



INVESTIGATIONS ON THE QUANTITATIVE FEATURES RELATED TO LARVAL GROWTH AND DEVELOPMENT AS WELL AS GOOD HEALTH OF A COMMERCIAL BREED OF SILKWORM, *BOMBYX MORI* L.

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ABSTRACT

To evaluate quantitative parameters tied in growth and development mechanisms of 4th and 5th instar healthy larvae of a commercial breed of mulberry Silkworm (Nistari x NB4D2) reared on two varieties of mulberry leaves in an ambient condition. Distinctiveness of the voltinism or of moultnism and hibernation is related to some features such as the number of rearing days, nourishment level, and the body weight that has been considered for substantial productivity. These features change depending on the abiotic factors in the environment and from the physiological point of view; such features are ultimately associated to the good healthy status of the silkworm. Two varieties of mulberry leaves viz., S-1 and S-1635 were selected for the leaf quality and palatability through rearing experiments. Active healthy silkworms of 4th and 5th instars were sorted batch wise and measured. The larval growth in both stages showed difference on all 1 to 7 days of growth in their body weights and logarithmical increase was distinctly noted till the 7th day of 5th instar. Just during the beginning of 5th instar larvae merged by moulting from the 4th instar, the larval bodyweight does not increase and remained as stationary phase. The experiment concerned the quality of nourishment during mature stages and the growth thereafter. The maximum value of weight and length 4th and 5th instar silkworm larva was noted feeding on S-1635 mulberry leaf variety than S-1 variety. S-1635 variety can be considered for high yield of cocoon, better larval availability and better silk productions and hence are found favourable under these present climatic conditions for our farmers' side.

KEYWORDS: Silkworm Growth, S-1 and S-1635 Varieties of Mulberry, Popular Silkworm Breed, Nourishment Level, 4th And 5th Silkworm Instar, Better Silk Production, Silkworm Health

INTRODUCTION

The mulberry silkworm, *Bombyx mori* L. (Lepidoptera: *Bombycidae*) feeds on only mulberry foliage for its nutrition and produces the naturally proteinaceous silk. The quantity and quality of the silk is directly proportional to the quality attributes of supplied leaves during rearing. The good quality of the mulberry leaves influencing silkworm larvae for full consumptions at every stage and thus increased cocoon / silk production (Chowdary et al. 1991; Gowde and Mendhe, 2010). It is very much important for proper selection of available plant variety for cultivation to the existing weather conditions. Silkworm passes through four stages of development- eggs, larva, pupa and adult. The period of embryonic development is called incubation period and the larval cycle consists of five prominent instars involving four moults at each interval. The total silkworm life cycle takes about 56-62 days at 23°C to 28°C and these four distinct stages of development constitute one generation of the *Bombyx mori* L. Among all the five instars first three instars are young larvae, fourth and fifth instars larvae are mature larvae or grown larvae. After hatching young and grown larvae of silkworm behave differently on the rearing bed according to room environment and type of feeding tendencies. Concerning mulberry leaf feeding, qualities, quantity and palatability differ distinctly for each instars. The higher moisture content of mulberry leaves contemplates the most suitable factor for their growth and development and thus increased metabolic functions (Paul et al. 1992).

The present investigation is focusing on the growth and development of a particular breed of commercial importance viz., Nistari x NB₄D₂ hybrids based on rearing schedule. Repeated experiments were conducted chiefly concerning the quality of nourishment for all stages of development. To evaluate quantitative growth parameters and development mechanisms of 4th and 5th instars healthy larvae feeding on two varieties S-1 and S-1635 of mulberry leaves were considered for better yield of cocoon in a target to select.

MATERIALS AND METHODS

Experimental study was conducted at the Sericulture Laboratory of Krishnath College, Berhampore, West Bengal during the period 2018-2019 and 2021-2022. The selection of variety for cultivation has been practiced in the college garden with proper measures taken during rearing schedules. Two mulberry varieties were selected as food source: S1, introduced from Myanmar for Eastern and NE India by CSR&TI, Berhampore: & S1635, triploid selection for Eastern and NE India by CSR&TI, Berhampore.

The silkworms were reared under standard conditions of 26±20°C with a relative humidity (RH) of 80- 85%. These silkworms were fed with apical chopped, tender and succulent mulberry leaves.

The quantitative profile analysis of 4th and 5th instars larvae

were studied by weighing and measuring replicated silkworms after their emergence. Rearing room temperature of 25°C and relative humidity 85% were obtained to rear for this commercial breed. The healthy larvae were measured for consecutive 7 days at 4th and 5th instars (Mathur et. al., 2002).

RESULTS AND DISCUSSIONS

The results were obtained for NB4D2 breed of silkworm against quality of nourishment dealing with larval weight, length, moulting behaviour and food consumption. The larval growth during 4th instar showed deviations on all days in their weight (Table-1).

Observation (Days)	Weight of 4 th instar silkworm larvae (g)	
	S-1	S-1635
1	0.570±0.19	0.450±0.10
2	0.708±0.22	0.633±0.11
3	1.157±0.25	1.200±0.16
4	1.207±0.18	1.241±0.12
5	1.230±0.11	1.300±0.09
6	1.345±0.33	1.430±0.10
7	1.490±0.55	1.617±0.17

Table 1: Weight of 4th instar silkworm larvae of breed NB₄D₂ treated with mulberry leaf varieties S-1, S-1635

The above data indicated that there is logarithmical increase in the larval body weight. So, it may be determined that the maximum value of body weight was found on the consumption of mulberry leaf variety, S-1635, compared to the mulberry leaf variety, S-1. On the contrary, the larval growth at the 5th instar stage observed difference (1-7) days in their body weight (Table 2).

Observation (Days)	Weight of 5 th instar silkworm larvae (g)	
	S-1	S-1635
1	1.490±0.55	1.617±0.17
2	1.550±0.33	1.675±0.33
3	2.273±0.55	2.360±0.49
4	3.007±0.49	2.950±0.67
5	3.215±0.39	3.375±0.63
6	4.180±0.73	4.275±0.60
7	4.240±0.51	4.375±0.63

Table 2: Weight of 5th instar silkworm larvae of breed NB₄D₂ treated with mulberry leaf varieties S-1, S-1635

The measurements here also showed the logarithmical increase in the larval body weight till the 7th day of 5th instar. Generally, in the 5th instar, larvae increased in their body weight until they reach a stationary state (Geetha Devi, 2001). Here, we examined also about the previous indications of growth and development as in 4th instar. Moulting from 4th instar larva, the beginning of 5th instar, larval body weight does not increase and remain in stationary phase. After the day 3, the larvae start feeding voraciously and moved in search of food. The reason behind the excess intake of mulberry was that the silkworm has the ability to digest large amount of mulberry to gain energy, which will be compensated during non-feeding pupal and adult periods

(Machii & Katagiri, K, 1991; Thangamani & Vivekanandan, 1984). It is obvious that during the process of larval spinning, it loses weight by ejecting out silk fibre. Hence there is a decrease in the percentage of weight gained on 8th day (Shen, 1986). During, 5th instar larval period of silkworm, the first four days feeding behaviour of the larvae assist in its development and growth and the later feeding capacities support the larvae to accumulate energy for successful spending of pupal stages (Trivedi and Nair, 1999). The larvae during 4th and 5th instar (Table-3 and Table-4) showed characteristic differences in their length from day 1 to day 7 on those two varieties S-1 and S-1635. The increase length of silkworm depends on amount of food they consume at the 4th and 5th instar (Table-5). In the 5th instar, especially the maximum larval length was observed on 7th day, 7.35cm (approx.) and a sudden reduction in the larval length was pointed out from day 8. Length of growing larvae continued till their spinning started on 7th day. Quite interestingly, when it reaches spinning activity stage, the size of the larvae reaches to one third of its normal length. These reductions in size and development increase pressure for silk extrude from the silk gland. Hence, there is a sudden decrease in length as noted on 8th day. This size limitation of length of larva continues until quiescent pupal stage. The pupa measures 1.3 cm in length.

Observation (Days)	Length of 4 th instar silkworm larvae (cm)	
	S-1	S-1635
1	3.01±0.12	3.17±0.37
2	3.73±0.54	3.72±0.40
3	4.30±0.60	4.05±0.53
4	4.47±0.33	4.17±0.39
5	4.86±0.11	5.27±0.19
6	4.88±0.74	5.34±0.52
7	4.96±0.50	5.56±0.41

Table 3: Length of 4th instar silkworm larvae of breed NB₄D₂ treated with mulberry leaf varieties S-1, S-1635

Observation (Days)	Length of 5 th instar silkworm larvae (cm)	
	S-1	S-1635
1	4.96±0.12	5.56±0.37
2	5.72±0.54	5.80±0.40
3	5.95±0.60	6.20±0.53
4	6.53±0.33	6.21±0.39
5	6.45±0.11	6.43±0.19
6	7.18±0.40	6.86±0.52
7	7.35±0.50	7.04±0.41

Table 4: Length of 5th instar silkworm larvae of breed NB₄D₂ treated with mulberry leaf varieties S-1, S-1635

Larval instar	Food Supply (gm)	Food consumption (g) of 4 th and 5 th instar silkworm larva	
		S-1	S-1635
4 th instar	For all 70gm	38.17g	37.56g
5 th instar	For all 80gm	57.132g	41.046g

Table 5: Food (S1 & S1635) consumption of 4th and 5th instar silkworm larva, Breed NB₄D₂

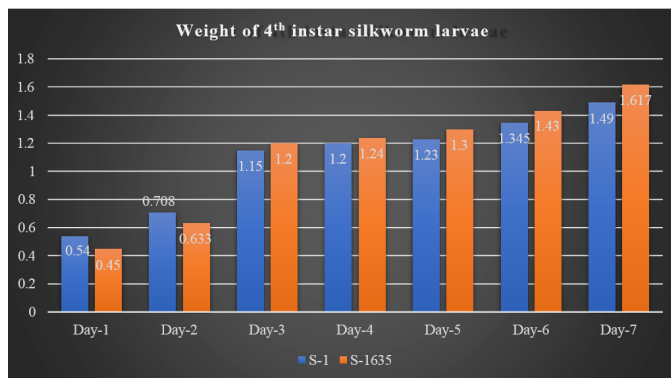


Figure 1: Weight of 4th instar silkworm larvae of breed Nistari X NB₄D₂ treated with mulberry leaf varieties- S-1, S-1635

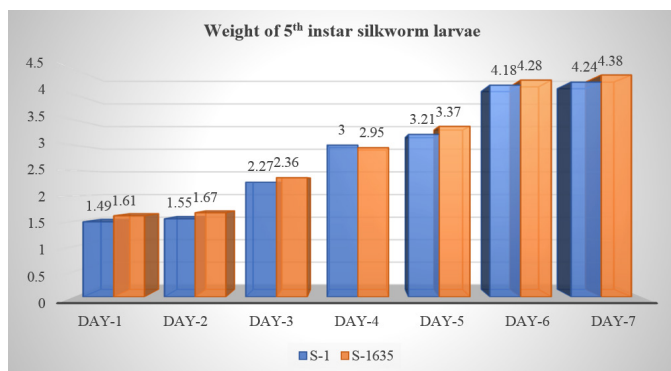


Figure 2: Weight of 5th instar silkworm larvae of breed Nistari X NB₄D₂ treated with mulberry leaf varieties S-1, S-1635

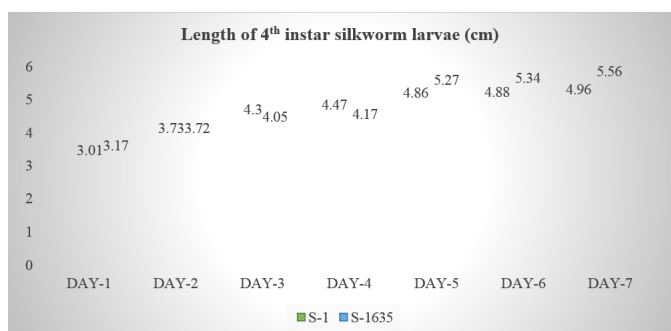


Figure 3: Length of 4th instar silkworm larvae of Breed Nistari X NB₄D₂ treated with mulberry leaf varieties S-1, S-1635

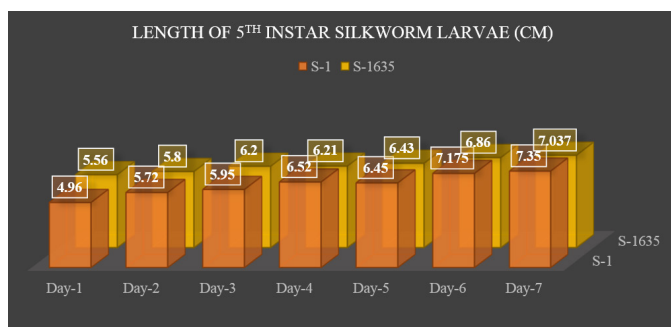


Figure 4: Length of 5th instar silkworm larvae of breed Nistari X NB₄D₂ treated with mulberry leaf varieties S-1, S-1635

Both the 4th and 5th instars exhibited maximum weight and growth of development when fed with our experimental variety S-1635 than to S-1 variety. So, it may ascertain to our farmers from above results that S-1635 ensures high yield of cocoon, better larval adaptability and increased silk production which can be acquired if quality leaves are provided to healthy worms.

CONCLUSION

Under different environmental factors feeding and nutritional quality of mulberry leaves plays a prime role in nutritional status for maintaining “good health” of silkworm larvae. The mulberry silkworm shows significant change in its ability for food intake, assimilation and conversion regulation to constituents of body. The feeding hours for grown larvae from 4th and 5th instars are classical and long- established followed by fasting related to growth and over all development of both external and internal structures.

NB₄D₂ is a bivoltine crossbreed that produces high quantitative parameters and when 4th and 5th instars silkworm larvae were observed comparing with two varieties of mulberry leaves (S-1 and S-1635) for their food, the analysis of quantitative estimation showed that the maximum weight and length of silkworm larvae was on 7th day of 5th instar healthy larva in favour of the S-1635 variety.

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