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Original Research Paper

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, Rajaiah & 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 CO_2 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

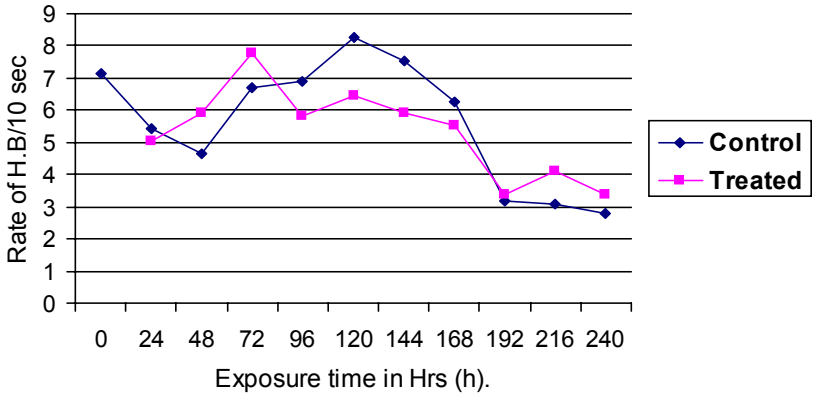

Fig. 1: Effect of zinc sulphate on rate of heart beats per 10 seconds for 24-240 h.

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

Exposure (h)	Control Crab (*Barytelphusa guerini*) Weight of crab in (g)	Mean Heart Beats (H.B.)	Treated Crab (*Barytelphusa guerini*) Weight of crab in (g)	Mean Heart Beats (H.B.)
0	33.5	7.16	-	-
24	38	5.43	36	5.05
48	42	4.67	38.5	5.93
72	35	6.68	40	7.79
96	47	6.91	42.5	5.82
120	44	8.29	41.5	6.45
144	36.5	7.54	38	5.90
168	38.5	6.24	34	5.52
192	35.5	3.18	34.5	3.36
216	41	3.10	39	4.12
240	45.5	2.80	47.5	3.37

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.

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REFERENCES

Ambore, N.E. 1976. Studies on some aspect of physiology in freshwater crab, *Barytephusa guerini* with special reference to sex and size. Ph.D. Thesis submitted to Marathwada University, Aurangabad.

Jagtap, A.R., Afsar, S.K., Kothole, S.D. and Mali, R.P. 2009. Effect of pollutants from car washing centre on oxygen consumption in freshwater fish, *Channa punctatus*. J. Aqu. Biol., 24(2): 189-192.

Krishnahan, A.P., Rage, M.S. and Joshi, A.G. 1987. Toxic effects of certain heavy metals mercury, cadmium, lead, arsenic and selenium on the intertidal crab, *Scylla serrata.* Mar. Environ. Res., 21: 109-120.

Kulkarni, K.M. 1980. The metabolic response of *Barytelphusa jacquemontii* to some pollutants. Geobios, 8: 133-135.

Lomte, V.S. 1982. Changes in the biochemical components of the prosobranch snail, *Belamia bengalensis* on exposure to malathion. Proc. Symp. Physiol. Rep. Anim. Pollutants.

Mali, R.P., Afsar, S.K. and Jagtap, A.R. 2010. Impact of cadmium induced alterations in the glycolytic potential of freshwater female crab *Barytelphusa guerini*. Geobios, 37: 100-102.

More, A.D. 1992. Studies on some aspects of physiology of freshwater male crab *Barytelphusa guerini* with special reference to inorganic pollutants. Ph.D. Thesis submitted to Marathwada University, Aurangabad.

Playle, R.C. 1998. Science Total Environment, 219(2-3): 147-163.

Prosser, C.S. and Brown, F.A. 1961. Comparative Animal Physiology. N.B. Sounders Company, Philadelphia.

Prosser, C.S. 1973. Comparative Animal Physiology. N.B. Sounders Company, Philadelphia.

Rajaiah, V. and Venkaiah, Y. 2007. Effect of parathion on esterase patterns of *Channa punctatus.* J. Aqu. Biol., 22(1): 181-185.

Ketpadung, R. and Olan, N.T. 2006. Changes in oxygen consumption and heart rate of the blue swimming crab, *Portunus pelagicus* (Linnaeus, 1766) following exposure to sublethal concentrations of copper. Journal of Environmental Biology, 27(1) 7-12.

Shailaja, V., Madhuri, E., Ramesh Babu, K., Rama Krishna, S. and Bhasker, M. 2008. Study of protein metabolism in hepatopancreas and muscle of prawn *Penaeus monodon* on exposure to altered pH media. J.E.F. 1: 85-92.

Tonapi, G.T. and Varghese, G. 1984. Cardiophysiological responses of the crab, *B. cunicularis* (Westwood) to three common pollutants. Ind. J. Expt. Biol., 22: 548-549.

Tungare, S.M. and Sawant, A.D. 2000. Physiological effects of heavy metals on prawns. International Conference on Probing in Biological Systems, Mumbai, Feb. 2000, pp. 139.

Varghese, G., Naik, P.S. and Katdare, M. 1990. Respiratory responses and blood sugar level of the crab, *Barytelphusa guerini* expressed to mercury, copper and zinc. Ind. J. Exp. Biol., 30(4): 308-312.

Wankhade, V.M. and Kulkarni, K.M. 2000. Liver protein profiles of the fish *Channa orientalis* exposed to endosulphan. J. Aqua. Biol., 15(1 & 2): 89-91.