

# The lethal effect of dimethoate on heart beat rate of female crab *Barytelphusa guerini*.

Deshai R. B<sup>1</sup>, Shinde V.D<sup>2</sup>, Katore B.P<sup>3</sup> and Ambore N.E.<sup>4</sup>

<sup>1</sup>Dept. Of Zoology, Mahatma Gandhi Mahavidyalaya, Ahmedpur, Dist. Latur (MS) India.

<sup>2</sup>Dept. Of Zoology and Fishery Science, Toshniwal ACS College, Sengaoon Dist Hingoli. (M.S.) India.

<sup>3</sup>Dept. Of Zoology, Nagnath Mahavidyalaya, Aundha Nagnath, Dist. Hingoli (MS) India.

<sup>4</sup>Ex-Dean Faculty of Science.S.R.T.M.University,Nanded(M.S.)India.

## Abstract

The circulatory system is communicating organ system as it communicates with various systems of the body. It ensures proper distribution of the oxygen and nutrients apart from collection of metabolic waste and delivery to excretory organs like kidney. The circulatory body fluids transport various chemical substances necessary for metabolic continuity like hormones etc. The system of structures, consisting of the heart, blood vessels and blood is named as circulatory system. In these animals the system of cavities should be considered as a haemocoel and the blood which fulfils the characters of a circulatory fluid and those of inertial lymph should be caused haemolymph. The pigment haemocyanin is found in the blood of most crustaceans hence it has light blue color. The experimental animals collected from paddy field. The toxic effect of dimethoate resulted to disturb the regular working of heart. In this paper study about the heart rate of female crab. *Barytelphusa guerini* shows variations from 24 hr; 48 hr; 72 hr and 96 hours. The results are comparatively discussed with using graph and table.

**Keywords:** Toxic effect, Dimethoate, Behavior, Female fresh water crab *Barytelphusa guerini*

## INTRODUCTION

As the most intelligent man acquired supremacy and mastery over each and every object on the earth and made them to keep under his control. With scientific temper and inexplicable Herculean strength he fought even against the supernatural powers like natural calamities. 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 well being of the total community to satisfy its basic needs like shelter, fabrics and food.

The animals required food and oxygen continuously for energy and to perform various metabolic activities. Thus digested food and oxygen should be transported to all the cells. This function is carried out with the help of body fluids. The arthropods possess the open type of circulatory system, which is presumably derived from the highly organized closed system of their annelids or pre-annelids ancestors. In most of the crustaceans the heart is dorsally placed inside the body.

The green revolution has increased the production utilization of various types of pesticides for increasing the agricultural productivity; the indiscriminate use of them has polluted the aquatic environment, because these pesticides ultimately find their way aquatic environment. These pesticides have been found to be extremely toxic not only to several aquatic biota including crustaceans [8, 1, 19, 22] and ultimately poisoning dual threat to mankind. Pollution of

aquatic environment by a variety of toxic substances has been a major concern for humanity. The adverse effects of industrial effluents on biological system have been well established in recent year; fishes are important aquatic animals and are particularly sensitive to a wide variety of pesticides and chemicals industrial effects [24, 10].

Whatever knowledge about cardio physiology of the crab does not fulfill the existing gap. Now-a-days investigators divert their concentrations to observe effects of toxicants pesticides upon the sensitive physiological system of animals. By considering the fact, that the present work was undertaken to determine the effect of the pesticides such as dimethoate on the heart rate of freshwater female crab, *Barytelphusa guerini*. This pesticide toxicant is mainly used in paddy field for pest control and from industries, they change the natural environment by industries, they change the natural environment by exerting their toxic effects on some other physiological and metabolic activities of the organ system.

## MATERIAL AND METHODS

The crabs, *Barytelphusa guerini*, are a freshwater crab collected from the paddy fields. The rate of heart beat was noted after exposure interval of hours, 24hrs, 48hrs, 72hrs and 96 hours. The method used as follows:

The dissected animal body of exposed heart was kept in crab ringer solution to determine the rate of heart beat. The crab ringer contains all the essential components somewhat similar to that of crab haemolymph.

### Crab Ringer Composition

Sodium sulphate – 1.5261 gm  
Sodium phosphate – 0.0358 gm  
Sodium chloride – 16.1000 gm  
Potassium chloride – 0.4162 gm

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\*Corresponding Author

Deshai R. B

Dept. Of Zoology, Mahatma Gandhi Mahavidyalaya, Ahmedpur,  
Dist. Latur (MS) India

Tel: +91-9921590483; Fax: +91-9921590483

Email: [rajdesai07@gmail.com](mailto:rajdesai07@gmail.com)

Magnesium chloride– 0.0804 gm  
 Glucose –0.6000 gm  
 Distilled Water –1000 ml

Preparation of ringer solution was prepared by using annual grade reagent and the pH was to 7.7 with the help of pH 7.7 tribuffer. The glucose was added to the crab ringer solution just before the use [20]. If the ringer is stored in refrigerator, could be used up to 15 days. It is the best quality composition in which the heart maintained a constant beat for 1 to 2 hours. The animals were collected from their natural habitat and acclimatized. Healthy female crabs weighing between 30–50 gm were selected for experimentation to avoid the effect of size and sex [3 , 21].

The heart beat was seen visually. Then the dissected animals were subjected to finger bowl filled with crab ringer and maintained 5 minute to allow the animal to recover from shock affect. The heart beat was noted and time taken 10 min. for each trials. The heart beat was determined in control exposure of dimethoate. The plotted graphical interpretation has been given the nature of toxicant and their intensity.

**RESULTS**

In present investigation when freshwater female crab, *Barytelphusa guerini* were exposed to pesticide dimethoate. A significant change in heart rate was noticed. The results of experiments conducted are presented in Table and graphical representation for pesticide illustrated in Figure respectively. When crabs exposed to lethal concentration of dimethoate, a significant decrease in rate of heart beat was observed. After the treatment of dimethoate, rate of heart beat significantly varies. It show slight increase in rate of heart beat initially at 24 hours further the heart rate accelerated up to 72 hours and again decline at 96 hours but not up to 96 hours as compared to control.

In dimethoate solution, the heart beat was accelerated at 48 hours and 72 hours simultaneously. Increase in heart rate due to increase in metabolic activity of heart at cellular level and nervous level because of shock of toxicant & stress on normal physiology of circulation. But later on it gradually recover, after the end of exposure the heart rate tends to normal.

**Effect of Dimethoate on Heart Rate Beats in Freshwater Female Crab *Barytelphusa guerini***

Effect of Dimethoate causes changes in Heart Beats. Heart Beats expressed in Beats/min. is the average of six observation ± S.D.

Table. Effect of Dimethoate on Heart Rate Beats in female crab *Barytelphusa guerini*

Sr.No.	Duration of Exposure	Control	Experimental
1	24	21.01 ± 0.098	25.11 ± 0.075*
2	48	21.08 ± 0.090	27.55 ± 0.055**
3	72	21.53 ± 0.072	31.83 ± 0.052**
4	96	22.16 ± 0.046	26.51 ± 0.059**

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

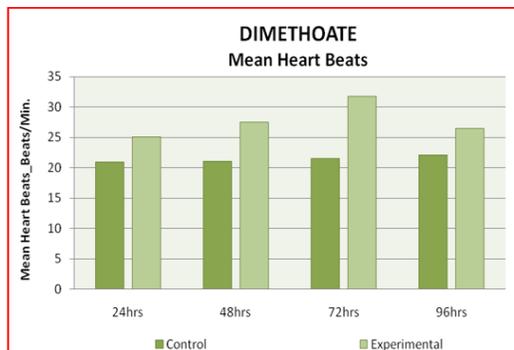


Fig. Effect of Dimethoate on Heart Rate Beats in *Barytelphusa guerini*

**DISCUSSION**

Crustaceans possess an open type of circulatory system and the haemolymph flows in the blood sinuses. A dorsally situated heart is present in most crustaceans. Though a true heart is lacking in cirripedes and many copepods and ostracodes [15]. The brachyran heart is rhomboidal in shape and helps in circulating the haemolymph in the body with the help of its rhythmic beating [15].

Haemolymph contains haemocyanin, which is oxygen binding site in blood. It is known, that the frequencies of crustaceans heart rate differ under different environmental conditions. It varies not only dismal rhythm, but also lie to temperature, hydrogen ion concentration, toxicants, sex and size. Hence recording time of observations and other factors were also taken into consideration and kept constant. Thus any environmental factor that alters the process of oxygen uptake can be expected to affect circulation. Of courses it is not exclude the possibility of some chemical acting directly on the heart and blood vessels.

The rate of heart beat frequency has been studied in different crustaceans with conclusive report that alteration in heart rate occurs with change in environmental conditions, temperature, and pH, salinity of water [13, 14, 9, 11, 12,18]. Crustaceans are the best studied invertebrate among which freshwater crabs have been intensively investigated with reference to their physiological aspects [17, 26]. The data which available on the rate of heart beat in a variety of crustaceans list it is influenced by several factors of which size [20]. As per the general rule it might be stated the heart rate varies inversely with body size and the trend is valid for most of the crustaceans. Blood volume has been determined in a number of crustaceans including crabs and it is evident that it is highly variable [16,23], studied different heart rates in a variety of crabs of different body weights and he showed clearly that the heart rate decreases in heart exponentially with increasing body size.

The fact that the heart weight always increases with body size while the heart rate decreases with the same, in might be suggested that decrease in heart rate might be due to heaviness of heart itself. Hence it can be stated that if the heart become heavier, the force required to beat will be grater and ultimately the rate of heart beat falls.

Environmental pollutants brings about the damage to different organs of disturb the physiological and biochemical processes of the organism following exposure to pollutant. Effects of different pesticides, inorganic ions, drugs and antibiotics on crustaceans hearts specially crabs have been used by many workers to reach the details about adrenergic and cholinergic property of crustacean heart

[2,5 and 7]. Some important contributions have been made regarding cardio-vascular system by [6] in land crab *Gecarcinus lateralis*. Likewise some other [4, 25, 12] have been studied about cardiovascular system in crab *Carcinus maenas*.

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