Changes in Oxygen Uptake in Mullet, *Liza parsia* (Hamilton-Buchanan) Exposed to Dichlorvos

B.C.Mohapatra and A.Noble
Central Marine Fisheries Research Institute, Cochin - 682 031, India

For acute study on oxygen consumption *Liza parsia* were exposed 96 h to 0.482 ppm of organophosphate insecticide, Dichlorvos 76% (96 h LC_{50} value) and for sublethal effects to 1/5, 1/10 and 1/15th of it for 15, 30 and 45 days. Initially the consumption of oxygen increased. But it was followed by decrease in acute experiment. In sub-lethal exposures the oxygen consumption remained high without decrease. However, the increase was higher in lower concentrations. The experiments were conducted in a brackishwater medium of salinity 10.0 ± 1.0‰, temperature 27.5 ± 1.5 °C and pH 6.0 ± 0.5.

Pesticides wherever applied find their way to the water system. They are known to affect adversely the physiology of the fishes and even cause mass mortality (Saunders, 1969; Holden, 1973; Konar, 1981). Although organophosphate pesticides (OPP) are highly toxic they are not as persistent as chlorinated hydrocarbons. Hence they are extensively being used in forestry, agriculture and public health. The water soluble organophosphate insecticide "Dichlorvos 76%" (brand name "Nuvan") is widely used in Kolleru region of Andhra Pradesh for control of *Lernea and Argulus* (Muthu *et al.*, 1988). But its after effects are not known. In this investigation an attempt was made to study the oxygen consumption of *L. parsia* to "Dichlorvos 76%" toxicity and to evaluate the lowest concentration which can be recommended to the aquaculturists for safe use.

Materials and Methods

L. parsia of 85-120 mm size were used as test animals. The commercial grade "Dichlorvos 76%" was used as the toxicant. Static bioassay method (Reish & Oshida, 1987) was used for toxicity study and the data obtained from experiments were processed by probit analysis on computer for determination of LC_{50} value.

The 96h LC_{50} value was used for acute toxicity and 1/5, 1/10 and 1/15th of it for chronic exposures. All experiments were conducted in triplicate with simultaneous controls. In acute toxicity studies the test media were not renewed and the animals were not fed. In chronic experimental studies the animals were fed once a day with pellet feed and half of the medium was changed once in two days. Ten fishes were exposed in each experimental tank holding 40 l of well aerated medium. The medium used had a salinity of 10.0 ± 1.0‰, temperature 27.5 ± 1.5°C and pH 6.0 ± 0.5.

In acute experiment, one specimen each, from each tank was taken for oxygen consumption estimation after 24, 48, 72 and 96 h. In chronic studies, the test organisms removed from control and one tank of each concentration, after 15 days of exposure, were put in respirometer for estimation of oxygen consumption. This process was repeated after 30 and 45 days.

In respirometer, water of same quality was used to avoid stress on the experimental animals. Utmost care was taken to avoid stress while handling the fishes. To recover them from the effects of handling if any, they were kept in respirometer for two hours without any distrubance. Dissolved oxygen in water samples collected just before and after experiment from respirometer were estimated by using unmodified Winkler's method. After each ex-

periment the individual weight of fishes was recorded.

The oxygen consumption of fishes was calculated using the formula:

$$(\text{Initial } O_2 - \text{Final } O_2) \times \frac{\text{Water vol in ml}}{1000 \text{ ml}} \times \frac{1000 \text{ g}}{\text{wt. in g of fish}} \times \frac{60 \text{ min}}{\text{time in min}}$$

The values were expressed in mg/kg body wt/h

Results and Discussion

The LC_{50} value was found to be 0.482 ppm for 96 h by probit analysis.

Brafield and Matthienssen (1976) observed the oxygen uptake to rise and become extremely erratic in the beginning and then decline as death approaches. In the present study, oxygen consumption in acute experiment (Table 1) is similar. But the possible reasons are not known.

Table 1. *Variation in oxygen consumption during acute exposure*

Exposure period,h	Control value in mg/kg body wt/h	Exposure value in mg/kg body wt/h	% variation from control
0	383.3 ± 25.7	383.3 ± 25.7	0
24	397.0 ± 15.6	445.0 ± 15.0	+12.30
48	433.2 ± 15.6	446.4 ± 19.3	+3.06
72	462.6 ± 21.8	407.5 ± 35.4	-11.91
96	484.6 ± 41.2	396.2 ± 14.5	-18.24

Note: Control without feed

Increased oxygen uptake was observed in sockeye salmon exposed to sub-lethal concentration of bleached draft mill effluent-BKME by Davis (1973) who indicated that the arterial oxygen tension declined rapidly increasing the oxygen uptake through gills to maintain equilibrium. Sastry & Siddiqui (1983) reported high levels of lactic acid and haemoglobin in the blood of *Channa punctatus* chronically exposed to endosulfan. According to them, stress increases the lactic acid which decreases the pH probably causing high heamoglobin. High haemoglobin content enhances the oxygen carrying capacity of the blood. The fish therfore exhibits increased respiratory movements. In a related study, higher acid phosphatase content was observed in the blood serum of *L. parsia* chronically exposed to "Nuvan" (Mohapatra & Noble, MS). Similarly the oxygen consumption also was high. The oxygen consumption at higher concentration was lower than those in lower concentration in *Anabas testudineus* chronically exposed to lindane (Bakthavathsalam & Reddy, 1983). Similar results were obtained at present (Table 2). Owing to the physiological stress on fish even at the lowest concentration of 1/15th 96 h LC_{50} assayed now it cannot be suggested to the aquaculturists for direct application, but may be recommended for treatment as bath. Further experiments to find a safe level are needed.

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Table 2. *Variation in oxygen consumption during chronic exposures*

Exposure period, days	Control value in mg/kg body wt/h	1/15th 96 h LC50		1/10th 96 h LC_{50}		1/5th 96 h LC_{50}	
		O_2 consumption in mg/kg body wt/h	% variation from control	O_2 consumption in mg/kg body wt/h	%variation from control	O_2 consumption in mg/kg body wt/h	%variation from control
15	411.7±34.3	442.2±26.4	+7.41	449.3±45.8	+9.13	437.8 ± 37.9	+6.34
30	446.0±40.6	525.6±47.9	+17.85	472.3±34.7	+5.90	485.7 ± 17.2	+8.74
45	488.5±36.8	594.7±27.0	+21.74	550.7±38.1	+12.73	525.3± 45.4	+7.47

Note: Control with feed

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