

Gokhale Education Society's

SWAYAMPRAKASH

Luminescence

Journal of Research



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Effect of *Sapindus mukorossi* on Biochemical and Physiological Parameters of Crab, *Paratelphusa jacquemontii* (Rathbun)

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Crab, *Paratelphusa jacquemontii* (Rathbun), is important food as well as pest in the paddy field and cause destruction in Canals, dam and water reservoirs. In present investigation, toxicity of *Sapindus mukorossi* plant leaves was evaluated and variations in glucose and protein content were demonstrated at 10 ppm and 20 ppm concentration for 24 and 48 hrs. Simultaneously oxygen consumption was also determined to know mode of toxicity of *Sapindus mukorossi* extract. Where decrease in glucose and proteins were noted while oxygen consumption was increased. This may be due to the stress, increased energy demand lead increased metabolic pathways like Glycogenolysis, and Gluconeogenesis resulted in alterations of oxygen consumption. *Sapindus mukorossi* extract cause toxicity and alteration of physiological state.

Key Words : *Paratelphusa jacquemontii*, *Sapindus mukorossi*, Oxygen consumption. Glucose, Protein.

Introduction:

Crabs are highly proteinaceous food, useful to humankind. Moreover, many crabs can serve as feed for fish cultures, for turtles and domestic birds and other animals. On duck farms, food mixed with crab powder not only stimulates, but responsible for the fattening of ducks and raise their spawning rate. Crabs supply food for fishes are of great service as scavengers and are used as human food in various parts of the world. They are important diet for man with great nutritive value¹. Crabs have been reported to cause heavy losses to paddy crops. They burrow into the soil to conceal during the daytime. They make burrows in the fields or also river dams causing great damage. Especially in the paddy fields, development of crops is greatly attacked by such pests. They cut the young paddy plants near the ground level and carry them to their burrows for feeding. They are active during night as they are nocturnal. Besides their crop damaging activity, they prepare a series of burrow in the paddy fields due to which water is not retained in the field². Thus, crab is major crustacean pest of paddy crop field. In Maharashtra, they cause heavy losses to paddy fields in Ratnagiri (Konkan), Thana, Kolaba districts. There are three species of crabs known to damage in our country locally referred as Khekada, Chimburi and Muthya. All these crabs are polyphagous.

The toxicity of the pesticides due to their indiscriminate use causing the destruction of natural environment. Despite many research investigations, predicted of toxicity of pesticides to crab has been uncertain. The earlier research on toxicity of pesticides to

the crab was totally centered on the organo-phosphorus and organo-chlorines. Synthetic organic pesticides used to control crab have produced ill effects on non-target organisms. In addition, most crab species have becoming physiologically resistant to such synthetic pesticides³. Some plants have been found to contain natural substances, effective against crab and acts as pest control. Citronella, Neem oil, Lemon, acts as a natural pesticide that will kill crabs and their eggs⁴. In present investigation natural plant toxicant have been used to evaluate toxicity on crab. Plant extract of *Sapindus mukorossi* is supposed to cause toxicity in crab, which is reinvestigated, and its possible impact on metabolic activity in the crab was evaluated. This research may contribute in knowing the route of toxicity and mechanism of poisoning, which certain proved helpful in deciding the consumption of intoxicated crab as food.

Materials and methods:

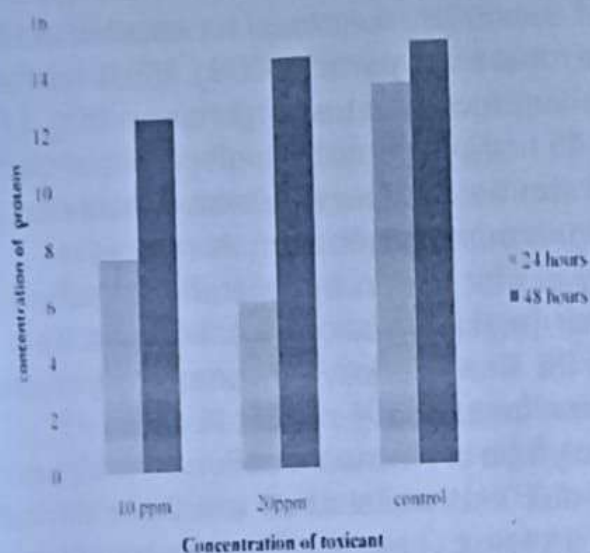
S. mukorossi leaves were collected from gardens at Nashik city, Maharashtra State, India, in December 2009. Leaves were shed dried and powdered. Percolation method⁵ is used for alcoholic extraction of dried and powdered leaves. It was concentrated using rotary evaporator, dried, weighed (13 gm) and stored in glass bottle. Further, it was washed with petroleum ether and used for stock solutions preparation. Crabs were collected from Trimbakeshwar paddy fields with the help of the net and plastic jars and brought to laboratory. These crabs were observed and identified as *Paratelphusa jacquemontii*. Crabs were acclimatized with well-aerated dechlorinated water for one week in laboratory. Feeding was restricted during experimentation.

Alcoholic extract of *Sapindus mukorossi* was used in two different concentration of 1/2 sublethal (10 ppm) and sublethal (20 ppm). Experiment was run in triplicate. In each jar three crabs of average weight of 350 gm were released in 1 liter of dechlorinated water. After 24 hrs and 48 hrs, crab hemolymph was withdrawn by hypodermic syringe and immediately proceed for biochemical test for total protein by Biuret method and glucose by DNSA method⁶. For oxygen consumption, crabs were dried, weighed, and subjected for oxygen consumption test in two separate jar with 10 ppm, and 20 ppm, extract. Water sample was collected and estimated O₂ consumption using Wrinkler's method⁷. For all experiment, appropriate control was maintained.

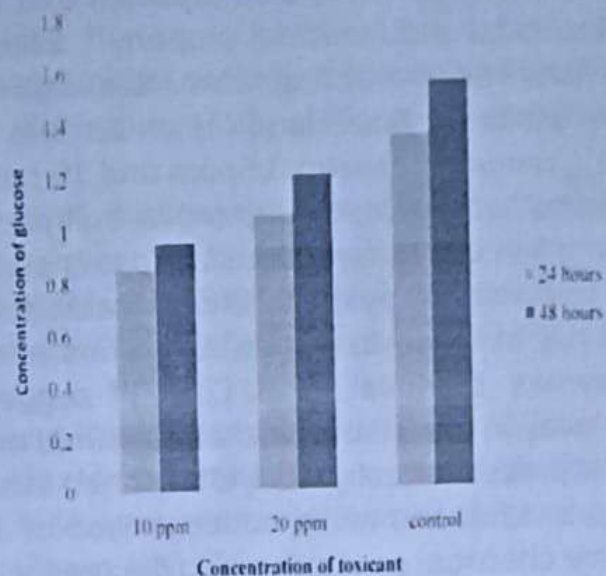
Results:

In previous laboratory bioassay on crab, LC₅₀ for 24 hrs and 48 hrs. was used as reference. In present research 1/2 sublethal and sublethal dose of same extract is used to evaluate biochemical response in the crab. Biochemical tests on intoxicated crab hemolymph showed remarkable effect of stress. At 24 hrs, and 48 hrs. Total protein level, Glucose level and oxygen consumption was presented in Graph 1, 2, and 3 at 1/2 sublethal and sublethal dose respectively. There is significant variation in the total protein, glucose, and oxygen consumption level with respect to duration of exposure and concentration of extract.

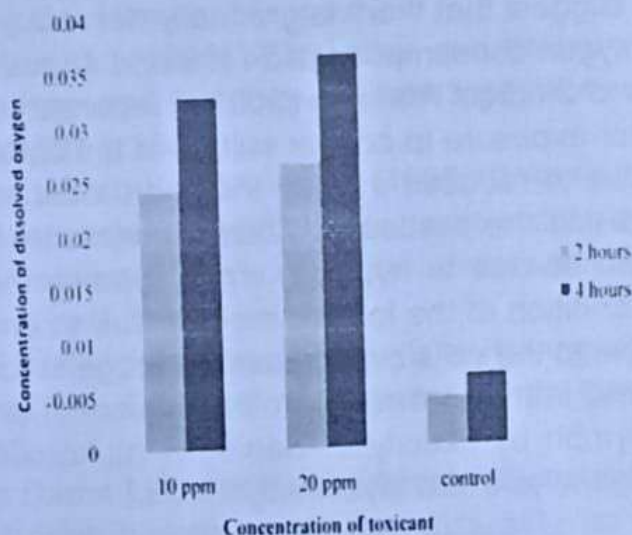
Graph No. 1 Variation in total protein concentration of crab haemolymph after exposure to *Sapindus mukorossi* at 24hr and 48hrs.



Graph No. 2 Variation in total glucose concentration of Crab haemolymph after exposure to *Sapindus mukorossi* at 24hr and 48hrs.



Graph No. 3 Variation in oxygen consumption of crab after exposure to *Sapindus mukorossi* at 24hrs and 48hrs.



Discussion:

Crabs are important protein food. However, they are pests and destroy the crop fields. Many paddy fields are damaged due to crabs. They make burrows into the paddy fields due to which water is not retained in the field. Thus, Crab is a major crustacean pest of paddy fields². Many chemical pesticides are widely used to destroy the crab species, which in turn results in decrease population of crabs, simultaneously causing deleterious effect

on environment and public health^{8,9}. Thus, in present investigation an attempt was made to evaluate biochemical and physiological impact of *Sapindus mukorossi* a prospective bio-control agent for crab. *Sapindus mukorossi* is a deciduous plant, containing saponin as a major component in fruit and leaves; saponin is toxic glycoside having soap like characteristics¹⁰. It is also reported that seed powder of *Sapindus mukorossi* possess insecticidal and larvicidal property¹¹. Effects of *Sapindus mukorossi* have been studied on fish. Pericarp of *Sapindus mukorossi* is the most toxic parts yielding 100% mortality rate within 12 hours and mean survival time was found to be 1.18 hours. LD₀₁, LD₅₀, LD₁₀₀ ranging between 3.5ppm and 10 ppm at 48 hrs and possess high potential for fish eradication. *Sapindus mukorossi* fruit pericarp can be used as a selective eradicator for horned fish like *Heteropneustes fossilis* and *channa punctate*¹².

In biological systems, the biocatalysts play a vital role in the metabolic pathways. Animal exposed to stress conditions alter their physiological status with the help of enzymes. Elumalai, et al. (2007)¹³ suggested an interference with energy production pathway in the tissues of crab *Carcinus maenas* due to heavy metal toxicity.

In present investigation, total protein in haemolymph of crab were observed decreasing in sub lethal and lethal concentration of *Sapindus mukorossi* at all exposure periods. Some chemical pesticides also decrease total protein contents in the gills and muscles of freshwater crab *Paratelphusa jacquemontii* and this was due to alternative source of energy under stress condition^{14,15}. The result of this study indicates that, haemolymph is the sensitive medium for measuring biochemical parameters in crab. Due to the effect of *Sapindus mukorossi*, there is increase in oxygen consumption. In stress condition, crab utilizes more oxygen dissolved in the water so the oxygen consumption of crab increases. Graph No. 3 suggest that there is gradually decrease in protein and glucose levels and increase in oxygen consumption at 24 hrs and 48 hrs.

Akhter Ali Siddiqui and Siddiqui Afsheen (2007)¹⁶ reported a declining trend in the oxygen consumption after exposure to copper sulfate in the crab *Baratelpheusa guerini*. Haemolymph acidosis due to reduced oxygen transport must have also favoured the process of glycogenolysis in the tissues of *Themis orientalis*. Further, the decrease in carbohydrate may also be due to hypoxia, since hypoxia increases carbohydrate consumption. Hypoxia condition of the lobster may be due to anaerobic breakdown of glucose, which is available to the cells by increased glycogenolysis.

These reports suggest that decreased protein, glucose, and increased oxygen consumption of haemolymph by toxicity of *Sapindus mukorossi* alter the metabolic processes through glycogenolysis and glyconeogenesis.

Conclusion:

Present study is related with toxicity of *Sapindus mukorossi* plant leaves extract on crab *Paratelphusa jacquemontii*. It is exhibited in the results as the protein and glucose content demonstrated a considerable decrease on exposure to 10 ppm and 20 ppm concentration of *Sapindus mukorossi* for 24 hrs and 48 hrs, but the oxygen consumption increases at 24 hrs and 48 hrs indicating that more utilization of protein and glucose to meet calorie demand. This may be due to the stress developed during intoxication in the crab.

To meet the increased energy demand the crab might have undergone some metabolic pathway like glycogenolysis and gluconeogenesis, which results in alteration of oxygen consumption. Thus, in present investigation it was observed that *Sapindus mukorossi* extract induces physiological alteration of the crab.

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