SUMMARY

CHAPTER 1

A brief account of the systematic position, general morphology and stages of development of the dermestid beetle, Anthrenus vorax Waterhouse is given. A description of a hitherto unrecorded spermathecal gland associated with the female reproductive system is also included.

CHAPTER 2

To develop a suitable medium for the maintainance of a laboratory culture, the insects were reared on different media such as horn, dried pigeon breast muscle, dried muscle supplanted with 5% yeast, and casein supplanted with 5% yeast, and their influence on the larval period was studied. All experiments were carried out in an incubator at 32 ± 1°C. On a diet of dried muscle the larval period was 84 ± 23 days, the individual values varying between 40 and 140 days. The addition of 5% Brewer's yeast to this medium reduced the larval period to 36 ± 4 days. On sheep horn the larval period lasted 37 ± 5 days and on a mixture of casein and yeast 43 ± 3 days. Dried pigeon breast muscle supplanted with yeast was used for rearing the insects for the subsequent studies.

The incubation period of the egg was 6.78 ± 0.42 days. The actual pupal period was found to be 6.46 ± 0.25 days for male and 6.61 ± 0.24 days for female at 32 ± 1°C. The quiescent adult period lasted 4.27 ± 0.69 days at the same temperature.

Without food the adult lived for about 14 to 30 days, the average longevity being 22.75 ± 2.75 days for the male and 18.25 ± 0.50 days for the female. It was observed that egg production was autogenous, the majority of eggs being laid without feeding. The eggs were laid in batches with a few days interval showing at least three well-defined peaks of oviposition. An average of 72 eggs were laid per female, a number which was considerably higher than that reported earlier by some authors. The larvae and adults were found to be capable of constructing an irregular 'mat-work' made up of detached larval hairs which possibly served as an egg laying bed. Egg laying was hampered in the absence of a suitable oviposition medium.

The larvae and adults of this species were recorded from the nests of swifts.

CHAPTER 3

The histology of the larval fat body was studied and was shown to be a syncytium, composed of numerous globular configurations, each consisting of a nucleus, a central fat globule and numerous peripheral globules. They are regarded as specialized units of organization having some significant physiological implications and marking a specialized line in the evolution of insect fat body.

CHAPTER 4

The central globules of the larval fat body are shown

to consist of neutral triglycerides. The exact chemical nature of the peripheral globules could not be fully elucidated. They were both basophilic and acidophilic and showed an affinity for vital dyes. They gave histochemical reaction for protein. Deposits of uric acid were demonstrated inside these globules. Reaction for phospholipids were obtained both before and after extraction with pyridine. Though they gave a positive staining reaction for ribonucleic acid, treatment with crystalline ribonuclease, saliva, or trichlorøacetic acid did not prevent a subsequent positive staining for RNA.

It is suggested that the peripheral globules are composed of a complex of phospho-lipo-protein and that they are the lipopoietic centres of the fat body where the dietary aminoacids are deaminated and converted into specific fatty acids or fat to be stored in the central globule as neutral fat. The amino part of the deaminated aminoacids are thought to be converted to uric acid at these sites. Though the peripheral globules would correspond to the so-called 'albuminoids' of other authors, it is pointed out that they are to be considered as specialized organelles and not as mere protein inclusions.

CHAPTER 5

A quatitative study of fat and glycogen contents in the larva and their changes during metamorphosis was made. The larval fat content was found to be 53.7 $\pm$ 1.5% of the dry weight. The water content amounted to only 47.44% in the larva but increased to 50.99% in the newly emerged adult. Glycogen

constituted only 0.81% of the fresh body weight of the larva.

There was a gradual decrease in body weight during metamorphosis. A decrease of 33.69% was recorded in the fat content. Glycogen content showed a sharp rise in the prepupa. With an initial drop in the 1st day pupa, glycogen remained at a high level till the 5th day and then decreased progressively till emergence.

It is concluded that fat and glycogen are used as energy sources during metamorphosis. The possibility of glycogen being used for the synthesis of chitin is not ruled out. Fat as a possible source of glycogen during the initial stages of metamorphosis is suggested and discussed. The high fat content of the emerged adult is considered an adaptation for the reproductive phase, fat being mobilized for the formation of the reproductive elements.

CHAPTER 6

The changes in the activity of the fat splitting enzyme, lipase, during metamorphosis was studied. Lipase activity was high in the larva and only a small part of it was contributed by the alimentary canal lipase. Lipase activity remained high in the prepupa, decreased in the initial stages of pupation, and increased again in the pre-emergent and emerged adult, thus following a U- shaped course. The significance of the lipase activity observed in the different stages is discussed in the light of our present knowledge about lipase.

Homogenates of the larva were found to be incapable

of oxidising Sodium butyrate under in vitro conditions. The respiratory quotient of the larva was found to be 0.83 ± 0.07. Oxygen uptake followed the classical U- shaped curve during metamorphosis. CO_2 production was found to be inconsistent and erratic in some of the pupal stages though it was continuous in the larval stage.

CHAPTER 7

The larval and post-larval stages of Anthrenus vorax were exposed to different doses of gamma radiation and their influence on moulting and pupation of the larva, fecundity and fertility of the adult, and ovarian development were studied.

At all dose levels employed viz. 5, 10, 15 and 20 k rad, pupation was more or less completely inhibited. A few larvae, however, underwent pupation after repeated moults, reduction in size and regrowth and emerged as normal adults. The percentage of successful moults decreased progressively with increasing dosages. At lower doses, comparatively more of the last stage larvae died after reaching the prepupal stage, whereas, at higher doses more of them died during the larval stage itself.

The larval-pupal moult was unhampered by irradiation of the late prepupa in contradistinction to those irradiated as early prepupa. Irradiation of the late prepupa produced certain malformations in the emerging adults. The most significant of these was the complete or partial absence of scales in the adult, an effect which was obtained only when the insects were irradiated

at this stage. Sac-like hind wings were observed in the adults on irradiation of the early pupa.

It is shown that the radiosusceptibility of the pupal stage is inversely proportional to the extent of developmental progression at the time of exposure to radiation. The most susceptible period was found to be the first three days of pupal life.

The 6th & 7th day pupae and the pre-emergent adults were exposed to different doses of radiation. The results of the various mating combinations of irradiated and nonirradiated males and females are presented and discussed. Fecundity and fertility were considerably affected at doses of 5 and 8 k rad. The 6th & 7th day pupae were more susceptible with regard to fecundity. As regards fertility, the male appeared to be more susceptible than the female. The general effect of radiation on the ovaries was a temporary or a permanent arrest of growth.

CHAPTER 8

Certain biological and metabolic adaptations of Anthrenus vorax are discussed briefly. Some preliminary observations made during the course of the present investigation are also presented to indicate some problems and avenues for further studies.