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Neuroendocrine and Pesticidal Impact on the Rate of Oxygen Consumption in Freshwater Crab *Barytelphusa* guerini (H.M. EDWARDS)

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Abstract

The deleterious influence of pesticide on the physiological biochemical and histological aspects of several aquatic non-target organisms including gas stations have been well documented. However, much it needs to be studied in the context of ever fluctuating and environmental conditions due to the increase in the pesticidal influx into the ecosystems including the freshwater bodies, at present dealing with the impact of an organophosphate best decide monocrotophos on the whole animal oxygen consumption in normal bilateral eyestalk ablated and eyestalk extract injected freshwater the crab. *Barytelphusguerini*. Oxygen consumption after day-1, day -4 and day 7 of exposed crabs to lethal and sub lethal concentrations of the pesticides has been estimated although oxygen consumption was found to increase initially in the ablated crabs, rate of oxygen consumption decreases later with the exposure period, whereas eyestalk extract injected crabs exhibit increased oxygen consumption reaching near normal levels for the same period the observation reveals the role of neuroendocrine control of oxygen consumption in the crab. Histological changes In the Gills under lethal exposure and concentration have also been observed.

***Keywords*:** Barytelphusa guerini, Neuroendocrine, monocrotophos, gills, oxygen consumption

INTRODUCTION

Oxygen consumption is a measure of the metabolic state of the animal it is considered as a vital parameter and changes in the oxygen consumption indicates the physiological and metabolic state of the animal in crustaceans, eyes talk hormones control a number of Physiological process namely somatic changes blood glucose levels osmoregulation, moulting reproduction and also oxygen consumption (Fingerman ,1970).Increasing demand for pesticides in agriculture has resulted in the production of new formulations which are known to produce cumulative deleterious effect not only on target animals but also on non-target species, such as the crabs ***Barytelphusa guerini*** *Which* is best animal in the present study. The number of pesticides was organophosphate, organochlorine and carbamate groups have been reported to play a vital role in increasing the agricultural productivity by the abatement of pests in the agriculture field (Holden, 1973).Among these pesticides organophosphates have a wide spectrum of action in the insect control and also comparatively faster biodegradablility nature (Tilak ,et al 2001). These pesticides because of their potential toxicity are known to produce a deleterious physiological changes in non-target species many attempts have been made to evaluate these hazards to non-target animals especially crabs (Brayan,1971 ; Nammalwar, 1984).Gills of aquatic animals such as crustacean would be the important target tissues and thus the change in the gill structure due to the influence of pollutants and a neuroendocrine imbalance would affect the respiratory activity of the animal .The eyestalk in crustaceans is known to have a neurochemical function due to the presence of the X organ and the sinus complex, excision of eyestalk is a classical endocrinological techniques to determine the functions of the eyestalk neuro secretary system as per the toxicity done Chandrakala (2008) .An attempt has been made herewith to study the toxic impact of monocrotophos and the role of a Neuroendocrine influence in the control of oxygen consumption in the crab.

MATERIAL AND METHODS

The freshwater crabs *Barytelphusa guerini* intact appendages were collected from their habitat. Adult male and a female crabs with an average weight of 35 -40 grams were used in the experiment observations were made on a minimum of six animal at a fixed at time. Mean, S.D was calculated and significance is represented. The crabs were accumulated to laboratory conditions for a week by maintaining them into plastic troughs of appropriate size with enough water so as to keep the animal partly submerged. They were fed with fish muscle and water was changed daily. Feeding was stopped one day prior to and during experimentation. The crabs were divided into six groups of six individuals each. Group 1: normal crab (control); group 2: eyestalk ablated ; group 3 eyestalk ablated +extract injected; group 4: normal exposed; group 5:ablated exposed to monocrotophos; group 6 extract injected and exposed. Commercial grade pesticides, monocrotophos of 36% EC was used for the study, as it is widely used by the fanners to control pest in this region. Stock solution was prepared by dissolving the material in distilled water to give concentration of mg/1 equivalent to 1000 ppm and test concentrations were prepared by dilutions. Crabs exposed to sub-lethal concentration as detailed below; 1.06 ppm for normal, (LC 50 as per probit analysis (3.19ppm); 0.86ppm for ablated (LC 50 2.59ppm); 1.02 ppm for

eyestalk ablated +injected (3.08 ppm). All animal oxygen consumption was determined by Winklers modified method (Ambore and Venkatachari 1978)of crabs were carefully and quickly dissected and fixed for the histological studies following counter staining technique.

RESULTS

The results of the experiment evaluate oxygen consumption of the *crab, Barytelphusa guerini. T*he oxygen consumption in normal crabs, when exposed to pesticides, increases from 5.85 to 6.81 and is observed to be significant (P<0.001)on the first day of exposure. As the period of exposure increased, oxygen consumption decreases significantly (by 65%) on the 7th day. The same crabs exhibited recovery upon shifting to pesticides-free medium even on the 1st day and appeared similar to control crabs.

The rate of oxygen consumption in the ablated crabs also increased initially from 2.67 to 3.46 which later decreased significantly P< 0.001 on 7thday. The crabs when place in pesticide-free medium were observed to consume more oxygen (by 44.94%) but were unable to come back to normal level and were found to be highly significant (P<0.001). The ablated crabs when injected with Eyestalk extract exhibited increased oxygen consumption which was 17.60% higher than that of ablated crabs. These crabs upon further exposure to sub-lethal concentration of the pesticide showed further increase in oxygen consumption from 4.82 to 5.29 on the 1st day of exposure and the values were highly significant(9.75) and during the subsequent days of exposure, oxygen consumption decreased significantly (70.12%) in comparison with control crabs. The extract injected crabs on exposure to pesticide-free medium were observed to consume more oxygen on the 1st day by 3.73%, but this increase was less than the ablated crabs indicating the presence of respiratory inhibiting factors in eyestalk. As the days of the recovery increased oxygen consumption went on increasing (in normal, ablated and ablated injected crabs) upto 5.81% in normal,44.94% in ablated, 16.59% updated injected crabs. Gills of the crab showed the changes like thickening of epithelium, cells were necrosed and the haemocytes were highly granulated , vacuolization was observed, lamellas sinus was damaged interlamellar distance was increased, connective fluid was reduced.

Oxygen consumption of Barytelphusa guerini on exposure to sub-lethal concentration of monocrotophos at different periods.

Experiment al animals	Control	1st day	4th day	7th day	1st day	4th day	7th day
Normal	5.85±5.06	6.81± 6.28* (-16.28%)	4.07± 2.85* (-31.89%)	2.02± 2.02** (65.00%)	5.71± 7.12* (12.82 %)	5.36± 13.1 6 (8.37%)	5.51±12.79 **(5.81%)
Ablated	2.67± 2.99 (54.35%)	3.46± 1.70 (-29.58%)	1.951± 1.75 * (26.96%)	1.321± 2.08* (50.00 %)	2.07±2.67** (22.47 %)	1.961± 2.93**(2 6.59%)	1.471±1.77 *(44.94%)
Ablated + injected	4.82±2.55 (17.60%)	5.29± 5.11 (-9.75%)	3.40±7.34 (29.46%)	1.441± 1.50(70.12%)	4.641±1.86** (3.73%)	4.521±1.7 2 (6.22%)	4.02±12.35 ** (16.59%)

DISCUSSION

Organophosphate pesticide monocrotophos adversely affects the respiratory metabolism in the crab *B.guereni* evidenced by the result obtained. Similar observation were made by the several workers Jaiswal and Lonekar (1991) in *B.cunicularis* on ekalux exposure . Monica (2002) such changes in the rate of oxygen consumption in *B.cunicularis* on cadmium exposure; Bharti et al (2002) report gradual decrease in oxygen consumption in *P.hydromous* on monocrotophos exposure; cirrinus mrigala on exposure to lethal, sub-lethal concentrations of cypermenthin decreased whole animal oxygen consumption Prashant et al, (2003); Sabita Borah (2006) reported increased oxygen consumption initially and gradually decreased with advancing days of crude oil; Venkateshwaralu and venkatachary (1995) in *B.guerini* in relation to oxygen consumption in earlier studies. Such initial Increase in oxygen consumption is attributed to a sudden change in the medium whereas the decreased in oxygen consumption thereafter could be due to reduced capacity of diffusion across the gills. Exposed crabs on transfer to pesticide -free medium reached normalcy of oxygen consumption.

It is observed that removal of both eyestalk in the crabs, leads to increase in oxygen initially which decrease later on. however, the increased rate of oxygen consumption ablated crabs comes to normal level when the eyestalk extract was injected to eyestalk ablated crabs . It appears that the oxygen consumption inhibiting factor is present in the eyestalk of *B.guerini*. Nagabhushanam and Kulkarni (1979) reported the respiratory inhibiting hormone in eyestalks and respiration enhancing hormone in the thorasic ganglion of the fresh water prawn *Macrobrachium kistnensis*; it was observed by Bodkhe (1983) that neurosecretory material has been observed in the brain and thorasic ganglion *B.cunicularis* exposed the lethal concentration of carbomate .increased utilisation of oxygen initially may be due to requirement of more energy during the sudden stress withstand toxic conditions as observed in *B. cunicullaris* exposed to endosulphan shanmugum(2001); In Barytel-phusa

cunicularis Diwan Nanabshanam(1972) observed eyestalk removal led to definite decrease of oxygen consumption by 48hr after eyestalk ablation, oxygen consumption increases, it may be Monocrotophus inhibiting AchE, this enzyme is indirectly playing major role in regulation of RH (respiratory inhibiting hormone) and this in turn regulates oxygen consumption as observed Bharti et al, (2001) in *P. hydrodromous*. Injection of cerebral ganglionic extract to the ganglia removed animals restore the rate of oxygen consumption (Vedpathak and Wagh, 2009), Vedpathak et al (2011) and Mangesh Jadhav et al (2012); Vedpathak et al (2015) in freshwater bivalve Indonaia Caeruleus. Thorat & Vedpathak (2016) studied the role of cerebral and visceral ganglia in respiratory metabolism in esturine bivalve Katelysia opima. The pollution may induce stress to exposed animals New well,(1973);many workers have shown the harmful pesticides on histological structure of gills of crustaceans sarojini et al, (1989); Kurian (2002); Monica (2002); jayakumar (2002).Bhavan et al (2000);The decline in rate of consumption may be the result of formation coagulated mucous over the gills and body surface of the crab. Thus the change in the gill structure due to pollutant would affect the respiratory activity of animals.

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