



ACUTE TOXICITY OF WATER BORNE Cd, Cu, Pb AND Zn TO *MUGIL CEPHALUS* FINGERLINGS

J. S. I. RAJKUMAR*, M. C. JOHN MILTON and T. AMBROSE

Department of Advanced Zoology and Biotechnology, Loyola College,
CHENNAI – 600034 (T.N.) INDIA

ABSTRACT

In the present study the fingerlings of *Mugil cephalus* was exposed to acute toxicity test under static renewal bioassay to cadmium, copper, lead and zinc. The fingerlings were sensitive to copper followed by cadmium and lead. The fingerlings of *M.cephalus* showed tolerance behaviour towards zinc.

Key words: Toxicity, Cd, Cu, Pb, Zn, *Mugil cephalus*.

INTRODUCTION

In order to study the response generated in the stressed system, environmental toxicology plays a crucial role¹. Heavy metals concentrations are omnipresent in the biosphere, hence the need to investigate the short-term toxic effects of these substances for the structure and balance of ecosystem². Fish is an integral component of the aquatic ecosystems. In addition to being a source of protein to man. They play an important role in energy flow, nutrient cycling and maintaining community balances in these ecosystem³. Thus, utility of fish for assessing environmental conditions in aquatic ecosystem has gained prominence in recent years⁴.

EXPERIMENTAL

Fingerlings of *Mugil cephalus* of mean 1.5 ± 0.4 cm in length and 0.13 ± 0.02 g in weight were used. Collected juveniles were immediately transported to the laboratory in air filled plastic bags and acclimatized fish fingerlings in 200 L Fiberglass Reinforced Plastics (FRP) tanks with aerated natural filtered seawater. Stock solutions of cadmium, copper, lead and zinc were freshly prepared by dissolving the proper metal salts of cadmium chloride hemi (pentahydrate), copper (II) chloride, lead (II) nitrate, and zinc sulfate in

* Author for correspondence; E-mail: rajloyola83@gmail.com

deionized (double distilled) water. Fresh stock solutions were prepared daily. These solutions were serially diluted to get the experimental concentration for the toxicity test. The experimental method includes static renewal (24 hour renewal) test by following the method of USEPA⁵. Five concentrations in a geometric series including control were prepared for the test for 4 days in acute toxicity test (USEPA)⁶. Toxicant and seawater were replaced on daily basis. Test animals were not fed during acute test. Maximum-allowable control mortality was 10 percent for a 96 hour period of testing and 20 percent for 30 days for chronic (USEPA)⁶. A computerized probit analysis program (USEPA probit analysis program version 1.5) (Probit Program version 1.5)⁷ was carried out for the calculations of LC₅₀ values at the termination of each test and upper and lower 95 percent confidence levels were also calculated.

RESULTS AND DISCUSSION

The fingerlings of *M. cephalus* were sensitive to copper and tolerant to zinc concentrations. The sensitivity of mullet juveniles to metals are in the order of Cu > Cd > Pb > Zn (Fig. 1). The higher rates of mortality were observed with *M. cephalus* when exposed to copper than lead and zinc in the acute toxicity test. The animal experienced dark colouration, gasping of air, rapid movements of operculum and eyeballs, losing their stability, falling of scales, the juveniles remained tilted in the highest copper concentration (160 mg/L).

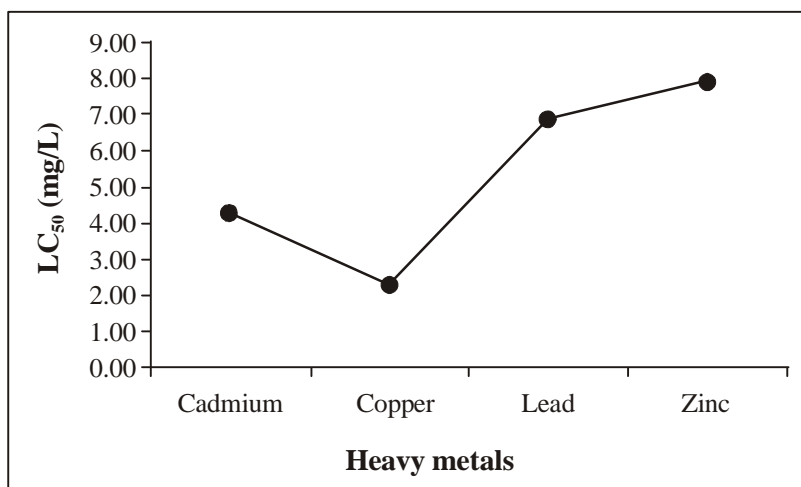


Fig. 1: *M. cephalus* exposed to cadmium, copper, lead and zinc in acute toxicity test under static renewal

Taylor *et al.*⁸ reported that mullet, *Chelon labrosus* LC₅₀ value was 1.4 mg/L for copper, > 4.5 mg/L for lead and 21.5 mg/L for zinc in Continuous Flow Through System (CFTS) for 4 days, *C.labrosus* was sensitive to copper and gave the sensitivity in the order of Cu > Pb > Zn. Dab, *Limanda limanda* an estuarine fish showed a 96 h LC₅₀ of 0.3 mg/L for copper and no value was derived for lead and zinc, Taylor *et al.*⁸ summarized that *L. limanda* was sensitive to copper than lead and zinc. These results correlate the present study, *M.cephalus* was sensitive to copper than lead and zinc.

Mohapatra and Rengarajan⁹ reported that mullet, *Liza parisa* exposed to lead, copper and zinc in acute toxicity test revealed the 96 hour LC₅₀ of 64.7, 21.8 and 13.7 mg/L. Copper was sensitive to *L.parisa* than zinc and lead (Cu > Zn > Pb). This difference was brought about by the difference in salinity, even though the *L.parisa* is an estuarine fish also thrived in varied salinities. Bioassays conducted for 12, 24 and 72 hours with *Tilapia nilotica*, Somsiri¹⁰ reported that the copper is toxic than zinc. Based on 96 hour LC₅₀, copper was found to be toxic to *M.cephalus* than cadmium, lead and zinc in the present study. The 96 hour LC₅₀ of copper and zinc on Longfin dace *Agosia chrysogaster*, Lewis¹¹ reported toxic nature of zinc than copper to fish. Pundir¹² reported that the zinc is toxic than lead to *Nemacheilus bolia*. Stripped mullet, *M. cephalus* of two different sizes 5 and 1 cm exposed to cadmium chloride showed LC₅₀ of 28 and 7.1 mg/L¹³. Lydy and Wissing¹⁴ reported that LC₅₀ for fantail (*Etheostoma flabellare*) and johnny (*E. nigrum*) darters exposed to copper was 0.39 and 0.60 mg/L.

REFERENCES

1. S. Duquesne, M. Liess and D. J. Bird, Mar. Environ. Res., **58**, 245-250 (2004).
2. P. M. Chapman and F. Wang, Environ. Toxicol. Chem., **20**, 3-22 (2001).
3. M. Tuzen, Food Chem., **80**, 119-123 (2003)
4. J. Sikorska and J. Wolnicki, Rev. Fish Biol. Fisheries, **20**, 417-423, (2010).
5. USEPA, US Environmental Protection Agency, <http://www.epa.gov/owow/monitoring/calm.html>, (2002).
6. USEPA, United States Environmental Protection Agency, Washington DC, EPA 821-R02-012, 275 (2002)
7. PROBIT, Program Version 1.5, U. S. Environmental Protection Agency, Cincinnati, Ohio - 45268.
8. D. I. Taylor, B. G. Maddock and G. Mance, Aquat. Toxicol, **7**, 135-144, (1985).

9. B. C. Mohapatra and K. Rengarajan, *J. Mar. Biol. Ass.*, **39(1-2)**, 69-78, (1997).
10. Somsiri, *Thai. Fish. Gat.*, **35(3)**, 313-318 (1982).
11. M. Lewis, *J. Fish Biol.*, **13**, 695-700 (1978).
12. R. Pundir, *J. Hydrobiol.*, **5(1)**, 23-28 (1989).
13. USEPA, Update for Ambient Water Quality Criteria for Cadmium (2001).
14. M. J. Lydy and E. T. Wissing, *Aquat. Toxicol.*, **12**, 311-322 (1987).

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