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Effect of fenitrothion pyrethroids on the respiratory rate of Singhi, *Heteropneustes fossilis* (Bloch)

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Abstract- While using several insecticides to control insect pests especially hemipterans in the agricultural field (Paddy), it has been found many pests become resistant to the common pesticides - deltamethrin (a pyrethroid) normally used to treat the crops for making them insect free. However, the pond also provides a good shelter to the bottom dwelling fishes like Singhi, *Heteropneustes fossilis* (Bloch) which are concomitantly exposed to the pesticides being used for insect control.
In the present article the effect of a substitute pyrethroid-fenitrothion in place of deltamethrin on the respiratory rate of *H.fossilis* has been observed as because many of the farmers are trying this insecticide as safe to control the insect pests. Befittingly, the researchers are supposed to investigate the impact of safer variant on the coexisting fauna at like fishes. The effect of this pyrethroid on the respiratory function of the selected fish has been observed to be less stringent and lethal because its LC_{50} & LD_{50} values are relatively low. In the normal fishes (control) per minute opercular beat as index of respiratory function has been found to be 30 while fenitrothion treated fishes at 10%, 20% & 30% concentration (weight/ volume in distilled water) for 15 days duration exhibited the increased opercular beat to 34, 39 & 52 per minute respectively. Higher concentration of fenitrothion could push the opercular beat to 52 per minute only as compared to 68 in case of Deltamethrin treatment. Gradual increasing trend by 20-30% and sharp peak of opercular beat have also been recorded in 30 and 45 days of exposure leading to high rate of casualty (in 30% concentration and 45 days of exposure).

Keywords : fenitrothion, pyrethroid, low toxicity, LC_{50} value-41.66 & LD_{50} value-8.33, less respiratory stress, *H.fossilis*

INTRODUCTION

The respiratory function in fish is morphologically the function of pulsatory alternative opening and closing of mouth with related opercular movement. Hence, the rate of opercular beat may be taken as the quantitative parameter to evaluate the respiratory function in both normal (control) and insecticides exposed (treated) in such cases. Recording the rate of opening and closing of mouth in conjunction with the per unit time opercular beat, although is preliminary protocol to evaluate the respiratory function, yet it is sometime misreading and unreliable as many of the fishes may stream in water current through nostrils and side clefts of oral aperture (cartilaginous fishes) to import the dissolved oxygen without opening and closing of mouth.[1-3]

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The physiological profile of consuming dissolved oxygen at cellular level during metabolic process linked with rate and efficiency of transportation of oxyhaemoglobin through RBC in the bold of fishes. Significantly depend on the rate of opercular beat, hence both these parameters directly impact each other. Therefore, in the present investigation ample focus has been given on the accurate counting of opercular beat per unit time in the test fishes both in control and treated conditions.[4-6]

MATERIAL & METHOD

35 adult fishes (*Heteropneustes fossilis*) irrespective of sex consideration weighing 200-225 gm were collected in the control tank in the lab from the local market of Madhepura having same shape and size. Keeping 5 fishes in the reserve tank as control 30 fishes were distributed in the group of 5 which were transferred to six different tanks of experimental treatment. Three sets of tanks (containing three in each) with 10%, 20% and 30% of fenitrothion concentration marked for 15 days, 30 days & 45 days duration of exposure were installed for experimental observation with respect to altered rate of opercular movement in different concentration and exposure gradient.

The standard rate of opercular beat (OB/OM) was recorded from the fishes of controlled tank and the changed respiratory behavior if any in the treated fishes kept in three sets of tanks were recorded separately in the observation table.

Multiple observations (at least five) for counting of opercular beat per unit time with the help of stop watch and electronic alarm counter (counting machine) were taken to calculate the mean value of opercular beat in the experimental set up and correlate it with the overall respiratory function.

RESULT & DISCUSSION

The present study exposure of fish to sub lethal concentration of fenitrothion in the range of 10%, 20% & 30% with LC50 value- 41.66 & LD50 value- 8.33 for 15, 30 & 45 days caused gradual but significant alterations in opercular beat being the index of respiratory function of the fish, *Heteropneustes fossilis*. The alterations in the rate of per minute opercular beat were found to be asphyxiating for the fishes in tank no. 3 at 30% concentration of fenitrothion with 45 days exposure. The effect of deltamethrin on the respiratory function of this fish as observed in previous investigation[7] was more stringent as the opercular beat got elevated to 68 beats per minute in 10% concentration only for 15 days duration. Therefore, the LC50 & Ld50 values of the previous insecticides deltamethrin were also high resulting into high degree of casuality of the fishes in the agricultural crop field.

In order to protect the life of the Singhi fish which is a delicacy food of the area and also to keep the crop free from the attack, lower concentration with mild dose spraying of fenitrothion in recommended for the health and benefit of agricultural crop and all components of the ecosystem.

Table 1.- Gradient of opercular beat per unit time as indicator of respiratory functions in *H.fossilis* treated with 3 different concentration of fenitrothions for 15 days duration

No. of Observations of respiratory function in terms of opercular beat/minute	Control	Altered rate of opercular beat in different concentration of fenitrothion treated fishes			LC50	LD50
		10%	20%	30%		
1	30	35	41	58	41.66	8.33
2	30	33	38	45		
3	30	34	39	62		
4	30	35	38	51		
5	30	33	39	44		
Mean value	**30**	**34**	**39**	**52**		

Table 2.- Gradient of opercular beat per unit time as indicator of respiratory functions in *H.fossilis* treated with 3 different concentration of fenitrothions for 30 days duration

No. of Observations of respiratory function in terms of opercular beat/minute	Control	Altered rate of opercular beat in different concentration of fenitrothion treated fishes			LC50	LD50
		10%	20%	30%		
1	30	39	45	59	**46.66**	**9.33**
2	30	38	44	69		
3	30	36	42	61		
4	30	38	43	59		
5	30	39	46	48		
Mean value	**30**	**38**	**44**	**58**		

Table 3.- Gradient of opercular beat per unit time as indicator of respiratory functions in *H.fossilis* treated with 3 different concentration of fenitrothions for 45 days duration

No. of Observations of respiratory function in terms of opercular beat/minute	Control	Altered rate of opercular beat in different concentration of fenitrothion treated fishes			LC50	LD50
		10%	20%	30%		
1	30	41	47	60	**50.00**	**10.00**
2	30	44	48	59		
3	30	41	45	61		
4	30	43	49	64		
5	30	41	51	56		
Mean value	**30**	**42**	**48**	**60**		

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