might therefore aid them in utilising dextran as a substrate in their saprophytic survival.

Division of Microbiology, S. ANTHONI RAJ.
Faculty of Agriculture, N. N. PRASAD.
Annamalai University, Annamalainagar,
Tamil Nadu, *September* 22, 1975.

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FATTY ACID OXIDATION BY THE LEG MUSCLES OF *CYBISTER* BEETLE DURING VIGOROUS EXERCISE

IT is well recognized now that some insects are capable of utilizing fatty acids during their vigorous muscular activity as in flight[1-2]. Earlier studies have revealed that the flight muscles of some insects are capable of oxidizing only short chain fatty acids—butyrate and octanoate but not higher chain fatty acids—palmitate and stearate[3-4]. George and Bhakthan[5], observed that the flight muscle homogenate of the honey bee *Apis dorsetta* was capable of oxidizing butyrate.

That added carnitine stimulates fatty acid oxidation is now very well understood[6-7]. The aquatic dytiscid beetle *Cybister confusus* has an efficient leg muscle system. It is possible therefore that the leg muscles have an efficient biochemical machinary to meet the exigencies of energy demands, for all its spasmodic actions. The present investigation is aimed at ascertaining the ability of the leg muscles of the *Cybister* beetle to oxidize various fatty acids during its vigorous exercise.

The adult *Cybister* beetles, were vigorously exercised following the method described elsewhere[8]. Muscle homogenate and mitochondrial preparations were obtained as outlined in an earlier study[7]. Sodium salts of butyrate, octanoate, palmitate and stearate were used as substrates for fatty acid oxidation. The oxygen uptake by the different preparations was expressed as μl per mg protein per 30 min. The procedure followed was essentially similar to that described elsewhere[7]. The effect of added carnitine on palmitate oxidation was tested in the muscle homogenate as well as in the mitochondrial preparation with 0·15 M DL-carnitine. The protein contents of the homogenate and mitochondrial fraction were determined according to the method of Lowry *et al.*[9].

The respiratory measurements obtained by the unexercised and exercised leg muscles homogenate preparations (Table I) after the addition of the various fatty acids revealed that they are capable of oxidizing only short chain fatty acids butyrate and

TABLE I

Oxidation of butyrate, octanoate. palmitate and stearate by the exercised and unexercised leg muscle homogenates of the Cybister *beetle*

Substrates	O_2 uptake (μl/mg. protein/30 min.)	
	Unexercised	Exercised
Endogenous	38	46
Butyrate	49	55
Octanoate	45	55
Palmitate	37	37
Stearate	36	37
Succinate*	70	103

The results presented in Tables I and II are averages of three readings in each case.
* Used for comparison.

TABLE II

Effect of added carnitine on the palmitate oxidation by the leg muscle homogenate and mitochondrial fraction of the Cybister *beetle*

Substrates	O_2 uptake (μl/mg. protein/30 min.)	
	Homogenate	Mitochondrial pellet
Endogenous	39	32
Palmitate added	37	33
Carnitine added	45	39
Carnitine + Palmitate added	47	50

octanoate but not the higher chain fatty acids—palmitate and stearate even when the leg muscles were metabolically active (as indicated by succinate oxidation in the exercised muscles). That the butyrate acts as primer in the oxidation of higher chain fatty acids in the locust thoracic muscles[10], and also as energy source during flight in the flight muscles of the honey bee *Apis dorsetta*[5] have been very well demonstrated. It has also been shown that the flight muscles of the dragonfly *Pantala flavescens*[7], which are involved in sustained action utilize short chain fatty acids to begin with, and subsequently switch on to its reserves of palmitic acids. It may be inferred from these observations that the leg muscles of this beetle which take part in short and abrupt actions derive their metabolic energy through limited oxidation of low chain fatty acids—butyrate and octanoate.

It is well understood now that carnitine stimulates the rate of oxidation of fatty acids both in the homogenate as well as in the mitochondrial fraction[11]. In the present investigation also palmitate oxidation in the homogenate as well as in the mitochondrial preparation was indicated after the addition of carnitine. This may suggest that in the leg muscles of this insect carnitine acts as an extra mitochondrial factor accelerating palmitate oxidation. It may be that the leg muscles of the *Cybister* beetle have insufficient carnitine reserves to support palmitate oxidation.

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Department of Zoology, V. L. KALLAPUR.
Karnatak University, A. V. NARASUBHAI.
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CHANGES IN THE CORPUS ALLATUM VOLUME OF FEMALE *SPODOPTERA LITURA* (FABR.) RELATED WITH AGE AND REPRODUCTION

THE importance of the corpus allatum in growth and reproduction of insects was first demonstrated in *Rhodnius prolixus*[1] (Hemiptera : Heteroptera). Since then it has been confirmed in a number of species belonging to Orthoptera, Hemiptera, Coleoptera, Lepidoptera and Diptera. Several workers reported larger corpora allata in females than in males of different species and emphasized its role in oocyte growth and yolk deposition during the maturation of eggs. Further, in *Calliphora erythrocephala*[2,3], *Sarcophaga bullata*[4], *Iphita limbata*[5], *Leucophaea maderae*[6], *Locusta migratorea*[7] and *Schistocerca* sp.[8], the increase in the volume of corpora allata of the females was related with oocyte growth and the maturation of the eggs in different reproductive cycles. But in moths, except *Bombyx mori*[9], males have larger corpora allata than females and gland was not necessary for the ovarian maturation. On the contrary, in butterflies *Pieris brassicae*[10], *P. napi*[11] and *Danaus plexippus*[12], studied so far, the corpora allata are larger in females than in males and these are necessary for the oocyte growth and egg maturation.

The present observation on the female *Spodoptera litura*, not only compares the volume of corpora allata with that of other moths but also indicates the changes in their volume related with age and reproduction. Further, the present data on *S. litura* particularly add information on the role of corpora allata in the short lived moth which requires food in imaginal life unlike *B. mori* and others which emerge only to lay eggs.

From a stock culture maintained at 27° C ± 1° C and 70–80% relative humidity, newly emerged *Spodoptera litura* were isolated in single pairs and maintained age-wise at the above-mentioned temperature and humidity. Their corpus allatum volume was determined by the method of Highnam (1958)[13]. The mean values of the corpus allatum volume of the females of different age groups was compared and significant difference was known by using the formula of Rao (1952)[14].

The data in Table I show the changes in the corpus allatum volume of the females of different ages. The volume of the gland was also determined in the newly emerged males and its mean value ($5{\cdot}47 \pm 0{\cdot}36 \times 10^6\mu^3$) was lower than that of the females of the corresponding age ($5{\cdot}51 \pm 1{\cdot}26 \times 10^6\mu^3$). However, in the females of the subsequent age, the gland volume significantly decreased and in the four day old females