

Effect of Organophosphate Pesticides on The Oxygen Consumption of A Freshwater Leech, *Hirudo Birmanica* (Blanchard)

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ABSTRACT

The present study was conducted to track changes in the rate of oxygen consumption freshwater leech *Hirudo birmanica* exposed to sublethal concentration of malathion (0.98 ppm at 96 h) and monocrotophos (1.2 ppm at 96 h). The gradual depletion was observed in oxygen consumption rate after initial couple of hours.

Keywords : *Hirudo birmanica*, Malathion, Monocrotophos, Oxygen consumption.

I. INTRODUCTION

The pollution of aquatic ecosystem with chemical contaminants has become critical environmental concern. The freshwater animals including medicinally important leeches are adversely affected by agricultural pesticides. Pesticide is defined by United Nations Environment Programme (UNEP, 2005) as any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. The health of aquatic ecosystem is being adversely affected due to indiscriminate use of pesticides. Such pesticides reach to aquatic ecosystem through rains, wind and surface runoff.

Malathion (O,O-dimethyl phosphorodithioate of diethyl mercaptosuccinate) and monocrotophos are synthetic organophosphate, non-systemic, broad spectrum insecticides are extensively used in agriculture and household practices for pest eradication. These organophosphates are highly toxic to non-target organisms. Both represent major source of environmental pollution. Organophosphate pesticides are highly soluble in water and can therefore easily contaminate aquatic ecosystem, thereby increasing the exposure risk of aquatic flora

and fauna (Agdi *et al.*, 2000). Once malathion is introduced into the environment, it may cause serious intimidation to the aquatic organisms and is notorious to cause severe metabolic disturbances in non-target species (USEPA, 2005 Ojha *et al.*, 2011).

Leeches are medicinally important animals which are adversely affected by pesticide pollution in freshwater ecosystem. Leeches are hermaphrodite which carries both the male and female reproductive organs. For the present study, *Hirudo birmanica* were selected as a test animal.

Assessment of rate of oxygen consumption is an important parameter to assess and understand the physiological state of metabolic activity of an organism and the toxicants stress on aquatic organisms. Since it is also an index of energy expenditure to fulfill the demands due to environmental and biological alterations (Nagabhushnam and Kulkarni, 1981; Kale and Kulkarni, 2003).

The present work is aimed to observe changes in oxygen consumption of a freshwater leeches *Hirudo birmanica* exposed to malathion and monocrotophos.

II. METHODS AND MATERIAL

The freshwater leeches *Hirudo birmanica* (length 10 ± 1 cm and weight 8 ± 0.5 gm) were procured from freshwater ponds around Partur Dist. Jalna. These leeches were acclimatized to the laboratory conditions in wet mud for 10-15 days at a room temperature ($27 \pm 2^\circ\text{C}$) prior to the experiment. 10 leeches were exposed to 96 h LC50 (0.98 ppm) concentration of malathion and monocrotophos (1.2 ppm) to quantify their oxygen consumption rate by standard Winkler's method (Welsh *et al.*, 1968). The quantity of oxygen consumed was calculated in relation to the unit wet weight of animal and the values obtained were expressed as the rate of oxygen consumed in $\mu\text{l/h/l/g}$ body weight. The data was statistically analysed using student 't' test

III. RESULTS AND DISCUSSION

In general, the rate of oxygen consumption of poikilothermic animals is highly complex process and it is subjected to the influence of various extrinsic and intrinsic factors. The respiration rate of animal is an indicator of environmental stress (Capuzzo, 1977). The results of the present study show oxygen consumption rate was decreased in both organophosphate pesticides exposure after initial couple of hours. In exposure of malathion it shows depletion in 4 h 6 h 8 h 10 h and 12 h for -09.86% - 14.75%, -23.65%, -36.43%, -44.29% respectively in compare to control, where in initial two hours it shows elevation in oxygen consumption viz. +41.13% and +63.92% for 1 h and 2 h respectively. Similar depletion was observed in monocrotophos exposure for 4 h 6 h 8 h 10 h and 12 h at -12.21% -15.68%, -19.84%, -32.54%, -38.86% respectively in compare to control and elevation in first couple of hours was also observed 31.62% as and +45.94%). The observed values of oxygen consumption rate are presented in Table no. 1.

Leeches increase their respiration by undulating movement while adhering to the vegetation with the posterior sucker. They have haemoglobin in the haemoelomic fluid and use oxygen normally. The present study showed that the normal respiratory rate of *Hirudo birmanica* was affected due to sublethal exposure of Malathion (0.98 ppm) and Monocrotophos (1.2 ppm). Oxygen consumption rate of *Hirudo birmanica* was constantly decreased from 4 h to 12 h of exposure to both the pesticides which shows as the period of exposure is increase the rate of oxygen consumption is decrease.

The pesticides alter the rate of respiratory metabolism in invertebrates are reported in somewhat detail. Mane *et al.*, (1984) observed decrease in the respiratory activity, when freshwater bivalve molluscs exposed to cythion-malthion. *Metapenaeus monoceros* a marine prawn was exposed to phosphomidon, DDT and fenvalerate, showed significant reduction in oxygen consumption rate (Reddy 1987). Sagar (1989) noted that malathion produced a significant hike in the rate of oxygen consumption for the first couple of hours and after that it reduced when another freshwater leech was *Poecilobdella granulosa* exposed to malathion. Jaiswal *et al.*, (1990) reported constant decline in the rate of oxygen consumption of a crab *Barytelphusa cunicularis* after exposure to the organophosphate pesticide. Chaudhari (1997) reported the significant decline in oxygen consumption rate in *Hirudo birmanica* when exposed to endosulfan. Changes in respiration rate indicate the probable modulations in the metabolism of the animals (Kondekar, 1998). There was an elevation in the rate of oxygen consumption for the first two hours when *H. birmanica* exposed to malathion and monocrotophos, as the exposure period increase the rate of oxygen uptake gradually decreased with a severe fall after four hours and continued till the animal death. This variation in oxygen consumption is due to impaired

oxidative metabolism and stress caused by toxicants (Pakhare, 2017).

Table 1 : The rate of oxygen consumption ($\mu\text{l/g/h/l}$) of *H. birmanica* exposed to sublethal exposure of Malathion and Monocrotophos at 96 h.

Concentration (in ppm)	% change after.....hours						
	1	2	4	6	8	10	12
Control	22.2 3 ± 0.40 *	22.2 8 ± 0.36 *	22. 39 ± 0.3 4*	22. 46 ± 0.2 5*	22. 51 ± 0.2 0*	22. 56 ± 0.1 7*	22. 59 ± 0.1 4*
Malathion 0.98 ppm	+41. 13	+63. 92	- 09. 86	- 14. 75	- 23. 65	- 36. 43	- 44. 29
Monocrotophos 1.2 ppm	+31. 62	+45. 94	- 12. 21	- 15. 68	- 19. 84	- 32. 54	- 38. 86

[* Values are the original values in $\mu\text{l/g/h/l}$] [Values are significant at $p < 0.05$]

IV. CONCLUSION

The present study reveals that malathion and monocrotophos interfere in respiratory metabolism leading to lowering of oxygen consumption rate which causes death of leeches.

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