SURVIVAL RATE OF FRESHWATER CRUSTACEAN, *BARYTELPHUSA GUERINI* IN PADDY FIELDS OF NANDED DISTRICT UNDER INFLUENCE OF TEMPERATURE STRESS

Jagtap, A. R. and Mali R. P
Department of Zoology, Yeshwant Mahavidyalaya, Nanded - 431602, Maharashtra
E-mail of Corresponding Author: ashu_anamica@rediffmail.com

Abstract

Climate change may strongly influence distribution and abundance through changes in survival rate of animals. The freshwater crustacean, *Barytelphusa guerini* collected from paddy fields of Nanded district. The present paper deals with the survival rate of freshwater crab under temperature stress. The crabs were exposed to six different temperatures ranging from 15°, 20°, 25°, 30°, 35° & 40° C. The survival rate was found to be high at lower temperature (15° & 20° C). The survival rate was initiating to reduce at 25° C and became lowest from 30° C.

Keywords: Temperature, Survival Rate, *Barytelphusa guerini*

1. Introduction

Today temperature is being a serious problem throughout the world. Out of various environmental factors that influence aquatic organisms, temperature are the most all-pervasive\(^2\). It limits the survival and distribution of various forms of life on the earth. Normal life activities go on smoothly at specific range of temperature i.e. optimum- temperature. The organisms react to any rise or fall of optimum temperature range and biotic communities shows alterations due to increased environmental temperature. Numbers of factors are responsible for the increase in temperature of the environment that are uncontrolled increased pollution, green houses which emits enormous amounts of carbon dioxide and nitrous oxide which absorbs infrared radiations are reflected back from the earths warming by the sun and redirects it to the earth. This leads to the inclined heat on the Earth’s Surface \(^4\), \(^9\), \(^{24}\). Other gases such as nitrogen oxide, methane, ozone etc. also absorbs the infrared radiations \(^{21}\). The increase in concentration of gases in the atmosphere causes Global Warming trend in Earths Climate \(^{23}\), \(^{20}\). The global warming is ascribable in large part to human activities causing rapid deterioration of the environment and increasing the threat to biodiversity \(^{15}\). Due to human activities changes occurred in thermal environment the activities of aquatic organisms must also change. Depending on the magnitude & rates of thermal changes, there may be minor readjustments of rates of metabolism and growth or major changes in the distribution of species and functioning of affected aquatic ecosystems \(^2\), \(^8\). Water temperature is most notable factors influence on aquatic organisms\(^{16}\). The ectothermic animals show body temperature changes with the ambient temperature which influences the metabolic rate and performance of animals. An increase in or decrease in ambient temperature increases or decreases the animal’s metabolic rate until an upper or lower critical temperature is reached respectively. The upper & lower critical temperature in animals variable cause’s inclined biological processes of organisms impaired by effect of temperature until of animal death\(^{12}\). The mechanism behind thermal death leads to number of primary mechanisms which include failure of neuronal function, excessive membrane fluidity, loss of nervous system integrity & oxygen supply as well as enzyme functions\(^{11}\), \(^{18}\).

Several researchers studied on effect of temperature on physiological processes in aquatic animals suggest high temperature within tolerance limits does not have any direct effect on mortality, but some factors Viz., reduced feeding, poor growth, high metabolic expenditure responsible along with temperature \(^1\), \(^{16}\). The effects of temperature have been considered both in terms of acute, temporal changes during course of acclimation to new temperature and in terms of homeostatic compensations or adaptation compromises to changed environment \(^{19}\). To overcome from this recent burning problem the present paper is trying to fulfill gap of the study of temperature stress on survival rate on biological indicator, freshwater crustacean *Barytelphusa guerini*.

2. Materials and Methods

The fresh water crab, *Barytelphusa guerini* is available abundantly in the paddy fields of...
Nanded district, Maharashtra. They were maintained in the glass aquarium, fed with goat meat and acclimatized for 09-10 days prior to experimentation. The crabs were fed with the small pieces of earthworms. Only healthy crabs of same size (35-40 gms) were selected for experimentation. The water in the aquarium was replaced daily with fresh tap water. The time and temperature at which death occurred in experimental set were noted. Thermal death occurs at 12° C and 45° C i.e. the survival rate of *Barytelphusa guerini* selected for the present experiment was between > 12° C and < 45° C. The freshwater crab, *Barytelphusa guerini* were subjected under variable temperatures i.e. for 15°, 20°, 25°, 30°, 35° and 40° C for experiment. The animals were divided into seven groups having 10 crabs in each aquarium. The first set was control and maintained under laboratory at seasonally ambient conditions of water temperature and photoperiod. The 2nd, 3rd, 4th, 5th, 6th & 7th set was subjected to 15°, 20°, 25°, 30°, 35° and 40° C temperatures respectively. Animals to cold temperatures (15°, 20°, 25° C) were enabled by subjecting the animals in glass aquarium in BOD incubator pre-adjusted to particular temperature. The 5th, 6th & 7th set was designed to study the effect of warm temperature stress (30°, 35° and 40° C) in thermostatic water bath pre-adjusted to particular temperature. The experimental sets were designed to investigate influence of temperature on survival rate of freshwater crustacean, *Barytelphusa guerini*.

### Results

The present investigation focused attention on the survival rate of freshwater crab, *Barytelphusa guerini* under influence of variable temperatures. The crustaceans were exposed to different temperatures i.e. 15°, 20°, 25°, 30°, 35° and 40° C for 07 days. The results at which the death of animal and temperature at which death occurs were noted simultaneously.

The present data reveals that under low temperature exposure minimum mortality was observed. The survival rate was found to be more. At 20° C, 25° C & 30° C the survival rate in crabs were 10, 30 & 40 % respectively. 100 % survive lance of animals was found at 15° C temperature exposure. As temperature increases the survival rate of crabs was found to be decreased. The resultant mortality at 35° C & 40° C was 60 % & 100 % respectively.

#### 3.1 Table: Percentage of Mortality and Survival Rate observed at different temperature Stress in Freshwater Crab, *Barytelphusa guerini*

| Sr. No. | Temperature Range | Number of Animals Dead | Percentage of Mortality | Survival Percentage |
|---------|-------------------|------------------------|-------------------------|---------------------|
| 1       | 15° C             | NIL                    | NIL                     | 100 %               |
| 2       | 20° C             | 01                     | 10 %                    | 90 %                |
| 3       | 25° C             | 03                     | 30 %                    | 70 %                |
| 4       | 30° C             | 04                     | 40 %                    | 60 %                |
| 5       | 35° C             | 06                     | 60 %                    | 40 %                |
| 6       | 40° C             | 10                     | 100 %                   | NIL                 |

#### 3.2 Graph - Graphs showing percentage of mortality versus temperature range
4. Discussion
The distribution and existence of crabs depends on specific environmental parameters viz., temperature salinity, pH and dissolved oxygen. The concept of temperature regulation in animals into homeotherms and poikilotherms has also emerged through studies. The poikilotherms, having a variable body temperature, not able to expend energy on thermoregulation which causes serious ecological implications. Since metabolic machinery of such organisms is susceptible to changes in environmental temperature. This led to considerable interest amongst the biologists in temperature relation of poikilotherms.

The metabolic machinery of crustaceans directly correlated with the external variable i.e. temperature which directly or indirectly affects the normal activities in animals. If affects directly in terms of activation energies of key biochemical reactions. Temperature affects the organisms indirectly through its effect on the metabolic rate of organism. Oxygen consumption of crustaceans changes according to temperature. The rate of oxygen consumption and temperature has been attributed to the physiological changes and biochemical reactions that take place in animal body. The metabolic rate of animal increased with temperature which results incline in bronchial water flow to supply extra oxygen demand in crab. This causes utilization of more oxygen which leads finally death of animal due to less availability of oxygen. The reason behind thermal death could be because of inactivation of enzymes at rates exceeding their formation rate or depletion or accumulation of certain intermediary metabolic products in which formation and transport mechanism are temperature dependent.

The increase in temperature reduced binding capacity of copper containing blood pigment called as haemocyanin. This causes depletion of available oxygen affects survival rate of animals. The animals death occurs at high temperature may be due to asphyxiation. At lower temperature the death may be due to enzyme inactivation and accumulation of toxic substances in animal body which makes crabs impossible to survive.

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