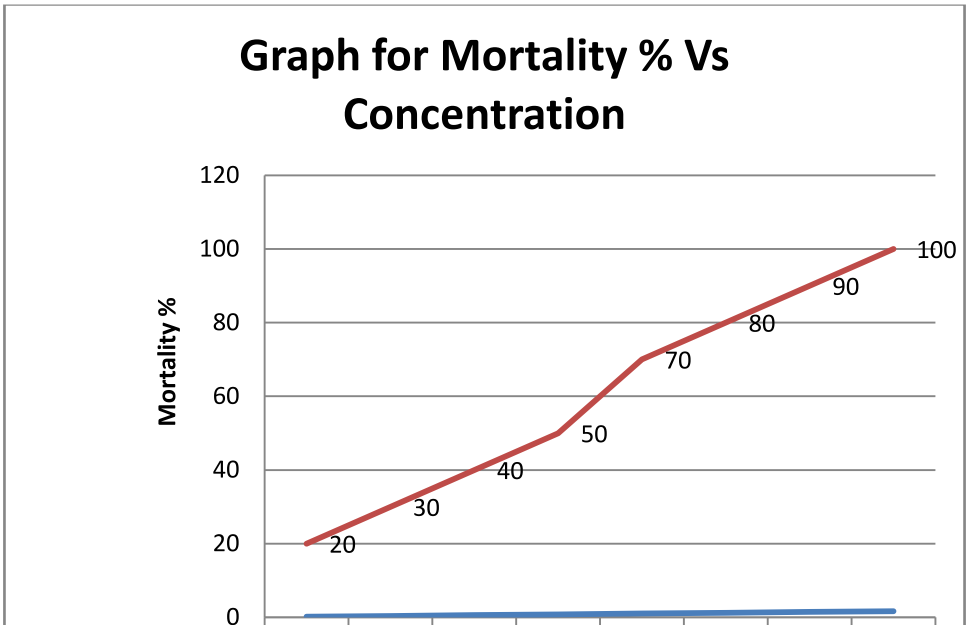
II. Materials and Methods

The crab *Barytelphusa guerini* were collected from their natural habitat near and around lakes in Hingoli. Then they were subjected for experimentation. Before commencing of the experiment they were subjected to acclimatization for 48 hours. They were fed with insect larvae and kept in normal tap water. Healthy crabs ranging between 30 – 35 gm in weight were subjected for the present work.

The animals were divided into different groups with 10 crabs each. The water volume in the experimental glass aquaria were adjusted such that the lower surface of each animal was submerged below the water level. The stock solution of Lead nitrate was prepared in 100 ml of distilled water.

Table 1: Percentage Mortality of *Barytelphusa guerini* Exposed To Lead Nitrate

Group	Conc. in ppm	No. of crabs	Exposure Time in hours				No. of dead animals	Percentage Mortality
			0-24	24-48	48-72	72-96		
1	Control	10	---	---	---	---	---	00
2	0.2	10	1	---	1	---	2	20
3	0.4	10	1	1	---	1	3	30
4	0.6	10	1	---	2	1	4	40
5	0.8	10	1	1	1	2	5	50
6	1.0	10	1	2	2	2	7	70
7	1.2	10	1	2	3	2	8	80
8	1.4	10	2	2	2	3	9	90
9	1.6	10	---	2	3	5	10	100
	Total	90	8	10	14	16	**48**	



	1	2	3	4	5	6	7	8
Conc. In ppm	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6
Mortality %	20	30	40	50	70	80	90	100

III. Result

Behavioural changes shown by crabs in response to Lead nitrate toxicity

Group 1: Control

In this group all the physical and physiological activities were keenly observed and recorded. There was a normal feeding and all the crabs looked healthy. Crawling movements were normal and showed no signs of stress. Excretion was normal. Eye movements and body posture were normal. They lived gregariously with each other with no signs of any aggression. There was no any mortality observed in this group for 96 hours.

Groups 2 and 3

There was a slight increase in feeding quantity for first few hours. Excretion was found to be normal. The mortality rate was found to be 20% and 30% in the groups 2 and 3 having concentration of 0.2 ppm and 0.4 ppm. respectively. No significant eye movements.

Groups 4 and 5

There was an increase in the activity. The feeding also increased from moderate to higher compare to previous group. Slight increase in excretion. Mortality rate was recorded to be 40% and 50% in the groups 4 and 5 having concentrations 0.6 ppm and 0.8 ppm respectively.

Groups 6 and 7

The animals looked quite restless. Movements increased initially then became dull gradually. Eye movements normal. Excreta sticky. Mortality rate was recorded to be 70% and 80% in the groups 6 and 7 having concentrations 1.0 ppm and 1.2 ppm respectively.

Groups 8 and 9

Most of the animals showed aggressive behaviour. Rapid movement of chelate legs. Crawling upon each other. Trying to attack each other. Some animals showed very little or no feeding at all. Group 8 recorded a mortality of 90 % having concentration 1.4 ppm. The highest mortality of 100% was recorded in group 9 having concentration 1.6 ppm.

IV. Discussion

The present investigation was aimed at the study of impact of Lead nitrate on behavioural pattern of crab *Barytelphusa guerini*. Heavy metal induces certain metabolic and physiological changes in aquatic organisms under stress (Srinivas et al., 2000). It is observed that several crustaceans can detect eutrophication and show avoidance or escape behaviour. It was reported that blue crab (*Callinectes sapidus*) can avoid hypoxic conditions by migrating to locations with more favourable oxygen concentrations (Bell et al.2003a). A decline in feeding rate was also reported in blue crabs when exposed to hypoxia, (Bell et al. 2003b)

The use of measures of animal behavior as indicators may provide sensitive information about a population's condition. For example, toxicologists are currently using behavioral measures (e.g., activity, feeding, and antipredator behavior) as bioindicators (Clotfelter et al. 2004). It has been showed that increased concentration of chloride, nitrate and phosphate can be used as bioindicator of pollution as the plankton population was found to be increased (Trivedi and Goel, 1986). Under stress conditions the ability to locate food can also be affected (Breithaupt et,al., 1999). The increase in activity and aggressive behavioural shows the increased metabolic rate, which could be to overcome the induced stress of Lead nitrate concentration. It was recorded for some brachyuran crabs that individuals reach adulthood at smaller sizes compared to the time before populations were affected by intense fishing pressure (Abbe, 2002). Rapid tail flipping and escape behaviour was recorded in lobsters.(Butterworth et,al.2004)

In the shrimp *Crangon crangon*, exposure to high sulfide concentrations observed avoidance behavior as well as panic reactions (Vismann 1996). The concentrations of trace metals in invertebrates accumulates differently in body tissue and organs (Eisler. 1981)

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