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Creatine and Creatinine Levels in the Larval Fat Body of the Moth, *Spodoptera mauritia*, during Development

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Changes in the level of creatine and creatinine in the fat body of the last larval instar of *Spodoptera mauritia* exhibited a marked difference between unit and total weight of the tissue. There is an inverse relationship in the concentrations of creatine and creatinine indicating that creatinine is a metabolite of creatine as in vertebrates.

Key Words : Creatine, Creatinine, *Spodoptera mauritia*, **Fat body**

Introduction

The fat body contents of creatine and creatinine have not been investigated earlier in insects, in spite of their importance in the energy metabolism of animals. The previous studies on the excretion of creatine and creatinine in insects were inconclusive regarding their metabolic origin (Bursell 1967). However, a recent investigation with the larval excreta and haemolymph of the moth, *Spodoptera mauritia* by Lazar (1983) revealed that creatine and creatinine occupy a significant position among nitrogenous constituents and that there is a striking variation in these during the development. The results also indicated that the metabolism of these compounds shows a general similarity to that found in vertebrates. Here changes in the level of creatine and creatinine in the fat body of the last instar of *S. mauritia* has been studied with a view to elucidate their significance in the larval fat body.

Materials and Methods

Fat body was removed from final instar larvae of *S. mauritia* of same age at 24 hr intervals from the time of its last moult until pupation. Creatine and creatinine were determined according to Mac Fate et al. (1954).

Results

The changes in the level of creatine and creatinine in the larval fat body exhibited a marked difference between unit and total weight of the tissue (table 1). On the basis of unit tissue the levels of creatine and creatinine were high in the early larval stages (growing stages) but declined towards pupation. On the basis of total tissue the level of creatine was low in the early stages and at pupation but high in the middle stages while the reverse situation existed in the case of creatinine.

Discussion

Insect phosphagens have drawn little attention in the past. Phosphocreatine, the phosphagen characteristic of vertebrate muscle was thought to be substituted by phosphoarginine in invertebrates and this forms the basis of invertebrate phosphagen theory (Baldwin 1937). Ennor and Morrison (1958) in a review on the distribution of phosphocreatine in marine organisms have concluded that "phosphocreatine and phosphoarginine cannot be regarded as characteristic of the vertebrates and invertebrates, respectively, for, while phosphocreatine is a phosphagen characteristic of the vertebrates, no one phosphagen is characteristic of the invertebrates". In insects no information is available on the involvement of phosphoarginine in the metabolism of muscles or any other tissue. The present study clearly demonstrates that creatine and creatinine are definite constituents of insect fat body. This is indicated by their presence in the excreta and haemolymph of the larva (Lazar 1983). The changes in

Table 1 *Creatine and creatinine content of the fat body*

Larval stages	Creatine		Creatinine	
	μg/g dry tissue	μg/total tissue	μg/g dry tissue	μg/total tissue
0 hr	1378.38 ± 193.89	5.34 ± 0.75	1259.26 ± 134.48	4.88 ± 0.52
24 hr	1523.78 ± 217.10	5.04 ± 0.72	561.20 ± 104.50	1.86 ± 0.35
48 hr	1448.66 ± 217.36	13.25 ± 1.99	125.65 ± 18.89	1.15 ± 0.17
72 hr	1253.05 ± 221.17	16.84 ± 2.97	206.07 ± 22.05	2.77 ± 0.29
96 hr	1002.26 ± 226.28	15.38 ± 3.47	203.13 ± 32.23	3.12 ± 0.49
120 hr	194.95 ± 30.02	3.34 ± 0.51	314.42 ± 54.40	5.38 ± 0.93

The values are the means of five determinations with standard deviations

the level of creatine and creatinine per unit tissue indicate their interrelationship with each other. The concentration of creatine was high in the active stages of the larva and declined towards pupation while a reverse situation *per se* was observed in the case of creatine pointing to the possibility that creatinine is a metabolite of creatine as in vertebrates. The total fat body content of these materials in the larva indicates that there is a storage of creatinine in the later phases of the larval development while the reverse is true for creatine. It may be noted that the fat body creatinine is depleted during the early stages of the larva (excretory phase) and replenished towards pupation (post-excretory phase) while creatine maintained a high level during the excretory phase and was depleted sharply in the prepupal stage.

The turnover rate of creatinine has long been considered as a pointer in the evaluation of the active protoplasmic mass in animals (Platt et al. 1964). This proposition is further modified to the extent that its turnover rate is an index of the muscle mass rather than the lean body weight though this has not been found correct in all cases (Waterlow 1969). In mammals, the creatine content in the muscle of different species is distinctive but varies within relatively small limits and bear distinct relationship with the creatine output. This is apparently true in the case of the larva of *S. mauritia*, where there is a relationship between the creatine content of the tissue and creatinine excretion (Lazar 1983), i.e. the excretion of creatinine was proportional to the tissue content of creatine.

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