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Interaction Between Salinity and Toxicity of Phosphamidon in *Metapenaeus monoceros* (Fabricius)

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Pesticides occupy a rather unique position among the many chemicals that man encounters daily (Tucker and Leitzke 1979). Most pesticides are not highly selective, but are generally toxic to many nontarget species including man. Less information is available on synergistic effects on interaction between toxicity and salinity stress in crustaceans. It is reported that an increase in oil toxicity in shrimps is related to a decrease in salinity (Heitz et al, 1974). This paper is an evaluation of the phosphamidon toxicity in prawn M. monoceros which has high adaptability to varying salinities.

MATERIALS AND METHODS

M. monoceros of 60±10 mm length and 1.8±0.5 g wet weight were collected from Buckingham canal and adjacent estuaries of Tummalapenta sea coast about 10 km from Kavali. They were kept separately in glass troughs containing 15‰ and 25‰ sea water and acclimatized to laboratory conditions for a week with continuous aeration. The p^H of both the media were found to be 7.6 and 7.3 respectively. The prawns were fed with groundnut cake and rice bran. Water was changed daily to remove the scattered food particles and excreta. Technical grade phosphamidon of 92% purity obtained from CIBA was used. A stock solution of 1000 ppm of phosphamidon was prepared and appropriate concentrations were prepared by dilution.

Dosage-mortality studies were conducted at 15‰ and 25‰ salinities at 27±1° c for 24 and 48 hr exposure periods.

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Appropriate working concentrations ranging from 1 ppm to 2 ppm were used for prawns kept in 15‰ salinity and concentrations ranging from 0.1 to 1.2 ppm were used for prawns kept in 25‰ salinity. Twenty prawns were used for each experiment. During LC_{50} determination, the prawns were not fed but aerated frequently to prevent hypoxia in the medium (Khorram and Knight 1977).

The data was subjected to probit analysis and the probit mortality was determined from percent mortality (Finney 1964). The graphs showing log concentration vs probit mortality were plotted. LC_{50} value was calculated by four methods namely (a) probit analysis (b) Karber's method (Karber 1931) (c) from the graph and (d) from cumulative mortality. The fiducial limits, slope and chi-square values were also calculated for both 24 hr and 48 hr exposures at 15‰ and 25‰ salinities. The consolidated data is given in Table-1.

RESULTS AND DISCUSSION

Table-1 Consolidated data on phosphamidon toxicity in *M. monoceros* obtained by four methods.

Duration (hr)	LC_{50} (mg/L)					Fiducial Limits		Slope	chi-square
	Probit Analysis	Karber's Method	Graphical method	Cumulative mortality	Mean LC_{50}	Up	Low		
	At 15‰ salinity.								
24	1.36	1.35	1.38	1.34	1.36	1.43	1.27	9.12	1.94
48	1.24	1.24	1.20	1.30	1.25	1.31	1.13	8.68	2.49
	At 25‰ salinity								
24	0.61	0.61	0.65	0.63	0.63	0.66	0.53	4.70	5.61
48	0.47	0.45	0.49	0.45	0.46	0.54	0.40	3.21	6.51

Table-1 depicts the toxicity of phosphamidon to be more at 25‰ rather than at 15‰ salinity, thus confirming an increase in salinity to produce increase in toxicity of insecticides (Eisler 1970a). But the LC_{50} value is higher at 15‰ salinity indicating that lower salinity results in high uptake of phosphamidon. Similar finding was reported in mosquito fish with DDT (Murphy 1970).

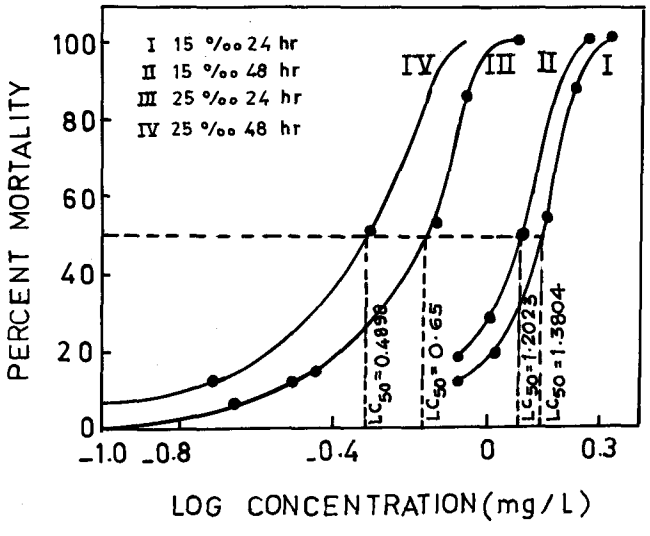

Figure.1. Mortality of M.monoceros in different log concentrations of Phosphamidon at 15‰ and 25‰ salinities for 24 hr and 48 hr exposure periods.

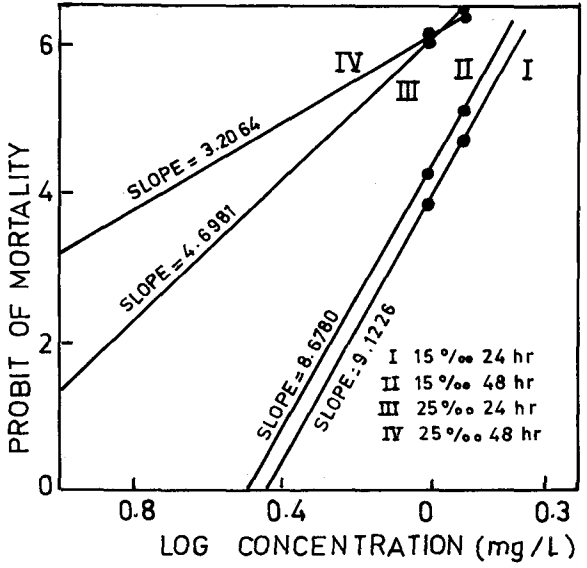

Figure.2. Probit Mortality of M.Monoceros in different log concentrations of Phosphamidon at 15‰ and 25‰ salinities for 24 hr and 48 hr exposure periods.

The relatively near alkaline p^H of the two media should have also contributed to some extent to the differential rates of toxicity reflecting the phenomenon of degradation of a pesticide by alkaline hydrolysis, which increases the apparent LC_{50} (Eisler 1970b).

The LC_{50} values obtained by the four methods are agreeable and they lie well within the fiducial limits at 15‰ and 25‰ salinities for 24 hr and 48 hr exposure periods. The LC_{50} values of 24 hr and 48 hr of exposure in both media do not vary much as the period of exposure is short. From the table and from the plots (Figs.1 and 2) it is observed that the toxic effect of phosphamidon is more pronounced at 25‰ salinity, as seen from the LC_{50} values and the rate of mortality is higher at 15‰ salinity, as indicated by the slope values.

At 15‰ salinity the probit regression lines are found to be almost parallel demonstrating constancy in the rate of mortality, irrespective of the period of exposure. The slope values indicate a homogeneous response of the individuals at 15‰ salinity.

Interestingly at 25‰ salinity, the response of the individuals is heterogeneous as indicated by the slope values. Under the same salinity but at different periods of exposure the probit regression lines are found to be non-parallel indicating differential rates of mortality (Fig.2).

Since the values of X^2 (Chi-square) indicate absence of heterogeneity, the variances may be derived from true weights without the use of heterogeneity factor (Snedecor and Cochran 1967).

From this it can be inferred that an alteration in the physico-chemical qualities of the test sample influences the apparent toxicity in aquatic tests. The differences in the LC_{50} values at 15‰ and 25‰ salinities may be attributed to the quality of water which can act to reduce the toxicant present by way of aiding chemical breakdown, or precipitation.

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