Since the regression between the carapace length and body weight shows no significant difference for male and female it is much better to use the carapace length in the comparative study. We could conclude that the male attained their maturity stages at CL smaller than the famale but this does not mean that male *P. ornatus* attained their age at maturity earlier than the female. Ageing studies should be done to clarify this statement.

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EFFECT OF MALATHION ON RESPIRATION OF MARINE EDIBLE CRAB *UCA MARIONIS* (DES)

ABSTRACT

Respiration rate is an important parameter to find out physiological and metabolic state of the animal in toxic medium. It can help to evaluate the rate of toxicant entering in the body and affecting the availability of molecular oxygen which is essential for the cell development, cellular function and energy metabolism. Oxygen is one of the most important requirements in aerobically respiring aquatic organism. The crab *Uca marionis* (Desmarest) depends on aerobic mechanism for its energy need. In the present study attempts have been made to investigate and to find out the effect of Malathion pesticide on marine crab *U. marionis* (Des) at lethal and sublethal concentration both under acute toxicity exposure and chronic toxicity exposure.

RESPIRATION is one of the most vital physiological activities in any animal. In aquatic animal the main source of oxygen for aerobic metabolism is dissolved oxygen in the water. The gills are the major organs in the respiration process of aquatic animals such as crustaceans and fishes. When the toxic contaminants are water borne, the gills are the site of damage which can be easily assayed. Thus the change in gill structure due to pollutant would affect the respiratory activity of animals. The normal respiratory area of gills may be altered due to intimate contact with the polluted water, which would affect the diffusing capacity of the gills.

Oxygen consumption of animals is an important parameter to assess stress because it is a valuable indicator of the energy expended to meet the demands of environmental alterations. The measurement of oxygen consumption of animal therefore, would provide an additional clue to the physiological mode of action of the pollutant. In all the respiration rate of an organism is an indicator of physiological state and any change in respiration rate may be indicator of changed environmental and physiological state.

The respiratiaon response of marine crab after exposure to various concentration of pesticides is useful device for qualitative assessment of sublethal effect on physiology without restoring to biochemical and histopathological techniques.

MATERIAL AND METHODS

Marine crab *Uca marionis* (Desmarest) were collected from the lagoon area of Mithbav creek and were acclimatized to laboratory condition for 24 hours in plastic trough containing saline water. After acclimatisation equal size and weight active crabs were selected for the experiment.

The following experiment was designed to study the lethal and sublethal effect of Malathion on respiration of crab *U. marionis*.

A batch of 10 crabs were prepared in a plastic trough containing a liter of saline water (28‰). One trough was kept as blank and one trough was used for control. The other batches of crabs were exposed to various concentrations of Malathion ranging from 0.02 ppm for LC_{10}, 0.03 ppm for LC_{20}, 0.04 ppm for LC_{30} 0.05 ppm for LC_{40} and 0.06 ppm for LC_{50}. The values were selected based on the observations done in acute toxicity test for 24 hrs. The experiment was run for one hour after which the rate of oxygen consumption of all batches was determined by standard winkler method.

The initial and final differences in blank trough was determined to eliminate any natural BOD change.

The weight of animals in trough were taken before the start of experiment by paper blotting and weighing precisely as quickly as possible and then transferring to respiratory chamber (i.e., test trough). The total batch weight was kept approximately constant.

The initial and final differences of control and experimental animals were determined and the rate of oxygen consumption was calculated in ml of oxygen utilized per hour per gram body wt. per litre unit. [ml of O_2/hr/g/l.]

The experiment was repeated five times and the mean was considered for calculation. The data obtained was statistically analyzed to test the significance of probability level.

RESULTS

The variation in rate of respiration in *U. marionis* was studied at various toxicity levels of the pesticide Malathion.

The animals from control group showed a respiration rate of 0.3471± 0.0042ml O_2/hr/g/l.

Whereas in experimental group the respiration rate observed was 0.3904 ± 0.0040, 0.3223 ± 0.0041, 0.2943 ± 0.0039, 0.2801 ± 0.0038, and 0.2619 ± 0.0043 $mlO_2/hr/g/l$ for LC_{10}, LC_{20}, LC_{30}, LC_{40} and LC_{50} respectively. The values were significant at $P < 0.05$, $P < 0.01$, $P < 0.001$.

The respiration rate for LC_{10} was found to be comparatively higher than that of control by + 12.48%. This might be due to excitation of physiological systems at lower concentration as Malathion is a neurotoxicant.

As the concentration increased, there was a significant drop in the rate of oxygen consumption which ranged from -7.14% for LC_{20} to - 24.54% for LC_{50}.

This is due to interference of pesticide in the working of physiological system and lowering of gill permeability. Table 1 shows the observed rate of oxygen consumption where as a comparison of various toxicity level and rate of oxygen consumption is shown in Fig. 1.

DISCUSSION

Respiration is one of the vital physiological life process during which the organism (aerobic) obtains oxygen from external environment which is utilized to release energy during oxidative metabolism of stored foods. The availability of oxygen in turn limits the distribution of several animals.

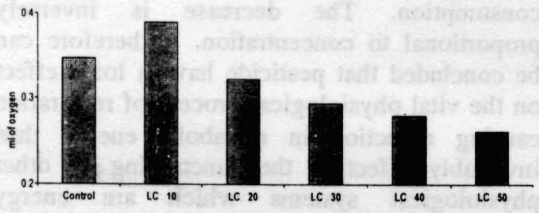

FIG. 1. *Rate of Oxygen consumption of crab* Uca marionis (Desmarest) *on exposure to various concentration of pesticide Malathion at different toxicity levels.*

The call for oxygen is a continuous one throughout the life of active animals as Lavoiser realized in the 18th century. Life is a combustion but the similarity between life and fire is not deeper than science of Lavoiser century (Kheiller, 1961). In today's time scientist have shown far greater complexity of metabolic fires and established in some detail the molecular change through which the potential energy in the fuel is channeled in the high energy phosphate bond of a ATP. The production of large amount of ATP requires a continues supply of oxygen. The rate of supply depend on anatomical and physiological character of the organs of respiration and the transport of cellular pigments. In addition to this the actual oxygen content of environment may be a limiting factor while other environmental factors like temperature, carbon dioxide or salinity may impose extra demands for oxygen and in turn affect the rate of exchange.

Aerobic mode of life is a characteristic of most animals, it demands a steady flow of oxygen in the cell and ready removal of carbon dioxide released during metabolism. At the cellular level physical forces of diffusion alone effect these exchanges. Knowledge of the limits of respiratory function are important for the understanding of physiological adaptation of a species. This is possible since many features of aerobic metabolism can be studied indirectly by measurement of the rate of oxygen consumption by the animal.

The rapid growth of industrial and agriculture process has increased the use of

different chemicals to achieve the growth of economic level. Thus indiscriminate use of different agricultural pesticide cause release of the chemicals into environment which is causing hazards to several non-target biota in the environment. (Fingerman, 1982).

TABLE 1. *Rate of Oxygen consumption of crab Uca marionis on exposure to various concentration of pesticide Malathion at different toxicity levels.*

	Control	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5
Toxicity	LC_{00}	LC_{10}	LC_{20}	LC_{30}	LC_{40}	LC_{50}
Conc. of Malathion in ppm	00.00	6.0	7.0	8.0	9.0	10.0
Mean Value	0.3471	0.3904	0.3223	0.2943	0.2801	0.2619
S.D.	± 0.0042	± 0.0040	± 0.0041	± 0.0039	± 0.0038	± 0.0043
P.Value		P < 0.05	P < 0.05	P < 0.01	P < 0.01	P < 0.001
P.C.		+ 12.48	-7.14	-15.21	-19.33	-24.54

Rate of oxygen consumption is expressed as ml O_2/hr/g body wt/litre.
Each value is mean of five observations : ± (S.D.)
Value were significant P < 0.05, P < 0.01 and P < 0.001
(P.C.) Indicates percentage variation over control.

In aquatic animals gills are the major respiratory organ. The efficiency of gills determines the rate of energy supply for all the metabolic pathway. Therefore, any damage to this vital organs causes a chain of destructive events in oxidative metabolsim. Mackie *et.al.*, (1975), stated that the damage to gill epithelium reduces the gas exchange across the gill surface. Ghate and Mulherkar (1979), have observed gill damage of two species of fresh water prawn after exposure to copper sulphate.

In the present study it was observed that there was increase in rate of oxygen consumption at sublethal level of LC_{10} which might be due to initial excitation of nervous system caused by the pesticide in low doses. Similar result are observed by Kulkarni *et.al.*, (1983), on freshwater crab *Barytelphusa querini* after exposure to Hildon (pesticide). Rice *et. al.*, (1977) have suggested that part of the increased oxygen is utilized by the exposed animal to support and to enhance physiological activities, in metabolism and eliminating the pollutant.

At higher concentration the decrease in the oxygen content is due to the direct interference of the toxic material in the metabolism and restriction of the metabolic activity. Pesticides have the ability to produce disturbance in morphological, physiological and behavioural changes in the organism.

In the present study marine crab *U. marionis* when exposed to lethal and sublethal concentration of Malathion showed that the body parts like gill may be altered in permeability and decrease the oxygen consumption. The decrease is inversely proportional to concentration. It therefore can be concluded that pesticide have a toxic effect on the vital physiological process of respiration causing reduction in metabolic energy thus invariably affecting the functioning of other physiological systems which are energy dependent. In final analysis it is seen that the death of the organism can also be a result of low energy availability for normal functioning of the animal's physiological systems.

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RECORD-SIZED MACKEREL, *RASTRELLIGER KANAGURTA* CAUGHT FROM KARWAR WATERS ON THE WEST COAST OF INDIA

THE LARGEST MACKEREL ever caught from Karwar waters or for that matter the largest mackerel so far caught from the Indian waters measured 421 mm in total length and weighed 859 g in fresh condition (Photograph 1). This female specimen was caught in purse seine from a depth of 70 meters off Karwar (west of the light house) on 19th August 1999. Two days earlier, on 17th August 1999, another comparatively smaller specimen, measuring 347mm in total length and weighing 524 g. was landed by another purseiner. Thus the present specimen has broken all the earlier records (Table 1) in total length and weight. The fully grown female specimens had turgid ovaries. The well developed ovaries with fully packed ova indicate that even at such size mackerel spawns in the nature. Every year at the begining of the "mackerel season" it is customary to observe larger adults in the catches

TABLE 1. *Record sized mackerel Rastrelliger kanagurta so far caught in India.*

Locality	Depth	Net/Boat	Year	Size	Sex	Weight	Authors
Goa Siridao	30 m.	Purse seine	15.1.1976	348 mm	Not known	520 g	Dhawan R.M. 1976
Karwar		Purse seine	1983	360 mm	Male	560 g	Dhulkhed, M.H. & G.G. Annigeri. 1983.
Chendia Binagar, Karwar	30 m	Purse seine	11.9.1984	366 mm	Not known	592 g	N.C. Gowda & G.G. Annigeri
Karwar	70 m	Purse seine	17.8.1999	347 mm	Female	524 g	V.S. Kakati & N.C. Gowda (Present specimen)
Karwar	70 m	Purse seine	19.8.1999	421 mm	Female with full ovaries	859 g	V.S. Kakati & N.C. Gowda (Present specimen)