

Significance of Standardized Feed Additives on Biochemical Profiles in Silk Gland of Mulberry Silkworm Hybrids $CSR_2 \times CSR_4$ and $ND_7 \times CSR_2$ (Jayalakshmi)

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Abstract Investigations on silkworm hybrids $CSR_2 \times CSR_4$ and $ND_7 \times CSR_2$ with standardized feed additives during late age with mulberry shoots fortified with flours of horse gram + grain amaranthus (50 : 50) from fourth instar onwards up to ripening once daily and alternate day resulted in significantly higher in total protein (356.88µg/mg, 352.48µg/mg, 638.63µg/mg, 636.54µg/mg), total carbohydrates (5.843µg/mg, 5.834µg/mg, 5.943µg/mg, 5.935µg/mg) and DNA content (84.18µg/100mg, 81.32µg/100 mg, 96.36µg/100 mg, 94.38µg/100 mg), respectively in both silkworm hybrids compared to unsupplemented control.

Keywords Silkworm hybrids, Feed additives, Horse gram, Grain amaranthus, Biochemical profiles.

Introduction

Mulberry being a perennial crop requires a continuous and adequate supply of nutrients to get sustained yield. The quality of mulberry leaves depends on soil type, available plant nutrients and other agro climatic conditions. Earlier workers have tried fortifying mulberry leaf with additional nutrients like glycine, phenylalanine, glucose, jaggery, molasses and milk powder for improving cocoon quality. The nutritional status of mulberry leaves can also be improved by enriching with extra nutrients before feeding silkworms, so as to improve the quality and quantity of cocoon. Hence, the present work was carried out to study the biochemical profiles of two popular silkworm hybrids ($CSR_2 \times CSR_4$ and $ND_7 \times CSR_2$) following two feeding schedules.

Materials and Methods

The silkworm hybrids $CSR_2 \times CSR_4$ and $ND_7 \times CSR_2$ (Jayalakshmi) were reared on mulberry shoots of V_1 harvested from irrigated garden and supplemented individually or in combination with nine different flours as reported elsewhere (Sudhakara, 2008), also maintaining an unsupplemented control. Individual measuring cups and plastic sieves were maintained for application of each feed additive. Bulk rearing was done upto third moult and worms were then separated, to maintain two feeding schedules (once daily and alternate day) with feed additives. The flours of 5 g/10g each of the feed additives were initially weighted and placed in plastic measuring cups sepa-

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Table 1. Influence of feed additives on total protein ($\mu\text{g}/\text{mg}$) content in silk gland of Mulberry silkworm hybrids $\text{CSR}_2 \times \text{CSR}_4$ and $\text{ND}_7 \times \text{CSR}_2$ (Jayalakshmi). H_1 : $\text{CSR}_2 \times \text{CSR}_4$, H_2 : $\text{ND}_7 \times \text{CSR}_2$ (Jayalakshmi), D_1 : Daily once, D_2 : Alternate day.

Feed additive treatments	Hybrids				Feed additive mean
	D ₁	H ₁ D ₂	D ₁	H ₂ D ₂	
FA ₄ : Horse gram flour + Grain Amaranthus flour (50 : 50%)	356.88	352.48	638.63	636.54	496.13
FA ₈ : CFTRI mixture (100%)	328.59	326.52	624.54	622.41	475.51
FA ₁₀ :Control / Unsupplemented	304.26		607.26		455.76
<i>F</i> -Test	•				•
SEm±	0.200				0.059
CD at 5%	0.340				0.172

rately to mark levels. This was done after ensuring that the feed additives were sieved (150μ).

Each feed additive application was then through measuring cups followed by dusting with plastic sieves on mulberry shoots @ 5 g/10 g per kg of shoots based on marked levels and fed to silkworm hybrids. There were two batches in each schedule of feed additive application where in shoots dusted with feed additives were provided once daily during fourth instar till spinning. In the second batch, feed additives were provided once every alternate day from fourth instar till spinning. In both batches however, the remaining two feeds /day were normal (unsupplemented). In order to keep the bed dry and facilitate easy moulting, feeding was resumed half an hour later after dusting bed disinfectant (Resham Jyothi) when more than 95% of the worms were out of moult [1].

The total protein content of silk gland was estimated by Folin Ciocalteu Reagent (FCR) method

and total carbohydrate level in silk gland was determined by standard procedure. Similarly, total DNA estimation was conducted according to standard method. The data on biochemical profiles were analyzed statistically using three way factorial CRD (completely randomized design) method.

Results and Discussion

The silk gland profile of two silkworm hybrids, $\text{ND}_7 \times \text{CSR}_2$ and $\text{CSR}_2 \times \text{CSR}_4$ was studied during the larval stage (fifth day of fifth instar), in both feeding schedules with two feed additive treatments and compared with control.

Significant differences in total protein (356.88 $\mu\text{g}/\text{mg}$, 352.48 $\mu\text{g}/\text{mg}$, 638.63 $\mu\text{g}/\text{mg}$, 636.54 $\mu\text{g}/\text{mg}$ (Table 1), total carbohydrates (5.843 $\mu\text{g}/\text{mg}$, 5.834 $\mu\text{g}/\text{mg}$, 5.943 $\mu\text{g}/\text{mg}$, 5.935 $\mu\text{g}/\text{mg}$) (Table 2) and DNA content (84.18 $\mu\text{g}/100\text{mg}$, 81.32 $\mu\text{g}/100\text{mg}$, 96.36 $\mu\text{g}/100\text{mg}$, 94.38 $\mu\text{g}/100\text{mg}$) (Table 3) in silk glands was registered in $\text{H}_1\text{D}_1\text{FA}_4$, $\text{H}_1\text{D}_2\text{FA}_4$,

Table 2. Influence of feed additives on total carbohydrates ($\mu\text{g}/\text{mg}$) content in silk gland of Mulberry silkworm hybrids $\text{CSR}_2 \times \text{CSR}_4$ and $\text{ND}_7 \times \text{CSR}_2$ (Jayalakshmi). H_1 : $\text{CSR}_2 \times \text{CSR}_4$, H_2 : $\text{ND}_7 \times \text{CSR}_2$ (Jayalakshmi), D_1 : Daily once, D_2 : Alternate day.

Feed additive treatments		Hybrids				Feed additive mean
		D ₁	H ₁ D ₂	D ₁	H ₂ D ₂	
FA ₄ :	Horse gram flour + Grain Amaranthus flour (50 : 50%)	5.843	5.834	5.943	5.935	5.889
FA ₈ :	CFTRI mixture (100%)	5.317	5.311	5.342	5.336	5.327
FA ₁₀ :	control / Unsupplemented	5.212		5.222		5.217
<i>F</i> -Test		*				*
		0.0001				0.001
		0.001				0.002

Table 3. Influence of feed additives on DNA ($\mu\text{g}/100\text{ mg}$) content in silk gland of Mulberry silkworm hybrids $\text{CSR}_2 \times \text{CSR}_4$ and $\text{ND}_7 \times \text{CSR}_2$ (Jayalakshmi). H_1 : $\text{CSR}_2 \times \text{CSR}_4$, H_2 : $\text{ND}_7 \times \text{CSR}_2$ (Jayalakshmi), D_1 : Daily once, D_2 : Alternate day.

Feed additive treatments	Hybrids					Feed additive mean
	D_1	H_1	D_2	H_2	D_2	
FA_4 : Horse gram flour + Grain Amaranthus flour (50 : 50%)	84.18		81.32	96.36	94.38	89.06
FA_8 : CFTRI mixture (100%)	80.28		78.48	90.65	88.43	84.46
FA_{10} : Control / Unsupplemented		67.41			85.41	76.41
			*			*
<i>F</i> -Test			0.090			0.027
			0.160			0.078

$\text{H}_2\text{D}_1\text{FA}_4$ and $\text{H}_2\text{D}_2\text{FA}_4$ with Horse gram + Grain Amaranthus flour (50 : 50%) feed additive application daily once and alternate day application from fourth instar up to spinning in both hybrids.

Next best succeeding observation were recorded with CFTRI mixture as feed additive in $\text{H}_1\text{D}_1\text{FA}_8$, $\text{H}_1\text{D}_2\text{FA}_8$, $\text{H}_2\text{D}_1\text{FA}_8$ and $\text{H}_2\text{D}_2\text{FA}_8$ in respect of total protein (328.59 $\mu\text{g}/\text{mg}$, 326.52 $\mu\text{g}/\text{mg}$, 624.54 $\mu\text{g}/\text{mg}$, 622.41 $\mu\text{g}/\text{mg}$ (Table 1), total carbohydrates (5.317 $\mu\text{g}/\text{mg}$, 5.311 $\mu\text{g}/\text{mg}$, 5.342 $\mu\text{g}/\text{mg}$, 5.336 $\mu\text{g}/\text{mg}$ (Table 2) and DNA content (80.28 $\mu\text{g}/100\text{ mg}$, 78.48 $\mu\text{g}/100\text{mg}$, 90.65 $\mu\text{g}/100\text{ mg}$, 88.43 $\mu\text{g}/100\text{ mg}$) (Table 3), respectively.

However, minimum levels were registered in unsupplemented control for hybrid $\text{CSR}_2 \times \text{CSR}_4$ ($\text{H}_1\text{D}_1\text{FA}_{10}$ and $\text{H}_1\text{D}_2\text{FA}_{10}$), in respect of total protein (304.26 $\mu\text{g}/\text{mg}$, 607.26 $\mu\text{g}/\text{mg}$) (Table 1), total carbohydrates (5.212 $\mu\text{g}/\text{mg}$, 5.22 $\mu\text{g}/\text{mg}$) (Table 2) and DNA content (67.41 $\mu\text{g}/100\text{mg}$, 85.41 $\mu\text{g}/100\text{ mg}$) (Table 3), respectively followed by hybrid Jayalakshmi ($\text{H}_2\text{D}_1\text{FA}_{10}$ and $\text{H}_2\text{D}_2\text{FA}_{10}$)

Proteins have always been an interesting biochemical tool for insect biochemists because of the pertinent role in development, morphogenesis and almost in all the intermediary metabolic pathways of insect.

The growth of the silk gland results in the manifestation of accumulation of organic components with particular reference to protein. Enhanced synthesis of silk protein is the result of morphological and cytological nature of the silk glands. Thus the

silk glands, seen to accumulate protein components during fifth instar and thereby more protein content is mobilized towards silk formation. Amino acids present in feed fortificant when consumed get activated and forms polypeptide chains of the proteins on polysomes. The silk protein is biosynthesized in different regions of the silk glands using amino acids namely serine, alanine and glycine in large quantities and lesser amounts of tyrosine, valine, aspartic acid, glutamic acid.

The total carbohydrate level in silk gland was observed minimum, might due to the fact that the feed fortificant consumed was effectively utilized in converting the nutrients into the silk protein essential for silk production. The silk gland of silkworms, *B. mori* is highly specialized for massive production of proteins for silk thread. In silk glands, number of cells is fixed during late embryogenesis and subsequent growth is associated with endomitosis. Mulberry leaves dipped in metallic salts of KI, CoCl_2 , CaCl_2 and KNO_3 @ 20 $\mu\text{g}/\text{ml}$ and fed to third instar larvae onwards, enhanced significantly the body weight, silk gland weight, protein and DNA content of silk glands. Increase in these traits may be due to the stimulation of protein and DNA synthesizing machineries of the silk gland cells by these minerals leading to an overall increase in silk gland weight and helps in shortening the larval life.

The present findings are in harmony with observations of Ramesha and Govindan [2] on mulberry leaves supplemented with plant growth regulators. The winter season was found favorable for

selecting promoting the growth and organic constituency of the silk gland.

The present findings are supported by Andal et al. [3] who reported that higher protein in silk gland in PM $\times$ CSR₂ silkworms fed with mulberry leaves fortified with Horse gram + Grain Amaranthus. The results of the present study reconfirm the trend. Silkworm requires certain essential sugars, proteins, amino acids, fatty acid and vitamins for normal growth of silk glands and higher production of good quality silk.

References

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