



Effect of different mulberry plant varieties on growth and economic parameters of the silkworm *Bombyx mori* in Mizoram

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ABSTRACT

Three varieties of commonly used mulberry leaves (V1, Local, S1635) were fed to the *Bombyx mori* larvae [Bivoltine double hybrid – (AP71 × AP9)(AP72 × AP8)] and their influence on the larval weight, filament length and larval protein content was studied under natural conditions in Mizoram. The mean weight of larvae, pupae, cocoon and shell as well as cocoon shell ratio and larval protein content of *B. mori* were increased when fed with S1635. In addition, the filament length produced by this silkworm in response to S1635 showed significant increase with respect to the other two varieties. Positive correlation was observed in filament length against protein content. The overall performance of *B. mori* in terms of growth and economic parameters was significantly improved with S1635 and this variety has the potential to enhance the commercial qualities of silk. Therefore, it is suggested to be used in sericulture for higher yield of silk.

Key words: *Bombyx mori*; mulberry variety; growth performance; filament length; larval protein content.

INTRODUCTION

The mulberry silkworm *Bombyx mori* L. belonging to the family *Bombycidae* are of common use in sericulture. They feed solely on leaves of mulberry (*Morus alba* L). Therefore, the quality and quantity of mulberry leaf have an intimate relation with the health of silkworm and quality

silk production.¹ Humans have immensely benefited from silk produced by silkworms and subsequently researchers have always been trying to unveil the factors that can be manipulated to the benefit of the silkworm rearers.² The major factors which determine the productivity and profitability in sericulture are yield and quality of mulberry leaves.³ The growth and development of silkworm and the economic characters of cocoon are influenced to a great extent by the nutritional content of mulberry leaf and this in turn

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influences silk production. Several reports are available on the evaluation of mulberry varieties through silkworm rearing performances.^{4,5} The nutritive value of mulberry depends on various factors and one of them is the varietal component of the leaf. Besides, the effect of feeding of different varieties of mulberry on the economic characters of the worm has been studied by a number of workers. Therefore, this study was undertaken by conducting a test between three different mulberry genotypes V1, S1635, and local in order to suggest suitable variety for more silk productivity under Mizoram conditions which will be beneficial for the silkworm rearers.

MATERIALS AND METHODS

The *Bombyx mori* larvae [Bivoltine double hybrid – (AP71 x AP9)(AP72 x AP8)] collected from Department of Sericulture, Aizawl, Mizoram, were reared using three mulberry genotypes namely V1, S1635 and local. Rearing was done up to third instar on locally available mulberry leaves and the larvae are segregated into three different treatment groups (namely V1, S1635, Local). Each treatment consisted of 3 replicates (20 worms/replicate) fed with different mulberry varieties. Locally available varieties were treated as control. All the treated larvae were fed four times a day till harvest. The important economic characters namely larval

weight, and cocoon filament length are recorded for all treatments. The silk thread from the corresponding cocoons was carefully reeled employing a reeling apparatus and the total length was measured in meters.⁷ The protein content was also determined by using Lowry *et al.* method.⁸ All the results were statistically analyzed. Data collected on various parameters were tabulated and subjected to critical statistical analysis by adopting ‘method of analysis of variance’ appropriate to the design of the experiment.⁹

RESULTS

Table 1 gives the economic parameters of *Bombyx mori* L. treated in different mulberry varieties. The mean weight (g) of fifth instar larvae recorded in S1635 was 4.88 followed by V1 (4.34) and minimum weight was in local (4.13) variety. It was observed that cocoon weight (2.263 g), pupal weight (1.560 g), shell weight (0.87 g), cocoon shell ratio (30.43) and filament length (1292 m) scores higher in *B. mori* fed with S1635 variety than V1 and local. The larval protein content was highest in S1635 (147.03 µg/g) followed by V1 varieties (128.83 µg/g), least in local varieties (93.77 µg/g). The protein content was positively correlated with the larval weight ($r = 0.90$), pupal weight ($r = 0.81$), cocoon weight ($r = 0.58$), shell weight ($r = 0.4576$) and

Table 1. Economic parameters of *B. mori* L. reared on different mulberry host plant varieties.

Host plant	Larval weight (g)	Pupal weight (g)	Cocoon weight (g)	Shell weight (g)	Cocoon shell ratio	Silk filament length (m)	Protein (µg/g)
V1	4.34 ± 0.08 ^a	1.498 ± 0.10 ^a	2.086 ± 0.08 ^a	0.61 ± 0.004 ^a	29.00 ± 0.05 ^a	1197 ± 1.73 ^a	128.83 ± 0.720 ^a
S1635	4.88 ± 0.07 ^b	1.560 ± 0.20 ^b	2.263 ± 0.30 ^b	0.87 ± 0.014 ^c	30.43 ± 0.17 ^b	1292 ± 5.68 ^b	147.03 ± 0.840 ^c
Local	4.13 ± 0.03 ^a	1.492 ± 0.02 ^a	2.130 ± 0.20 ^a	0.71 ± 0.018 ^b	29.30 ± 0.15 ^a	1185 ± 0.03 ^a	93.770 ± 1.34 ^b
P value	0.0006	0.0229	0.0007	0.0001	0.0008	0.0001	0.0001
F Value	32.730	7.572	30.932	90.787	29.67	266.10	1185.2

n = 60 (3 replicates, 20 worms/replicate). ANOVA Kramer- Tukey Test: Mean within a column followed by the same letter (a,b,c) are not significant ($p = 0.05$)

Table 2. Correlation and regression analysis of larval, pupal, cocoon and shell weight, cocoon shell ratio against larval protein and silk production.

Independent variable (X)	Dependent variable (Y)	Regression	R	R ²	Standard deviation	Sum of squares	F value	P-value
Protein	Larval weight	Y=2.849 + 0.0129900X	0.90	0.82	0.227900	0.0519300	4.76590	0.27
	Pupal weight	Y=1.378 + 0.0011280X	0.81	0.65	0.031130	0.0009693	1.92430	0.39
	Cocoon weight	Y=1.914 + 0.0019930X	0.58	0.34	0.105700	0.0111600	0.52130	0.60
	Shell weight	Y=0.4569 + 0.0022170X	0.45	0.20	0.164900	0.0272000	0.26480	0.69
	Cocoon shell ratio	Y=27.456 + 0.0172100X	0.61	0.38	0.838400	0.7029000	0.61790	0.57
Silk filament	Larval weight	Y= -3.513 + 0.0065030X	0.98	0.97	0.093810	0.0088000	33.0223	0.10
	Pupal weight	Y=0.7304 + 0.0006420X	0.99	0.99	0.001212	1.4680000	1929.41	0.01
	Cocoon weight	Y=0.3470 + 0.0014800X	0.94	0.88	0.043900	0.0019270	7.81190	0.21
	Shell weight	Y=-1.683 + 0.0019700X	0.88	0.77	0.087890	0.0077250	3.45330	0.31
	Cocoon shell ratio	Y=14.539 + 0.0122800X	0.95	0.91	0.318000	0.1011000	10.2470	0.19
	Protein	Y=-342.98+ 0.3807000X	0.82	0.67	21.67500	969.80000	2.11980	0.38

it was also observed that the silk filament length was positively correlated with the larval weight ($r = 0.98$), pupal weight ($r = 0.99$), cocoon weight ($r = 0.94$), shell weight ($r = 0.88$), cocoon shell ratio ($r = 0.95$), protein ($r = 0.82$) (Table 2).

DISCUSSION

Plants contain all nutrients required by herbivorous insects but the concentrations and proportions of these nutrients vary greatly among species.¹⁰ Digestion in different insects is appropriately adapted to the nutritional composition of host upon which the specific insect feeds.¹¹ Growth and development of silkworm, *B. mori* L. are known to vary depending on the quality and quantity of mulberry leaf used as food source, which in turn indicated by commercial

characteristics of cocoon crop.¹² Thangamani and Vivekananda¹³ reported the significant influence of different mulberry genotypes on the growth and development of silkworm and cocoon production. Sujathamma *et al.*¹⁴ evaluated mulberry genotypes in Andhra Pradesh and recommended two varieties (Tr-10 and Mr-2) for commercial cultivation. Bohidar *et al.*¹⁵ reported effect of different mulberry genotypes on the economic parameters of silkworm in Orissa climate and made suggestion for use of mulberry variety (V1, S36, and DD) for more silk production. Present study also confirms the same as S1635 mulberry variety gives better results in pre-cocoon and post-cocoon characters when compared to other varieties tested. Gangawar¹⁶ reported that, among eight mulberry varieties i.e. S1, S146, S1635, AR12, AR14, TR10, BR2 and K2 evaluated for nutritional potential by silk-

worm rearing experiments, silkworm larvae fed on BR2 variety leaves showed higher larval weight and improved economic traits like cocoon weight, shell weight and silk percentage in comparison to other varieties. Cocoon weight and shell weight are the most important characters evaluated for productivity.¹⁷ Shell weight percentage indicates the amount of raw silk can be reeled from the given quantity of fresh cocoons and shell weight percentage varies according to age and breed of silkworm. According to FAO¹⁸ total silk filament length is ranging from 600-1500 m out of which only 80% is reelable. In the present study, silk filament length of cocoons recovered from silkworms reared on different mulberry varieties falls within this range and cocoons recovered from silkworms reared on S1635 (1292 m) mulberry variety leaves produced longest filaments length followed by V1 (1197 m) and minimum filament length was observed in local variety (1185 m). The most preferred plant or plant part not only provided the nutritive requirements but also capable of being assimilated and converted into energy and structural substances required for the normal activities and development.¹⁹ Insects feeding on protein-rich host plants will be more successful than those that consume plant material which is less rich in protein.⁷ It was observed that the larval protein content was highest in S1635 followed by V1 varieties, least in local varieties. Mulberry leaves are rich in protein and amino acids, and there is a high correlation between leaf protein levels and the production efficiency of the cocoon shell, i.e., the cocoon shell weight relative to the total amount of mulberry leaves consumed by the silkworm.²⁰ It is therefore possible that an increase in the protein level of mulberry leaves may lead to improvements in cocoon productivity. The protein content was positively correlated with the larval, pupal, cocoon and Shell weight while silk filament length with larval, pupal, cocoon and shell weight, cocoon shell ratio and protein. Out of the three genotypes tested, S1635 showed maximum performance followed by V1 and local variety for the silkworm (AP71 x AP9) (AP72 x AP8) under

Mizoram conditions.

CONCLUSION

Leaves of S1635 and V1 mulberry varieties supported good growth and development of silkworm larvae, which is reflected in better commercial cocoon characteristic features. Such mulberry variety can be recommended for more trials at field level by farmers and could be exploited for commercial purpose in Mizoram for sustainable growth and development of sericulture industry.

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