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# Toxicity of Some Metals on the Fish *Therapon jarbua* (Forsskal, 1775)

L KRISHNAKUMARI*, P K VARSHNEY, S N GAJBHIYE, K GOVINDAN & VIJAYALAKSHMI R NAIR
National Institute of Oceanography, Regional Centre, Versova, Bombay 400 061

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Hg, V and Pb were more toxic to *T. jarbua* than the other metals studied. Recorded 96 h $LC_{50}$ for Hg, V, Pb, As, Cu, Zn, Ni and Co was respectively at 0.06, 0.62, 1.23, 3.38, 4.5, 11.0, 19.4 and 52.5 mg.l$^{-1}$. The 90% survival for 96 h for the above metals in the respective order was 0.018, 0.23, 0.71, 1.03, 2.2, 5.9, 6.8 and 25 mg.l$^{-1}$. Toxicity of these metals was discussed and compared with earlier reports.

A few metals, being cumulative poisons, are potentially harmful to most organisms at some level of exposure and absorption[1]. It is necessary to determine the acute toxicity of these metals which act as pollutants on aquatic life. Keeping this in view a series of bioassay experiments have been done to evaluate the effect of selected heavy metals on the marine fish *Therapon jarbua* (Forsskal, 1775) and the results are presented in this communication.

Juveniles of *T. jarbua* were collected from a clean area off Thal, south of Bombay (lat. 18°42′ N and long. 72°49′ E) during January to May 1981. In the laboratory they were acclimatised for 7 d. They were fed normally except for 48 h preceding the test. The fish selected for the tests varied from 2.4 to 3.6 cm in length and weighed between 0.2 and 0.7 g. Loading of the fish was done at a rate of 1 fish per litre and 10 fish were used in each experiment. The criteria for determining death were the lack of respiratory movements and no response to prodding.

Seawater (sal. 35.8-36.4 $\times 10^{-3}$) collected off Thal was brought to the laboratory in carboys and filtered before use. Continuous slow aeration was maintained for keeping the dissolved oxygen content slightly above 4 ml.l$^{-1}$. Static bioassays were conducted as per standard procedure[2,3]. The metal salts used for the tests were $HgCl_2$, $V_2O_5$, $As_2O_3$, $(CH_3COO)_2Pb.3H_2O$, $CuSO_4.5H_2O$, $ZnSO_4.7H_2O$, $NiSO_4.10H_2O$ and $CoSO_4.6H_2O$. Test solutions were prepared by diluting stock solution of the concerned metal salt.

Preliminary screening tests were conducted to ascertain the lethal and sublethal concentrations of each metal and based on these results the definitive tests were carried out. The selected concentration ranges for Co, Ni, Cu, As, Pb, V and Hg were 10-60, 3-33, 3-17, 1-8, 0.2-6.2, 0.1-2.2, 0.05-1.2 and 0.005-0.1 mg.l$^{-1}$ respectively. State of the treated fish in the test vessel was noted at 3, 6, 12, 24, 48, 72 and 96 h. Relevant parameters like *p*H, oxygen, temperature and salinity were monitored. Dead fish were recorded and removed periodically. Experiments were repeated thrice and each concentration was run in triplicate. The values were averaged. The cumulative number of dead fish after 96 h was plotted against the concentration and regression line fitted. By interpolating the graph at 90 and 50% survival levels, the expected lethal concentrations of the given metal were obtained.

*Cu*—During the 96 h experimental period no mortality was observed up to 2 mg.l$^{-1}$ conc. (Fig.1a). Observed 90% survival of fish for 96 h was 2.2 mg.l$^{-1}$. Mortality rate increased from 6 mg.l$^{-1}$ onwards. The $LC_{50}$ values for 24, 48 and 96 h were 9.65, 6.65, 5.2 and 4.5 mg.l$^{-1}$ respectively. The 96 h $LC_{50}$ for Cu was 20 mg.l$^{-1}$ for *Fundulus heteroclitus*[4] compared to the lower level observed for *T. jarbua* (4.5 mg.l$^{-1}$). On the other hand, for oysters[5] and pink shrimps[6] the values reported were 0.1-0.5 $\times 10^{-6}$ (96 h) and 0.14 $\times 10^{-6}$ (48 h) respectively. It appears that toxicity of Cu to different animals varies widely.

*Zn*—The fish were quite active for 96 h up to 5 mg.l$^{-1}$ conc. (Fig.1b). From 7 mg.l$^{-1}$ onwards the mortality rate started increasing and at 17 mg.l$^{-1}$ all the fish were dead after 96 h. The 90% survival for 96 h was recorded at 5.9 mg.l$^{-1}$. $LC_{50}$ values for 24, 48, 72 and 96 h were at 19.6, 15, 13 and 11 mg.l$^{-1}$ respectively. Earlier 10 $\times 10^{-6}$ of Zn has been reported to be toxic to adult fish[6] which is close to the present value (11 mg.l$^{-1}$ for 96 h).

*Hg*—Swimming of *T. jarbua* became abnormal at 0.1 mg.l$^{-1}$ conc. and within 18 h all fish were dead. However, 100% survival was recorded for 96 h at 0.01 mg.l$^{-1}$ (Fig.1c). The 90% survival for 96 h was at 0.018 mg.l$^{-1}$. $LC_{50}$ values for 24, 48, 72 and 96 h were 0.071, 0.071, 0.07 and 0.06 mg.l$^{-1}$ respectively. It has been reported that acute toxicity of Hg can occur at 1 $\times 10^{-6}$

*Present address: National Institute of Oceanography, Dona Paula, Goa 403 004

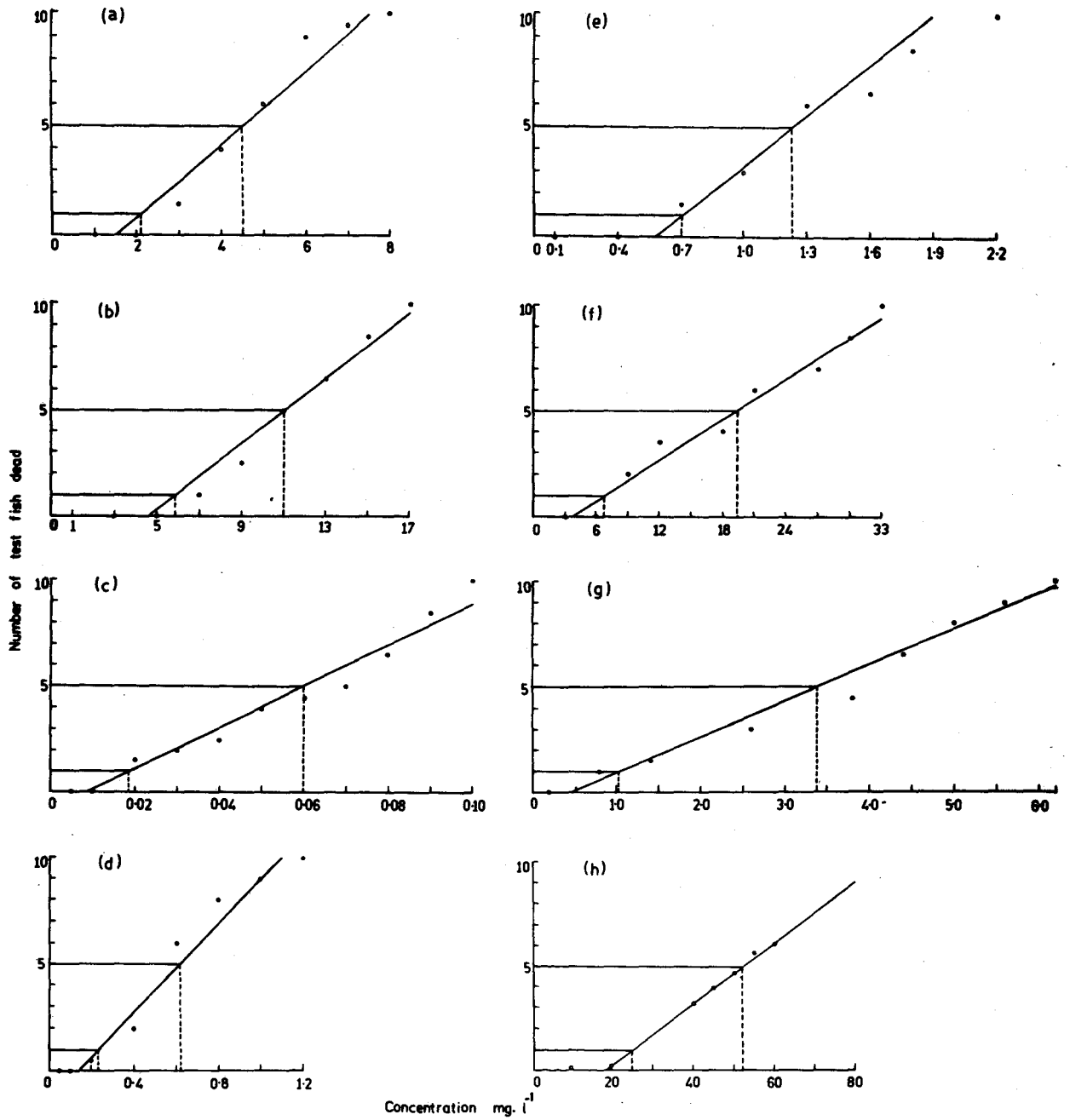


Fig. 1—Mortality rate of *T. jarbua* at different concentration of Cu(a), Zn(b), Hg(c), V(d), Pb(e), Ni(f), As(g) and Co(h) for 96 h

and chronic exposure to as low as $0.01 \times 10^{-6}$ can be lethal to marine organisms[7]. But concentration of $0.075 \times 10^{-6}$ is reported[6] as lethal to pinkshrimps in 48 h and concentrations much lower than mentioned above cause the death of lamellibranch larvae[8]. Present result on $LC_{50}$ for Hg for 96 h (0.06 mg.l$^{-1}$) is comparable with the above report.

*V*—The 100% survival was observed at 0.4 mg.l$^{-1}$ conc. for 48 h. The survival rate started decreasing above 0.4 mg.l$^{-1}$ conc. and at 1.2 mg.l$^{-1}$ all fish were dead during 96 h (Fig. 1d). The 90% survival was at 0.23 mg.l$^{-1}$ for 96 h. $LC_{50}$ values were 1, 0.97, 0.8 and 0.62 mg.l$^{-1}$ respectively for 24, 48, 72 and 96 h. The toxicity of V compounds is quite variable[9]. The present observation clearly indicates that V is more toxic but ranks only next to Hg for *T. jarbua*.

*Pb*—All fish were able to thrive up to 96 h against 0.4 mg.l$^{-1}$ conc. (Fig. 1e). The 100% mortality for 96 h was at 2.2 mg.l$^{-1}$ while the estimated concentration for 90% survival for 96 h was 0.71 mg.l$^{-1}$. $LC_{50}$ for 96 h was at 1.23 mg.l$^{-1}$ conc. The corresponding $LC_{50}$ values for 24, 48 and 72 h intervals were at 3.04, 2.2 and 1.6 mg.l$^{-1}$. Pb is a chronic cumulative poison and the present $LC_{50}$ value for 96 h (1.23 mg.l$^{-1}$) is in

agreement with the recorded toxic level of $1 \times 10^{-6}$ of Pb for marine animals[10].

*Ni*—The 100% survival, up to 48 h was at 12 mg.l$^{-1}$ conc. Mortality rate was considerably increased beyond 18 mg.l$^{-1}$ (Fig.1f). Concentration for 90% survival for 96 h was 6.8 mg.l$^{-1}$. The fish were very active even up to 96 h at concentration of 6 mg.l$^{-1}$. $LC_{50}$ values for 24, 48, 72 and 96 h were respectively at 36.2, 24.4, 21.2 and 19.4 mg.l$^{-1}$. Ni and most of its salts are generally considered less toxic to marine animals[10].

*As*—The 100% survival for 48 h was at 1.4 mg.l$^{-1}$ conc. Mortality rate increased from 2.6 mg.l$^{-1}$ and 100% mortality was at 6.2 mg.l$^{-1}$ within 96 h (Fig.1g). The 90% survival was observed at 1.03 mg.l$^{-1}$. $LC_{50}$ values for 24, 48, 72 and 96 h were 5.5, 4.08, 3.68 and 3.38 mg.l$^{-1}$ respectively. Concentration of As varying from 1 to $10 \times 10^{-6}$ is toxic to many marine organisms[10]. Observed 96 h $LC_{50}$ of As (3.38 mg.l$^{-1}$) for *T. jarbua* is within the lower level of the above given range.

*Co*—No mortality was observed up to 20 mg.l$^{-1}$ conc. for 96 h (Fig.1h). Even in 60 mg.l$^{-1}$ 100% survival was observed for 24 h. During the 96 h experimental period, mortality showed an increasing trend from 40 mg.l$^{-1}$ onwards. The 90% survival and $LC_{50}$ for 96 h were respectively at 25 and 52.5 mg.l$^{-1}$. There are only a few studies on the toxicity of Co on marine organisms and concentration up to $10 \times 10^{-6}$ is reported to be non-toxic[10].

The experimental $LC_{50}$ values obtained provide data on comparative effect of pollutants and are useful in screening potentially toxic substances. The present data indicate that among 8 metals studied Hg is the most toxic and Co the least. The remaining metals show toxicity in the order — V, Pb, As, Cu, Zn and Ni.

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