PHYSIOLOGICAL STUDY OF THE HUMP BEETLE GIBBIUM PSYLLOIDES CZEMP.

A THESIS PRESENTED FOR THE
Ph. D. Degree

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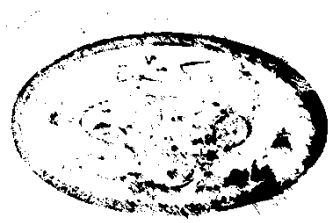

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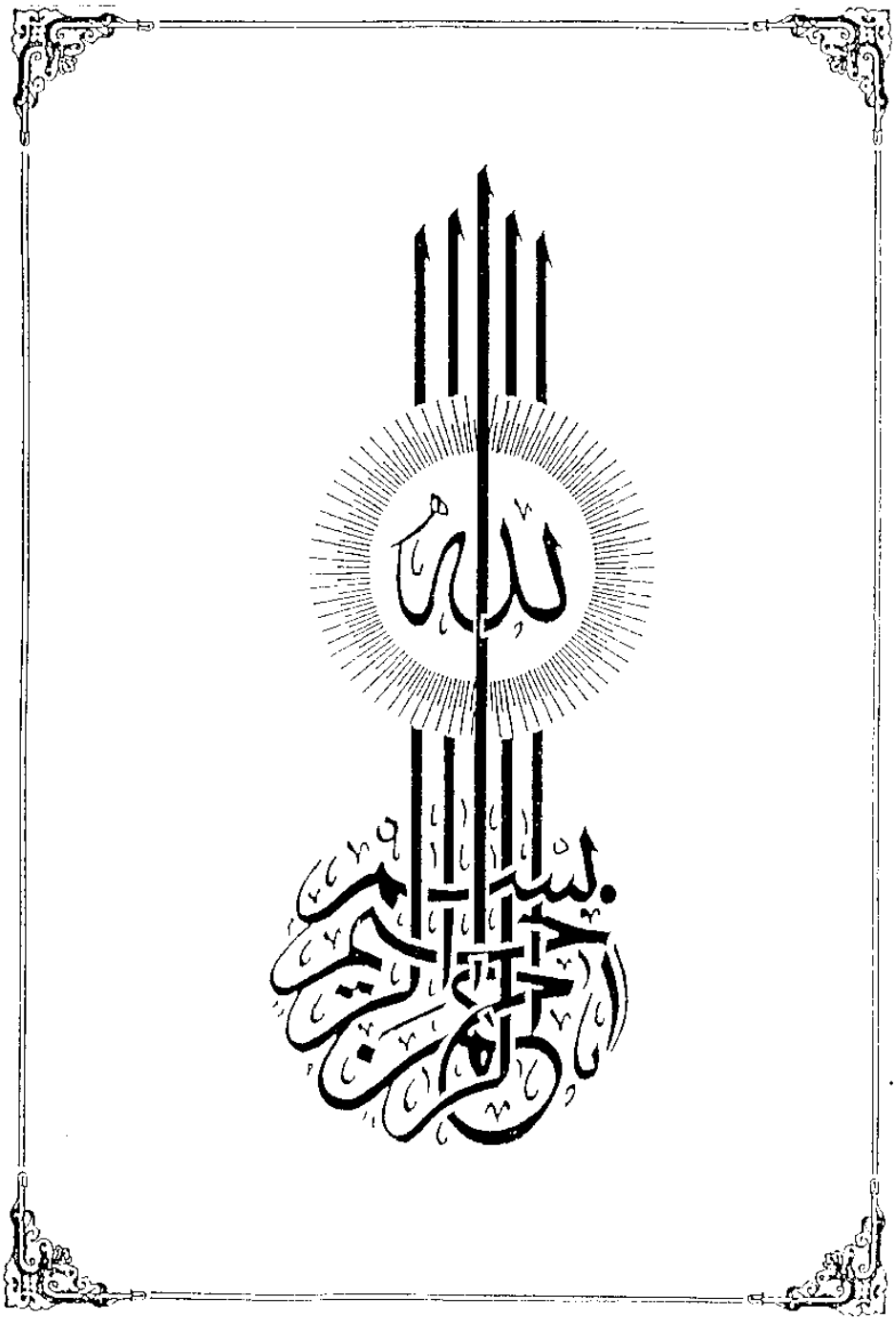

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A C K N O W L E D G E M E N T

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I- INTRODUCTION

Although the hump beetle, Gibbium psylloides Czemp., is an economicaly important pest of stored products, its feeding behaviour and physiology did not receive enough attention.

Accordingly the present study is an endeavour to investigate the feeding behaviour of the adult insects towards different types of nutrients, the digestion of different types of carbohydrates known to be essential nutrient to this insect, and the respiratory metabolism of the different developmental stages at different ages and temperatures.

It has also been tried to study the effect of gamma-irradiation as a practical mean to control this pest in the stores. The importance of the gamma-irradiation is due to its effect on the reproductive potential of the stored products beetles, which is directly reflected on the population density of the pest.

Aim of the present study:

The present study of the hump beetle, Gibbium psylloides Czemp., aimed to investigate the following points:

1- The response of the adult beetles to different types of nutrients (carbohydrates, proteins, lipids, vitamins and inorganic salts).

2- The digestion of carbohydrates in the midgut of larvae and adult beetles.

3- The respiratory metabolism (oxygen consumption and respiratory quotient) of the different developmental stages at different ages and to what extent it is influenced by temperature.

4- The effect of gamma-irradiation on emergence, survival and sterility of the insect.

II- LITERATURE REVIEW

(1) Feeding behaviour:

While nothing has been reported on the feeding behaviour of the hump beetle, Gibbium psylloides Czemp., much can be found in the literature on the nutritional requirements of many other insects.

Flügge (1934), found that Drosophila in presence of a strong source of odour, can steer in a straight line towards it from a distance of 15 - 20 cm.

Davenport et al. (1960), commented that slow adaptation may result in aggregation of directly Klino-Kinetic animals near the point of greatest intensity stimulation, while rapid adaptation would result in aggregation away from the point of high intensity stimulation.

Thorsteinson (1960), reported that sucrose, and some amino acids stimulated feeding behaviour of the clear-winged grasshopper, Camnula pellucida. Also he indicated that KCL exhibits an inhibitory effect on the feeding responses to sucrose, but that KH_2PO_4, which does not by itself evoke feeding responses, appreciably enhanced the response to sucrose. The mixture of the amino acids

evokes considerable feeding response, even at a very lower molar concentration. This apparent synergistic effect was further increased by adding sucrose.

Mallis et al. (1962), found that the inorganic salts K_2HPO_4, Kcl, Nacl and Na_2HPO_4 stimulate the feeding responses of larvae of the webbing clothes moth, Tineola bisselliella Hummel., and the furniture carpet beetle, Anthrenus flavipes LeConte.

Loschiavo et al. (1963), reported that the feeding behaviour of Scolytus multistriatus, seems to be regulated by a chemokinetic or chemotactic influence of one or more components of the host, which may act as an arrestant, a feeding stimulant, an attractant, or a combination of these. He found that the highest response usually occurred in the first hour of exposure to extracts. Subsequent exposure evoked decreasing responses.

Loschiavo (1965), found that feeding response in Tribolium confusum was unaffected by sex ratio. The flour beetles were sensitive to different concentrations of sucrose.

Shmuel and Stanley (1967) pointed out that larval feeding was stimulated by, proteins, sugars, wheat germ

oil, and inorganic salts. Of the proteins tested, casein was the best feeding stimulant for Trichoplusia ni. The order of effectiveness of sugars as feeding stimulants was: Sucrose > fructose > dextrose. The response threshold to sucrose was found to be 5×10^{-5} M. Wesson inorganic salt mixture stimulated feeding when incorporated in the complex meridic diet, and the salt mixture was found to senergize the stimulatory effect of wheat germ oil.

Hsiao and Fraenkel (1968), found that one sugar (sucrose), several amino acids and three phospholipids elicited marked feeding responses of Leptinotarsa decemlineata. Inorganic salts (Kcl, KH_2PO_4 and Nacl) were inactive alone, but acted synergistically with other feeding stimulants. Additive effects on feeding responses were observed when two different feeding stimulants were combined.

Akeson et al. (1970), found that from 21 sugars and related compounds which were used as feeding stimulants for Sitona cylindricollis, sucrose was the most effective feeding stimulant. Compounds with moderate stimulant activity were fructose, glucose, galactose, manose, myo-inositol and maltose. Slightly active stimulants were ribose, xylose, sorbose and sedoheptulose. Arabinose,