GLYCOGEN AND ACID MUCOPOLYSACCHARIDES IN THE OVARY, TESTIS, BRAIN NEUROSECRETORY CELLS AND CORPORA ALLATA OF *DYSDERCUS KOENIGII* (HEMIPTERA: PYRRHOCORIDAE)

INVESTIGATIONS on several aspects of the biology of reproduction of *Dysdercus koenigii*, a hemipteran pest on bhindi plants (*Hibiscus esculentus*) in India, by Sharma *et al.*[7–10] and Sinha *et al.*[11] have provided sufficient information on the development of oocytes and sperms and the secretory activities of the brain neurosecretory cells (NSC) and corpora allata (CA). The present communication is a report on the distribution of glycogen and acid mucopolysaccharides in the ovary, testis, brain NSC and CA of this insect.

Adult male and female insects were developed in the laboratory from fifth instar nymphs collected from the field. Insects were fixed in appropriate fixatives and 6 μm thick paraffin sections were processed for the demonstration of glycogen by Best's carmine technique as described by McManus and Mowry[3] and for acid mucopolysaccharides by alcian blue method.

Observations presented in Table I reveal that heavy deposits of glycogen occur in the germarium of ovary, follicular epithelium around oocytes and in the substance of eggs in all stages of development after yolk has been deposited. Young oocytes without yolk are devoid of glycogen. This material is also present in all stages of spermatogenesis and in the brain NSC and CA. Heavy reserves occur in spermatocytes and in those NSC which are full of neurosecretory material. Acid mucopolysaccharides are observed in the germarium of ovary, follicular epithelium around oocytes, ground substance of eggs, all stages of spermatogenesis, and in the NSC of brain. Small to moderate amounts also occur in the young oocytes and CA.

The occurrence of glycogen has been observed in insect tissues by a number of workers[4, 6, 12, 13]. Ovary, testis, NSC and CA are seats of intense biological activity and glycogen as a readily available source of energy will be required to support growth and development of oocytes and subsequent embryogenesis, spermatogenesis in testis and elaboration of secretory material in the NSC and CA. Heavy deposits of glycogen in the spermatocytes and its sparse distribution in the sperms indicates utilisation of this polysaccharide during spermatogenesis.

The presence of acid mucopolysaccharides has been demonstrated in a number of insects[1, 2]. These are complex carbohydrates characterised by the presence of a hexuronic acid along with an N-acetylhexosamine, stable and resistant to chemical hydrolysis, and therefore, they are found at places where strength and chemical resistance are required. Hyaluronic acid, a biologically important acid mucopolysaccharide found in many animal tissues, acts as a barrier to fluid diffusion and prevents leakage of materials across cell membrane. It would be interesting to know if the acid mucopolysaccharide, histochemically demonstrated in *Dysdercus koenigii*, is hyaluronic acid. The presence of such a substance appears to be essential to prevent leakage of nutritive substances from the oocytes and spermatocytes, and the secretory material from the CA and neurosecretory cells.

TABLE I

Distribution of glycogen and acid mucopolysaccharides in the ovary, testis, brain NSC and corpora allata of Dysdercus koenigii

Structures examined	Glycogen	Acid mucopolysaccharides
OVARY		
Germarium	+++	+++
Follicular epithelium	++	+++
Early oocyte	–	+
Late oocyte	+++	+++
TESTIS		
Spermatogonia	++	+++
Spermatocytes	+++	+++
Spermatids	++	+++
Sperms	+	+++
NSC OF BRAIN	+++	+++
CORPORA ALLATA	+++	++

+ weakly positive, ++ moderately positive, +++ strongly positive, – absent.

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UPTAKE AND RELEASE OF 1-C^{14} PALMITATE BY THE FAT BODY OF THE BEETLE *CYBISTER CONFUSUS*

SEVERAL observations on lipid release and transport add credence to the opinion that diglycerides are released from the fat body into haemolymph so that they can be absorbed by the muscles.[1–4]. However, there are also other evidences that triglycerides and free fatty acids are the lipid components released from fat body of certain developmental stages of insects[5–7]. That the fat body of the *Cybister* beetle contribues its lipid store during beetle's flight as well as during its swimming activity has been very well demonstrated[8–9]. The short *in vitro* experiments when a fat body is incubated in haemolymph, the outlined in the present experiment are meant to obtain information on the nature of lipid release into the haemolymph from the prelabelled fat body of th *Cybister* beetle.

About 400 mg of fat body collected from a number of adult male *Cybister* beetles maintained in the laboratory were used. The method of Wlodawer *et al.*[5] was followed to label the fat body with 1-C^{14} palmitate (Sigma, USA). Extraction of the labelled lipids from the fat body and haemolymph as well as their separation by thin layer chromatography into individual glycerides and free fatty acids was essentially similar to that described elsewhere[9]. Release of glycerides in different haemolymph concentration was determined by diluting the original haemolymph with a known quantity of Ringer's solution (with or without bovine serum albumin).

The results obtained in the present investigation are summarised in Tables I and II. During initial period of 30 min, the major radioactivity was recovered from free fatty acids (FFA) while moderately less from diglyceride (DGL) and triglyceride (TGL). However, in subsequent periods of incubation lasting for 120 min, the major radioactivity was obtained from the TGL. The mechanism by which fatty acids are incorporated into glycerides in insect fat body is unknown[10]. Several investigators have shown that

TABLE I

Uptake and release of 1-C^{14} *palmitate by the fat body of the* Cubister *beetle*

Lipid fraction	Uptake (cpm × $10^3/\lambda$min / μ moles equivalent radioactivity)		Release (cpm × 10^3/min)	μ moles equivalent radioactivity
MGL	2±0·018	0·05	..	..
DGL	8±0·03	0·2	5±0·02	0·125
TGL	50±0·135	1·25	31±0·3	0·77
FFA	15±0·04	0·375	12±0·12	0·3

TABLE II

Release of glycerides and FFA from the prelabelled fat body of the Cybister *beetle in different incubation medium*

Incubation medium	cpm × 10^3/min			
	MGL	DGL	TGL	FFA
Ringer sol.	..	..	0·86±0·001	2·8±0·03
Ringer sol. with bovine serum albumin	..	..	0·88±0·001	3·0±0·01
Haemolymph + Ringer sol. (1 : 1)	1·0±0·002	5·0±0·12	31·00±0·23	12·0±0·035