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Impact of Starvation on Worms and ionic composition of Haemolymph of *Philosamia Ricini*

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ABSTRACT

The fifth instar larvae of *Philosamia ricini* were reared under food stress. These were kept on starvation for three days. After that the haemolymph was taken for the analysis. Monovalent cations sodium, potassium and divalent cations calcium and magnesium were estimated, to observe the impact of starvation. With respect to ther control worms Na+ ions increased significantly while Mg++ ions showed rather insignificant change. Divalent cation Calcium showed an insignificant change but Magnesium ions showed a significant decrease.

KEYWORDS: Haemolymph, monovalent cation, divalent cation, starvation,

INTRODUCTION

P*hilosamia ricini* is a wild insect. It is exposed to many stresses under natural environment. The insect is commonly known as Eri silk worm and produces poor quality of silk. The food material of insect is castor leaves (*Ricinus communis).* The ionic composition of phytophagous insects vary in different species as well as in different developmental stages (Florkin and Jenniuax, 1974). The ionic composition of haemolymph also vary with the physiological conditions of the insects, specifically when there is scarcity of food or water or there is some ecological stress on insects. The ionic composition of the haemolymph of the American cockroach*, Periplanata americana*, has been fully studied during the past twenty years (Tobias,1948; Asperen and Esch,1956; Treherne, 1961; Pichon, 1963; Pichon and Boistel,1963a,b; Brady, 1967a,b). It has been shown that the sodium ion concentration was higher than the potassium, the potassium concentration may vary widely; the potassium level of the haemolymph increases, for example when the insect is fed on a leaf diet (Tobias, 1948; Pichon and Boistel, 1963b) or submitted to prolonged starvation and dehydration (Pichon and Boistel, 1963a) and may reach or even exceed 50mM/l. Moreover, extremely large variations of the Na^+/K^+ ratio have been recorded between different insects reared apparently identical conditions (Pichon, 1963).

Pichon (1963) reported the effect of starvation & dehydration on sodium and potassium ions. The effect of starvation on the ionic balance of haemolymph in the insect *Carausius morosus* was studied by Nicolson *et al* (1974). Cohen and Patana (1982 b) studied the stress of starvation on the biochemical composition of haemolymph of *Spodoptera exigua* larvae. They reported that starved fourth instar larvae of the insect show changes in the ionic composition of haemolymph.

MATERIAL AND METHODS

The fifth instar worms of *Philosamia ricini*, were reared under normal conditions *i e.* at 29^0C ±2^0C, R.H. 90%±5% (Pant and Agrawal, 1965). The larvae of *Philosamia ricini* are voracious feeder, specially fifth instar larvae, and were provided full diet as per recommendation of Sericulture Department.

Stress of food:

To observe the effect of starvation of food to the worms, two days old well fed fifth instar larvae were kept in wooden trays without food for three days at normal temperature *i.e.* 29ºC±2ºC and R.H.=90%±5%.

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The haemolymph was withdrawn from five days old larvae for analysis.

Estimation of sodium, potassium and calcium ions:

The quantitative estimation of *i.e*. ions, sodium, potassium and calcium was determined with the help of automatic analyzer.

The automatic analyzer was model number- 9180, a product of *COBAS* and is a trade mark of Roche Diagnostic GmbH D-68298 Mannheim, Germany.

Estimation of magnesium ions :

The Mg^{++} ions were measured by Xylidyl blue method (*Bouhen. Clin. Chem. Acta.16, 155:1957).*

RESULTS

The starved worms showed shrinking of foregut, region of crop and other parts of the alimentary canal were filled with air. The malpighian tubules usually filled with white granules of probably uric acid. The fat bodies show signs of disintegration. The quantity of haemolymph extremely decreased and it was nearly impossible to obtain haemolymph after the fifth day from starved larvae.

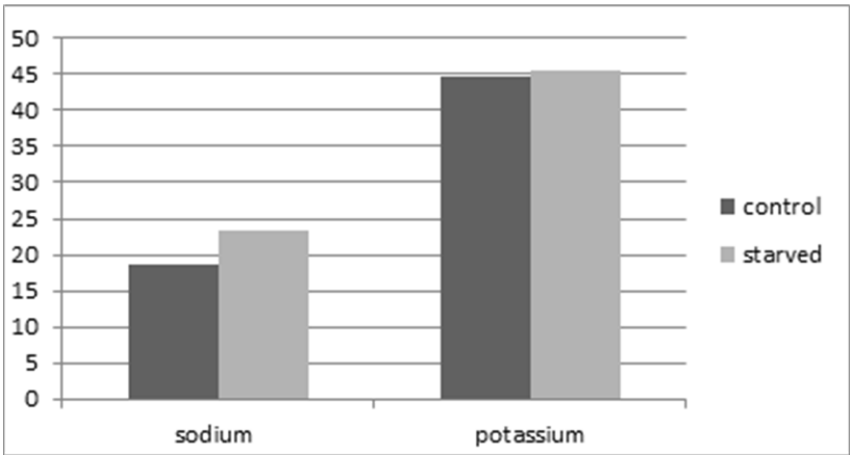
As shown in graph (1), the concentration of sodium ions of starved larvae shows a significant increase. The changes in the concentration of potassium ions also showed an insignificant increase during starvation.

The divalent cations, calcium and magnesium ions both were affected by the starvation. Concentration of calcium ion shows an increase in concentration, but this increase was insignificant. The concentration of magnesium decreased significantly.

DISCUSSION

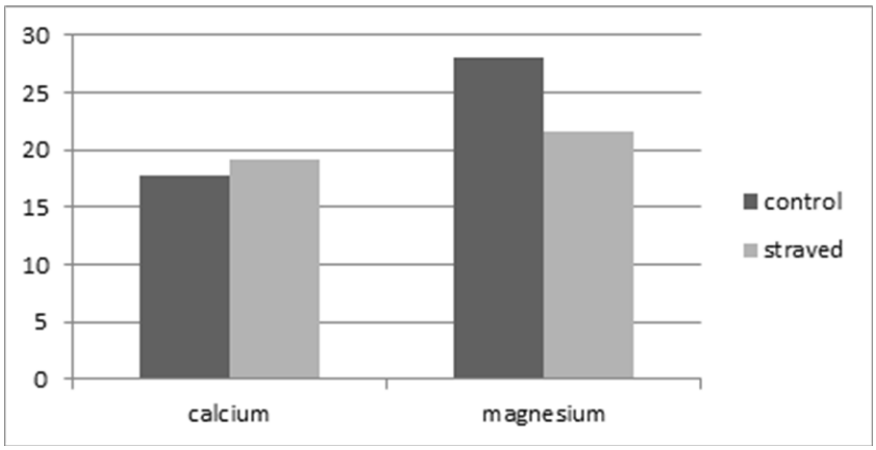
Nicolson *et al.* (1974) studied the effect of starvation and dehydration on the osmotic and ionic balance in *Carasius morosus*. They concluded that due to unavailability of food, insects have lost about 40% of body weight. They further reported that the volume of haemolymph decreases during starvation, though, the osmotic concentration increased. They reported that the main weight loss was due to loss of water from the body and the change in sodium, potassium and magnesium ions was due to water loss. As per their reports Na^{+} and ,K^{+} increased slightly while regarding the Mg^{++} ions they concluded that Mg^{++} ion concentration increased in the beginning then decreased on the fifth day and again increased on the seventh day. If we compare our results with the studies of Nicolson *et al*. (1974), then it is evident that the weight of worms decreased nearly 50% in fifth instar larvae of *Philosamia ricini* which was probably due to water loss . The sodium ions increased but potassium ions remained more or less in same concentration. In case of calcium ions there was a slight increase in the concentration but it was insignificant. Magnesium ion concentration was decreased significantly. Cohen and Patana (1982) also studied the effect of starvation on the larvae of *Spodoptera exigua* but it could not be compared with our studies because they kept the larvae under stress for only 10 hours. However, they reported the low concentration of sodium, high concentration of potassium, low

Graph and table-1. Concentration of sodium and potassium ions (mg/dl) in the fifth instar larvae of Philosamia ricini during starvation



	Sodium	Potassium
control	18.6±0.17	44.6±0.30
starved	23.4±0.45	45.5±0.08

Graph and table 2: Concentration of calcium and magnesium ions (mg/dl) in the fifth instar larvae of Philosamia ricini during starvation



	Calcium	Magnesium
Control	17.7±0.15	28±0.30
Starved	19.2±0.79	21.6±0.65

concentration of calcium and but the concentration of magnesium was more or less same.

In our experiment the increase in sodium ions may be due to the fact that sodium is released from tissues to maintain osmotic balance and potassium ions are excreted from malpighian tubules. Magnesium ions are obtained from food, but during starvation food was not available.

CONCLUSION

Present study indicates the significant increase in sodium ions which may be due to the fact that sodium is released from tissues to maintain the osmotic balance. Potassium mions show insignificant increase which indicates the excretion of ions from malpighian tubules, whereas magnesium ions were decreased because they are obtained from food, but during starvation food was not available. Calcium ions have shown insignificant increase which may be due to muscular inactivity of insect.

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Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

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