

Static bioassay with *Liza parsia* exposed to DDVP, an organophosphate

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DDVP, a water-soluble organophosphate insecticide, is widely used in the Kolleru region of Andhra Pradesh for the control of ectoparasites, such as *Lernea* and *Argulus*, on fishes (Muthu *et al.* 1988). DDVP is used as medicine in salmon farming against the sea lice. The use of this chemical in salmon farming, however, appears to have deleterious effects on marine invertebrates (Egidius and Moester 1987). Stephanie Pain (1989) linked the epidemic of eye disease in salmon of the wild to the use of this chemical in farms. Acute toxicity tests of DDVP were, therefore, conducted on *Liza parsia*. Among mullets, *Liza parsia*, along with *Mugil cephalus*, has gained considerable importance in fish culture because of its resistance to environmental changes and easy availability. It was, therefore, selected for this study.

Liza parsia of 85–120 mm size and 6.50–13.25 g weight were collected live by cast nets from brackishwater canals of Pudukkottai area in Cochin. They were acclimatized to laboratory condition for about 2 weeks by maintaining in salinity $10.0 \pm 1.0\%$, pH 6.0 ± 0.5 and temperature $27.5^\circ \pm 1.5^\circ\text{C}$. To avoid fungal attack the medium was treated with 11 mg of malachite green per 100 litres of water. The fish were fed

once a day.

The commercial grade DDVP composed of Dichlorvos 76% m/m, emulsifier 10.6% m/m and solvent 13.4% m/m was used for the preparation of stock solution.

A range-finding bioassay was conducted as per APHA-AWWA-WPCF (1975) and Reish and Oshida (1987). No mortality was observed at 0.1 ppm but 75% mortality occurred at 1 ppm at 96 hr. Hence the concentrations between 0.1 and 1.2 ppm were selected for bioassay procedure.

Static bioassay method (Reish and Oshida 1987) was used in the entire experiment. Each bioassay consisting of a series of 6 test concentrations and a control was used. Each concentration was run in duplicate

Table 1. Mortality at different exposure periods obtained in *Liza parsia* at different concentrations of DDVP*

Concentration (ppm)	Animals released (No.)	Mortality (No.) after			
		24 hr	48 hr	72 hr	96 hr
0.2	16	0	2	2	2
0.4	16	2	4	5	6
0.6	16	4	5	7	9
0.8	16	6	9	11	13
1.0	16	7	10	13	16
1.2	16	10	11	14	16

*Composition of DDVP was: Dichlorvos 76% m/m, emulsifier 10.6% m/m and solvent 13.4% m/m.

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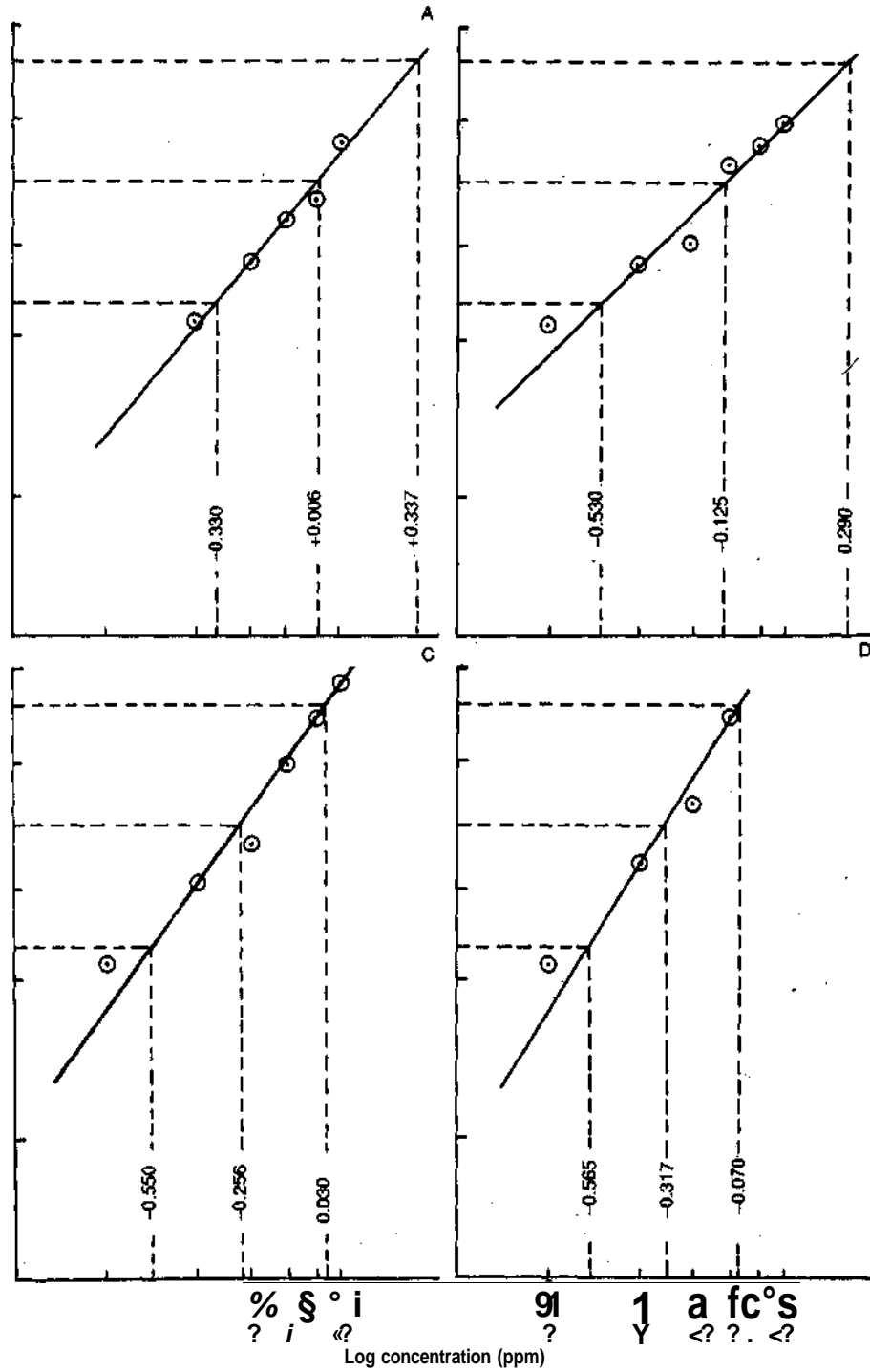


Fig.1 LC_M values of DDVP for *Liza parsia* after 24,48,72 and 96 hr of exposure. A. Response curve for 24 hr lethal concentration ($LC_n = \text{Anti log}(0.006) = 1.015$ ppm). B. Response curve for 48 hr lethal concentration ($LC_n = \text{Anti log}(-0.125) = 0.750$ ppm). C. Response curve for 72 hr lethal concentration ($LC_M = \text{Anti log}(-0.256) = 0.554$ ppm). D. Response curve for 96 hr lethal concentration ($LC_W = \text{Anti log}(-0.317) = 0.482$ ppm).

(APHA-AWWA-WPCF 1975). Precautions were taken to avoid contamination of the controls. Test animals were not fed during the experiment. The percentage of survival at the end of every 24, 48, 72 and 96 hr was accounted (Table 1). The data were processed by Probit analysis (Reish and Oshida 1987) in computer. The LC_M values obtained for 24, 48, 72 and 96 hr were 1.014725, 0.750109, 0.554255 and 0.482347 respectively. The percentage mortality vs log concentrations were plotted in probability papers (Fig. 1) and the LC_M values were got graphically (Seegert *et al.* 1979) also (Table 2). The slope function, 95% confidence limit and 95% fiducial limits (upper and lower) were calculated using the formulae from response curves for different exposure times after Reish and Oshida (1987).

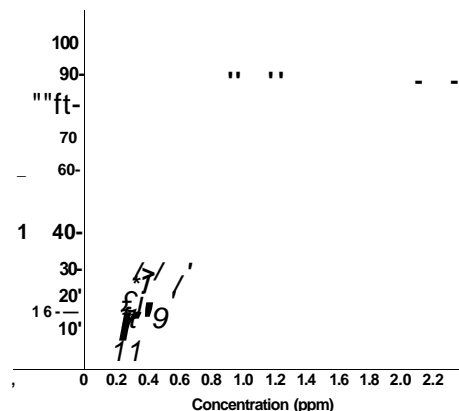


Fig. 2. Lethal concentration v e n a time curvet.

The LC_{jg} Values showed gradual decrease with increase in time and 95% fiducial limits of each of response curves for different exposure periods showed decreasing trend (Table 2). The 95% confidence limit and slope function shown against each LC_M values have overall decreasing trend except for a slight increase in 48 hr LC_M .

The LC_M , LC_{JI} and LC_{I_1} obtained from response curves for 24, 48, 72 and 76 hr (Table 2) were graphically plotted for non lethal concentrations (Fig. 2) which showed that for a short application a concentration around 02 ppm can safely be used.

The variations in percentage mortality (Table 1) and LC_w , LC_j , and LC^{\wedge} values (Table 2) at different exposures indicated differential toxicity of DDVP to *Uia parsia*. Verma *et al.* (1982) found the acute toxicity range of 6-10 ppm and 15-20 ppm

Slope (S)

$$95^* \text{ confidence limit} = \frac{2.77}{\sqrt{N}}$$

where N, total number of organisms tested at those exposure concentrations whose expected results were between 16% and 84%; and 2.77, a constant.

95% fiducial limits are :

$$\text{Upper limit} = LC_M \times LC_{50}$$

$$\text{Lower limit: } LC_{25}$$

Table 2. Graphical analyfis : Acute toxicity value* of DDVP* to *Liia parsia*

Exposure period (hr)	LCpt (ppm)	95* Fiducial limits		LCi6 Cppm)	" * * (ppm)	Slope function	95* confidence limit
		Upper (ppm)	Lower (ppm)				
24	1.015	1.324	0.778	0.468	2.175	2.157	1.305
48	0.750	1.005	0.560	0.295	1.950	2.571	1.340
72	0.554	0.698	0.440	0.282	1.072	1.950	1.260
96	0.482	0.606	0.384	0.272	0.851	1.768	1.256

*See compoiition in Table 1.

for DDVP and malathion respectively on *Saccobranchus fossilis*. Their results proved that malathion is 2-3 times more toxic to fishes than DDVP. Pal (1983) reported 1.7 ppm and 12.9 ppm of DDVP as LC_{50} and LC_{100} at 48 hr for *Tilapia mossambica*. According to Sailalha *et al.* (1981), the commercial grade malathion was 16.8 times more toxic than the technical grade malathion on *Tilapia mossambica*. In the present bioassay study 0.75 ppm of commercial grade DDVP was found as 48 hr LC_{50} for *Liza parsia*. Studies on acute toxicity of DDVP for brackishwater teleosts are not available hence data could not be compared with other results.

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