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Oxygen Consumption in Anabas Testudineus To Selected Lethal & Sublethal Concentration of Dimethoate and Cypermethrin Individually at Selected Periods

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ABSTRACT

The Fish Anabas testudineus exposed to Lethal & Sublethal Concentration of both pesticides, dimethoate & ciperimethrin for different period of exposures showed frequent surface breaking to engulp ari especially in higher concentrations, reflects the inability of the gills to cope the normal oxygen uptake as in evident by about three fold increase in surface breaking and initial increase followed by decrease after considerable period in opercular beat, also indicates injury to gill tissue.

Keywords :- Anabas testudineus, Dimethoate, Cypermethrin Oxygen Consumption.

INTRODUCTION:-

India is one of the largest & fast growing developing nations.Obviously, the most vital problem before this country is how to feed the never ending growing population. Fish is most important and easily available nutritious food in India. Fish not only provide protein rich and economical source of food especially millions of human being suffering from malnutrition & protein &vitamins but also contains large amount of phosphorus, calcium and other elements.

Oxygen consumption rate in Fish has been considered as an index for denoting the intensity of metabolism (Fry 1957,1971). The metabolic activity of an organism is increased by its oxygen utilization and So, it becomes. Possible to determine " no stress" effects of any toxicant on the organism if we know oxygen utilization rate of that particular organism.

In air breathing Fish,the gas exchange is bimodal & is dependent both on exchange diffusion with water through gills, buccopharynx & skin and with air through air-breathing organs (Johnsen 1970). However, the relative role of gill & air breathing organs during respiration varies from species to species. Hence, any change in normal respiratory surface of the gill would ultimately affeect the oxygen consumption rate.

Recently, pesticide induced changes in respiratory behaviours & metabolic rate of fish have been drown attention of several biologists (Holden 1973, choudhary at al,1993 & kumar 1999) , Rao et al (1983) observed severe damage in the gill leading to hypoxia and finally failure of respiratory mechanism in Tilapza mossambica exposed to malathion. Any change in the normal respiratory epithilim of the gill would ultimetely affeect the role of oxygen consumption.

Since the effects of lethal & sublethal doses of pesticides particularly organophosphate & pyrethroids on the rate of oxygen consumption in freshwater air brething fish has little been investigated. Where as by studing oxygen utilization rate, it is possible to determine "No stress effect" The oxygen consumption rate in the fish Anabas testudineus exposed to different Lethal &sub – Lethal concentrations of dimethoate (an organaphosphate) and cypermethrin (A synthetic pyrethroid) individually at different period of exposure.

MATERIALS AND METHODS

The oxygen consumption rate of the fish ,Anabas testudineus in normal and toxicants induced conditions were measured in a continuous flow glass respirometer at selected time intervals as per design shown in fig. 1. The fish was introduced in the respirometer, which is connected to a water, toxicant induced water reservoir tank maintaining contant level to maintain the water flow through the respirometer under constant hydrostatic pressure. The water from reservoir tank enters from one side of the respirometer (1/hr) is adjusted with the help of screw clip. The routine oxygen consumption rate of the fish during different condition has been measured by estimating the difference between oxygen content of the in let water (ie. Prior to enter in respirometer, where fish of a known weight was placed.) and the outlet water at a specific time .In each case normal /toxicant induced water was allowed to flow at least 15 minutes through the respirometer containing test fish prior to collection of water of both inlet & outlet for the analysis of their oxygen contents.

The ground water was used for control and water having selected concentration of both dimethoate and cypermethrin individurlly (ie. 0.7^{th},0.5^{th},0.3^{rd} & 0.1 of 96 hrs Lc50 value of respective pesticides) were used for experiments. To study the effect of dimethoate &cypermethrin on the oxygen consumption rate, ten fish were exposed to each selected concentrations and out of this five fish from each concentration were used to measure the oxygen consumption rate at selected periods of exposure.

RESULTS:- The fish, anabas testudineus exposed to different concentrations of dimethoate & cypermethrin (individually), were quite active initially followed by a gradual decrease in their activities. The opercular beat per minute was also increased initially followed by a significant decline depended on concentration & exposure period. The also showed frequent surface breaking to engulp atmospheric air as the number of visit on the water surface was about three times more than the normal condition during 10 minute observations, indicating their avoidance to the toxic environment.

The measurement of oxygen consumption rate of the fish of 3.4 ± 2.8 gm weight group at $27.5 \pm 2.75^{o}C$ in normal and experimental conditions at selected hours of exposure along with O_2 uptake rate /gm.body wt. And per kg body weight (O_2 ml/1/hr/gm and O_2 ml/1/hr/kg body wt.) are summarized in Table-2-1 .

The fish exposed to lethal concentrations i.e 8.46 & 6.04mg/1 dimethoate,showed an initial increase of 14.59 &10.81% in O2 –uptake at 8 hrs of exposure but declined to 20.0% at 24hrs of exposure to 8.46mg/1 concentration &the decline was found statistically significant at 96hrs (30%) with maximam decline at 240hrs of exposure (36.22%), where as, the fish exposed to 6.04mg/1 dimethoate showed an increase up to 13.51% at 24hr. Of exposure followed by a decline which was found statistically significant at 960 hr (28.11%) with maximum at 1440hrs of exposure (41.08%)

Similarly the fish exposed to 47.30 mg/1 cypermethin concentration showed a decrease up to 12.17% at 8hrs of exposure &the decline was found significant at 96 & 240hrs of exposed (25.65 & 38.58% respectively) where as the fish exposed to 33.78 mg/1 cypermethrin, showed slight increase and their O2 uptake rate up to 96hr. Of exposure followed by a decrease which was found statistically significant at 960hrs of exposure(30.49%) with maximum decrease at 1440hr of exposure (43.96%) while the fish exposed to 20.27&6.76 mg/1 cypermenthrin concertration showed a slight decrease at 8hr of exposure, which significantly increased up to 5.60 &1.29% at 96 hrs of exposure followed by a decline which has been found statistically significant at 1440hr of exposure as the decline were recorded to be 34.27 & 29.96% respectively when compared with that of their respective normal values.

Thus the increase/decrease in O2 –consumption rate might be due to capacity of the fish, Anabas testudineus (Koi) to take atmospheric air directly as the fish used to visit water surface to engulp air or due to the formation of mucus on the gill or injury to it might be the reasons for a rapid fall in O2 –uptake rate after a considerable period of exposure to both lethal & sublethal concentration of dimethoate and cypermethrin pesticides. However, changes in the oxygen consumption rate by the individual fish in same concentrations are not of same magnitude and vary a/c to the metabolic activity of the fish.

TABLE ;- Oxygen consumption (Vo_2) rate (mlo_2/hr mlo_2/gm/hr & mlo_2/kg/hr) in Anabas testudineus exposed to selected lethal & sublethal concentrations of Dimethoate & cypermethrin individually at selected period of water temp.27.5± 2.75°C.

Average wt.of fish 30.4± 2.8gm

Hour of Exposure	concentration	Oxygen consumption (VO_2)			
		ml O_2/hr	mlo2/gm/hr	mlo_2/kg/hr	% change AV.Nor
1	2	3	4	5	6
(A)Dimethoate(mg/l)					
8	control	1.91 ± 0.13	0.63± 0.004	62.62± 4.26	
	8.46	2.12± 0.12	0.069± 0.004	69.51± 3.93	14.59
	6.04	2.05± 0.14	0.067± 0.004	67.21± 4.59	10.81
	3.62	1.99± 0.11	0.065± 0.004	65.24± 3.61	7.57
	1.21	2.02± 0.13	0.066± 0.004	66.23± 4.26	9.19
	control	1.80± 0.12	0.059 ±	59.02 ± 3.93	

			0.004		
	8.46	1.27± 0.11	0.042 ± 0.004	41.64± 3.61	-31.35
96	6.04	1.73± 0.13	0.057± 0.004	56.72± 4.26	-6.49
	3.62	1.76 ± 0.12	0.058± 0.004	57.70 ± 3.93	-4.86
	1.21	1.80 ± 0.10	0.059± 0.003	59.02± 3.28	-2.7
	control	1.84 ± 0.13	0.060± 0.004	60.33± 4.26	
	8.46	-	-	-	-
480	6.04	1.45 ± 0.10	0.047± 0.003	47.54± 3.28	
	3.62	1.59± 0.11	0.052 ± 0.004	52.13 ± 3.61	-21.62
	1.21	1.67± 0.10	0.055± 0.003	54.75± 3.28	-14.05
	control	1.77± 0.13	0.058± 0.004	58.03± 4.26	
	8.46	-	-	-	-
	6.04	1.09± 0.10	0.036 ± 0.003	35.74 ± 3.28	-41.08
1440	3.62	1.17± 0.12	0.038 ± 0.004	38.36 ± 3.93	-36.76
	1.21	1.28 ± 0.10	0.42 ± 0.003	41.97 ± 3.28	-30.81

		Oxygen consumption (VO_2)			
Hour of Exposure	concentration	ml O_2/hr	mlo2/gm/hr	mlo_2/kg/hr	% change AV.Nor
1	2	3	4	5	6
(B) cypermethrin(µg/l)					
	control	1.80± 0.11	0.059 ± 0.004	59.02 ± 3.61	-
8	47.30	1.62± 0.12	0.059 ± 0.004	53.11 ± 3.93	-1271
	33.78	1.84 ± 0.11	0.053± 0.004	60.33± 3.61	-0.86
	20.27	1.79 ± 0.12	0.060± 0.004	58.69 ± 3.93	-3.56
	6.76	1.77± 0.13	0.058± 0.004	58.03± 4.26	-4.63
	control	1.86 ± 0.13	0.061 ± 0.004	60.98 ± 4.26	-
	47.30	1.38 ± 0.11	0.045± 0.004	45.24 ± 3.61	-25.65
96	33.78	1.91 ± 0.12	0.063 ± 0.004	62.62± 3.93	2.91
	20.27	1.96± 0.10	0.064 ± 0.004	64.26 ± 3.28	5.60
	6.76	1.88 ± 0.13	0.062± 0.003	61.64± 4.26	1.29
	control	1.91 ± 0.12	0.063 ±	62.62 ± 3.93	-

			0.004		
480	47.30	-	-	-	-
	33.78	1.58± 0.13	0.052 ± 0.004	51.80± 4.26	-14.87
	20.27	1.66 ± 0.12	0.054± 0.004	54.43± 3.93	-10.56
	6.76	1.72± 0.13	0.056± 0.004	56.39± 4.26	-7.33
1440	control	1.83 ± 0.12	0.060 ± 0.004	60.00± 3.93	
	47.30	-	-	-	-
	33.78	1.04 ±0.10	3.34 ± 0.003	34.10± 3.28	-43.96
	20.27	1.22 ±0.11	0.040± 0.004	40.00 ± 3.61	-34.27
	6.76	1.30 ± 0.10	0.043± 0.003	42.62 ± 3.28	-29.96

DISCUSSION:-MAZIO & BABIKER (1975) have stated that dissolved oxygen content in water can influence the breathing pattern of the fish and consequently the oxygen uptake rate may change. LEE et al (1972) has reported a progressive but steady decline in oxygen uptake rate of the fish exposed to organophosphate pesticides.

Reddy et al (1977) observed an elevation of oxygen uptake during first 2hrs of exposure followed by a decrease in subsequent hours to desyston in colisa latia.

In the present study the fish Anabas testudineus exposed to different concentrate showed an initial increase in their O2 –uptake rate, but after a considerable time i.e after 8hr. Of exposure, the O2-uptake gradually declined in lower concentration, but sharply in lethal concentration as the decline was statistically significant at 96hrs of exposure with maximum decline at 240hr of exposure in 8.46 mg/1 concentrate where as, the decline was found significant at 960 hr of exposure with maximum decrease at 1440 hr of exposure to 3.62 & 1.21 mg/1 dimethoate concentration where compared with that of their normal values.

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