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Relative toxicity of Bifenthrin and Carbosulfan Fresh water fish *Gara mullya* (sykes)

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ABSTRACT

Toxicity tests have been found to be useful to provide answers to the human curiosities i.e relative toxicity of different toxicants to test species or relative sensitivity of species to different toxicants. In present investigation, the toxicity tests of bifenthrin and carbosulfan in freshwater fish *Gara mullya* (sykes) are carried out. The LC_{50} values for 24, 48, 72 and 96 hours exposure to Bifenthrin are 1.5538 ppm, 1.4811 ppm, 1.3240 ppm and 1.2537 ppm and for Carbosulfan are 13.6144 ppm, 11.0255 ppm.8.9227 ppm and 6.9807 ppm respectively. Bifenthrin is more toxic carbosulfan.

Key words: Acute toxicity tests, *Gara mullya*(sykes), Bifenthrin, Carbosulfan

INTRODUCTION

The pesticides and related chemicals that originates from human activity or agricultural farming are discharged directly or indirectly into the receiving waters. The wide spread use of pesticides not only brought adverse effects on agro ecosystems but also cause alteration in physiological processes of non target organisms. The movement of pesticides into surface and groundwater is well documented. Bifenthrin [2-Methyl-3-phenylpheny l)methyl (1S,3S)-3-[(Z)-2chloro-3,3,3-trifluoroprop-1-enyl]-2,2dimethyl cyclo propane-1-carboxylate] is a third-generation synthetic pyrethroid insecticide characterized by strong environmental persistence and high insecticidal activity (Mokry and Hoagland, 1989). Though they have contributed considerably to human welfare, their adverse effects on non-target organisms are significant (John, 2007; Hazarika and Das, 1998). Hill, 1985; Sibley and Kaushik, 1991 reported contamination of surface waters by pesticides used in agriculture is a problem of worldwide importance.

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Carbosulfan, a benzofuranyl methyl carbamate pesticide, has been widely used in agriculture and is reported to be very effective against pyrethroid resistant mosquitoes. In many countries, large scale mortality of fishes has been recorded due to pesticides in water bodies as pollutants. They produce many physiological changes in fresh water organisms by influencing the activities of several enzymes. Fishes have great nutritional significance and their intoxication by pesticides reduces their nutritive value. Pesticides reaching water bodies manifest their toxic effect not only in the aquatic organism but also ultimately affect human beings through aquatic food source (Sahai, 1992). The toxicity study is essential to find out toxicant limit and safe concentration, so that there will be minimum harm to aquatic fauna in near future. Toxicity tests have been found to be useful to provide answers to the human curiosities i.e. relative toxicity of different toxicants to test species or relative sensitivity of species to different toxicants. In present investigation, the toxicity tests of bifenthrin and carbosulfan in freshwater fish *Gara mullya* (sykes) are carried out.

MATERIAL AND METHOD

Gara mullya used in the present investigation ranging in length 9-10 cm and weight 5-7 grams were collected from Bhavare dam of Navapur Taluka, District Nandurbar. They were acclimatized to the laboratory condition for ten days. During acclimatization period the fishes were fed with commercially available

standard palletized feed. Aeration was provided. Physicochemical parameters of water used for experimentation were studied by method given in APHA and AWWA (1985). The healthy looking fishes of approximately equal weight 5-7 gm and length 9-10 cm were selected for experimentation. Ten fishes of each group were exposed to different concentrations of Bifenthrin and carbosulfan in water troughs containing ten litres of water. The fishes which fails to respond even to strong tactile stimuli, were considered dead and removed immediately. The resulting mortality was recorded in the range of 10% to 100% for each concentrations for the duration of 24, 48, 72 and 96 hours. The experiment was repeated thrice and the arithmetic mean of the three experiments at each concentration was taken to express the result of mortality with respect to the period of exposure. The data collected was then analysed statistically by means of the Probit analysis method (Finney, 1971). LC_{50} and LC_{10} values were calculated for 24, 48, 72 and 96 hours. The variance, fiducial limits, chi square test, lethal dose were also calculated. The safe concentration for the pesticides Bifenthrin and Carbosulfan were calculated by method described by Hart *et.al*.(1945).

RESULTS

The results of LC_{10} , LC_{50} and Safe concentration are summarized in Table 1 and Figure-1.

Figure-1. Comparison of LC10, LC50 and safe concentration at different exposure periods of Bifenthrin

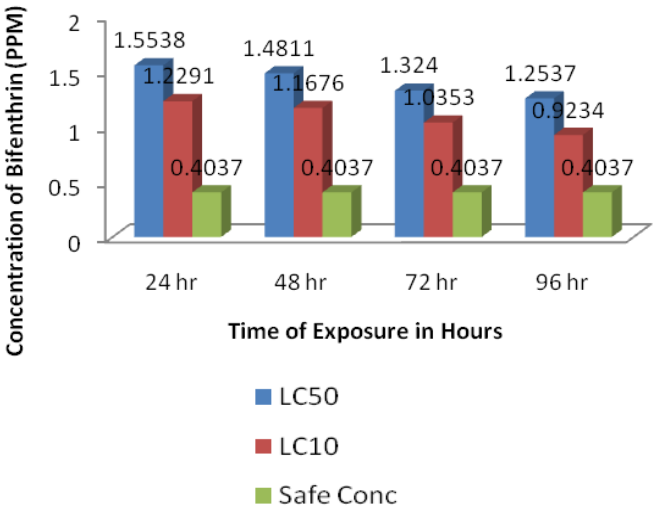


Table-1. Comparision of LC_{10} , LC_{50} and Safe concentration values of Bifenthrin and Carbosulfan to fresh water fish *Gara mullya* (Sykes)

Name of Pesticide	Time of Exposure	Regression Equation $Y = \bar{Y} + b(X - \bar{X})$	LC_{10} value (PPM)	LC_{50} value (PPM)	Safe Conc. (PPM)
Bifenthrin	24 Hrs	Y = 12.5853 X + 2.5904	1.2291	1.5538	0.4037
	48 Hrs	Y = 12.4142 X + 2.8823	1.1676	1.4811	
	72 Hrs	Y = 11.9946 X + 3.5369	1.0353	1.3240	
	96 Hrs	Y = 9.6434 X + 4.0529	0.9234	1.2537	
Carbosulfan	24 Hrs	Y = 6.2781 X – 2.1195	8.5074	13.6144	2.1693
	48 Hrs	Y = 4.5632 X + 0.243	5.7936	11.0255	
	72 Hrs	Y = 4.1019 X + 1.1009	4.3461	8.9227	
	96 Hrs	Y = 2.8091 X + 2.6293	2.4417	6.9807	

Table-2. Comparison of Variance, Chi Square, Fiducial limits, Lethal Dose and Safe Concentration values of Pesticides Bifenthrin and Carbosulfan to Fresh water fish *Gara mullya* (Sykes)

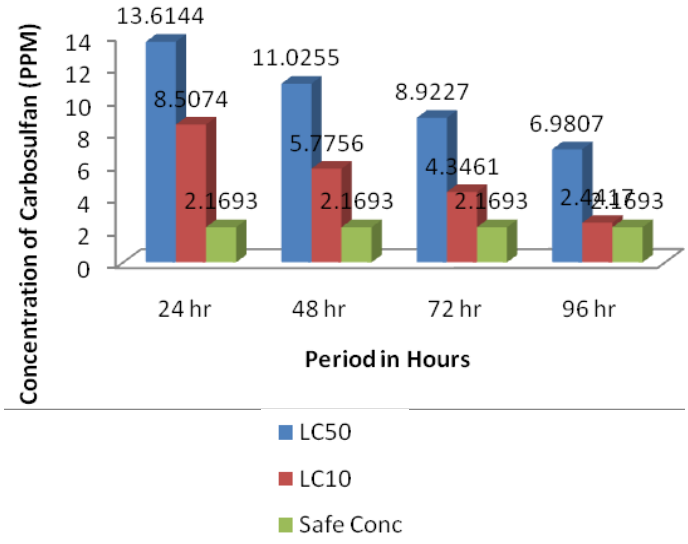
Name of Pesticide	Time of Exposure	Variance	χ^2 value	Fiducial limits		Lethal Dose in PPM	Safe Conc 'c' in PPM
				m_1 PPM	m_2 PPM		
Bifenthrin	24 Hrs	0.000190	0.5507	0.1646	0.2182	37.2912	0.4037
	48 Hrs	0.000213	0.1357	0.1422	0.199	71.0928	
	72 Hrs	0.000337	0.4331	0.0861	0.1577	95.328	
	96 Hrs	0.000321	0.119	0.0632	0.1332	120.3552	
Carbosulfan	24 Hrs	0.0050	0.3303	0.9951	1.2729	326.7456	2.1693
	48 Hrs	0.0059	0.3618	0.8909	1.1939	529.224	
	72 Hrs	0.0006	0.1965	0.9027	0.9983	642.4344	
	96 Hrs	0.0089	0.6857	0.6591	1.0287	670.1472	

The LC_{10} and LC_{50} values were calculated for 24, 48, 72 and 96 hours by the method described by Finney (1971) and simplified by Busvine (1971).

The results of Variance, Chi Square, Fiducial limits, Lethal Dose and Safe Concentration of Pesticides Bifenthrin and Carbosulfan to fresh water fish *Gara mullya* (Sykes) are summarized in Table-2 and Figure-2

It is evident from the result that fresh water fish *Gara mullya* was found to be highly sensitive for Bifenthrin (Synthetic pyrethroid) than Carbosulfan (Carbamate). The behavioural changes were most prominent in Bifenthrin than Carbosulfan.

Figure-2. Comparison of LC50, LC10 and safe concentration at different exposure periods of Carbosulfan



DISCUSSION

The living world in water is currently under threat due to continuous addition of toxicants in aquatic bodies. Indiscriminate use of pesticides by human activities to control different pests causes high risk to non- target organism's especially aquatic life forms. The contamination of surface waters by pesticides used in agriculture is a problem of worldwide importance (Hill, 1985; Sibley and Kaushik, 1991). The evaluation of pollutant is the necessary step as there are adverse effects of pollutants on no target animals. Jothi and Narayan, 1999 reported long term effect of pesticidal poisoning and incidence of poisoning of fish and other aquatic life forms. Determination of LC_{50} value provides fundamental data to design more complex disposal model. Worldwide investigators reported effect of pesticides on aquatic organism. (Cripe, 1994; Shanmugam *et al.,* 2000). In the present investigation fresh water fish Gara mullya (Sykes) showed increased mortality with the increased concentration of Bifenthrin and Carbosulfan. It is again estimated that bifenthrin is more toxic than carbosulfan.

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Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

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