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Effect of two pesticides like Endosulfan and Dimethoate on Oxygen consumption ratio by Fresh water Female Crab *Barytelphusa guerini* (H. Milne Edwards, 1853)

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Abstract

Man with extraordinary intellectual capability conquered the age; old traditional world by establishing modern technological world to cater the needs of all the human beings. As the most intelligent man acquired supremacy and mastery over each and every object on the earth and mode them to keep under his control. He has been totally transformed an arboreal barbarian to a highly polished and sophisticated civilian by exploiting the innovative applications in the field of science and technology for the wellbeing of the total community to satisfy its basic needs like shelter, fabrics and food.

Respiration is a proces during which the organisms obtain oxygen from external medium and use it for the purpose of energy release during oxidative metabolism. As such the process of respiration in animals is studied by determining the oxygen consumption. The total oxygen consumption of the animal reflcts the basal metabolic status which reflects the general effect of several intrinsic and extrinsic environmental stresses. This serves not only as a tool in evaluating the susceptibility or resistance potentiality of animal, but also useful to correlate the behaviour of the animal.

Present work elaborates the comparative study. The effect of two pesticides, Endosulfan and Dimethoate on Total oxygen consumption and Rate of Oxygen consumption of fresh water Female crab *Barytelphusa guerini*. This paper presented data graphically as well as statistically.

Pesticides of chemical compound which are deliberately added to the environment for killing or injuring rests in order to enhance agricultural output and to control certain disease of main and his domestic animals. Which they produced desirable effects like

environmental pollution and damage to several non–target organisms ranging from invertebrate to vertebrates. In fact, most of the chemical which are used as pesticides are not highly selective but are generally toxic to many non–target species and other desirable forms of like that co-inhabit the environmental. As early as 1948 an urgent need was described for intensive studies on biological after effects of pesticides on non–target species[9]. However, as has pointed out by Edward[4], even after 40 years since this need was described, the extent and seriousness of the potential hazards due to these chemicals to non–target species are yet to be fully defined, notwithstanding a phenomenal increase in the amount and number of pesticides used.

India is one of the countries which manufacture basic pesticides chemical in large scale. Although pesticides are manufactured keeping in view a specific pest as the target, in practice, they never reach the target into. It has been calculated that only 1% of the pesticides applied would reach target pests while the remaining portion drifts slowly into the environment. Further, the pesticide will never remain in the area of application only but reach nearby water bodies through run–off waters badly affecting the aquatic non–target organisms. Therefore, it is imperative to have a better understanding of "Pesticide–Biosystem interaction".

The birth of pesticide era in the late 1940's was hailed as major breakthrough for mankind. The chemicals provide potent in the war against vectors of disease and pests of crops, forests and rangeland. These ling lasting poisons which belong to a group of chemicals called organochlorine compounds were successful weapons against mosquitoes, grasshoppers, weevils and other harmful insects. It was beloved that organochlorines would stop pests in their tracks, eradicating diseases and saving the products of forestry and agriculture for human consumption. This led to a progressive increase in the use of the compounds.

As the use of pesticides reached massive proportion, a darker side of these toxic chemicals revealed itself. Carried by natural forces such as wind, rain and the flow of rivers and ocean currents, residues of organochlorines being to appear everywhere on the globe, from tropical forests to Antarctic snows. Wrose still, the slowly decomposing chemicals were talking their toll among many non–target fish and wildlife species. It becomes clear from the residue found in the bodies of dead or dying birds, that pesticides were directly responsible for their deaths.

Oxygen consumption was determined by Wrinkler method (Welsh and Smith, 1953). The freshwater female crab *Brytelphusa guerini* was used for experimentation. The collection of animals from natural sources, their maintenance in the laboratory, proper selection of animals for present investigation and procedure for the exposure of animal with pesticide pollutant such as Endosulfan and Dimethoate.

The apparatus used in this experiment was similar as described by Saroja. The apparatus mainly consisted of a reservoir (R)

and respiratory chamber (RC). A 500 ml wide mouthed bottle was used as respiratory chamber. The size of the bottle was such that it was not too big for the enclosed crab to give considerable difference in oxygen content between initial and final sample. The chamber was coated with black paint to avoid the activity due to light.

Before starting the experiment crab was left in running tap water for about 10 minute to facilitate them to reach a state of normality from a state of excitement; if any. After this equilibration period, one crab was kept in respiratory chamber without causing any damage to the animal and initial sample was collected immediately as described above. Then the crab was allowed to respire for one hour. Immediately after one hour final sample was collected. The amount of dissolved oxygen in these samples was determined by the stander Winkler's method, as given. The total oxygen consumption and rate of oxygen consumption was calculated by considering the wet. Weight of animals.

The values for total oxygen consumption are expressed as ml. (c.c.) of O_2 animals / hr and for the rate of O_2 consumption are expressed as ml. (c.c.) of O_2 / gm / hr wet weight of animal.

The pesticides are always not good for consumption for any aquatic living organism. So, this study shows the effect of pesticides on oxygen consumption ratio in the freshwater female crab *Barytelphusa guerini*. The freshwater female crab *Barytelphusa guerini* showed variation in the rate of oxygen consumption and total oxygen consumption when exposed in Endosulfan and Dimethoate.

In the present investigation it was showed that the oxygen consumption in the animal exposed to Endosulfan and Dimethoate was decreased up to 96 hours. The Endosulfan exposed animals showed initially decreasing at 24 hours while increased rate of respiration at 48 hours and then gradually decreased in oxygen consumption up to 96 hours as compared with control. The animals exposed to sublethal concentration of Endosulfan almost different as compared to Dimethoate.

I] ***Effect of Endosulfan:*** The oxygen consumption was studied in the present investigation with the effect of Endosulfan. It shows a sudden increase & deeply decreasing graph. It exhibits a decreasing trend of respiration up to 96 hours as compared to control. As shown in Table (1 and 2) and Figure (1 and 2).

II] ***Effect of Dimethoate:*** The total oxygen and rate of oxygen was studied in the present study. The effect of Dimethoate show increased trend at 24 hours and then slowly decline up to 96 hours. The oxygen rate and total oxygen consumption shown in Table (3 and 4) and Figure (3 and 4).

I] ***Effect of Endosulfan on Total Oxygen Consumption and Rate of Oxygen Consumption in Freshwater Female Crab Barytelphusa guerini :***

Effect of Endosulfan causes changes in total oxygen consumption. Total oxygen consumption expressed in ml/lit., is the average of six observation ± S.D.

Table (1) Effect of Endosulfan on total oxygen consumption in female crab *Barytelphusa guerini*

Sr. No.	Duration of Exposure	Control	Experimental
1	24	1.28 ± 0.072	0.74 ± 0.076***
2	48	1.23 ± 0.069	1.78 ± 0.032**
3	72	1.19 ± 0.072	1.35 ± 0.057***
4	96	1.33 ± 0.072	0.70 ± 0.057***

Note: 1) Values expressed as Beats/min. of animals.
2) Each value is mean of six observations ± S.D.
3) Value are significant at * = P<0.05, ** = P < 0.01, ***=P < 0.001 & NS – Not significant

Effect of Endosulfan causes changes in rate of oxygen consumption. Rate of oxygen consumption expressed in ml/hr/gm wt. /lit., is the average of six observation ± S.D.

Table (2) Effect of Endosulfan on rate oxygen consumption in female crab *Barytelphusa guerini*

Sr. No.	Duration of Exposure	Control	Experimental
1	24	0.035 ± 0.0019	0.023 ± 0.0024**
2	48	0.033 ± 0.0018	0.053 ± 0.0009**
3	72	0.030 ± 0.0018	0.041 ± 0.0017*
4	96	0.032 ± 0.0017	0.021 ± 0.0017**

Note: 1) Values expressed as Beats/min. of animals.
2) Each value is mean of six observations ± S.D.
3) Value is significant at * = P<0.05, ** = P < 0.01, ***=P < 0.001 & NS – Not significant

II] Effect of Dimethoate on Total Oxygen Consumption and Rate of Oxygen Consumption in Freshwater Female Crab Barytelphusa guerini :

Effect of Dimethoate causes changes in total oxygen consumption. Total oxygen consumption expressed in ml/lit., is the average of six observation ± S.D.

Table: (3) Effect of Dimethoate on total oxygen consumption in female crab *Barytelphusa guerini*

Sr. No.	Duration of Exposure	Control	Experimental
1	24	1.184 ±0.081	0.601 ±0.058 ***
2	48	1.208 ±0.064	1.791 ±0.041***
3	72	1.241 ±0.076	1.394 ± 0.051**
4	96	1.208 ±0.083	1.171 ± 0.061**

Note: 1) Values expressed as Beats/min. of animals.
2) Each value is mean of six observations ± S.D.
3) Value is significant at * = P<0.05, ** = P < 0.01, ***=P < 0.001 & NS – Not significant

Effect of Dimethoate causes changes in rate of oxygen consumption. Rate of oxygen consumption expressed in ml/hr/gm wt. /lit., is the average of six observation ± S.D.

Table (4) Effect of Dimethoate on rate oxygen consumption in female crab *Barytelphusa guerini*

Sr. No.	Duration of Exposure	Control	Experimental
1	24	0.033 ± 0.002	0.018 ± 0.003*
2	48	0.034 ± 0.003	0.056 ± 0.002**
3	72	0.036 ± 0.002	0.044 ± 0.001***
4	96	0.029 ± 0.002	0.033 ± 0.002***

Note: 1) Values expressed as Beats/min. of animals.
2) Each value is mean of six observations ± S.D.
3) Value are significant at * = P<0.05, ** = P < 0.01, ***=P < 0.001 & NS – Not significant

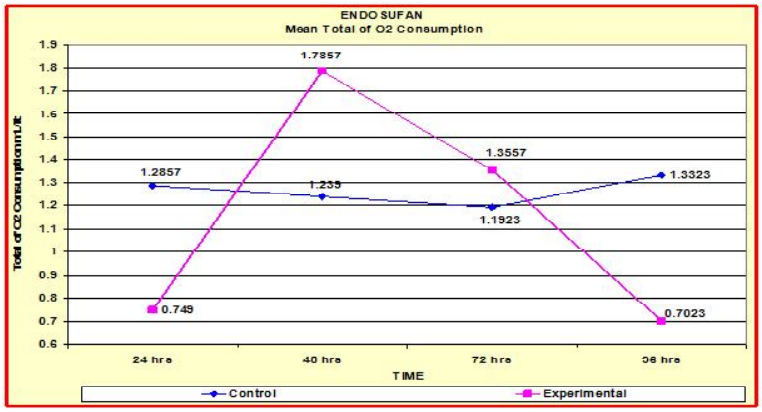

Fig. (1): Effect of Endosulfan on Total Oxygen consumption in *Barytelphusa guerini*

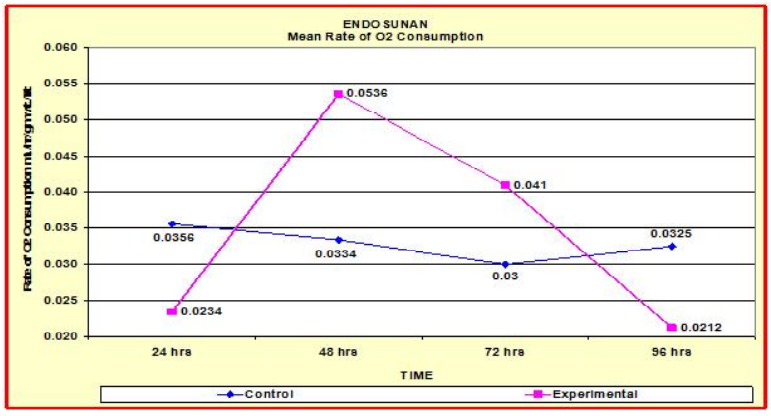

Fig. (2): Effect of Endosulfan on Rate of Oxygen consumption in *Barytelphusa guerini*

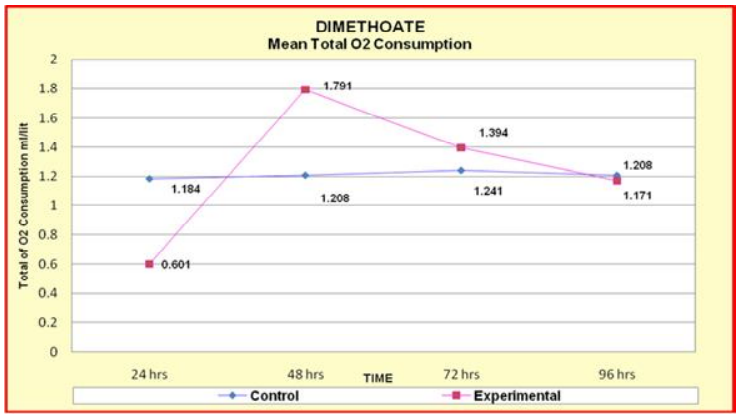

Fig. (3): Effect of Dimethoate on Total oxygen consumption In *Barytelphusa guerini*

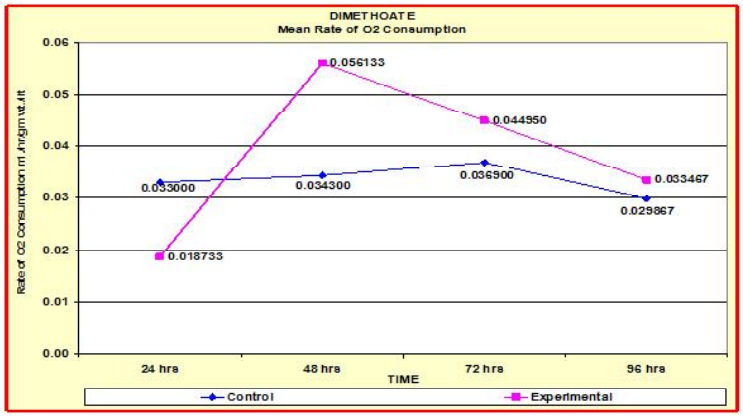

Fig. (4): Effect of Dimethoate on Rate of Oxygen consumption in *Barytelphusa guerini*

The decrease in oxygen consumption of crabs exposed to sublethal concentrations of endosulfan is the formation of a thin 'mucus film' over gill surface which is likely to affect respiratory rate by reducing the effective surface area of diffusion and the rate at which diffusion occurs. Formation of thin mucus film over gill has been observed in fishes[2] and crabs[1] exposed to different pesticides such a phenomenon has also been observed in the present study which may account for the decrease in animal oxygen consumption. Further it has been observed that mucus deposition over gills surface was greater, is responsible for a greater decrease in oxygen consumption.

It was observed that the metabolic rate of both male & female crab, *Uca pugilator* was initially high when the animals were exposed to Polychlorinated biphenyls. It was showed that silver, elevated the rate of oxygen consumption in bivalve *Mytilus edulis*. Some workers have ported respiratory metabolic

condition which indicates increase in oxygen consumption of animals following exposure to petroleum hydrocarbons.

The decline in the rate of oxygen consumption after an initial increase and after prolonged exposure periods might be the result of the unset of poisoning. The decline is depending upon the increasing concentrations of in the pollutants at the time of experiment. An initial increase and then gradual decrease in the rate of oxygen consumption during acute exposure to pesticide endosulfan & dimethoate in present study. The decrease in oxygen consumption may also be due to failure of crab to compensate for the new steady state of metabolism to the stress of heavy toxicant pesticides endosulfan and dimethoate.

Decline rate of oxygen consumption after pesticide exposure in present work may be due to the change in the gill structure. Many workers have shown the harmful effects of pollutants on histological structure of gills of Crustaceans. Eller[5], & Savant[8], have studied the histopathology of gills of animals exposed to different pollutants.

Decrease in oxygen consumption was observed by Naganath[6] in black crab, *Barytelphusa cunicularis* when exposed to endosulfan and Eklaux. These observations suggest that decrease in oxygen consumption of *Barytelphusa guerini* could be due to the synergistic effect of the factors explained above resulting in respiratory distress. Evidance to show taht respiratory disttress is one of the main symptoms of insecticide toxicity in Crustaceans is unequivocal[3,7].

Generally, metabolism of an organism is measured by estimating oxygen consumption. The rate of oxygen consumption of an intact animal and its tissues reflects the respective metabolic rates and hence energy output. It also provides information on the ability of the organism to extract oxygen from the environment. While the influence of the environment is on metabolism, the effect of that influence is displayed through the activity of an organism whose metabolism has been affected. Growth rate increases as a result of increased energy intake and indirect proportion to respiratory output.

Mean total oxygen consumption decreases at 24 hours as compared to control then increased at 48 hours, it slows down up to 96 hours when crabs exposed in Endosulfan. Dimethoate decline mean total oxygen consumption at 24 hours, at 48 hours reaches to pick level then decreases at 96 hours. Mean rate of oxygen consumption showed high decread rate in Endosulfan as compared to Dimethoate. The pollutants act as physiological stressor and affect the freshwater organism ultimately obstruct the respiratory mechanism and reduces oxygen uptake.

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