EFFECT OF LEAF SUPPLEMENTATION WITH SECONDARY METABOLITES ON REELING PARAMETERS OF MULBERRY SILKWORM

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ABSTRACT

Lower concentrations of pectin (0.5 %), amino acid mixture (0.01 %) and proline (1 %) proved to be considerably effective showing higher filament length and denier value i.e. 1105 m and 2.40, 1088 m and 2.42 And 1046 m and 2.46 as against higher concentrations of pectin (1.0 %), amino acid mixture (0.02 %) and proline (2 %). In respect of raw silk recovery percentage, it was significantly higher in lower concentration of pectin (45.24 %); amino acid mixture (45.38 %) and proline (41.57 %) than the higher concentrations of secondary metabolites. These findings reported that reeling parameters was noticed and found to be superior in lower concentration of pectin, amino acid mixture and proline which performed best results amongst the treatments and natural diet, which showed that significantly, improved the silk production and they can recommend the leaf supplementations.

Key words: *Fortifications, Secondary metabolites, reeling parameters, silkworm*

INTRODUCTION

Growth and development of *Bombyx mori* L nutrition plays an important role. It is stated that silk production is dependent on the larval nutrition and nutritive value of mulberry leaves, which plays a very effective role in producing good quality of silk (Legay., 1958). Significant seasonal variations occur in the nutritional value and composition of mulberry leaves depending on factors *viz*., weather, pests and diseases as well as good crop package of practices (Ito, 1978), leaf supplementation with secondary metabolites is one of the important role by which cocoon and silk productivity can be increased and quality can be enhanced and maintained. Sengupta *et al*., (1972) revealed that *Bombyx mori* L. requires specific essential sugars, amino acids, proteins and vitamins for the growth of silkworm, survival and also for the improvement in the growth of silk gland. Good quality silk can obtained when silkworms fed on nutritionally supplemented leaves (Seki and Oshikane, 1959). In silkworms, silk fibroin is derived mainly from 4 amino acids: alanine, serine, glycine and tyrosine (Kirimura, 1962) which come from their dietary source of protein and amino acids (Ito, 1983). Silkworms obtain 72-86 % of their amino acids from mulberry leaves and more than 60 % of the absorbed amino acids are used for silk production (Lu and Jiang, 1988).

The amino acid plays an important role in glucose, tryptophan and organic acid metabolism. Few studies have been conducted on amino acids supplementation; their results improved the silk production (Etebari and Matindoost, 2005). Thus, in the present study a comprehensive effort was made to determine whether mentioned secondary metabolites supplementation influences the growth and development along with the reeling parameters.

MATERIALS AND METHODS

Silkworm rearing: Eggs of Kolar Gold (PM x CS2) were reared in the Sectional Laboratory, Agriculture College, Pune under standard conditions of 29 ^{0}C with a RH of 75±5 % and a photoperiod of 16 L: 8D as described by Harizanis (2004). Fresh mulberry leaves were used for feeding the silkworms.

Leaf supplementation with secondary metabolites: Experiment constituted 7 treatments. Pectin, proline and amino acid mixture were dissolved in 1 liter of distilled water and the test concentrations are given below.

Table 1: Leaf supplementation with amino acids

Treatment	Ingredient	Concentration (%)
T_1	Pectin	0.50
T_2	Pectin	1.00
T_3	Proline	1.00
T_4	Proline	2.00
T_5	Amino acid mixture	0.01
T_6	Amino acid mixture	0.02
T_7	Natural diet	-

Method/ Treatments: Amino acids was dissolved in distilled water and diluted to lower and higher concentrations of three amino acids *viz.*, pectin (0.5 %) and (1.0 %), proline (1 %) and (2 %) And amino acid mixture (0.01%) and (0.02 %) along with natural diet. Silkworms fed on supplemented leaves to all larval instars. Fresh leaves were dipped in different solution concentration and then after drying within 15 minutes under fan were then fed to the silkworm larvae four times in a day. 100 larval batches were fed with untreated leaves in five replicates. Experiment was accomplished using a completely random design with five replications for each of the treatment by using 100 silkworms per replication. After pupation, the cocoons were boiled and reeling parameters were recorded as advocated by Rahmathulla *et al*. 2007 and calculated with the following formulae.

Reeling parameters: Average filament length, non-breakable filament length, denier, raw silk percentage and raw silk recovery were recorded, by selecting 10 cocoons/replicate for the reeling process and were done from Government reeling centre, Islampur (Maharashtra State).

1. Average filament length: Mean single cocoon filament length was recorded from 10 cocoons/replicate on epprouvate machine and worked out by the formula,

Average filament length (m) = Total filament length ÷ Total no of cocoon reeled.

2. Non-breakable filament length: It denotes average length of filament that can be unwound from cocoon without break and it was calculated by the formula, Average filament length (m) = Total filament length (m) ÷ (1 + number of breaks during reeling).

3. Denier: Denoting silk-thickness (1 g weight of 9000 m silk yarn) and it was calculated by the formula, Denier = (Weight of reeled silk ÷ length of reeled silk) × 9000.

4. Raw silk percentage: It gives an idea about raw silk prevailing in cocoons and calculated by the formula, Raw silk (%) = (Weight of raw silk ÷ Weight of cocoons reeled) ×100.

5. Raw silk recovery: Ratio between reeled silk quantity and shell quantity used during reeling and calculated by the formula, Raw silk recovery (%) = (Raw silk percentage ÷ Shell ratio percentage)
×100. Data were subjected to analysis of variance.

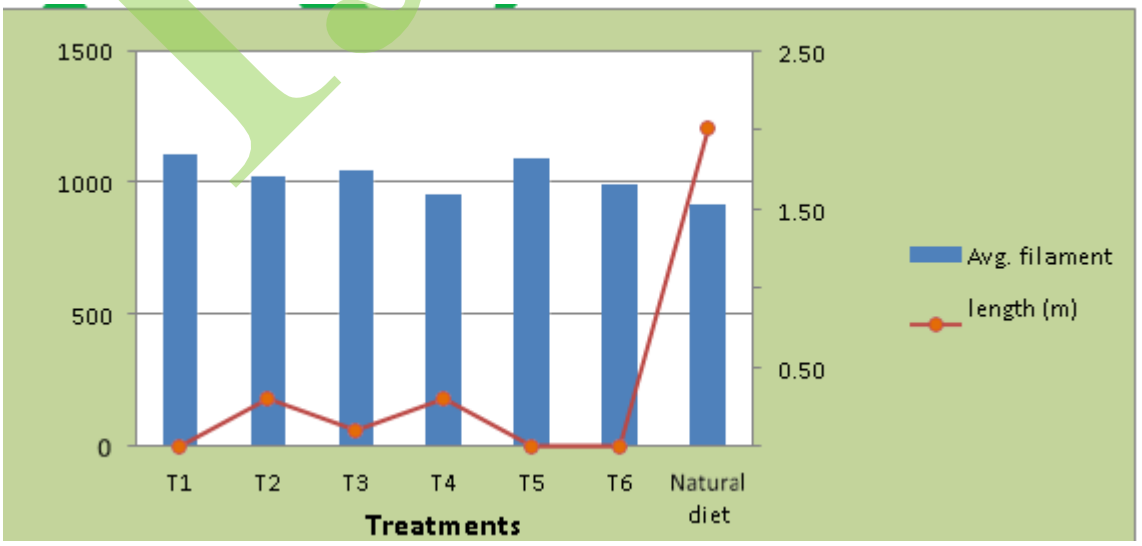
RESULTS AND DISSCUSSIONS

Reeling parameters: Data on reeling parameters, average filament length, NBFL, denier value, raw silk per cent and recovery per cent were tabulated in Table 2 and depicted in Fig. 1

Table 2: Effect of Secondary metabolites on reeling parameters of *Bombyx mori*. L

Treatments	Avg. filament length (m)	No. of breaks	NBFL (m)	Denier	Raw silk (%)		Raw silk recovery(%)	
Pectin (0.5 %)	1105	0.00	1105	2.40	9.94	(18.34)	45.24	(42.25)
Pectin (1.0 %)	1025	0.30	998	2.58	4.35	(12.11)	20.71	(27.06)
Proline (1 %)	1046	0.10	997	2.46	8.71	(17.16)	41.57	(40.16)
Proline (2 %)	956	0.30	929	2.76	7.57	(16.00)	37.86	(38.00)
Amino acid mixture (0.01 %)	1088	0.00	1088	2.42	9.74	(18.15)	45.38	(42.36)
Amino acid mixture (0.02 %)	994	0.00	994	2.62	9.07	(17.56)	45.30	(42.30)
Natural diet	919	2.00	621	2.50	4.14	(11.83)	40.66	(39.64)
SE ±	9.024	0.007	8.603	0.02	0.229		0.346	
C.D. at 5 %	26.157	0.020	24.938	0.07	0.663		1.003	

Results revealed that cocoon filament length was significantly longest filament length to the extent of 1105 m was recorded in Pectin (0.5 %) treatment over all the treatments. It was followed by Amino acid mixture (0.01 %) (1088 m) and Proline (1 %) (1046 m), which were at par with Pectin (1.0 %) (1025 m). This was followed by Amino acid mixture (0.02 %) (994 m) that was followed by Proline (2 %) (956 m). Whereas, significantly shortest length was noticed in natural diet (919 m). Data on number of filament breaks was recorded to be highest in natural diet over the rest of the treatments. This was followed by Proline (1 %) (0.10), Pectin (1.0 %) and Proline (2 %) treatment with breaks of 0.30, which were at par with each other. Whereas, there were no filament breaks occurred in Pectin (0.5 %), Amino acid mixture (0.01 %) and Amino acid mixture (0.02 %) treatments. In case of non-breakable filament length significantly lowest breaks of the filament were noticed in Pectin (0.5 %) (1105 m), which was at par with Amino acid mixture (0.01 %) (1088 m) treatment over the rest of the treatments. It was followed by Pectin (1.0 %) (998 m) and Proline (1 %) (997 m), which were followed by Amino acid mixture (0.02 %) (994 m) were found to be at par with each other. This was followed by Proline (2 %) (929 m). Significantly highest breaks of the filaments were recorded in natural diet (621 m). Significantly lowest denier values were noticed in Pectin (0.5 %) (2.40). this was followed by Amino acid mixture (0.01 %) (2.42) and Proline (1 %) (2.46) that was at par with each other. It was followed by natural diet (2.50) followed by Pectin (1.0 %) (2.58) and Amino acid mixture (0.02 %) (2.62). significantly higher denier values was noticed in Proline (2 %) (2.76) treatment. The data on silk prevailing in the cocoon indicated significantly highest raw silk was noticed in Pectin (0.5 %) (9.94 %), which was at par with Amino acid mixture (0.01 %) (9.74 %). This was followed by Amino acid mixture (0.02 %) (9.07 %) and Proline (1 %) (8.71 %) that was followed by Pectin (1.0 %) (4.35 %). Whereas, significantly lowest raw silk was noticed in natural diet (4.14 %). Data on raw silk recovery was significantly highest recovery was recorded in Amino acid mixture (0.01 %) (45.38 %). This was followed by Amino acid mixture (0.02 %) (45.30 %), which was followed by Pectin (0.5 %) (45.24 %) that were at par with each other. It was followed by Proline (1 %) (41.57 %) and natural diet (40.66%), which was at par with each other. Significantly lowest recovery was noticed in Pectin (1.0 %) (20.71 %). At lower concentrations of secondary metabolites, lower denier co-relates with less filament breakages with largest length depicted better silk quality. These results agree with those Trivedy (2003) that the conversion rate of leaf into silk was also found to be promising depicting higher silk content; lower denier and longer filament length that represented superiority of silk quality.



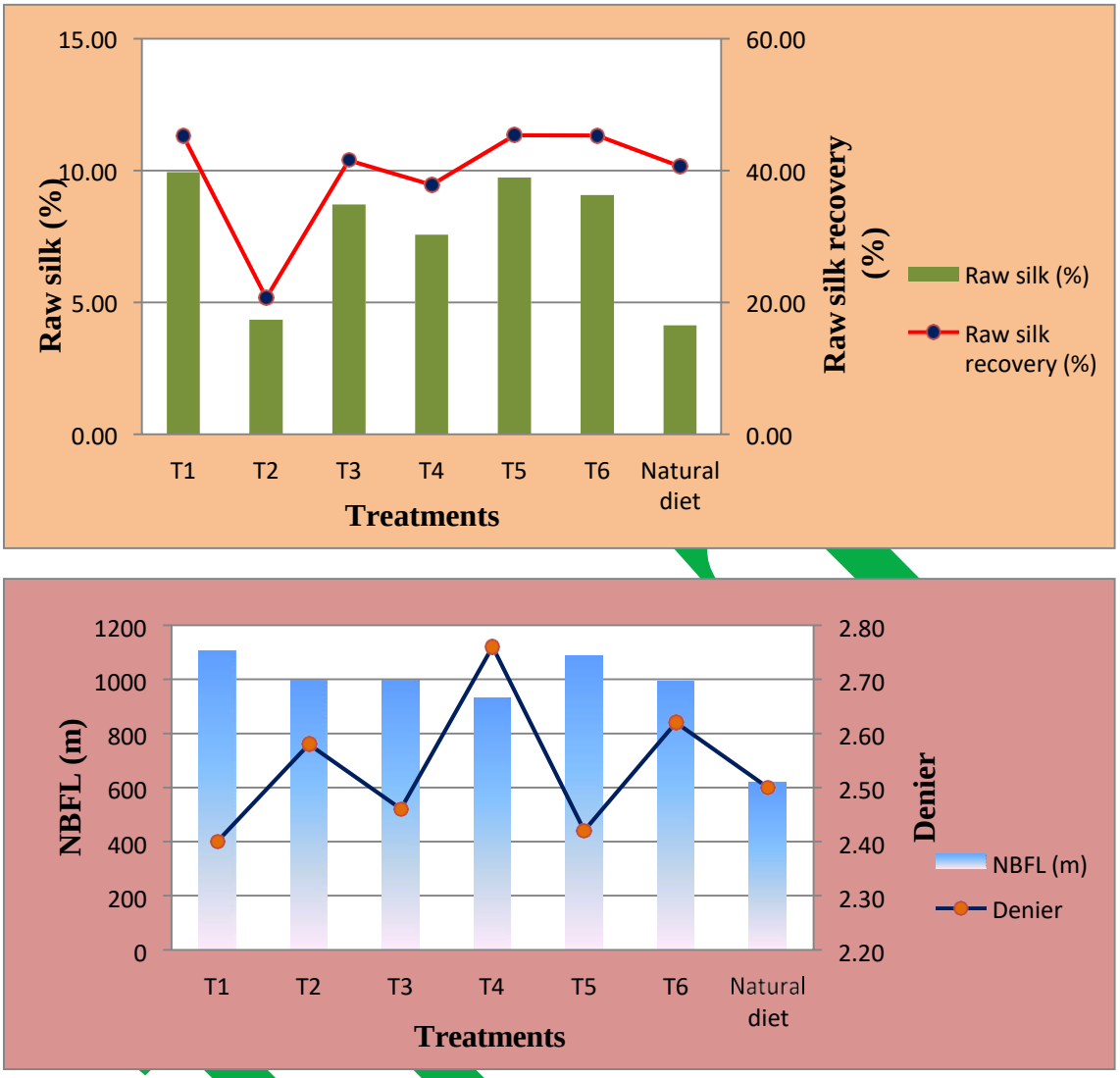


Fig. 1: Effect of secondary metabolites on reeling parameters

CONCLUSION

Conversion rate of leaf into silk was also found to be promising depicting higher silk content; lower denier, longer filament length that represented superiority of silk quality as pointed out earlier by Trivedy (2003). Reeling parameters viz., filament length, raw silk content and silk recovery were found more whereas co-related with lower denier value, respectively pointing out better silk quality.

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REFERENCES

Etebari, K. and L. Matindoost. 2005. Application of multivitamins as supplementary nutrients onbio-economical characteristics of Bombyx mori J. Asia- Pacific Ent., 8 (1): 107- 112.

Harizanis, C. P. 2004. Manual of Sericulture Silkworm Rearing and Mulberry Cultivation. Athens,pp: 22.

Ito, T. 1983. Nutrition of silkworm and the artificial diet (In Japanese). Jpn. Seric. J. Press, Tokyo. JP. Pp: 292.

Kirimura, J. 1962. Studies on amino acid composition and chemical structure of silk protein by microbiological determination. Bull. of Seric. Expt. Stn., 17: 447-522.

Legay, J. M. 1958. Recent advances in silkworm nutrition. Ann. Rev. Ent. 3: 75-86.

Lu, S. L and Z. D. Jiang. 1988. Absorption and utilization of amino acids in mulberry leaves by Bombyx mori L. Acta Sericologia Sancta. 14: 198-204.

Rahmathulla, V. K.; Priyabrata, D. S.; Ramesh, M. and R. K. Rajan. 2007. Growth rate pattern and economic traits of Bombyx mori under influence of folic acid administration. J. Appl. Sci. Envn. Manage. 11(4); 81-84.

Seki, K.; and K. Oshikane. 1959. Res. Rept. Fac. Text. And Seric., Shinshu Univ., China.

Sengupta, K.; Singh, B. D.; and J. C. Mustafi. 1972. Nutrition of Bombyx mori. Studies on enrichment of leaf with sugars, proteins, amino acids and vitamins for vigorous growth ofsilkworm and increased cocoon crop production. Ind. J. Seric. 11: 11-27.

Trivedy, K.; Nair, K. S.; Ramesh, M.; Gopal, N.; and S. N. Kumar. 2003. New Semi-synthetic diet "Nutrid" – A technology for rearing young instar silkworm in India. Ind. J. Seric., 42 (2): 158-161.