International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG(USA) Volume 3, Issue 10 - 2016

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2016.03.10.031

Evaluation of some silkworm *Bombyx mori* L. genotypes for cocoon associated traits during different seasons

Z. I. Buhroo[1], M.A.Malik[1], N.A Ganai[2], A. S. Kamili[1] and B.A.Bhat[3]

[1]Temperate Sericulture Research Institute, Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, India-190025.
[2]Division of Animal Genetics and Breeding, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir, Shuhamma, Alusteng, Srinagar-190006
[3]Faculty of Fisheries, Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir, Rangil, Ganderbal-191131.
*Corresponding author: *bzafariqbal@yahoo.com*

Abstract

Twelve bivoltine silkworm *Bombyx mori* L. genotypes were evaluated for cocoon associated traits during spring and summer seasons of 2012 and 2013 respectively. The data generated in respect of different traits was pooled separately, analyzed statistically and subjected to multiple trait evaluation indexes. The genotypes were ranked as per the cumulative score and the value of a particular trait in a particular genotype was compared with the ranking. Out of twelve genotypes, six genotypes viz., SKAU-R-1, SKAU-R-6, SKUAST-31, NB_4D_2, SH_6 and SKUAST-28 were shortlisted for spring season and eight genotypes viz., SKAU-R-1, SKAU-R-6, NB_4D_2, SH_6, SKUAST-31, $CSR_{18,}$ DUN_6 and DUN_{22} for summer season. These genotypes scored higher Evaluation index (E. I)values (>50) and were identified as promising genotypes hence recommended for rearing under temperate climatic conditions to push up silk productivity in the temperate region of India. Furthermore, the genotypes viz., SKAU-R-1, SKAU-R-6, SKUAST-31, NB_4D_2, SH_6, and DUN_6 performed significantly better irrespective of the seasons and scored higher Evaluation index (E. I) values (>50). Hence, these genotypes can be recommended for both seasons to boost bivoltine silk production in temperate region.

Keywords: Evaluation index, Genotype**,** Silkworm, Trait, Seasons.

Introduction

Sericulture being one of the most appropriate avenues for socio-economic development of a largely agrarian economy like India stands for livelihood opportunity for millions in the world owing to high employment oriented, low capital intensive and remunerative nature of its production. The very nature of this industry with its rural based on-farm and off-farm activities and enormous employment generation potential has attracted nearly about 30,000 rural families presently generating their income worth Rs. 2026.00 lakh annually. 3.5 lakh mandays (3.0 lakh on-farm and 0.50 lakh in off-farm) from the activities associated with this venture (Economic survey, *J & K*, 2014-15). The importance of sericulture in India was realized in 1950's when it contributed to the economic growth of India and became a prominent cash crop. Even today, all aspects associated with the production of silk yarn and fabrics are essential components of the rural economy in India (Giridhar *et al*., 2010). Jammu & Kashmir State bestowed with ideal climatic conditions

is famous for quality bivoltine silk production of international grade supplementing the income of the rural farmers in additions to their returns from the other crops. With very salubrious climatic conditions, the state excels other states in suitability to sericultural activities. *''Kashmir in view of its favorable climatic conditions could be converted into silkworm gene bank for sustaining the sericulture of the whole world''* as quoted by a leading Japanese sericulture scientist Dr. Tazima on observing the strength of sericulture in J & K (Ganaie *et al*, 2012). Though, the state is known for producing bivoltine silk of international quality. However, production of quality bivoltine silk is still a challenge in J & K having enormous potential to produce bivoltine silk of international grade, which can help to reduce the import of bivoltine silk in the country. Presently, with unpredictable market trends of different kinds of produces by the farmers and the increased economic needs due to changing social status of the farmers, Sericulture in the state has assumed special significance as an important subsidiary occupation, as such the growing economic compromises resulting in decreased productivity must be anticipated to overcome shortfalls by concurrent genetic improvements of the silkworm genotypes/breeds to push up the productivity levels in the interest of the temperate sericulture industry.

Evaluation of genetic resources is an essential prerequisite for their effective utilization in order to gauge the extent of variability among genotypes. In silkworm *Bombyx mori* L. large numbers of breeds were tested and promising ones were selected based on the economic traits (Mano *et al.*, 1993; Bhargava *et al.*, 1993). The silk yield is contributed by more than 21 traits (Thiagarajan, *et. al*., 1993) and there exists an interrelationship between multiple traits in silkworm. Any effort to improve the yield requires consideration of cumulative effect of the major traits, which influences the silk yield impartially. Evaluation index method developed by Mono *et. al*., 1993 is one such method that increases the precision of selection of breed among an array of breeds by a common index giving due weightage to all the yield attributing traits (Bhargava *et al.*, 1994). In this context, the evaluation study was undertaken on some potential bivoltine genotypes to identify most promising genotypes suitable for temperate regions during spring and summer specific seasons.

Materials and Methods

Twelve bivoltine mulberry silkworm genotypes namely; SKAU-R-1, SKAU-R-6, SKUAST-28, SKUAST-31, CSR_2, CSR_4, CSR_{18}, CSR_{19}, NB_4D_2, SH_6, DUN_6 and DUN_{22} formed basis for this study. The disease free laying's (DFL's) of these selected silkworm races were obtained from the Germplasm Bank of Temperate Sericulture Research Institute (TSRI), Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K) Mirgund, Central Sericultural Germplasm Resources Centre (CSGRC) Hosour, Tamilnadu, India and Central Sericultural Research and Training Institute (CSR&TI) CSB, Pampore, Srinagar Kashmir. The eggs were incubated under hygienic conditions at 25±1 ^{0}C temperature and 75-80% relative humidity for about 10-12 days till their hatching. The silkworms were fed with mulberry leaves harvested from the popular mulberry varieties viz; Goshoerami and Ichinose maintained in Mulberry Germplasm Bank of TSRI, SKUAST-Kashmir, Mirgund. The spring rearing was conducted in April-May while as summer rearing was conducted during July-August by following the standard package of practices (Krishnaswami, 1978).

The experiment was laid out in Completely Randomized Block Design with three replications for each treatment. Each replication comprised of 250 silkworms of uniform age and size retained after third moult. At the end of 5th instar, the mature larvae were collected manually and mounted in plastic collapsible mountages. During the rearing period, larvae and cocoons were assessed for different parameters viz; larval weight, single cocoon weight, single shell weight, shell ratio and filament length during spring and summer seasons (2012 and 2103). The data generated in respect of different traits (Table 2 & 3) was pooled separately, analyzed statistically and subjected further to multiple trait evaluation index method as per the procedure outlined by Mano *et al*., 1993.

$$Evaluation\,Index\,(EI) = \frac{(A-B)}{C} \times 10 + 50$$

The EI value fixed for the selection of breed / genotype is 50 or >50. The index value obtained for the entire traits was combined and the average EI values were obtained. The genotypes, which scored above the limit, were considered to possess greater economic value.

Results and Discussion

Evaluation index values were calculated for each of the genotype with respect to cocoon associated traits for both spring and summer seasons the data of which is presented in Tables 3 and 4. During spring, out of 12 genotypes, 5 genotypes viz., SKAU-R-1, SKAU-R-6, SKUAST-28, SKUAST-31 and NB_4D_2, scored the average EI value >50 for all the studied traits. SKAU-R-1 occupied the top position with average EI score value of 60.87 while in summer, 3 genotypes viz., SKAU-R-1, SKAU-R-6 and NB_4D_2 scored average EI value >50 for all the studied traits SKAU-R-6 recorded the highest average E. I. value of 58.80 among the 12 genotypes evaluated in summer. However, the analysis of data indicates that all the genotypes utilized in the study vary significantly with respect to parameters studied during spring and summer seasons. In the recent past evaluation index method developed by Mano *et. al*. (1993) has been utilized for short listing some potential silkworm genotypes/hybrids for commercial exploitation Bhargava, *et. al*. (1992); Malik, *et. al*. (2002), Nisar, *et. al*. (2005 and 2008*ab*), Quadir *et. al*. (2000) and Rajalakashmi, *et. al*. (2000) and the same has been utilized in the present study as well. The healthiness of larvae is a very important character from the point of view of silkworm rearers and as such stabilization of cocoon crop is very important for the sericulture industry. The genotypes that have maximum larval weight produce good cocoons qualitatively and quantitatively (Basavaraja, *et al*., 2005). The top ranking genotypes recorded larval weight in the range of 48.87 to 50.19 in NB_4D_2 to SKAU-R-1 during spring (Table-1) and 43.36 to 45.17 in NB_4D_2 to SKAU-R-6 during summer (Table-2). The findings of the present study are well supported by the earlier findings of Nisar, *et. al*. (2013). The single cocoon weight in the top ranking genotypes ranged from 1.89g in NB_4D_2 to 2.09 in SKA-U-R-1 during spring while it ranged from 1.74g in NB_4D_2 to 1.76g in SKA-U-R-6 during summer. High cocoon shell weight is an important trait for high productivity. The cocoon shell weight and shell ratio shows variability in different environments. According to Mano *et al*., 1993, if the breed is showing cocoon shell weight of 0.45g and above, it becomes weak and not suitable for summer rearing. The identified genotypes for spring and summer climatic conditions recorded shell weight in the range of 0.39g (NB_4D_2) to 0.45g (SKA-U-R-1) in spring while in summer it ranged from 0.34g (NB_4D_2) to 0.38g (SKA-U-R-6). Shell ratio ranged from 21.45 to 20.70 during spring while it ranged from 19.60 to 20.60 during summer. The length of cocoon filament is one of the important attributes of the silkworm breed/hybrid. The present study identified spring and summer specific genotypes having filament length in the range of 1197 m to 1121 m and 993 m to 1012 m respectively. The variation observed in the cocoon traits analyzed can be attributed to the genetic constitution of the genotype and the degree of expression to which the particular genotype is exposed during the rearing period. The argument is well documented (Naseema Begum *et al*., 2001, Narayanswamy *et al*., 2002). Hence, identification of potential genotypes call for consideration of the cumulative effects of the entire cocoon associated traits.

In silkworm *Bombyx mori* L multiple trait evaluation method has been utilized in testing large number of breeds and promising ones have been selected based on the economic traits (Mano *et al.*, 1993; Bhargava *et al*., 1993; Rajalakashmi *et al*., 2000; Malik *et al*., 2000; Malik *et al*., 2006; Malik *et al*., 2010; Nooruldin *et al*., 2014). Evaluation index is one such method that increases the precision of selection of breed among an array of breeds by a common index giving due weightage to all the yield component traits (Bhargava *et al.*, 1994). The silk yield is contributed by more than 21 traits (Thiagarajan, *et. al*., 1993) and there exists an interrelationship between multiple traits in silkworm. Any effort to improve the yield requires consideration of cumulative effect of the major traits, which influences the silk yield impartially. To judge the superiority of the silkworm breeds, a common index method is required (Bhargava *et. al*., 1994, Mano *et. al*. 1993). A selection index makes it possible to select for a character by selecting simultaneously for two or more characters related to it. Obviously, the present investigation on evaluation of some bivoltine silkworm genotypes with respect to important cocoon associated traits has yielded rich information, to identify potential breeds which can be recommended for commercial exploitation in the interest of the industry.

Table -1: Mean performance of twelve silkworm genotypes during spring*

Genotype	Weight of Ten mature larvae(g)	Single cocoon weight (g)	Single shell weight (g)	Shell ratio (%)	Filament length (m)
SKAU-R-1	50.19	2.09	0.45	21.45	1197.00
SKAU-R-6	49.47	2.04	0.43	21.14	1168.00
SKUAST-28	48.27	1.84	0.38	20.74	1060.50
SKUAST-31	49.17	1.91	0.40	20.85	1148.00
CSR_2	40.53	1.71	0.34	19.94	898.17
CSR_4	43.48	1.74	0.35	20.07	917.48
CSR_{18}	40.78	1.69	0.34	20.17	928.23
CSR_{19}	39.70	1.67	0.32	19.24	920.17
NB_4D_2	48.87	1.89	0.39	20.70	1121.00
SH_6	42.17	1. 84	0.38	20.60	1098.00
DUN_6	41.18	1.78	0.37	20.69	1019.50
DUN_{22}	40.13	1.76	0.36	20.40	1013.67
Mean	**44.5**	**1.83**	**0.38**	**20.5**	**1040.81**
S.D	**4.28**	**0.13**	**0.04**	**0.59**	**107.08**
CD p≤0.05	**0.32**	**0.60**	**0.61**	**0.15**	**23.91**

*** (Data pooled over same seasons of 2012 and 2013)**

Table-2: Mean performance of twelve silkworm genotypes during summer*

Genotype	Weight of Ten mature larvae(g)	Single cocoon weight (g)	Single shell weight (g)	Shell ratio (%)	Filament length (m)
SKAU-R-1	43.65	1.74	0.36	20.60	998.23
SKAU-R-6	45.17	1.76	0.38	21.53	1012.60
SKUAST-28	42.23	1.70	0.32	18.76	934.62
SKUAST-31	42.70	1.72	0.33	19.13	987.43
CSR_2	36.20	1.59	0.29	18.30	752.00
CSR_4	38.82	1.62	0.31	19.07	789.00
CSR_{18}	34.70	1.64	0.33	20.08	929.12
CSR_{19}	33.80	1.49	0.28	18.91	878.16
NB_4D_2	43.36	1.74	0.34	19.60	993.36
SH_6	39.87	1.73	0.33	19.12	975.97
DUN_6	38.48	1.67	0.32	19.22	896.61
DUN_{22}	37.40	1.64	0.32	19.45	883.17
Mean	**39.70**	**1.67**	**0.33**	**19.48**	**919.19**
S.D	**3.74**	**0.08**	**0.03**	**0.88**	**83.71**
CD p≤0.05	**0.71**	**0.90**	**0.33**	**1.43**	**7.76**

*** (Data pooled over same seasons of 2012 and 2013)**

Table -3: Multiple trait evaluation index in respect of twelve silkworm genotypes during spring*

Genotype	Weight of Ten mature larvae(g)	Single cocoon weight (g)	Single shell weight (g)	Shell ratio (%)	Filament length (m)	Average EI (%)	Rank
SKAU-R-1	63.31	69.43	69.51	66.21	64.59	63.31	1
SKAU-R-6	61.63	65.69	64.25	60.93	61.88	62.88	2
SKUAST-28	58.82	50.75	51.50	54.11	51.84	53.40	5
SKUAST-31	60.93	55.98	56.36	55.98	60.01	57.85	3
CSR_2	40.73	41.03	40.57	40.47	36.68	39.90	11
CSR_4	47.63	43.27	43.20	42.68	38.48	43.05	9
CSR_{18}	41.32	39.54	40.57	44.39	39.49	41.06	10
CSR_{19}	38.79	38.04	35.31	28.53	38.73	35.88	12
NB_4D_2	60.22	54.48	53.73	53.42	57.49	55.87	4
SH_6	44.57	50.75	51.10	51.72	55.34	50.70	6
DUN_6	42.25	46.26	48.47	53.25	48.01	47.65	7
DUN_{22}	39.80	44.77	45.83	48.31	47.47	45.24	8

*** (Data pooled over same seasons of 2012 and 2013)**

Table-4: Multiple trait evaluation index in respect of twelve silkworm genotypes during summer*

Genotype	Weight of Ten mature larvae(g)	Single cocoon weight (g)	Single shell weight (g)	Shell ratio (%)	Filament length (m)	Average EI (%)	Rank
SKAU-R-1	60.56	58.90	62.60	62.69	59.44	60.84	2
SKAU-R-6	64.63	61.45	69.97	73.24	61.16	66.09	1
SKUAST-28	56.77	53.82	47.85	41.83	51.84	50.42	6
SKUAST-31	58.02	56.36	51.54	46.02	58.15	54.02	4
CSR_2	40.65	39.83	36.79	36.61	30.03	36.78	11
CSR_4	47.65	43.64	44.16	45.34	34.45	43.05	10
CSR_{18}	36.64	46.18	51.54	56.79	51.19	48.47	7
CSR_{19}	34.23	27.11	33.10	43.53	45.10	36.61	12
NB_4D_2	59.79	58.90	55.22	51.35	58.86	56.82	3
SH_6	50.46	57.63	51.54	45.91	56.78	52.46	5
DUN_6	46.74	50.00	47.85	47.04	47.30	47.79	8
DUN_{22}	43.86	46.18	47.85	49.65	45.70	46.65	9

*** (Data pooled over same seasons of 2012 and 2013)**

Conclusion

Based on the evaluation of genotypes during different seasons, present study concludes that six genotypes viz., SKAU-R-1, SKAU-R-6, SKUAST-31, NB_4D_2, SH_6 and SKUAST-28 were shortlisted for spring season and eight genotypes viz., SKAU-R-1, SKAU-R-6, NB_4D_2, SH_6, SKUAST-31, CSR_{18}, DUN_6 and DUN_{22} for summer season. These genotypes scored higher E I. values (>50) and have been identified as promising genotypes hence recommended for rearing under spring and summer climatic conditions of temperate region to push up silk productivity in the temperate region of India.

Acknowledgments

The first author wishes to thank Directorate of Research, Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar-India for financial support. The author sincerely acknowledges Director, CSGRC Hosur and Director, CSR&TI Pampore (Central Silk Board, Ministry of Science & Technology, Govt. of India) and Head, TSRI, SKUAST-K, Mirgund for proving silkworm germplasm.

References

Basavaraja, H. K., Ashwath, S. K., Suresh Kumar, N., Mal Reddy, N. and Kalpana, G. V. (2005). Silkworm Breeding & genetics, *Central Silk Board Publication,* pp 523.

Bhargava, S. K., Raja Lakshmi, E. and Thiagarajan, V. 1994. An evaluation index for silk yield contributing traits in *Bombyx mori* L. *Indian Textile Journal*, **105** : 83 - 84.

Bhargava, S. K., Thiagarajan, V and Majumdar, M. K., 1993. Impact of silkworm breeds on reeling parameters. *Indain Textile Journal*, **104** : 66 - 69.

Bhargava, S.K., Thiagarajan, V., Rameshbabu, M. and Nagaraj, B. 1992. Combining ability and genetic analysis of quantitative traits in silkworm (*Bombyx mori* L.). *Journal of Genetics and Breeding* , **46**(4):327-330.

Economic Survey, J&K 2014-15. Directorate of Economics and Statistics, Govt., of Jammu and Kashmir, Srinagar. pp.37-138.

Ganie, N. A., Kamili, A.S., Baqual, M. F., Sharma, R.K., Dar, K.A. & Khan, I.L. 2012. Indian sericulture industry with particular reference to Jammu & Kashmir. *International Journal of Applied Biological Research* 2(2): 194-202.

Giridhar, K., Mahanya, J.C., Kantharaju, B.M. and Nagesh, S. 2010. Raw silk production. *Indian Silk* **8** (1): 27-29.

Krishnaswami, S. 1978. New Technology of silkworm rearing, bulletin No.2, *Central Sericultural Research and Training Institute, Mysore, India*, p. 23.

Malik, G. N., Kamili, A.S., Wani, S. A., Dar, H. U., Ahmad, R. and Sofi, A. M. 2000. Evaluation of some bivoltine silkworm (*Bombyx mori* L.) genotypes. *SKUAST Journal of Research*, **4**: 83-87.

Malik, G. N., Rufaie, S. Z, Baqual, M. F., Kamili, A. S and Dar, H. U. 2006. Comparative performance of some bivoltine silkworm, *Bombyx mori* L. hybrids. *Entomon*. **1**: 61-64.

Malik, M. A., Kamili, A. S., Sofi, A. M., Malik, G. N., Sabahat, A and Malik, F. 2010. Evaluation and identification of region/season specific hybrids of the silkworm *Bombyx mori* L. suitable for Kashmir climatic conditions. *Journal of Experimental zoology*. **13**:171-176.

Mano, Y., Nirmal Kumar, S., Basavaraja, H. K., Mal Reddy N and Datta, R. K. 1993. A New method to select promising silkworm breeds/combinations. *Indian Silk*, **31** (10): 53.

Narayanswami, T. K., Govindan, R., Anantha Narayana, S. R. and Ramesh, S. 2002. Genetic divergence among some breeds of silkworm *Bombyx mori* L. *Entomon* **27**(3): 319–321.

Naseema Begam, M., Basavaraja, H.K., Sudhakara Roa, P., Rekha, M. and Ahsan M.M. 2001. Identification of bivoltine silkworm hybrids suitable for tropical climate. *Indian Journal of Sericulture.* **39**(1) : 24-29.

Nisar, M., Chisti, M.Z. and Khan, M.A. 2013. Studies on the identification of summer specific silkworm Bombyx mori L. hybrids under temperate climatic conditions of Jammu and Kashmir, India. *Journal of International Academic Research for Multidisciplinary*.**1**(3): 1-14.

Nisar, M., Khan, M.A. and Quadir, S.M. 2005. Evaluation for identification of spring specific silkworm *Bombyx mori* L. hybrids for commercial exploitation under Kashmir climatic conditions. In: 20th Congress of the International Sericultural Commission, Bangalore, India, 15-18 December, 2005, Vol I, pp.351-356.

Nisar, M., Khan, M.A. and Quadir, S.M. 2008b. Studies on identification of new silkworm *Bombyx mori* L. hybrids and their introduction in field for commercial exploitation. Science for Better Tomorrow, University of Kashmir: 373-376.

Nisar, M., Khan, M.A., Quadir, S.M. and Siddiqui, A. A. 2008a. Breeding of Spring Specific Bivoltine Silkworm hybrid SBGP5 X SBGP22. Mulberry Sericulture- Problems and Prospects, APH Publishing Corporation, New Delhi: 95-104.

Nooruldin, S., Bhat, S. A., Malik, M. A., Khan, I. L and Sahaf, K. A. 2014. Comparative performance of silkworm, *Bombyx mori* L. hybrids during different seasons under Kashmir climatic conditions. *Green Farming*. 6 (6) : 1392-1395.

Quadir, S. M., Nisar, M., Khan, M. A. and Ahsan, M. M. 2000. Identification of season specific silkworm hybrids for temperate climatic conditions of Kashmir. In: *National Conference on Strategies for Sericulture Research and Development*, Central Sericultural Research and Training Institute, Srirampura, Mysore, India, 16-18, November 2000, P.21.

Thiagarajan, V., Bhargava, S. K., Ramesh Babu, M. and Nagaraj, B. 1993. Differences in seasonal performance of twenty six strains of silkworm, *Bombyx mori* L. (Bombycidae). *Journal of Lepidopteron Society*. **47** : 321-337.

Access this Article in Online	
	Website: www.ijarbs.com
Quick Response Code	**Subject:** Sericulture
DOI:10.22192/ijarbs.2016.03.10.031	

How to cite this article:
Z. I. Buhroo, M.A.Malik, N.A Ganai, A. S. Kamili and B.A.Bhat. (2016). Evaluation of some silkworm *Bombyx mori* L. genotypes for cocoon associated traits during different seasons. Int. J. Adv. Res. Biol. Sci. 3(10): 225-231.
DOI: http://dx.doi.org/10.22192/ijarbs.2016.03.10.031