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# Effect of 0.2% N with Various Combinations of Ascorbic Acid on Growth and Silk Production of Silkworm (*Bombyx mori* L.)

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**Abstract:** The study was conducted to determine the effect of 0.2% N with different doses (0.025, 0.05, 0.075, 0.1, 0.125 and.1.50%) of ascorbic acid on growth and silk production of larvae. Larvae were fed on mulberry leaves treated with 0.2% N and ascorbic acid in various combinations. Data was recorded on food consumption, co-efficient of utilization, body weight, body length and cocoon shell ratio and analyzed statistically. It was revealed that $T_5$ (0.2%N +0.05% vitamin C) proved as the best treatment, which yield better results than all other test treatments about all the parameters under study. In conclusion, the higher doses of vitamin C, lowered the silk yield and caused decline in growth of silkworm larvae.

**Key words**: Ascorbic acid, growth, silk production, silkworm

## Introduction

Sericulture is one of the most important cottage industries, which involves the utilization of mulberry trees and rearing of silkworm on commercial basis to produce new silk.

In Pakistan, sericulture is widely distributed and according to an estimate some 12400 families are engaged in rearing of silkworm in different areas of Pakistan (Siddiqui, 1988). The local yield of green cocoons is almost half than that of the countries having advanced sericulture technology (Khawaja, 1980).

Scientists have tried alternative hosts for the rearing of silkworm and many of them used mineral elements as food supplements. They found positive impact of supplements on the silkworm growth and silk production. Monophagous feeding habit of silkworm requires improvement in the diet to enhance the silk production Ahmad (1993) found that different combinations of mineral nutrients gave better larval growth and silk production.

These studies helped in the improvement of the diet of silkworm. The present studies were in continuous with the work of the scientists who have tried different mineral elements and alternate hosts to increase silk yield qualitatively and quantitatively.

The aim of the present study was to determine the effect of 0.2% N, combinations with different doses of ascorbic acid on larval growth, silk production, coefficient of food utilization and cocoon shell ratio.

## Materials and Methods

The study was conducted in Sericulture Laboratory at National Agricultural Research Centre (NARC), Islamabad during March to June, 2001. The experiment was carried out to determine the effect of 0.2% N used in different combinations with ascorbic acid (vitamin C) on the larval growth and silk production of silkworm (*Bombyx mori* L.).

The eggs of Japanese strain of silkworm (*Bombyx mori* L.) were obtained from Sericulture Department of National Agricultural Research Center, Islamabad. The eggs were placed at ambient temperature of 25 ± 2°C and relative humidity of 70-80% in an incubator for hatching.

After hatching, larvae were isolated from stock culture and divided into 27 groups of 50 larvae each. The larvae were reared in cardboard boxes measuring 22 x 15 x 5 $cm^3$ covered with polythene sheet turned over cardboards to prevent the moisture loss. The larvae were subjected to following treatments. There were 9 treatments used in the experiment:

| Treatment | Description |
|---|---|
| $T_1$ | Simple mulberry leaves |
| $T_2$ | Mulberry leaves dipped in water |
| $T_3$ | Mulberry leaves dipped in 0.2% N solution |
| $T_4$ | Mulberry leaves dipped in 0.2% N + 0.025% vitamin C |
| $T_5$ | Mulberry leaves dipped in 0.2% N + 0.05% vitamin C |
| $T_6$ | Mulberry leaves dipped in 0.2% N + 0.075% vitamin C |
| $T_7$ | Mulberry leaves dipped in 0.2% N + 0.10% vitamin C |
| $T_8$ | Mulberry leaves dipped in 0.2% N + 0.125% vitamin C |
| $T_9$ | Mulberry leaves dipped in 0.2% N + 0.150% vitamin C |

Different combinations were prepared from urea and ascorbic acid (vitamin C) except $T_1$ and $T_2$ (simple leaves and leaves dipped in water). First three larval instars were fed on chopped mulberry leaves of *Morus alba* and last two were offered full grown leaves, thrice a day. Before feeding, the leaves were dipped in treatment solutions and dried in shade. At the start of $4^{th}$ instar, 40 larvae with best vigor and uniform size were maintained in each replication of each treatment and the rest were discarded.

Experiment was carried out in completely randomized design (CRD). The larval length and weight were recorded on the last day of each instar using scale and electronic balance, respectively.

The data recorded on:

Food consumed during each instar, cumulative food consumption of all instars, coefficient of utilization for each instar, cumulative coefficient of utilization of all instars, larval weight in each instar, larval length in each instar, weight with pupa, cocoon weight without pupa, cocoon shell ratio and mortality was analyzed statistically. Duncan's multiple range test was applied to test the significance of results (Steel and Torrie, 1985).

The residual leaves and feces were collected separately and dried in an oven at 100°C for 24 h and food consumption was measured as:

$$\text{Food consumption} = \text{Dry weight of leaves offered} - \text{Dry weight of residual leaves}$$

The coefficient of utilization (CU) of food was calculated after Evans (1939):

$$CU = \frac{\text{Dry weight of food consumed} - \text{Dry weight of feces}}{\text{Dry weight of food consumed}} \times 100$$

Cocoon shell ratio was obtained by the formula:

$$\text{Cocoon shell ratio} = \frac{\text{Weight of shell}}{\text{Weight of cocoon}} \times 100$$

Table 1: Effect of 0.2% N with various combinations of ascorbic acid on growth parameters of *Bombyx mori* L.

| Treatments | Food consumption g/10 larvae | Coefficient of utilization (%) | 5th larval body weight/10 larvae | Body length 5th instar cm/larvae | Cocoon shell ratio |
|---|---|---|---|---|---|
| $T_1$ | 44.55 ± 1.20de | 59.96 ± 0.55e | 40.49 ± 0.44de | 6.33 ± 0.07fg | 19.71 ± 0.78ef |
| $T_2$ | 48.93 ± 0.78b | 63.50 ± 0.41c | 41.98 ± 1.51cde | 6.44 ± 0.08f | 20.95 ± 1.85def |
| $T_3$ | 52.65 ± 0.45a | 66.39 ± 0.76b | 43.71 ± 0.73c | 6.77 ± 0.07e | 23.24 ± 1.38abc |
| $T_4$ | 53.74 ± 1.95a | 66.84 ± 0.48b | 48.19 ± 1.93b | 7.49 ± 0.07c | 23.56 ± 1.20ab |
| $T_5$ | 55.20 ± 2.02a | 71.11 ± 0.09a | 53.72 ± 1.01a | 7.90 ± 0.04a | 24.32 ± 0.90a |
| $T_6$ | 48.47 ± 2.76bc | 62.13 ± 1.68d | 49.53 ± 1.96b | 7.62 ± 0.03b | 22.17 ± 0.48bcd |
| $T_7$ | 45.81 ± 1.36cd | 59.31 ± 0.03e | 42.56 ± 1.39cd | 7.32 ± 0.04d | 21.52 ± 0.69cde |
| $T_8$ | 43.27 ± 1.65cd | 55.68 ± 0.49f | 41.35 ± 0.79de | 6.82 ± 0.11e | 19.59 ± 0.61f |
| $T_9$ | 41.60 ± 1.73e | 52.74 ± 0.79g | 39.93 ± 0.53e | 6.25 ± 0.07g | 19.41 ± 0.63f |

Means followed by different letters differ significantly at $P < 0.05$

## Results and Discussion

**Cumulative food consumption:** The data (Table 1) on cumulative food consumption showed significant ($P < 0.05$) differences among various treatments during the entire larval period. The maximum food consumption was observed in $T_5$ (55.20 ± 2.02) where as the second best treatment was $T_4$ (53.74 ± 1.95), which was followed by $T_3$ (52.65 ± 0.45). It was observed that $T_1$ (simple mulberry leaves) and $T_8$ (0.2% N + 0.1 vitamin C) showed statistical similarity. $T_9$ (41.60 ± 1.73) showed minimum cumulative food consumption (Table 1). The food consumption during all larval instars was maximum in $T_5$ and minimum in $T_1$. These results are in conformity with those of Javaid (1991), Ahmad (1993), Shafique (1993) and Nadeem (1996) who reported that larvae of *Bombyx mori* L. fed on mulberry leaves supplemented with optimum doses of N gave good food consumption as compared to simple mulberry leaves.

It may be due to that $T_5$ showed greater mean value of food consumption as compared to other treatments as 0.2% N used in different combinations with vitamin C. These findings are also in agreement with El-Karkarksy *et al.* (1990) who found that silkworm larvae ingest and digest more food when supplemented with ascorbic acid.

**Cumulative coefficient of utilization:** Data (Table 1) on cumulative coefficient of utilization, showed significant ($P < 0.05$) differences among test treatments. Maximum and minimum values of cumulative coefficient of utilization were recorded in $T_5$ (71.11 ± 0.09.) and $T_9$ (52.74 ± 0.79), respectively. Treatment $T_1$ (59.96 ± 0.55), $T_7$ (59.31 ± 0.03), $T_3$ (66.39 ± 0.76) and $T_4$ (66.84 ± 0.48) were statistically similar while all other treatments vary significantly ($P < 0.05$) with each other. It can be concluded that maximum food was converted into body matter in supplemented treatments. It was also found that higher doses of ascorbic acid were unable to provide proper food to silkworm for best larval.

**Body weight during fifth instar:** Data (Table 1) recorded on body weight during first instar showed that great statistical difference among various treatments. Maximum mean value of body weight was in $T_5$ (53.72 ± 1.01) followed by $T_4$ (48.19 ± 1.93) and $T_6$ (49.53 ± 1.96) (Table 1). Data further indicated that $T_1$, $T_2$ and $T_7$ were statistical similar. It was also found that $T_8$ and $T_9$ were statistically alike. These results depicted that (0.2% N + 0.05% vitamin C) was the best treatment. It was also observed that $T_9$ showed mean body weight lower than control ($T_1$). It can be concluded that this behaviour may be due to higher doses of vitamin C. Higher doses of micronutrients and other fatty acids may have negative impact on growth of silkworm larvae (Yamada *et al.*, 1967).

**Body length during fifth instar:** Maximum larval body length was observed in $T_5$ (7.90 ± 0.04) and the second best treatment was $T_6$ (7.62 ± 0.03) followed by $T_4$ (7.49 ± 0.07) and $T_7$ (7.32 ± 0.04) (Table 1). Data further indicated that $T_3$ (6.77 ± 0.07) and $T_8$ (6.82 ± 0.11) were statistically alike. All other treatments were found significantly different. From these results it can be concluded that food supplementation greatly influenced the body length of silkworm larvae. $T_5$ showed maximum body length while $T_9$ (6.25 ± 0.07) gave minimum. Thus, it was obvious that larvae subjected to different treatments of ascorbic acid and nitrogen gave better larval length. El-karaksy and Idriss (1990) reported that ascorbic acid ameliorates the growth of silkworm larvae.

**Cocoon shell ratio:** Maximum mean value of cocoon shell ratio had been observed in $T_5$ (24.32 ± 0.90). The second best treatment was $T_4$ (23.56 ± 1.21) followed by $T_3$ (23.24 ± 1.38) and $T_6$ (22.17 ± 0.48) respectively. It was seen that except $T_8$ (19.56 ± 0.61) and $T_9$ (19.41 ± 0.63) all other treatments were statistically different from each other (Table 1).

Data revealed that silkworm larvae fed on supplemented mulberry leaves, $T_5$ showed good cocoon shell ratio as compared to all other treatments. It is clear from data that 0.2% N + 0.05% vitamin C ($T_5$) proved as best treatment. Thus, it can be concluded that greater cocoon shell ratio may be due to better combination of 0.2% N + 0.05% vitamin C. These findings are in accordance with Haq and Saleem (1985) who investigated that when silkworm larvae were fed on 0.2% N treated mulberry leaves, increased the cocoon weight. Heaviest cocoon shell ratio can be obtained by supplementing mulberry leaves with minerals and other nutrients (Mahmood, 1989).

## References


Ahmad, S., 1993. Effect of nitrogen, phosphorus and potassium treated mulberry leaves on larval development and silk yield of *Bombyx mori* L. M.Sc. (Hons.) thesis, Deptt. Agric. Entomol., Univ. Agric., Faisalabad, Pakistan.

El-Karaksy, I.A. and M. Idriss, 1990. Ascorbic acid enhances the silk yield of mulberry silkworm (*Bombyx mori* L.). J. Appl. Entomol., 109: 81-86.

Evans, A.C., 1939. The utilization of food by certain Lepidopterous larvae. Trans. Roy. Entomol. Soc., 89: 13-22.

Haq, K. and M. Saleem, 1985. Quantitative and qualitative feeding effects on silkworm (*Bombyx mori* L.). J. Agric. Res., 23: 43-46.

Javaid, M.A., 1991. Effect of feeding potassium and nitrogen treated mulberry leaves on the development of silkworm, *Bombyx mori* L. and silk yield. M.Sc. (Hons.) thesis, Deptt. Agric. Entomol., Univ. Agric., Faisalabad, Pakistan.

Khawaja, 1989. Comparative studies on the prospects of rearing silkworm, *Bombyx mori* L., during the autumn and spring seasons at Faisalabad. M.Sc. (Hons.) thesis. Deptt. Entomol., Univ. Agric., Faisalabad, Pakistan.

Mahmood, R., 1989. Effect of nitrogen on the larval development and silk yield of *Bombyx mori* L. M.Sc. (Hons.) thesis, Deptt. Agric. Entomol., Univ. Agric., Faisalabad, Pakistan, pp: 133.

Nadeem, S., 1996. Collaborative effect of optimum dosages of N, K, Ca, P. and Mg on larval development and silk yield of *Bombyx mori* (L.). M.Sc. (Hons.) thesis, Deptt. Agric. Entomol., Univ. Agric., Faisalabad, Pakistan.

Shafique, M., 1993. Effect of feeding phosphorus and nitrogen treated mulberry leaves on the development of silkworm (*Bombyx mori* L.) and silk yield. M.Sc. (Hons.) thesis, Deptt. Agric. Entomol., Univ. Agric., Faisalabad, Pakistan.

Siddiqui, R.K., 1988. Sericulture its Status and Potential in Pakistan. Progressive Farming, PARC, Islamabad, 8: 5-9.

Steel, R.G.D. and J.H. Torrie, 1985. Principles and Procedures of Statistics. 2nd Ed. McGraw Hill Book Co. Inc., New York, pp: 633.

Yamada, M. and K. Masaru, 1967. Nutritional effect of several kinds of higher fatty acids on larval growth of silkworm and growth stimulation activity of oleic acid. The cocoon shell of the silkworm, *Bombyx mori* (L.) Jpn. J. Appl. Entomol. Zool., 27: 46-51.