

ORIGINAL ARTICLE

Possibility of preponement of Silkworm rearing under changing climatic conditions of Kashmir

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ABSTRACT

Sericulture is an agro-based industry, which suits rural people, entrepreneurs and artisans and requires low investment and fetches high returns. It is a two way process involving science of mulberry production and silkworm rearing for harvesting fabulous silk. The world is threatened with the climatic change and so is India including the state of Jammu and Kashmir which is reported to be warmer by 1.2°C over the last century. Like all other plant species, mulberry too will experience the effect of this change which necessitates the search for varieties that can be fed to worms if their rearing phase gets pre or postponed. Seeing the early sprouting in some mulberry genotypes viz; Goshorami, Ichinose and SKM-31 it was felt that it could prove helpful in advancing the silkworm rearing by a week or so which would in turn be helpful in having the second crop of cocoons more conveniently and regularly which normally becomes difficult for farmers in view of remaining busy with other agricultural crops. Three silkworm races viz: SK-6, SK-22 and SK-33 were fed with these early sprouting mulberry varieties to see their effect on commercial characteristics of silkworm. Among the various treatment combinations, silkworm race SK-33 fed on the leaves of SKM-31 mulberry variety performed better with respect to larval weight, larval duration, larval feed consumption, cocoon weight, shell weight, cocoon yield, raw silk recovery percentage, moth emergence and hatching percentage hence unveiling the possibility of preponement of silkworm rearing by 10 days.

Key words: Sericulture, mulberry, silkworm, sprouting, climate change.

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INTRODUCTION

Silkworm (*Bombyx mori* L.) is an important Lepidopteran insect and is utilized for the commercial production of natural silk. Silk is the most elegant textile in the world with unparalleled grandeur, natural sheen, inherent affinity for dyes, high absorbance, light weight, soft touch, and high durability thereby making it the "Queen of Textiles", unchallenged so far by other fibers. Even today, silk reigns supreme as an object of desire and fabric of high fashion. Sericulture is both an art and science of raising silkworms for silk production. This industry stands for livelihood opportunities to millions, owing to its high employment generation, low capital investment 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 the attention of the policy makers and planners to recognize the industry among one of the most appropriate avenues for socio-economic development of a largely agrarian economy like India. Jammu and Kashmir is the traditional sericulture state of India where sericulture is practiced in 20 districts. Kashmir silk is considered to be of very high quality as per the international quality standards. Among various constraints, the adequate quantity of mulberry production comes in the way of improved silk production in the state. On the other hand current global climate change is expected to affect some agricultural crops including mulberry in one or the other way posing an environmental threat to the global community [8]. The world is threatened with the climatic change and so is India including the state of Jammu and Kashmir which is reported to be warmer by 1.2°C over the last century. It has been seen that climatic change affects the mulberry sprouting behavior and the unprecedented changes in the weather and climate are giving the segos of early sprouting in mulberry because of rise in the temperature. Understanding the early sprouting behavior of some mulberry genotypes, it was felt that it could prove helpful in advancing the silkworm rearing by a week or so which

would in turn be helpful in avoiding the clash between fifth stage of silkworm rearing and rice transplantation in Kashmir and will help to harvest second crop of cocoons from the same plantation more conveniently and regularly thereby making sericulture more remunerative.

MATERIAL AND METHODS

The present study was carried out at College of Temperate Sericulture, Mirgund during spring 2017 & 2018. Since, the rearing schedule and growth of silkworms is greatly associated with the availability of leaf at a particular stage of silkworm hence, leaf of the three early sprouted mulberry varieties viz; and Goshorami, Ichinose and SKM-31 were used to study the rearing time initiation based on the time of availability of mulberry leaf. Goshorami sprouted at the end of March, Ichinose sprouted in the start of first week of April and SKM-31 sprouted in the third week of March. Three silkworm lines viz; SK-6, SK-22 and SK-33 obtained from Silkworm Germplasm Bank of CTS, Mirgund were selected for the study. The total number of treatment combinations was 9: T1 (V1L1):Goshorami+SK-6, T2(V1L2): Goshorami + SK-22, T3(V1L3):Goshorami+SK-33, T4(V2L1):Ichinose + SK-6, T5 (V2L2): Ichinose + SK-22, T6(V2L3):Ichinose + SK-33, T7(V3L1): SKM-31 + SK-6, T8(V3L2): SKM-31 + SK-22, T9(V3L3):SKM-31+SK-33.

RESULTS AND DISCUSSION

Effect of different treatment combinations on larval and moth characteristics in *Bombyx mori* L.

Based on the sprouting behavior of the mulberry varieties viz; SKM-31, Goshorami and Ichinose, date of release of seed from cold storage for spring rearing was fixed as 11th April in both the years (2017 & 2018), the incubation of silkworm seed was started on 13th April and the brushing of silkworms was done on 23rd April whereas the release of seed and brushing date for station rearing was 19th/20th April and 1st/2nd May respectively in the year 2017 & 2018. Therefore the silkworm rearing pertaining to study was 10 days in advance in comparison to the spring rearing schedule followed by this Institute. Analysis of the two year data (2017 & 2018) revealed that among the various treatment combinations, T9(V3L3) performed the best as far as various commercial characteristics of the silkworms are concerned. The highest larval weight (52.51g) was recorded by V3L3(SKM-31+SK-33 being statistically significant over the others where as the lowest larval weight was recorded in V1L2(Goshorami+ SK-22). The variation in the larval weight of silkworms in three different silkworm races fed on three different mulberry varieties can be attributed to varied nutrient content and moisture level of leaves of different mulberry varieties. The present findings are in tune with the findings of Bongale & Chaluvachari, [5]. The leaf utilization has been reported to vary based on the physiology of the silkworms. Present investigation revealed that the leaf of mulberry variety SKM-31 was utilized in less quantity as compared to other varieties. Significantly, the lowest quantity of feed of variety SKM-31 in the 5th age (1718.3g) was consumed by the worms of SK-33 silkworm race fed being the highest in V1L2 (Goshorami+ SK-22). Das and Sikdar [1] and Marbashetty *et al.* [6] have also reported that palatability and assimilation of feed in silkworms is affected by the moisture and nutrient levels available in the leaf. The larval duration is an important economic trait and silkworms with shorter duration are preferred for commercial exploitation. The shortest larval duration (26.3 days) was recorded in SK-33 silkworm race fed on SKM-31 being statistically significant over the rest where as the longest larval duration was recorded in V1L2 (Goshorami+ SK-22). The variation in the larval duration of different silkworm races under study can be attributed to the physiology of the larvae and also the quality of leaf fed to the larvae. Pakhale *et al.* (2014) have also reported similar effect of the mulberry leaf on the total larval duration. Moth emergence rate is the trait of importance for the breeders and is positively correlated to the pupation rate, the highest moth emergence rate (98.16%) was recorded by the worms of SK-33 silkworm race fed on leaves of SKM-31 variety being significantly different from others and the least rate was recorded in V1L2 (Goshorami+ SK-22). The variation in the moth emergence rate can be attributed to the variation in pupation rate. The present findings are in line with those of Krishnaswami *et al.* [2] who got similar results. Present investigation revealed that the worms of SK-33 silkworm race fed on leaves of SKM-31 variety recorded the highest hatching percentage of 98.46 per cent significantly different from others where as it was the lowest in V1L2 (Goshorami+ SK-22). The variation in the hatching percentage of various silkworm races under study can be attributed to the genetic background and physiological status of the moth. These findings are in tune with those of Das and Sikdar [1] who have got similar results. However the fecundity was non significant. (Table 1)

Table 1: Effect of different treatment combinations on larval and moth characteristics in *Bombyx mori*. L.

Treatment Combination	Weight of ten matured larvae (g)	Fifth age larval feed consumption (per 200 larvae) (g)	Total larval duration (days)	Moth emergence rate	Fecundity (no.)	Hatching percentage (%)
V1L1 (Goshoerami+ SK-6)	46.80	1767.0	27.4	95.63	582.66	95.85
V1L2 (Goshoerami+ SK-22)	46.43	1784.9	28.2	95.11	571.16	94.56
V1L3 (Goshoerami+ SK-33)	48.90	1756.9	27.2	96.40	587.83	96.85
V2L1 (Ichinose+SK-6)	48.86	1754.4	27.2	96.69	590.16	97.01
V2L2 (Ichinose+SK-22)	47.60	1766.2	27.5	96.30	579.33	96.03
V2L3 (Ichinose+SK-33)	49.46	1753.0	27.1	97.22	598.33	96.35
V3L1 (SKM-31+SK-6)	51.00	1734.2	26.9	97.62	616.16	97.33
V3L2 (SKM-31+SK-22)	50.36	1743.8	27.2	97.79	605.00	97.00
V3L3 (SKM-31+SK-33)	52.63	1718.2	26.3	98.16	628.50	98.46
C.D	0.364	5.01	0.542	0.310	NS	0.312

Effect of different treatment combinations on cocoon and post cocoon characters in *Bombyx mori*. L.

Pooled analysis of the two year data (2017 & 2018) revealed among the various treatment combinations, T9(V3L3) recorded the highest single cocoon weight of 2.316g being significantly different from others where as it was the least in V1L2 (Goshoerami+ SK-22). The variation in the cocoon weight can be attributed to the robustness and assimilation capacity of a particular silkworm breed. Koul [3] and Kulbir (2001) have also reported similar effect of mulberry leaf on the single cocoon weight. The worms of SK-33 silkworm race fed on leaves of SKM-31 variety recorded the highest single shell weight of 0.513grams being statistically significant over the others where as it was the least in V1L2 (Goshoerami+ SK-22). The variation in the shell weight can be attributed to the variation in cocoon weight. Bahar *et al.* [7] and Sajotra *et al.*, [11] have also reported similar effect of mulberry leaf on the single shell weight. The influence of feeding different mulberry varieties was significant both in case of yield /10000 larvae by number and weight. T9(V3L3) recorded the highest cocoon yield /10000 by number of 9383.3 and the highest cocoon yield /10000 by weight of 20.55 kg being significantly different from others where as it was the lowest in V1L2 (Goshoerami+ SK-22). The variation in the cocoon yield/10000 larvae can be attributed to the higher larval weight resulting in higher crop weight. The present findings are in line with those of Saratchandra *et al.* [4] who has made similar observations. Raw silk recovery percentage is the most important economic trait and is positively correlated with the shell weight. Present investigation revealed that the T9(V3L3) recorded the highest raw silk recovery percentage of 39.82 per cent being statistically significantly different from others whereas it was the lowest in V1L2 (Goshoerami+ SK-22). The variation in the raw silk percentage can be attributed to the variation in cocoon and shell weight. The present findings are in line with those of Krishnaswami *et al.* [2] who have made similar observations. (Table-2).

CONCLUSION

The silkworm rearing could be advanced by 10 days seeing the availability of quality leaf in SKM-31 which was reflected in the growth and economic parameters of SKM-31 race. This could a long way in avoiding the clash between silkworm rearing and other agricultural practices especially rice plantation in the region and help in popularization of silkworm rearing for at least two crops from the same set of plantation. Besides the advancement of silkworm rearing will lead to improvement in cocoon production in the region.

Table 2: Effect of different treatment combinations on cocoon and post cocoon characters in *Bombyx mori* L.

Treatment Combination	Single cocoon weight (g)	Single shell weight (g)	Shell (%)	Cocoon yield (by no.)	Cocoon yield (by weight) (kg)	Pupation rate (%)	Bave length	Raw silk recovery (%)
V1L1 (Goshoerami+ SK-6)	2.055	0.425	20.63	9372.1	17.94	96.05	1165.1	37.31
V1L2 (Goshoerami+ SK-22)	2.048	0.416	20.31	9325.3	17.86	95.89	1157.6	36.68
V1L3 (Goshoerami+ SK-33)	2.065	0.435	21.08	9351.5	18.03	96.38	1174.6	37.37
V2L1 (Ichinose+SK-6)	2.115	0.450	21.30	9377.3	18.31	97.29	1175.6	37.78
V2L2 (Ichinose+SK-22)	2.087	0.440	21.09	9349.0	18.21	96.76	1166.8	37.61
V2L3 (Ichinose+SK-33)	2.130	0.461	21.64	9363.6	18.40	97.90	1185.5	38.05
V3L1 (SKM-31+SK-6)	2.199	0.481	21.90	9372.0	19.61	98.30	1190.3	39.29
V3L2 (SKM-31+SK-22)	2.185	0.472	21.59	9366.3	19.32	97.75	1181.6	39.01
V3L3 (SKM-31+SK-33)	2.316	0.513	22.21	9383.3	20.55	98.38	1197.5	39.82
C.D	0.542	0.851	NS	7.16	0.745	NS	NS	0.892

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