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Effect of permethrin and cypermethrin on oxygen consumption of a fresh water fish, *H. fossilis*

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Abstract
Fish provide a high caloric diet to a large number of people all over the world but indiscriminate use of these pollutants has reduce fish growth synthetic pyrethroids may decrease nutritive value, as well as, there compounds may also rich to human body through fish flesh and will cause toxicity to human being also. Two sources of oxygen are potentially available to fishes while most use only dissolved oxygen; others have the ability to obtain oxygen from the atmosphere. All breathing fishes also use dissolved oxygen to some extent, under toxic condition, the oxygen supply becomes deficient and number of poisons become more toxic increasing the amount of poison being exposed to the animal. The fish breathe more rapidly and the amplitude of respiratory movement will increase. The result of the present study suggest that the altered rates of respiration of fresh water fish may serve as a rapid biological monitor of the pesticides exposure to important components of fresh water fish community.

Keywords: Bimodal breathing, sublethal concentration, homeostatic mechanism, oxygen consumption

Introduction
Fishes or any living being need food in order to stay alive and for the perpetuation of its own race. The complex process whereby this food is converted into heat and energy and used for growth and repair of tissues is turn metabolism. Bimodal air breathing fishes are noted for their resistance to environmental stress and aquatic hypoxia. A number of attempts have been made earlier to relate respiration two ecology in Indian air breathing fishes. Respiratory strategies appear two have important implications for many other aspects of a species physiology behaviour and ecology reported that respiratory rhythm apparently originates in a diffuse respiratory pattern generator in the reticular formation and these remain functional under anaesthesia.

Research Methodology
After the acclimatization of the fish in laboratory condition for ten days the animal of same size of body weights (20-25g) were taken up for experimentation.
Determination of VO2-the concentration of dissolved oxygen in water sample were determined by Winkler's volumetric method (welch 948), To study the effect of cypermethrin and permethrin on VO $_2$ The whole experimentation was divided into 2 stets with a control for each maintained in fresh aerated tap water. Feeding was stopped at least 24 hours before measuring the rate of oxygen consumption. The VO 2 has been expressed in cc/kg/h. Fishes were introduced in the respirometer in continuously flowing cypermethrin and permethrin ranging from 0.00015 to 0.00025 ppm concentration and VO 2 was measured at 12 h, 24 h, 36 h, 48h, 72 h, and 96 h interval. The details of the method used in the determination of bimodal oxygen consumption. The oxygen uptake through gills was calculated from the difference between the oxygen levels of the ambient water in the respirometer before and after the experiment and the volume of water in the respirometer. Oxygen consumption from air was measured 2 use of the combined gas law equation and vapour pressure

The calculation was made by A+N.T.P. = Or V1 =

Where, P 1 = Normal atm. pressure (i.e. 760mmHg)
T1 = Absolute temp. Or Kelvin temp. (i.e.27.3)

incoherent speech and delirium, and even now nearly 2 - 4% of the total Hg discharged by the Chisso factory between 1932 and 1968 remains in the bay sediments with flow access to Yatsushiro Sea [8, 9]. Recent two decades witnessed enormous number of studies in this field, pointing to the fact that consumption of fish could expose humans to dangerous levels of methyl mercury accumulation [10].

The risk is not in how much fish is eaten, but in which species

P2= Atm. pressure – Vapour pressure of water

V2= Volume of O 2consume (as read by the manometer)

T2= Temp. of air +Kelvin temp. (i.e. t+27.3)

The toxic solution of different concentration of cypermethrin and permethrin were taken in separate aquaria and well-formed specimens (N=5 for each concentration) of *H.fossilis* were introduced in them to acclimatize for 96h. A set of controlled fishes were also maintained. The determination of aquatic, aerial and total oxygen uptake in fishes were made at different concentration of cypermethrin (0.00012, 0.00016 and 0.00020 ppm) and permethrin (0.175, 0.225 and 0.275ppm) for different periods. The mean values of VO_2 of all the five fishes of each set of experiment were taken and compared.

Table 1: Showing bimodal oxygen consumption of *H. fossilis* in relation to long term exposure of different concentrations of cypermethrin.

Condition	Dose (mg/l)	Exp. time	Oxygen consumption (cc/kg/h)			% decrease in total VO_2	%decrease in aquatic VO_2
			Water	Air	Total		
Control		1 week	71.29	79.82	151.11		
		2 week	70.58	79.57	150.35		
		3 week	69.62	78.74	148.36		
		4 week	69.30	77.46	146.76		
cypermethrin Concentration	0.175	1 week	56.08	85.78	141.86	6.2	21.34
		2 week	53.20	82.55	135.75	9.65	24.62
		3 week	50.49	81.79	132.28	10.84	27.48
		4 week	48.57	81.03	129.60	11.69	29.91
	0.225	1 week	52.45	85.94	138.39	8.42	26.43
		2 week	50.86	84.47	135.33	9.93	27.94
		3 week	48.61	82.18	130.79	11.84	30.18
		4 week	44.82	80.19	125.01	14.82	35.32
	0.275	1 week	51.19	86.70	137.89	8.75	28.19
		2 week	48.11	86.72	134.83	10.26	31.84
		3 week	43.71	83.67	127.38	14.14	37.22
		4 week	39.85	82.86	122.71	16.39	42.49

Table 2: Showing bimodal oxygen consumption of *H. fossilis* in relation to long term exposure of different concentration of permethrin.

Condition	Dose (mg/l)	Exp. time	Oxygen consumption (cc/kg/h)			% decrease in total VO_2	%decrease in aquatic VO_2
			Water	Air	Total		
Control		1 week	71.29	79.82	151.11		
		2 week	70.58	79.57	150.35		
		3 week	69.62	78.74	148.36		
		4 week	69.30	77.46	146.76		
Permethrin Concentration	0.175	1 week	56.78	85.54	142.32	8.79	20.36
		2 week	53.82	83.49	137.31	12.94	23.75
		3 week	51.56	82.35	133.91	14.45	25.94
		4 week	49.72	81.01	130.93	16.03	28.26
	0.225	1 week	52.55	87.56	140.11	11.00	25.72
		2 week	51.57	85.25	136.82	13.43	26.94
		3 week	48.83	82.90	131.73	16.63	29.86
		4 week	46.89	81.54	128.43	20.33	32.34
	0.275	1 week	51.61	87.14	138.75	11.36	27.61
		2 week	49.04	86.88	135.92	14.33	30.52
		3 week	44.70	84.14	128.84	19.52	35.79
		4 week	42.94	80.92	123.86	28.90	38.04

Table 3: Oxygen consumption of *H. fossilis* exposed to sublethal levels of permethrin and cypermethrin.

Toxicant	Dose (mg/l)	Oxygen Consumption (cc/kg/h) on exposure at hour					
		12h	24h	36h	48h	72h	96h
	Control	74.85	75.12	74.91	75.22	75.41	74.94
Permethrin	0.175	84.72	80.91	75.64	71.83	58.19	54.16
	0.225	88.43	79.95	75.08	64.33	55.29	49.48
	0.275	91.86	77.64	74.52	60.87	49.63	44.46
Cypermethrin	0.00012	87.91	83.68	76.75	69.81	58.67	56.08
	0.00016	93.72	82.52	75.18	67.75	54.82	51.13
	0.00020	96.39	78.28	74.75	62.39	49.77	45.81

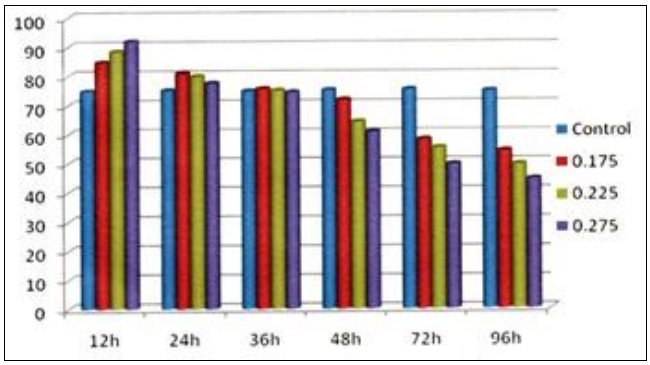

Fig 4 or 5: Oxygen consumption *H. fossilis* exposed to sublethal levels of permethrin

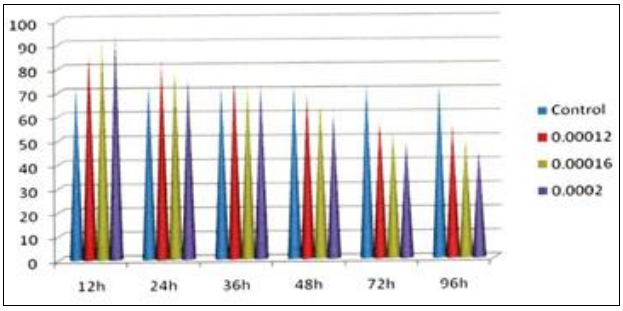

Fig 5 or 6: Oxygen consumption in *H. fossilis* exposed to sublethal levels of cypermethrin

Observation

VO_2 in relation to concentration of permethrin and cypermethrin The VO $_2$ in *H. fossilis* at different concentrations of permethrin and cypermethrin are summarized in Table. A perusal of table indicates that the exposure of permethrin and cypermethrin causes a increase in VO 2upto 24h with increasing concentration of pyrethroids. This followed by sudden decrease at 48 hours and gradual decrease upto 96 hours.

Effect of permethrin on bimodal oxygen uptake

The aquatic, aerial and total VO 2at different concentrations of permethrin exposure are summarized in Table. A look at table reveals that the total oxygen uptake on exposure to permethrin on different concentrations after 4 weeks resulted in decrease of VO 2, considerably. On 0.175, 0.275 and 0.275 ppm concentrations the total oxygen uptake was recorded to decrease from 151.11 (cc/kg/h) to 142.32, 14.11 and 138.75 (cc/kg/h) respectively after one week permethrin exposure.

Effect of cypermethrin on bimodal oxygen uptake

The oxygen uptake from water, air and total VO 2in *H.fossilis* after exposure to the different concentrations of cypermethrin after 4 weeks has been summarized in Table.

A perusal of table reveals that the VO 2 decreases

Considerably on exposure to 0.00012 ppm cypermethrin the aquatic VO 2 was reduced to 56.08 cc/kg/h from 71.29 cc/kg/h of control fishes and the total VO 2was also reduced to 141.86 cc/kg/h from 151.11 cc/kg/h of control fishes.

In recent years the effect of different pesticides of the fishes has been studied variously in relation to toxicity, survival and tolerance, growth and development, behavior and reproduction and histopathological changes in different body tissues but a perusal of literature indicates that the effect of different pollutants on the respiratory metabolism in fishes has not been studied in detail so far, except some fragmentary reports. There are mainly three groups of insecticides namely organochlorine, organophosphate and carbamate which are used for selective killing of a pest in a biological community.

Conclusion

In the present investigation it has been found that treatment of cypermethrin and permethrin caused significant decreases in

aquatic and total oxygen uptake at almost all the concentrations but the concentrations but the oxygen uptake through aerial route showed highly significant elevation. My present finding regarding the effect of cypermethrin and fenvalerate on oxidative metabolism is consistent with the above findings. The decrease in the rate of oxygen consumption in *H. Fossiles* may be due to inter subcellular level. The pyrethroid will pass through the gills, and interfere in the gill movements which is directly proportional to the respiratory activity of the fish, primarily effecting the oxygen uptake. The respiratory metabolism was impaired and damage was also observed in the gill of fish exposed to pesticides.

Under toxic conditions the oxygen supply becomes deficient and a number of poisons become more toxic increasing the amount of poison being exposed to the animal. The fish breaths more rapidly and the amplitude of respiratory movements will increase. Llord (1961) reported that the toxicity of several poisons to rainbow trout increased in direct proportion to decrease in oxygen concentration of water. In general, it is observed that the lack of oxygen increases the ventilation volume of fishes and the cardiac output is reduced. This reduces the rate of passage of blood through the gills, so allowing a longer period of time for uptake of oxygen, and also conserves oxygen by reducing muscular work. The zone of resistance is reached when the oxygen tension in the water is so low that homeostatic mechanisms of the fish are no longer able to maintain the oxygen tension in the afferent blood and the standard metabolism begins to fall. The results of the present study suggest that the altered rates of respiration of fresh water fish may serve as a rapid biological monitor of the pesticide exposure to important components of fresh water community.

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