

SUMMARY

CHAPTER 1

Food and temperature conditions to maintain the laboratory cultures of *Trogoderma granarium* were standardized. The insects were reared on crushed wheat at $35\pm 1^{\circ}\text{C}$ and 70% R. H. The number of moults and the duration of the developmental period was found to be 26.2 days and 30.9 days for male and female respectively. The female had six instars and the male five. An additional instar could be noticed in certain individuals.

CHAPTER 2

The effect of temperature and population density on the incidence of diapause was studied. At 20°C and 70% R. H., development was retarded, no pupation could be noticed even after 125 days, whereas at 30°C pupation was completed by the end of 35 days in individual cultures. In crowded 31.6% and in noncrowded cultures 16.5% of the larvae entered diapause. At 35°C and above no diapause larvae could be encountered in any of the population density employed. A study on the effect of diurnal variation of temperature between 25 and 35°C showed that the development is very much influenced by temperature change. The rate of pupation was very low, 3% of the larvae in the crowded cultures, 15% in the noncrowded cultures and 20% in the individual cultures (of the initial number) pupated by the end of 110 days. There was

a high incidence of mortality.

CHAPTER 3

A cytological and cytochemical study of the fat body of the normal and diapausing Trogoderma larvae was made. The fat body of the 2nd day of the Vth instar larva showed conspicuous nuclei with darkly stained chromatin and a large number of proteinaceous globules. The fat body at this stage appeared to be very active. The fat body of the 4th day of the Vth instar showed crumpled nuclei and a considerable increase in the number of proteinaceous globules. That of the diapause larvae showed more or less the same structure as that of the 4th day except for a greater accumulation of fat, glycogen and proteinaceous globules. The cytochemical reactions of the proteinaceous globules revealed its complex nature, These globules gave positive reactions for protein, phospholipids and nucleic acids. Many of these globules were found to enclose 'microvesicles'.

CHAPTER 4

The fat body of 3rd instar larva of Oryctes rhinoceros was studied with a view to throw light on the proteinaceous globules. The presence of protein, lipids, glycogen, uric acid and ribonucleic acid and the activities of the enzymes succinic dehydrogenase and esterases were investigated by quantitative and/or cytochemical methods.

While protein could be demonstrated inside the

proteinaceous globules neutral lipids and glycogen were present only outside them. The possible incorporation of phospholipids and ribonucleic acids in the proteinaceous globules was indicated by the results of the cytochemical methods warranted no definite conclusion. Similarly, though the proteinaceous globules gave certain histochemical reactions for uric acid, its presence remains doubtful, since none of the methods seem to be specific for uric acid. The proteinaceous globules also gave reactions for aldehyde and SH groups. Esterase activity could be demonstrated in the fat body around the proteinaceous globules. On incubation of the fat body in the medium for the histochemical demonstration of succinic dehydrogenase activity with nitro-BT as electron acceptor, an intense deposition of formazan was obtained around the proteinaceous globules. This, however, was not specific for SDH activity since the same result was obtained in substrate blank media. Data obtained on a comparative study of the reactions given by the fat body and flight muscle of Oryctes and pectoralis muscle of pigeon are presented and discussed.

The significance of the various histochemical reactions of the fat body are discussed. It is pointed out that the proteinaceous globules probably represent a complex of proteins and nucleic acids with phospholipids in some of them. A heterogeneity in the chemical constitution of the proteinaceous globules was also indicated by certain

histochemical reactions. It is suggested that the morphological and chemical diversity of the globules might be a temporal nature representing the various stages of a sequential transformation.

The present state of our knowledge of the protein containing inclusions of the insect fat body is briefly discussed and it is pointed out that a comparative study of the proteinaceous globules of various representative insects with respect to their structure, origin and fate would be highly rewarding.

CHAPTER 5

The histological changes in the fat body of T. granarium during the pupal-adult transformation has been studied. The prepupal fat body showed large nuclei and in addition to the proteinaceous globules, small deeply staining protein containing granules. In the pupa most of the proteinaceous globules showed evidences of fusion. In some regions the proteinaceous globules started breaking down especially near the body wall and other developing tissues. The second type of granules were seen distributed around the proteinaceous globules. In the pre-emergent adult the fat body showed granular patches representing broken down proteinaceous globules, near the developing imaginal tissues. In the adult the major part of the proteinaceous globules disappeared. A large number of haemocytes were found in the fat body showing cytoplasmic extensions to the proteinaceous

globules. Many haemocytes were seen to engulf the proteinaceous globules within their access. Some of the larger haemocytes were found disintegrating. The second type of granules noticed in the previous stages were wanting in the adult fat body. The imaginal fat body was represented by a cytoplasmic net work with conspicuous nuclei and with a few proteinaceous globules here and there. It is suggested that the proteinaceous globules provide a yolk-like material for the development of the imaginal tissues and for incorporation into the eggs.

CHAPTER 6

A study of the protein, fat and glycogen of the normal and diapausing larvae of Trogoderma was undertaken. The body weight of larvae in diapause, with food showed an increase during the first 3 months (normal larva weighed 2.91 mg, three months old diapause larva 6.27 mg). The fat content of the normal larva amounted to 21.05% of the body weight (61.25 mg/100 larvae), in two months old diapausing female the fat content was found to be 27.35% of the body weight (151.2 mg/100 larvar). Diapause larvae denied access to food for a period of two months showed a reduction in fat content of 22.35 mg/100 larvae in the male (30.9% of the initial fat content) and 70.9 mg/100 larvae in the female (40.35% of the initial fat content). In all stages the female had a higher fat content owing to its larger size.

A considerable increase in the glycogen content could be noticed during diapause (0.312% of the body weight in the normal larvae and 0.98% and 1.567% in two months old diapause male and female respectively). In diapause larvae denied access to food for two months the glycogen content showed a sharp decrease, 51.35% in the male and 51.1% in the female, (of the initial glycogen content). Females had a higher glycogen content both in percentage and absolute values in all the stages.

The protein content showed a considerable increase in the diapause larvae. No conclusions could however, be drawn from the available data as to the utilization of protein during diapause.

CHAPTER 7

A quantitative study of the changes in fat and glycogen contents during metamorphosis showed a considerable reduction in the levels of these metabolites. Of the lipid reserves in the first day pupa 40.46% in the male and 33.85% in the female were utilized during metamorphosis. In all stages the male contained a higher percentage of fat, but in absolute amounts the female possessed more fat, more than twice the amount in the male, owing to its bigger size. The amount of fat utilized per unit body weight was higher in the male (8.764 mg/100 mg of the first day pupal weight in male and 6.48 mg/100 mg of the first day pupal weight in the

female). Glycogen also showed a decline during metamorphosis. The female contained a higher percentage as well as a higher absolute amount of glycogen. As in lipids the amount of glycogen utilized per unit body weight was found to be high in the male.