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Effect of Oral Administration of Synthetic Vitamin 'C' on Food Utilization in Cross Breed Race of Silkworm *Bombyx mori* L.

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Abstract

The effect of Synthetic Vitamin 'C' on food intake and utilization were studied in Cross Breed race of Silkworm *Bombyx mori* (Linnaeus) from hatching to pupation, when fed with *ad libitum* Mulberry leaves *Morus alba* treated with different concentration of synthetic Vitamin C at $26^0 \pm 2^0$ c with a relative humidity $80 \pm 10\%$. The food utilization parameters like food intake, faeces defecation, assimilation, food converted, oxidation, feeding rate, assimilation rate, conversion rate, metabolic rate, assimilation efficiency, conversion efficiency (K1 and K2) were studied. It has been observed that the 0.5% vitamin C treated group plays a significant role with an increase in growth and better food intake which averages 6159.3 mg/mg/day compared to control group i. e. 3529.4 mg/mg/day and also other three Vitamin C treated groups i.e. 1.0%, 1.5% and 2.0% concentrations.

Keywords: Assimilation, *Bombyx mori*, *Morus alba*, Vitamin C

Introduction

Nutrition plays an important role in improving the growth and development of the silkworm. One of the important nutrients that plays a significant role in this field is vitamin C or L-ascorbic acid, which is a water soluble micronutrient and acts as a powerful antioxidant and potential phago-stimulant. The various combinations of ascorbic acid with 0.2% N increases the growth and silk production in silkworm [10]. The silkworm rearing can be improved by lower doses of synthetic vitamin C, is due to synergetic activity of ascorbic acid [1]. The silkworm and many other insects are incapable of synthesizing these vitamins in their body but harness it from their dietary sources [11]. Mulberry leaves with 3% vitamin c concentration fed to silkworm decreased the larval weight due to hypervitaminosis [5].

Ascorbic acid plays an important role when the silkworm larvae consumes along with *Morus alba* leaves. As such it is important to study the influence of vitamin c on the food utilization budget. A great deal of information is available on the effect of Ascorbic acid on various parameters [5, 12, 13]. Hence in this present study experiments were carried on different concentrations to know the effect of Synthetic Vitamin 'C' Supplementation on food utilization parameters in Cross Breed race of silkworm *Bombyx mori* L. and the Growth activity of silkworm larvae fed *ad libitum* *Morus alba* at $26^0 \pm 2^0$ c with relative humidity $80 \pm 10\%$.

Materials and Method

Disease free layings of Cross Breed race (CB) were obtained from Sericulture Department, Tumakuru. After the incubation period of 10 days, the freshly hatched larvae were transferred to enamel trays (36x 26 x4 cm) covered with paraffin paper to prevent loss of water from the leaf bed. The experiment was conducted in triplicate with 50 larvae in each group and the larvae from first to fifth instar was fed with *ad libitum* mulberry leaves *Morus alba* with the different concentrations of synthetic vitamin C i.e. (0.5%, 1.0%, 1.5% and 2.0% concentrations) at $26^0 \pm 2^0$ c and relative humidity $80 \pm 10\%$. The Synthetic Vitamin C is commercially available in powder form, tablets etc. In the present study Synthetic Vitamin C tablets were used. The larvae of experimental group was fed with mulberry leaves treated with different vitamin C concentration four times at 6.A.M, 11.A.M, 3.P.M and 8.P.M. Simultaneously, the larvae were reared under control condition without vitamin C concentration at $26^0 \pm 2^0$ c and R.H. $80 \pm 10\%$. Its effect on vitamin C concentration and food utilization were studied by using IBP formula and technology [19]. Sacrifice method described

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by [16] for accessing the growth of laboratory Mammals and fishes [7, 17, 18] and insects [4] was employed in the present study. The difference between the final weight and initial weight is the Growth of insect in each instar. The data were analysed by using Mean, standard deviation.

Results and Discussion

Food consumption indicates a good response to the quality of food consumed by *Bombyx mori* L. and has direct effect on growth, development and performance of the individual from first to fifth instar period of rearing (Table 1). The larval duration in silkworm decreased significantly in the vitamin C treated batches over the control batch. The food intake was highest at 0.5% concentration ranged to 6159.3mg dry weight and started decreasing from 1.0%, 1.5% and 2.0% feed concentration of vitamin C. The food assimilation and food oxidation were significantly higher in those silkworms treated with 0.5% concentration compared to that of control groups (Table 2). However, the gross conversion efficiency (K1) increases in control group i.e. it averages 8.33% compared to vitamin C treated groups which averages 7.51%, 7.69%, 7.88% and 7.49% in 0.5%, 1.0%, 1.5% and 2.0% vitamin C concentration respectively (Table 3). The total food intake, feeding rate, assimilation efficiency registered a slight increases over the control feed at $26^{\circ}\pm 2^{\circ}$ c and with relative

humidity $80\pm 10\%$.

From the data, it is evident that vitamin C plays a key role in silkworm physiology and that this role changes according to the development stage. During the hatching to pupation a stimulating effect was postulated [12]. Feeding trials conducted by several workers proved that the level of nutrients in different varieties of mulberry have significant influence on growth and development of silkworm and cocoon production [3, 6, 14, 15, 20]. Information about ascorbic acid biosynthesis capacity of insect tissue is scanty and some investigators have questioned whether the capability exists [8]. Feeding rate in the silkworm *Bombyx mori* decreased with increase in the body weight or age irrespective of the factors like food quality, Scotoperiod or photo period [2, 9]. Further it can be concluded that improvement in the quality of mulberry leaves by fortification methods with specific concentration of ascorbic acid can improve the economic parameters of *Bombyx mori* L.

Conclusions

In the present study it is evident that the Synthetic Vitamin C concentration effected Biological characteristics of Silkworm by increasing its efficiency of food conversion into larval growth. This confirms that Vitamin C affecting the Silkworm physiology and plays a significant role in its economic characteristics.

Table 1: Effect of Synthetic Vitamin 'C' on the total food intake, faced defecated, assimilation, conversion and food oxidized from hatching to pupation in the silkworm *Bombyx mori* L. [Cross Breed race], fed *ad libitum* *Morus alba* at $26^{\circ} \pm 2^{\circ}$ C and the $80 \pm 10\%$ RH. at different concentrations. The control worms were maintained at room temperature. All the values are expressed as mg dry weight per instar.

	Concentration				
	Control	0.5%	1.0%	1.5%	2.0%
Life Span	24.5	19	19	19	20
Food Intake	3529.4 ± 556.0	6159.3 ± 644.7	5686.6 ± 425.0	4901.8 ± 134.8	4658.5 ± 158.1
Faced defecated	1692.7 ± 376.3	3024.2 ± 150.0	2619.8 ± 339.1	2486.3 ± 27.68	2354.0 ± 79.24
Food assimilated	1836.7 ± 211.9	3135.0 ± 587.3	2884.1 ± 330.1	2415.5 ± 110.6	2304.6 ± 96.50
Food converted	385.4 ± 34.01	722.20 ± 30.51	574.1 ± 7.203	541.9 ± 17.88	484.06 ± 43.81
Food oxidized	1451.1 ± 183.9	2412.8 ± 566.3	2310.0 ± 324.6	2110.4 ± 395.1	1820.4 ± 115.1

Table 2: Effect of Synthetic Vitamin 'C' on the total feeding rate, assimilation rate, conversion rate and metabolic rate from hatching to pupation in the silkworm *Bombyx mori* L. [Cross Breed race], fed *ad libitum* *Morus alba* at $26^{\circ} \pm 2^{\circ}$ C and the $80 \pm 10\%$ RH at different concentrations. The control worms were maintained at room temperature. All the values are expressed in mg dry weight / mg live weight / insect / day.

Rates	Concentration				
	Control	0.5%	1.0%	1.5%	2.0%
Feeding Rate	0.844 ± 0.462	1.379 ± 0.093	1.345 ± 0.139	1.267 ± 0.057	1.177 ± 0.057
Assimilation Rate	0.683 ± 0.492	1.966 ± 0.086	1.143 ± 0.128	1.056 ± 0.076	0.977 ± 0.06
Conversion Rate	0.110 ± 0.010	0.0471 ± 0.002	0.0457 ± 0.004	0.0476 ± 0.002	0.0429 ± 0.002
Metabolic Rate	0.6513 ± 0.489	1.1425 ± 0.084	1.097 ± 0.129	1.009 ± 0.061	0.934 ± 0.061

Table-3 Effect of Synthetic Vitamin 'C' on the total Assimilation Efficiency, Gross Conversion Efficiency (K1), and Net Conversion Efficiency (K2) from hatching to pupation in the silkworm *Bombyx mori* L. [Cross Breed race], fed *ad libitum* *Morus alba* at $26^{\circ} \pm 2^{\circ}$ C and the $80 \pm 10\%$ RH. At different concentrations. The control worms were maintained at room temperature. All the values are expressed in percent.

	Concentration				
	Control	0.5%	1.0%	1.5%	2.0%
Assimilation Efficiency	67.52 ± 13.63	69.04 ± 1.926	68.78 ± 1.993	67.19 ± 1.332	67.31 ± 1.332
Gross conversion Efficiency (K1)	8.33 ± 71.03	7.51 ± 55.47	7.69 ± 94.53	7.88 ± 321.5	7.49 ± 76.27
Net Conversion Efficiency (K2)	15.02 ± 76.48	15.22 ± 79.04	13.84 ± 71.03	15.26 ± 384.3	14.51 ± 32.56

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