Growth rate pattern and economic traits of silkworm, *Bombyx mori* L.) under the influence of inorganic and organic supplementation diet

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Abstract

The growth and development of silkworm larvae and subsequently cocoons are greatly influenced by the mulberry leaf quality. Nearly 70% of the silk produced is directly derived from mulberry leaf proteins. Hence, silkworm should be fed abundantly with good quality mulberry leaves for the successful cocoon production and high yield of silk. Silkworm is a monophagous insect which feeds only on mulberry leaves. Nutrition improves the growth, development, health, feed consumption and conversion of silkworm thereby improving the economic traits. The present study deals with the supplementation of inorganic and organic diet for the growth and development of double strains (*FC*$_1$ × *FC$_2$). Oral supplementation of inorganic tissue salt and organic nutrients. The economic performance of double strains (*FC*$_1$ × *FC$_2$) evaluated based on larval, cocoon, pupa shell weights and average shell ratio % relationship of food consumption to larval weight, cocoon weight shell weight, avg. Shell ratio %, etc. The observed parameters showed improvement in inorganic and organic when compared to the respective control.

Keywords: Silkworm (*Bombyx mori* L.), supplementation, larval weight, cocoon weight, pupa weight, shell weight

Introduction

Salts may represent a limiting factor for the growth of insects, principally true for all types of diet composition (Wiglesworth, 1972). The salt significantly improved the growth of the developmental stages, increased the cocoon characters, elicited early cocoon production and increased the reproductive potential of the silkworms. Nutritional supplementation of zinc sulphide, sodium sulphide, potassium, sodium, calcium and calcium increased the economic parameters of the silkworm. It is reported that many salts considerably increased the growth of silkworm larvae, pupae, and adults and subsequently cocoon production, but higher salt concentrations produced terminal effects on these parameters. For silk productivity of silkworms, the most important physiological factor is nutrition. It is well known fact that growth and development of the silkworm and the economic characters of their cocoons are influenced to a great extent by the nutritional content of the leaves as food for silkworm. The supplementation fulfils the nutrition required to promote better growth and development with elevate economic characters. The organic component like carbohydrates, proteins, vitamins, lipids etc. play a vital role in the overall growth of silkworm. Nutrition is always a concern in silkworm rearing as the silkworm is not fed with health and nutritive leaves. It has also been that the supplementation with salt increases the biochemical content in the silkworm, *B. mori* (Etbari and Fazilati, 2003) [5]. Ahmed (1993) [6] has found that the combination of different nutrient gives better larval weight and silk productivity. The objective of the present study is to determine the growth rate pattern and economic traits of Silkworm, (*Bombyx mori* L.) under the influence of Inorganic and Organic Supplementation Diet.

Materials and Methods

Rearing techniques: The mulberry silkworm disease free laying (dfls) of double hybrid (*FC*$_1$ × *FC*$_2$), eggs was obtained from the Government Sericulture farm, Poonch. It was established in the PG, Department of Sericulture, Poonch Campus, and University of Jammu during one successive spring season (April – May 2015) by providing requisite environmental conditions. Sizes which enhancing the probability of extinction directly and indirectly causes the reduction.
Nutrition methods and Food intake
The native mulberry (Morus alba) leaves are used to feed the mulberry silkworm larvae. The worms were divided into three separate batches; Organic, Inorganic and Control. The inorganic batch was fed by treating the leaves with salts like zinc sulphide, sodium sulphide, potassium, sodium and calcium @0. 04 gm concentrate. While the organic batch was fed by treating the leaves with a solution prepared from jam, multivitamins tablets and soya bean extract. Whereas the control batch was fed with normal leaves. Treated leaves were given from beginning of the first day of first instars till it begins to spin the cocoon. The solution was sprayed 30 minutes earlier than feeding on the leaves. After the 3rd instar only 250 larvae were retained by maintaining 3 replications in each batch. The temperature in the rearing room was maintained at 28±2 °C and the RH was 73±5%. All the rearing operations were carried out according to Krishna swami et al. (1973).[8]

Statistical Analysis
The statistical analysis was carried out using ANOVA with two factors under significance level of 0.05 for the whole results using SPSS and complete randomized design were used according to (Steel et al. 1997). Multiple comparisons were carried out applying LSD.

Results and Discussion
Usage of a combination of organic and inorganic supplements, increasing the carbohydrate and crude protein percentage of the mulberry leaves significantly increased the silkworm larval body weight, silk gland weight and ultimately the cocoon yield etc (Jadhav et al., 2000). The results of the present investigations on leaf supplementation with inorganic and organic nutrient to silkworm larva considering the following economical traits such as pupation rate, cocoon weight, cocoon shell weight and cocoon shell percentage were calculated and are presented in Table no. 1. Many researchers have found that the larval characters of B. mori was improved by different nutrients such as ascorbic acid, folic acid, thiamin, vitamin B complex, etc. (Saha and Khan 1996; Nirwani and Kaliwal 1996; Etebari et al. 2004; Rahmathulla et al. 2007; ElKaraksy and Idris 2009) [5]. Healthiness of any biological system is directly correlated with the natural balance of inorganic tissue salt in the organism; any disturbance in the equilibrium of molecular motion of the inorganic salts can cause disease conditions in living tissue metabolism. It has been reported that thyroxin and vitamin B. It was observed that vitamin supplementation slightly reduced the larval periods in B. mori at lower concentrations as compared to the controls. The presence of vitamin is appropriate for growth of larvae and the reproduction in many insects (Ishii, 1971; Yazen 1972; Baker 1975; Ritter and Johnson, 1991; Levison, 1992; Ozalp and Emer 1992; Chang and Li, 2004). The dietary supplements like; protein, vitamins, lipids, etc. evincing their specificity at specific doses for various metabolic activities of silkworm (Horie, 1980). Nutritional study on silkworm is an essential prerequisite for its proper commercial exploitation. Nutrition of silkworms in sole factors which almost individually augment the quality and quantity of silk (Laskar and Datta, 2000). Bose et al. (1995) studied the bioassay of foliar application of micronutrients to mulberry on rearing performance of silkworm, NB3 and NB7. Maximum reduction in larval duration of 15-70 hr. was observed with the application of Boron (2.5 and 5.0 kg/ha/yr) over control. The maximum increase in cocoon weight, larval weight, yield, ERR, shell weight and shell percentage were observed with the application of Iron (2.5 and 5.0 kg/ha/year), Zinc (5.0 and 10 kg/ha/year), Copper (2.5 and 5.0 kg/ha/year) which showed 11.08, 10.55, 30.28, 16.15, 18.24 per cent and 11.86 per cent increase, respectively over control. Nutritional study on silkworm is an essential prerequisite for its proper commercial exploitation. Supplemented mulberry leaves significantly increased the body weight of silkworm larvae (Majumder and Medda 1975) [14]. Saha and Khan (1997) reported that the growth B. mori larvae were significantly influenced at lower doses when the worms were reared on a Sinafort supplemented diet. The oral supplementation of riboflavin resulted. With a significant increase in larval and silkgland weight (Nirwani et al. 1996). The silkworm, PM x NB,D2 fed with 0.5 per cent ‘Green leaf’ foliarly sprayed leaves gave better cocoon weight (1.679 g), shell weight (0.319 g), pupal weight (1.336 g) and filament length (1054.58 m) (Chikkaswamy et al., 1999a).

Fig 1: Supplementation effect of inorganic tissue salts on Good cocoon and larval weight

Fig 2: Supplementation effect of inorganic tissue salts on Cocoon weight, shell and Av. Shell ratio percentage

Fig 3: Supplementation effect of inorganic tissue salts on Pupation rate
Table 1: Performance of double hybrid (fc 1 × fc 2) for economical characters

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Batch</th>
<th>Larval wt.</th>
<th>Good cocoons</th>
<th>Pupation rate</th>
<th>Wt. of Cocoon</th>
<th>Wt. of shell</th>
<th>Av. Shell ratio %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Inorganic</td>
<td>54.43</td>
<td>235</td>
<td>95.5%</td>
<td>2.32</td>
<td>0.556</td>
<td>23.96</td>
</tr>
<tr>
<td>2.</td>
<td>organic</td>
<td>54.33</td>
<td>228</td>
<td>93.4%</td>
<td>2.24</td>
<td>0.527</td>
<td>23.52</td>
</tr>
<tr>
<td>3.</td>
<td>control</td>
<td>54.09</td>
<td>226</td>
<td>92.6%</td>
<td>2.18</td>
<td>0.493</td>
<td>22.61</td>
</tr>
</tbody>
</table>

Conclusion

It was generally considered that supplemented diets could not be used for silkworm rearing throughout the whole instars for silk production, due to the cost of the diet. However, with the breeding of polyphagous silkworms and the development of low cost diets this practice may become possible. Both theoretical and applied studies are currently in progress, including breeding of silkworms, improvement of artificial diets, development of rearing system and economical evaluation of the silkworm rearing system on supplemented diets throughout the instars and the effective production of silk eggs. The new method of rearing of the silkworm on supplemented diets is a renovated technique and its rapid expansion is expected in sericulture. To improve the quality of supplementation diet, the quality of mulberry leaf must be improved first. Since, the primary purpose of mulberry cultivation in most of the Asian countries is to feed the silkworm with its leaf, the impact of the salt that accumulated in leaf of mulberry on silkworm growth and development need to be investigated in details.

References

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