Effect of Zinc Sulphate on Cardiac Physiology of the crab *Barytelphusa guerini*

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ABSTRACT
The effect of zinc sulphate on cardiac physiology of *Bartelphusa guerini* was investigated after acute exposure to zinc sulphate. Remarkable differences were found between control and treated crabs. The rate of heart beat was studied at regular interval of 24 h up to 240 h (10days). The investigation showed an initial decline in heart rate up to 48 h, which then gradually decreases up to 240 h in control group. The treated animals showed initial increase up to 72 h and later there is a gradual decline in the rate of heart beat up to 240 h. The decline in rate of heart beat may indicate that animals try to settle down to the toxic medium and initial increase in the heart beat rate may be due to accelerative metabolic activity of the animal.

INTRODUCTION
Heavy metals in aquatic ecosystems often show levels above the expected values. Wide use of heavy metals by the industrial, agricultural and domestic sectors results in release of toxic pollutants in the environment posing a serious threat to the aquatic animals. Crabs are economically important as they serve as an important food source to man. But, since the last decade their natural environment is being disturbed by the pollution. The heavy metals such as a mercury, copper, zinc and cadmium are potent toxicants and cause various physiological effects on growth, food intake, metabolism and general development of aquatic animals (Kulkarni 1980, Lomte 1982, Tungare & Sawant 2000, Wankhade & Kulkarni 2000, Rajahia & Venkaiah 2007, Shailaja 2008, Jagtap et al. 2009, Mali et al. 2010).

Hence, the present work was carried out to investigate the effects of zinc sulphate on the crab *Barytelphusa guerini* to evaluate the toxic effect on cardiac physiology.

MATERIALS AND METHODS
Healthy and mature crabs (*Barytelphusa guerini*) were selected for experimentation weighing 30-50 g to avoid the effect of sex and size (Ambore 1976). The animals were exposed to sublethal concentration (0.0106 ppm) of zinc sulphate. They were cut through the lateral side and the dorsal carapace removed to expose the heart. They were kept in ringer bowl filled with crab ringer and maintained for 10 minutes to allow them to recover from shock effects and for the heart beat to get stabilized. The heart beat was seen visually and the time taken for 10 beats was determined with the help of stop watch. The rate of heart beat was noted for control and treated groups at 00, 24, 48, 72, 96, 144, 168, 192, 216, 240 h of exposure and average value of four observations was considered for calculating the rate of heart beat.

RESULTS AND DISCUSSION
On exposure to sublethal concentration of zinc sulphate (0.0106 ppm), the heart beat was studied at regular interval of 24 h up to 240 h for 10 days (Table 1).

The control showed decrease up to 48 h, and later after increasing up to 144 days, there was a gradual decrease up to 240 h. The treated crabs showed initial increase up to 72 h, and later there was a gradual decline in the rate of heart beat up to 240 h as plotted in graph (Fig. 1).

The literature available on the rate of heart beat in crustaceans indicate that the heart ratio is influenced by a number of factors like body size, activity, light, nutritional status, temperature, population density, oxygen and CO₂ content of the medium (Prosser & Brown 1961, Prosser 1973, Ambore 1976, Krishnaha et al. 1987, More 1992). The impact of pollutants on cardiophysiology of the freshwater crab, *Banytelphusa guerini* was studied by Tonapi & Varghese (1984). Some waterborne metals can bind to gills of freshwater fish and disrupt the ion-regulatory and respiratory functions of the gills (Playle 1998). The physiological modulations in cardiac rhythms of crab *B. cunicularis*, induced by heavy metals, has been studied. Depletion in the rate of oxygen consumption upon exposure to heavy metal stress might be due to penetration of pollutants at subcellular level and damage of gill tissue, thereby failure of an alternative compensatory mechanism to achieve energy generation for combating toxic stress.

In the present investigation, the initial increase in heart
rate in treated crabs may be due to accelerative metabolic activity of the animal and decline in the rate of heart beat indicating that animals try to settle down to the toxic medium.

ACKNOWLEDGEMENT

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REFERENCES


Table 1: Rate of heart beats/10 seconds of the crab *Barytelphusa guerini* after exposure to zinc sulphate for 24-240 h.

<table>
<thead>
<tr>
<th>Exposure Weight Mean Heart Exposure Weight Mean Heart</th>
<th>Control Crab (Barytelphusa guerini)</th>
<th>Control Crab (Barytelphusa guerini)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(h) of crab in (g)</td>
<td>Beats of crab (H.B.)</td>
<td>Beats of crab (H.B.)</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>0</td>
<td>33.5</td>
<td>7.16</td>
</tr>
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<td>24</td>
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<td>144</td>
<td>36.5</td>
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</tr>
<tr>
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<tr>
<td>216</td>
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<tr>
<td>240</td>
<td>45.5</td>
<td>2.80</td>
</tr>
</tbody>
</table>

Fig. 1: Effect of zinc sulphate on rate of heart beats per 10 seconds for 24-240 h.