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ORIGINAL ARTICLE

TOXICITY EVALUATION OF DIMETHOATE TO FRESHWATER FISH RASBORA DANICONIUS (HAMILTON)

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Abstract:

Static bioassay of the toxicity of dimethoate pesticide against the freshwater fish Rasbora daniconius was conducted in the laboratory. The LC 50 of values of dimethoate to the freshwater fish Rasbora daniconius at various exposure periods are 11.32, 10.69, 10.69 and 9.97 ppm for 24, 48, 72 and 96 hours respectively. From the present study it shows that the freshwater fish Rasbora daniconius is more susceptible to dimethoate toxicity as the LC 50 value for this organophosphate is less than other reported fish species. These results indicate that dimethoate to the fish caused toxic effects.

KEYWORDS:

LC 50 dimethoate, Rasbora daniconus,

INTRODUCTION

Application of pesticide has contributed greatly in enhancing agricultural yields and also for the control of insecticides diseases. Organophosphate compounds comprise insecticides currently used worldwide for agricultural and household's application. Fish serves as a bioindicator species as it responds with great sensitivity to changes in the aquatic environment and thus has an important role in the monitoring of water pollution. The necessity of determining the toxicity of substances to commercially aquatic forms at the lower level of the food chain has been useful and accepted for the water quality managements. Several studies have been conducted in assessing the toxicity of pesticide to the aquatic biota especially fishes (Verma et.al, 1982, Ravikrishanan et.al 1997, Vasit and Patil, 2005, Susan Anita, et.al 2010). The purpose of this investigation was to evaluate the toxicity of an organophosphate pesticide dimethoate for the Rasbora daniconius. The test fish Rasbora daniconius was selected because it is hardy, radialy available, easy handle and can be kept alive for longer duration in aquaria. This is a common edible fish form Latur district freshwater fish of great economic and forms important species in many water resources mainly ponds, river and reservoir. The selected pesticide dimethoate is selected for the study because it is widely used the farmers in agricultural lands for improving the crop.

MATERIALS AND METHODS

Live & healthy Rasbora daniconius fishes were collected from their habitate. Fishes were checked for injury & diseases & them washed in 1 % Kmno4 solution for 5 Min. Acclimatise that is fishes were swim freely & feeding well of two weeks in glass aquaria whose capacity is 300 liter water.

After two week acclimatization 100 adult, healthy, disease free fishes were selected for the experiment. The average length & weight of fishes was 20-25 ± cm & 100 ± gm respectively.

Each 10 groups of fishes were introduced in six different glass aquaria whose capacity is 300 liter

filled with 40 liter water to each aquaria. One aquarium is used as a control & other five is used as a experimental. Fishes were dose not fed during experimental period.

Before conducting experiment physico-chemical analysis of water was to be done by standard methods published in A.P.H.A. (1992) which is given below

PH	=	7.97
Temperature	=	30.10 C
Total dissolve solid	=	250 mg/ lit
Dissolved oxygen	=	6.4 mg/ lit
Hardness	=	75 mg/ lit
CO2	=	1.02 mg/ lit
Alkalinity	=	165 mg/ lit
Chlorides	=	45 mg/ lit

Dimethoate is used for calculating median lethal (LC 50) value at 96 hrs. 3, 4, 5, 6, 0.7, 8, 9, 10, 11 and 12 ppm. Dimethoate is dissolved in ten different experimental glass aquaria. These conc. of dimethoate is based on some previous research work was done in different aquatic animals by the different researchers.

During experimental period there is no mortality was observe in control groups of fishes. In experimental groups of fishes each 24 hrs. mortality record is tabulated. (Table:-1) The exposure & control experiment were replicates four times.

Determine LC 50 at 96 hrs through static bioassay (acute toxicity) probit value vs. conc. of toxicant and D & B methods with 95% confidence limit.

RESULTS AND DISCUSSION

In the present investigation the LC 50 of dimethoate exposed to the freshwater fish Rasbora daniconius for different exposure periods that is 24, 48, 72 and 96 hours 11.32, 10.69, 10.69 and 9.97 respectively. The LC 50 values of different exposure are shown in table no1 to 4.

K. Pugazhendy, et.al. Studies on acute toxicity of cypermethrin and its impact on biochemical alternation in the freshwater fish cirrihinus mrigala and observed that the LC 50 for selected concentration was ranging from 24, 48, 72 and 96 hours values were 300.11, 250.81,150.02 and 100.04 respectively. The LC 50 vales of dimethoate for the freshwater fish H. fossilis at 24, 48, 72 and 96 hours were 15.92, 13.42, 12.39 and 11.34 mg/l respectively observed by Anoop kumar srivastava (2010) similarly Shukla(1995) reported the LC 50 value of dimethoate for Colisa fasciatus as 13.0, 11.4, 10.0 and 9.3 mg/l respectively. The 96 hours LC 50 value for the dimethoate to the fish Cyprinus carpio has been reported as 26.11 mg/l. In the present study the results are correlated by by the above authors the 96 hours LC 50 of dimethoate to the freshwater fish Rasbora daniconius were 9.97 mg/l it is difficult to the compare the toxicity of individuals insecticides to different species of fish. In the present investigation the LC 50 of dimethoate is 9.97 mg/l to the freshwater fish Rasbora daniconius it may be due to the influences by several factor like temperature, pH, and dissolved oxygen content of water in aquaria. The rise in temperature reduces the solubility of oxygen in water it affect the mortality of fishes in aquarium.

CONCLUSION

In the present investigation it seems that the freshwater fish Rasbora daniconius at 96 hours LC 50 were 9.97 mg/l it is more susceptible to dimethoate toxicity it is less than other reported fish species. These results indicate that the dimethoate exposure to the fish caused toxic effects. Further such fish species the dimethoate is accumulated in the body it many the affect the human being after consuming the fish as food.

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Table 1 Showing Absolute and cumulative mortalities at 24 hrs. of fish Rasbora daniconius exposed to dimethoate

Sr. No.	Conc.(in ppm)	Log Conc.	Fish Exoposed	Absolute mortality		Cumulative mortality		% Kill	Probit kill
				Live	Dead	Live	Dead		
1	1	3.0	0.4771	10	00	55	00	00	00
2	2	4.0	0.6021	10	00	45	00	00	00
3	3	5.0	0.6990	09	01	35	01	2.77	3.72
4	4	6.0	0.7782	08	02	26	03	10.34	4.16
5	5	7.0	0.8451	07	03	18	06	25.00	4.48
6	6	8.0	0.9031	05	05	11	11	50.00	5.00
7	7	9.0	0.4542	03	07	06	18	75.00	5.52
8	8	10.0	0.0000	02	08	03	26	89.65	5.84
9	9	11.0	0.0414	01	09	02	35	95.59	6.28
10	10	12.0	0.0792	00	10	00	45	100	8.09

Log LC50 = log A + 50 – a/ b-a × log 2
= log 8.0 + 50 – 25 × 0.3010
75-25
= 0.9031 + 0.5 X 0.3010
= 0.9031 + 0.1505
Antilog of = 1.0536
Log LC50 = 11.32 ppm

Table 2 Showing Absolute and cumulative mortalities at 48 hrs. of fish Rasbora daniconius exposed to dimethoate.

Sr. No.	Conc.(in ppm)	Log Conc.	Fish Exposed	Absolute mortality		Cumulative mortality		% Kill	Probit kill
				Live	Dead	Live	Dead		
1	3.0	0.4771	10	10	00	53	00	00	00
2	4.0	0.6021	10	10	00	43	00	00	00
3	5.0	0.6990	10	09	01	33	01	2.77	3.72
4	6.0	0.7782	10	08	02	24	03	10.34	4.16
5	7.0	0.8451	10	07	03	16	06	25.00	4.48
6	8.0	0.9031	10	05	05	09	11	50.00	5.00
7	9.0	0.4542	10	03	07	04	18	75.00	5.52
8	10.0	0.0000	10	01	09	01	27	89.65	6.28
9	11.0	0.0414	10	00	10	00	37	95.59	8.09

Log LC50 = log A + 50 – a/ b-a × log 2
= log 8.0 + 50 – 27.27 × 0.3010
75-27.27
= 0.9031 + 0.4168 X 0.3010
= 0.9031 + 0.12546
Antilog of = 1.0286

Log LC50 = 10.69 ppm

Table 4 Showing Absolute and cumulative mortalities at 96 hrs. of fish Rasbora daniconius exposed to dimethoate

Sr. No.	Conc.(in ppm)	Log Conc.	Fish Exposed	Absolute mortality		Cumulative mortality		% Kill	Probit kill
				Live	Dead	Live	Dead		
1	3.0	0.4771	10	10	00	41	00	00	00
2	4.0	0.6021	10	08	02	31	02	6.06	4.16
3	5.0	0.6990	10	07	03	23	05	17.85	4.48
4	6.0	0.7782	10	06	04	16	09	36,00	4.75
5	7.0	0.8451	10	05	05	10	14	58.33	5.00
6	8.0	0.9031	10	03	07	05	21	80.76	5.52
7	9.0	0.4542	10	02	08	02	29	93.54	5.84
8	10.0	0.0000	10	00	10	00	39	100.0	8.09

$$\text{Log LC50} = \log A + \frac{50 - a}{b - a} \times \log 2$$

$$= \log 7.0 + \frac{50 - 36.00}{75 - 36.00} \times 0.3010$$

$$= 0.8451 + 0.4168 \times 0.3010$$

$$= 0.8451 + 0.12546$$

Antilog of = 1.0286

Log LC50 = 10.69 ppm

Table 4 Showing Absolute and cumulative mortalities at 72 hrs. of fish Rasbora daniconius exposed to dimethoate

Sr. No.	Conc.(in ppm)	Log Conc.	Fish Exposed	Absolute mortality		Cumulative mortality		% Kill	Probit kill
				Live	Dead	Live	Dead		
1	3.0	0.4771	10	10	00	45	00	00	00
2	4.0	0.6021	10	09	01	35	01	2.77	3.72
3	5.0	0.6990	10	08	02	26	03	10.34	4.16
4	6.0	0.7782	10	07	03	18	06	25.00	4.48
5	7.0	0.8451	10	05	05	11	11	50.00	5.00
6	8.0	0.9031	10	04	06	06	17	73.91	5.52
7	9.0	0.4542	10	02	08	02	25	92.59	5.84
8	10.0	0.0000	10	00	10	00	35	100.0	8.09

$$\text{Log LC50} = \log A + \frac{50 - a}{b - a} \times \log 2$$

$$= \log 7.0 + \frac{50 - 25.00}{73.91 - 25.00} \times 0.3010$$

$$= 0.8451 + 0.4168 \times 0.3010$$

$$= 0.9031 + 0.15388$$

Antilog of = 0.99898

Log LC50 = 9.972 ppm