

**M.S.24. LAKSHMANAN, P.T.—Investigations on the Chemical Constituents and Tracemetal Interactions in some Bivalve Molluscs of the Cochin Backwaters—1982—
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Studies on the seasonal variations of biochemical constituents and some of the tracemetals like copper, zinc, iron & lead, the lethal and sublethal effects of toxic metal ions, viz., Hg^{2+} , Cu^{2+} , Zn^{2+} & Pb^{2+} and the accumulation and depuration kinetics of these metals were carried out in three commercially important molluscs, viz., *Villorita cyprinoides* var. *cochinensis*, *Meretrix casta* (Chemnitz) and *Perna viridis* (Linnaeus) of the Cochin backwaters.

The biochemical constituents showed a distinct seasonal change in all the three molluscs. The body water content was the highest during monsoon months and it showed significant negative correlation with habitat water salinity. Protein and carbohydrate levels showed an inverse relationship in these species. Increase in lipid level was accompanied by an increase in total phosphorus. Highest calorific values were obtained during December to February for *V. cyprinoides*, December to April for *M. casta* and June-July in the case of *P. viridis*, suggesting the best harvesting period.

The tracemetal content in the molluscs also varied with season. Highest metal concentrations in general, were found when the habitat water salinity and pH were low i.e. during the monsoon periods and low values, during summer. Significant negative correlations ($P \leq 0.001$) existed between tracemetal content and salinity. Nearly all the four metals were positively correlated in the two clams. In *P. viridis*, only a few combinations (Cu/Zn, Cu/Pb and Zn/Pb) were significantly correlated. Iron was the most abundant tracemetal in all the three species. The levels of these metals were below the permitted limit in seafoods.

Among the different metals tested for toxicity, copper was found to be the most toxic metal ion to all the species. The order of toxicity was $Cu^{2+} > Hg^{2+} > Zn^{2+} \gg Pb^{2+}$. Upto 10 ppm, lead did not cause lethality to the molluscs in 10

days period. The mussel, *P. viridis* was found to be more susceptible to heavy metal ions than the two clams. In *P. viridis*, the 96 h-LC₅₀ values were 0.174 ppm Cu, 0.34 ppm Hg and 3.0 ppm Zn in *V. cyprinoides* the corresponding values were 1.214 ppm Cu, 1.57 ppm Hg and a 10 day LC₅₀ value of 5.47 ppm Zn. The 96 h-LC₅₀ values of these metals in *M. casta* were 2.188 ppm Cu, 3.25 ppm Hg and 6.67 ppm Zn. The difference in the toxicities of these metals is explained on the basis of their electronegativity data, the ionic radii and the pKs values of the metal sulphides.

Under sublethal concentrations of Cu²⁺ and Hg²⁺, the tissue lactic acid increased considerably in the molluscs with a concomitant fall in the glycogen level. The lactic acid content increased with increasing concentrations of metal ions and time of exposure. The severe anaerobic stress caused by metal intoxication, resulted in the breakdown of tissue glycogen.

Bioaccumulation of the tracemetals viz., Hg, Cu, Zn and Pb from water occurred at all concentrations studied. The metal content in the animal soft parts were found to be dependent on the concentrations of metals in the medium and length of exposure. Except for Zn, highest concentration factors (CF) were attained by *P. viridis* for these metals (Pb = 2469, Cu = 2450, Hg = 2179 and Zn = 219) during 6 days' exposure (dry wt. basis). *V. cyprinoides* showed higher CRs for Zn, Hg and Pb than *M. casta*. The highest CF for Zn was obtained by *V. cyprinoides* (534). The CFs decreased with increasing concentrations of the metals in the medium (exception Pb) showing greater uptake efficiency of lower concentrations. The study revealed gills as the major storage organ of metals in molluscs. The efficiency of metal uptake was ranked as *P. viridis* > *V. cyprinoides* > *M. casta*.

The depuration of metals in a metal free media was generally, a slow process. Copper was found to be depurated faster by all the species. Total purification of metals could not be achieved in any case during a cleaning period of 20-24 days. These studies establish the usefulness of molluscs as indicators of metallic pollution; the present investigation is the first ever risk in 'mussel watch' in India.