Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(4): 283-286

Received: 11-05-2020
Accepted: 13-06-2020

Deepa KB
Department of Sericulture, UAS GKVK, Bangaluru, India

Fathima Sadatulla
Department of Sericulture, UAS GKVK, Bangaluru, India

Nithya BN
Department of Sericulture, UAS GKVK, Bangaluru, India

Divyashree HJ
Department of Sericulture, UAS GKVK, Bangaluru, India

Vishaka GV
Department of Sericulture, UAS GKVK, Bangaluru, India

Nithin Kumar DM
Department of Sericulture, UAS GKVK, Bangaluru, India

Corresponding Author:
Deepa KB
Department of Sericulture, UAS GKVK, Bangaluru, India

Effect of Amino acid formulation sprayed mulberry leaves on silkworm growth and cocoon yield parameters

Deepa KB, Fathima Sadatulla, Nithya BN, Divyashree HJ, Vishaka GV and Nithin Kumar DM

Abstract
A study on "Effect of Amino acid formulation sprayed mulberry leaves on silkworm growth and cocoon yield parameters at department of Sericulture, UAS, G.K.V.K., Bengaluru during 2016-17.Silkworms (PM x CSR2) fed with V-1 mulberry during late age registered significantly shorter fifth instar larval durations (169.00 hr), total larval duration (608.00 hr), cocoon number (48.50 /50 worms), cocoon weight (92.83 g/50 cocoons), maximum ERR (96.67 %), maximum single cocoon weight (1.92 g), single shell weight (0.31 g), single pupal weight (1.61 g), shell ratio (19.40 %) finer denier (2.39) and filament length (835.67 m) respectively were recorded when silkworms were fed on mulberry raised with 3.5 % amino^{+} spray on 25th and 35th day after pruning. The details are discussed.

Keywords: Foliar spray, Amino acid formulation, silkworm growth, cocoon yield, parameters

Introduction
Sericulture is an agro-based cottage industry. It is one of the most labour intensive sectors of Indian economy comprising both agriculture and industry. In its production process sericulture makes a long chain of interdependent specialized operations which provide means of livelihood to a large section of population like farmers (56.8 %), reelers (6.8 %), twisters (9.1 %), weavers (10.7 %), hand spinners of silk waste and traders (16.6 %)(www.indiansilk.kar.nic.in).India, during 2015-16 produced 4,613MT of raw silk from bivotine and 15,865MT from multivoltine. (Anon, 2016) [2]. As Indian sericulture is basically an agro-based industry, largely in decentralized sector both in pre and post cocoon productions. It is largely employment oriented providing regular employment to millions of rural masses. Another important aspect is the flow of money from the higher to lower strata of the society. Area under mulberry cultivation is estimated to be 1, 83,773 ha and producing around 19,690 MT of raw silk (Giridhar *et al.*, 2010) [8]. In Karnataka, the extent of mulberry cultivation is 82,098 ha spread over 11,735 villages and 1, 41, 528 farmers are engaged in mulberry cultivation and silkworm rearing. The cocoon and silk production is 54,282 MT and 7360 MT, respectively and has a share of about 45.09 per cent of the country's raw silk production. Andhra Pradesh and Tamil Nadu in the southern peninsula and West Bengal and Jammu and Kashmir in the northern peninsula are the other major players (Nagambika Devi, 2011) [12].

Due to excessive use of synthetic chemicals a serious threat caused not only to mulberry crop but also to the environment so an alternative is necessary for enhancing mulberry production without causing serious damage to the ecosystem. A foliar spray in generally used as spray for increased production of crop yield, branches and improving leaf quality effectively. (Chikkaswamy *et al*., 2006) [6]. Important characteristics of the silkworm *Bomyx mori* L. is the ability switch plant proteins to silk proteins. Nutritional composition of mulberry leaves determine growth and development of silkworm larva and cocoon production (Seidavi *et al.*, 2005) [13]. Amino acids are the proteins which are required for bio synthesis of silk, hence an attempt is made to know the effect of amino acid foliar spray to mulberry and influence on silkworm rearing parameters

Materials and methods
The field experiment was conducted at the Department of Sericulture, G.K.V.K., UAS,

Bengaluru during 2016-17. The experiment was laid out in Randomized Complete Block Design with 10 treatments and three replications. The experiment consisted of foliar application of amino acids (amino$^+$) in different concentration at different intervals. The treatment were as follow

T1 -Absolute control (No POP)
T2- POP + Water spray
T3 -POP + 2.0 % amino $^+$ at 25th DAP and 35th DAP
T4- POPT5 -POP+ 3.0 % amino $^+$ at 25th DAP and 35th DAP
T6- POP+ 3.5 % amino $^+$ at 25th DAP and 35th DAP
T7 -POP + 2.0 % amino $^+$ at 25th DAP and 35th DAP
T8 -POP + 2.5 % amino $^+$ at 25th DAP and 35th DAP
T9- POP+ 3.0 % amino $^+$ at 25th DAP and 35th DAP
T10- POP + 3.5 % amino $^+$ at 25th DAP and 35th DAP+ 2.5 % amino $^+$ at 25th DAP and 35th DAP

*DAP- Days after pruning
POP- package of practice recommended dose of NPK at the rate of 350:140:140 kg/ ha/ year and FYM at the rate of 20 MT/ha/year was applied. Amino acid formulation Amino$^+$ used as a foliar spray applied at different concentration at different intervals. Amino$^+$ is a liquid organic plant growth promoter containing 16 free bio available and biodegradable amino acids, it is compatible with all commonly used agro chemicals. Amino$^+$ is neither toxic nor harmful and non-phototoxic. It is suitable for all agro-climatic zones. It contains total dissolved solids 30-33 %, hydrolysed protein 9-11 %, hydrolyzed carbohydrates 6-7 %, amino nitrogen 3.5-4 %.Amino acids which increase the endogenous plant hormones or inhibit some endogenous hormones e.g., auxins, cytokinins etc., inhibit the negative hormone like abscisic acid, ethylene etc. To know the effects of V-1 mulberry plant raised through the application of different concentrations of amino+ foliar spray, PM x CSR2 silkworm hybrid was reared by following standard silkworm rearing practices outlined by Dandin *et al*. (2003) [7].

Silkworm Hybrid	PM x CSR2 (Kolar gold)
Number of treatments	10
Number of replications	3
Number of silkworms /replication	50

Results and Discussion
Mulberry has the capacity to absorb nutrients much more effectively and quicker through leaf, owing to comparatively larger leaf area when supplied through foliar spray. Amino acid foliar spray to mulberry leaves has helped in improving the nutrient content of mulberry, in turn to provide the required nutrients for better growth of the silkworm leading to improved qualitative and quantitative cocoon production. This work is the first of its kind because there is no available literature pertaining to the use of amino acid foliar spray. In the present study, the effect of foliar spray of amino acids on mulberry growth and quality as well as its subsequent effect on growth, development and cocoon productivity of mulberry silkworm has been investigated. The results of the experiment carried out on the "Effect of foliar application of amino acids on mulberry *Morus indica* L. and its influence on rearing performance of silkworm *Bombyx mori* L.". This work is the first of its kind because there is no available literature pertaining to the use of amino acid foliar spray.
After third moult, the silkworms were separated into 10 treatments, with 3 replications and 50 silkworms per treatment were fed with mulberry variety V-1 raised by treatments of different concentrations of amino$^+$ foliar spray which showed positive results on late age silkworm during the experiment. However, the different parameters viz., fifth instar larval duration, total larval duration and cocoon parameters showed significant differences among the treatments.
Shorter fifth instar and total larval duration (169.00 and 608.00 hr.) was recorded when PM x CSR2 were fed with mulberry grown by supplying 3.5 % amino+ on 25th day after pruning and 35th day after pruning (T6). The larval developmental duration is an important character to be considered by sericulturists. Bose *et al.* (1995) [4] studied the bioassay of foliar application of micronutrients to mulberry on rearing performance of silkworm, NB18 and NB7. Maximum reduction in larval duration (15-70 hr) was observed with application of Boron (2.5 and 5.0 kg/ha/yr) over control. Maximum increase in cocoon weight, larval weight, yield, ERR, shell weight and shell percentage were observed with the application of Iron (2.5 and 5.0 kg/ha/year), Zinc (5.0 and 10 kg/ha/year), Copper (2.5 and 5.0 kg/ha/year) which showed 11.08, 10.55, 30.28, 16.15, 18.24 per cent and 11.86 per cent increase, respectively over control. The reduction in larval duration can minimize the quantum of total food consumption and labour requirement besides completion of larval period with in minimum time (25 days). The present findings clearly indicate the fact that, it is more effective to supply the nutrients to mulberry through foliar application. Reduction in larval duration in case of 3.5 % amino$^+$ spray on 25th and 35th day after pruning can be attributed to nutritionally superior leaf quality particularly crude protein and carbohydrates content in mulberry leaves, which has resulted in robust silkworm larvae. Vishwanath *et al.* (1997) [14] who attempted to inter relate the supplementation of mulberry leaves with combination of secondary or micronutrients on the rearing performance of the silkworm, *Bombyx mori* L. They found reduction in the larval duration, and increase in the larval, cocoon and shell weights as compared to those characters in the untreated control.
In the present investigation mulberry silkworm PM x CSR2 when fed with V-1 mulberry leaves sprayed with different concentration of amino+ resulted in better ERR. Significant ERR (96.67 %) was registered when mulberry raised with 3.5 % amino+ spray on 25th and 35th day after pruning (T6) was fed to silkworms. However, minimum ERR was recorded in T1 (76.67 %). Increase in ERR might be due to application of foliar spray of amino+, when amino+ applied to mulberry might have increased nutritional status and productive potentiality. The resultant quality of leaves are superior when fed to silkworms, which grow healthy enough to give higher ERR with good quality cocoons absolute control with 76.7 % might be due to the residual effect of the previous crop. Vivek uppar and Rayar (2014) reported foliar spray of Vermiwash 5 (5.78 cg/day) and 3 per cent (5.71 cg/day), Biodigester 3 per cent (5.41 cg/day), Panchagavya 1 (4.83 cg/day) and 3 per cent (4.81 cg/day) and Biodigester 5 per cent (4.81 cg/day) significantly enhanced the silk productivity over Vipul spray and unsprayed treatments. The effective rate of rearing was more due to spray of Vermiwash 5 (99.43 %) and 3 per cent (99.38 %) and Vipul spray (98.77 %), similarly rearing, PM x NB4D2 silkworms with mulberry leaves (M-5) raised by foliar application of 'Daman Penshibao' at 0.50 ml/10 lit significantly increased ERR (86.10 %) (Jyothi *et al*., 2000) [9]. 5.3.4 Cocoon weight (g/50 cocoons) and cocoon number In the present study, PM x CSR2 hybrid performed excellently

well and significantly higher cocoon weight and cocoon number (92.83g/50 cocoons and 48.50 cocoons/50 worms) was obtained, when silkworms were fed on mulberry raised with 3.5 % amino$^+$ spray on 25th and 35th day after pruning (T6) over other treatments (Table 3). This is due to increase in the quality of mulberry leaves which has probably resulted in enhanced palatability and acceptability of leaves, thereby resulting in good cocoon yield. The above results correlate with the findings of Mishra *et al*. (1993) [11] who has reported that spraying of Vipul on mulberry at 250 ml/ha twice at 15 days interval after 15 days of pruning has significantly increased the cocoon yield (18.55 kg/10,000 worms) of NB18 x NB7 silkworm as compared to untreated control (15.46 kg/10,000 worms) similarly Spraying of 'Fasal', a 1-tricontanol based product at 1.0 ml/lit on K-2 mulberry for three times at 10 days interval after 15 days of pruning and feeding such leaves to NB4D2 silkworm has reduced the larval mortality by 4.31 per cent and increased cocoon weight up to 1.954 g as compared to 15.79 per cent mortality and 1.553 g of cocoon weight from unsprayed treatment (Ankalagi and Ansari, 1992) [1].

Cocoon parameters of the PM x CSR2 hybrid fed on mulberry raised through foliar spray of amino acid formulation. The cocoons spun by the silkworms (PM x CSR2) fed on mulberry obtained by supplying the crop with different concentrations of amino+ foliar spray have had notable influence on cocoon traits. The maximum single cocoon weight (1.92 g), shell weight (0.31 g), pupal weight (1.61 g) shell ratio (19.40 %), denier (2.39) and single cocoon filament length (835.67 m) respectively, were recorded when silkworm were fed with mulberry grown by spraying 3.5 % amino$^+$ spray on 25th and 35th day after pruning (T6) followed by other treatments. However, the minimum cocoon weight, shell weight, pupal weight, shells ratio, denier and filament length (1.66g, 0.22g, 1.43 g, 16.16 %, 2.76, 740.58 m respectively) in absolute control (T1) treatment. Narayanan *et al*. (1966) reported that, application of nitrogen to mulberry through foliar spray significantly influenced the cocoon production, since it has profound influence on larval, cocoon and shell weights, shell percentage and cocoon yield as nitrogen promotes protein content in mulberry leaf. Similarly, the silkworm, PM x NB4D2 fed with 0.5 per cent 'Green leaf' foliar sprayed leaves gave better cocoon weight (1.679 g), shell weight (0.319 g), pupal weight (1.336 g) and filament length (1054.58 m) (Chikkaswamy *et al*., 1999a) [5]. Rearing, PM x NB4D2 silkworms with mulberry leaves (M-5) raised by foliar application of 'Daman Penshibao' at 0.50 ml/10L significantly increased mature larval weight (32.79 g/10 worms), ERR (86.10 %) and cocoon yield (114.73 g/100 worms) as compared to unsprayed leaves (28.708 g, 78.04 % and 99.85 g, respectively). Cocoon weight (1.45 g), shell weight (0.297 g), shell ratio (20.53 %) and filament length were also higher over untreated control (Jyothi *et al*., 2000) [9], similarly rearing of 'Swarandhra' silkworm by using the M-5 mulberry leaves sprayed with 'Biofert' at 1, 2, and 5 per cent could not improve the cocoon weight, shell weight and pupal weight, but significantly improved the shell ratio, filament length and reelability percentage (Mahadeva *et al*., 2006) [10]

Table 2: Effect of amino acid formulation foliar spray on total larval duration (hr), fifth instar larval duration (hr) and ERR of mulberry silkworm hybrid (PM×CSR2)

Treatments	Total larval duration(hrs)	Fifth instar larval duration(hrs)	ERR (%)
T_1-(No RDF) absolute Control	673.00	181.30	76.67
T_2-RDF+ Water spray	622.00	173.52	84.67
T_3-RDF+2.0% amino$^+$ at 25th DAP and 35th DAP	643.30	174.00	92.67
T_4-RDF+2.5% amino$^+$ at 25th DAP and 35th DAP	620.00	172.00	93.33
T_5-RDF+3.0% amino$^+$ at 25th DAP and 35th DAP	612.00	170.00	94.00
T_6-RDF+3.5% amino$^+$ at 25th DAP and 35th DAP	608.00	169.00	96.67
T_7-RDF+2.0% amino$^+$ at 30th DAP and 40th DAP	646.00	174.00	89.33
T_8-RDF+2.5% amino$^+$ at 30th DAP and 40th DAP	628.00	173.00	93.33
T_9-RDF+3.0% amino$^+$ at 30th DAP and 40th DAP	624.00	172.30	93.33
T_{10}-RDF+3.5% amino$^+$ at 30th DAP and 40th DAP	616.00	172.00	94.00
F-Test	*	*	*
S.Em±	0.527	0.212	3.476
CD@5%	1.555	0.626	10.256

DAP- Days after pruning*Significant

POP= NPK @ 350:140:140 kg/ ha/ year + FYM@20 MT/ha/year

Table 3: Effect of amino acid formulation foliar spray on single cocoon number /50 worms and cocoon weight/50 worms of mulberry silkworm hybrid (PM×CSR2)

Treatments	Single cocoon weight (g)	Shell weight (g)	Pupal weight (g)
T_1-(No RDF) absolute Control	1.66	0.22	1.43
T_2-RDF+ Water spray	1.72	0.26	1.46
T_3-RDF+2.0% amino$^+$ at 25th DAP and 35th DAP	1.79	0.27	1.51
T_4-RDF+2.5% amino$^+$ at 25th DAP and 35th DAP	1.82	0.29	1.53
T_5-RDF+3.0% amino$^+$ at 25th DAP and 35th DAP	1.90	0.30	1.59
T_6-RDF+3.5% amino$^+$ at 25th DAP and 35th DAP	1.92	0.31	1.61
T_7-RDF+2.0% amino$^+$ at 30th DAP and 40th DAP	1.76	0.27	1.48
T_8-RDF+2.5% amino$^+$ at 30th DAP and 40th DAP	1.78	0.28	1.5
T_9-RDF+3.0% amino$^+$ at 30th DAP and 40th DAP	1.86	0.30	1.55
T_{10}-RDF+3.5% amino$^+$ at 30th DAP and 40th DAP	1.87	0.30	1.57
F-Test	*	*	*
S.Em±	0.01	0.01	0.01
CD@5%	0.022	0.035	0.082

DAP- Days after pruning*-Significant,

POP= NPK @ 350:140:140 kg/ ha/ year + FYM@20 MT/ha/year

Table 3: Effect of amino acid formulation foliar spray on single cocoon weight, shell weight and pupal weight of mulberry silkworm hybrid (PM×CSR2)

Treatments	Cocoon number/ 50 worms	Cocoon weight (g)/ 50 worms
T_1-(No RDF) absolute Control	38.33	81.07
T_2-RDF+ Water spray	42.33	81.95
T_3-RDF+2.0% amino$^+$ at 25th DAP and 35th DAP	46.33	82.70
T_4-RDF+2.5% amino$^+$ at 25th DAP and 35th DAP	46.67	84.45
T_5-RDF+3.0% amino$^+$ at 25th DAP and 35th DAP	47.00	86.25
T_6-RDF+3.5% amino$^+$ at 25th DAP and 35th DAP	48.33	88.68
T_7-RDF+2.0% amino$^+$ at 30th DAP and 40th DAP	44.67	82.38
T_8-RDF+2.5% amino$^+$ at 30th DAP and 40th DAP	46.67	83.10
T_9-RDF+3.0% amino$^+$ at 30th DAP and 40th DAP	46.67	84.08
T_{10}-RDF+3.5% amino$^+$ at 30th DAP and 40th DAP	47.00	85.18
F-Test	*	*
S.Em±	1.738	1.091
CD@5%	5.128	3.218

DAP- Days after pruning * -Significant
POP= NPK @ 350:140:140 kg/ ha/ year + FYM@20 MT/ha/year

Table 4: Effect of amino acid formulation foliar spray on denier, Single cocoon filament Length and shell ratio of mulberry silkworm hybrid (PM×CSR2)

Treatments	Denier	Single cocoon Filament length (m)	Shell ratio (%)
T_1-(No RDF) absolute Control	2.76	740.58	16.16
T_2-RDF+ Water spray	2.75	757.34	17.85
T_3-RDF+2.0% amino$^+$ at 25th DAP and 35th DAP	2.45	788.31	18.28
T_4-RDF+2.5% amino$^+$ at 25th DAP and 35th DAP	2.65	799.67	18.59
T_5-RDF+3.0% amino$^+$ at 25th DAP and 35th DAP	2.40	823.73	18.91
T_6-RDF+3.5% amino$^+$ at 25th DAP and 35th DAP	2.39	835.67	19.40
T_7-RDF+2.0% amino$^+$ at 30th DAP and 40th DAP	2.47	768.34	18.12
T_8-RDF+2.5% amino$^+$ at 30th DAP and 40th DAP	2.54	792.44	18.37
T_9-RDF+3.0% amino$^+$ at 30th DAP and 40th DAP	2.66	795.00	18.64
T_{10}-RDF+3.5% amino$^+$ at 30th DAP and 40th DAP	2.72	806.31	18.68
F-Test	*	*	*
S.Em±	0.069	14.972	0.451
CD@5%	0.202	44.169	1.332

DAP- Days after pruning * -Significant
POP= NPK @ 350:140:140 kg/ ha/ year + FYM@20 MT/ha/year

References

1. Ankalagi RF, Ansari MF. Effect of 1-Triacontanal and 'Fasal' on the growth and yield of mulberry, Morus alba and Bombyx mori. Sericologia. 1992; 32(3):405-410.
2. Anonymous. Annual report. Central silk board, Ministry of Textiles, Government of India Bangalore, 2016, 15.
3. Anonymous. Latest sericultural statistics in India, 2016. *www.indiansilk.kar.nic.in.*
4. Bose PC ratnasen, Dutta RK. Effect of foliar application of micronutirents to mulberry on the rearing performance of silkworm, Bombyx mori L. J Seri. 1995; 3(1):15.
5. Chikkaswamy BK, Shivashankar M, Puttaraju HP. Effect of foliar spray of 'Greenleaf' on growth, yield and quality of mulberry in relation to silkworm. Paper presented In: Nat. Sem. Trop, Seric, Univ. Agric. Sci, Bangalore, 1999a, 124.
6. Chikkaswamy BK. Effect of foliar spray of Navaras on growth and leaf production of mulberry. Soil Health and Water Management for Sustainable Sericulture, India, 2006, 118.
7. Dandin SB, JayaswaL J, Giridhar K. Handbook of Sericulture Technologies, CSB, Bangalore, 2003, 259.
8. Giridhar K, Mahanta JC, Kantharaju BM, Nagesh S. Raw silk production, 2009-2010. *Indian Silk*. 2010; 48:27-29.
9. Jyothi BL, Govindan R, Shanthakumar K. Performance of silkworm, Bombyx mori on mulberry raised by foliar application of Daman penshibao. Paper presented In: Nation Conf. Seric. Res. Dev, CSR&TI, Mysore, 2000, 67.
10. Mahadeva A, Shree MP, Nagaveni V. Production potential of mulberry (*Morus sp*.) and performance of silkworm (*Bombyx mori* L.) as influenced by exogenous supply of plant growth promoters – The biofert. Paper presented In: *Nation. Conf. New Strat. Res. Dev. Seric*., Indian Perspective, CSR&TI, Mysore, 2006, 31-32.
11. Mishra RK, Shukla P, Choudhury PC, Das PK, Singh GB, Bajpai AK, *et al*. Studies on the effect of commercial formulations of Triacontanol on quality and yield of mulberry (*Morus indica* L.) var. Kanva-2. Indian J. Seric. 1993; 32(2):156-161.
12. Nagambika Devi N. Present status of sericulture in Karnataka and future vision. paper presented in: nation. conf. seric. innov. before and beyond, central sericulture research and training institute,Mysore, 2011, 27-28.
13. Seidavi AR, Bizhannia AR, Sourati R, Mavvajpour M. The nutritional effects of different mulberry varieties on biological characters in silkworm. Asia Pac. J. Clin. Nutr, 2005, 14.
14. Vishwanath GK, Jayaramaiah M, Shankar MA. Feeding of mulberry leaves supplemented with secondary and micronutrients through foliage on the rearing performance of the silkworm, *Bombyx mori* L. Mysore J Agric. Sci. 1997; 31(2):175-179.
15. Vivek Uppar, Rayar SG. Bio-efficacy of organic foliar sprays on mulberry and cocoon production. J ent. Res. 2014; 38(1):35-39.