Effect of 1% N with Various Combinations of Ascorbic Acid on Growth of Eri Silkworm (*Samia cynthia ricini*)

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**ABSTRACT**

The study was conducted to determine the effect of 1% N with different doses (0.025, 0.05, 0.075, 0.1, 0.125 and 0.150%) of ascorbic acid on growth and silk production of larvae. Larvae were fed on mulberry leaves treated with 1% 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 T5 (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.

**Keywords:** *Samia cynthia ricini*, ascorbic acids, feed efficiency, growth rate

**INTRODUCTION**

Sericulture is one of the most important cottage industries, which involves the utilization of Castor leaves and rearing of silkworm to produce new silk. In Assam, ericulture is widely distributed and according to an estimate some 12400 families are engaged in rearing of silkworm in different areas (Hussain & Javed, 2002). Various authors have tried alternative hosts for the rearing of silkworm and many of them using mineral elements as food supplements and have found positive impact of supplements on the silkworm growth and silk production as Balasundaram et al. (2013) 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 earlier workers 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 1% N, combinations with different doses of ascorbic acid on larval growth, silk production, coefficient of food utilization and cocoon shell ratio.

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MATERIALS AND METHODS

The study was conducted in Biotech HUB, DBT GoI, Pragjyotish College, Guwahati, Assam during March to November, 2019. The experiment was carried out to determine the effect of 1% N used in different combinations with ascorbic acid (vitamin C) on the larval growth and silk production of silkworm (Samia Cynthia ricini).

The eggs of ricini were obtained from Central Silk Board Mirza. 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 cm³ 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                                           |
|-----------|-------------------------------------------------------|
| T1        | Simple castor leaves                                   |
| T2        | Castor leaves dipped in water                          |
| T3        | Castor leaves dipped in 1% N Solution                   |
| T4        | Castor leaves dipped in 1% N Solution + 0.025% Vitamin C|
| T5        | Castor leaves dipped in 1% N Solution + 0.05% Vitamin C|
| T6        | Castor leaves dipped in 1% N Solution + 0.075% Vitamin C|
| T7        | Castor leaves dipped in 1% N Solution + 0.10% Vitamin C|
| T8        | Castor leaves dipped in 1% N Solution + 0.125% Vitamin C|
| T9        | Castor leaves dipped in 1% N Solution + 0.150 Vitamin C|

Different combinations were prepared from urea and ascorbic acid (vitamin C) except T₁ and T₂ (simple leaves and leaves dipped in water). First three larval instars were fed on tender castor leaves of Ricinus communis 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 4th 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. 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 & 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 as per Rajanna and Puttaraju (2000):

\[
\text{CU} = \frac{\text{Dry weight of food consumed} - \text{Dry weight of faces}}{\text{Dry weight of food consumed}} \times 100
\]
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 T₅ (54.20 ± 1.06) where as the second best treatment was T₄ (52.74 ± 1.65), which was followed by T₃ (51.65 ± 0.45). It was observed that T₁ (simple castor leaves) and T₅ (1% N + 0.1 vitamin C) showed statistical similarity. T₆ (40.60 ± 1.88) showed minimum cumulative food consumption (Table 1). The food consumption during all larval instars was maximum in T₃ and minimum in T₁. These results are in conformity with those of Hussain and Javed (2002), Balasundaram et al. (2013), who reported that larvae fed with supplemented with optimum doses of N gave good food consumption as compared to simple castor leaves.

It may be due to that T₅ showed greater mean value of food consumption as compared to other treatments as 1% N used in different combinations with vitamin C. These findings are also in agreement with Hussain and Javed (2002) 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 T₅ (70.11 ± 0.19) and T₆ (51.74 ± 0.86), respectively. Treatment T₁ (55.96 ± 0.45), T₇ (58.68 ± 0.76), T₃ (65.39 ± 0.66) and T₄ (65.84 ± 0.57) 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 T₅ (52.72 ± 0.52) followed by T₆ (48.53 ± 1.08) and T₄ (47.19 ± 0.93) (Table 1). Data further indicated that T₁, T₂ and T₇ were statistical similar. It was also found that T₅ and T₆ were statistically alike. These results depicted that (1% N +0.05% vitamin C) was the best treatment. It was also observed that T₅ showed mean body weight lower than control (T₁). 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 (Thangapandiyan and Dharanipriya (2019).

Body length during fifth instar: Maximum larval body length was observed in T₅ (6.90±0.98) and the second best treatment was T₆ (6.62±0.83) followed by T₄ (6.49±0.89) and T₇ (6.32±0.15) (Table 1). Data further indicated that T₃ (5.77±0.17) and T₈ (5.82 ±0.54) 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. T₅ showed maximum body length while T₆ (5.25 ± 0.77) gave minimum. Thus, it was obvious that larvae subjected to different treatments of ascorbic acid and nitrogen gave better larval length. Hussain and Javed (2002) reported that ascorbic acid ameliorates the growth of silkworm larvae.

Coconuz shell ratio: Maximum mean value of cocoon shell ratio had been observed in T₅ (23.32 ± 1.09). The second best treatment was T₄ (22.56 ± 1.21) followed by T₃ (22.24 ± 1.38) and T₆ (21.17 ± 1.35) respectively. It was seen that except T₅ (18.56 ± 0.65) and T₀ (18.41 ± 0.68) all other treatments were statistically different from each other (Table 1).
Data revealed that silkworm larvae fed on supplemented mulberry leaves, T5 showed good cocoon shell ratio as compared to all other treatments. It is clear from data that 1% N + 0.05% vitamin C (T5) proved as best treatment. Thus, it can be concluded that greater cocoon shell ratio may be due to better combination of 1% N + 0.05% vitamin C.

These findings are in accordance with (Thangapandiyan & Dharanipriya (2019) who investigated that when silkworm larvae were fed on 1% 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).

Table 1: Effect of 1% N with various combinations of ascorbic acid on growth parameters of Eri Silkworm (with standard deviation)

| Treatment | Food Consumption g/10 larvae | Coefficient of Utilization (%) | 5th Larval body weight/10 larvae | Body length 5th Instar cm/larvae | Cocoon Shell Ratio |
|-----------|------------------------------|-------------------------------|---------------------------------|---------------------------------|-------------------|
| T1        | 43.55 ±1.02                  | 55.96 ±0.45                  | 39.49± 0.45                    | 5.33 ±0.78                   | 18.71± 0.98       |
| T2        | 47.93 ±0.78                  | 62.50 ±0.51                  | 40.98± 0.98                    | 5.44 ±0.29                   | 19.95± 0.75       |
| T3        | 51.65 ±0.45                  | 65.39 ±0.66                  | 42.71± 0.79                    | 5.77 ±0.17                   | 22.24± 1.52       |
| T4        | 52.74 ±1.65                  | 65.84 ±0.57                  | 47.19± 0.93                    | 6.49 ±0.89                   | 22.56± 1.35       |
| T5        | 54.20 ±1.06                  | 70.11 ±0.19                  | 52.72± 0.52                    | 6.90 ±0.98                   | 23.32± 1.09       |
| T6        | 47.47 ±1.76                  | 61.13 ±0.98                  | 48.53± 1.08                    | 6.62 ±0.83                   | 21.17± 0.98       |
| T7        | 44.81 ±1.09                  | 58.68 ±0.76                  | 41.56± 1.07                    | 6.32 ±0.15                   | 20.52± 0.56       |
| T8        | 42.27 ±1.57                  | 54.68 ±0.89                  | 40.35± 0.89                    | 5.82 ±0.54                   | 18.59± 0.65       |
| T9        | 40.60 ±1.88                  | 51.74 ±0.86                  | 38.93± 0.68                    | 5.25 ±0.77                   | 18.41± 0.68       |

CONCLUSION
In the present study, the treatment of Vitamin C at the concentration of 1% N Solution + 0.05% Vitamin C may have beneficial effects on the feed efficacy, growth of the silkworm larval, pupal and cocoon length, width and weight and also increased the quantity of silk production by enhancing the feed efficacy than control. So, this supplementation could be prescribed to the farmers to get more quantity of silk.

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