

Effect of spring goshoramimulberry leaf extract on second commercial cocoon crop under temperate climatic conditions.

Comment [KV1]: Study need to be clarify,

Abstract

Nutrition plays an important role in silkworm rearing. It improves the growth, development, health and feed consumption, thereby improving the commercial traits. As reported, the mulberry leaf under Kashmir climatic condition during summer/autumn season is nutritionally poor. In Kashmir Valley 90% of silkworm rearers mostly do rearing only once in a year i.e during spring season and lesser number of rearers goes for second rearing during summer/ autumn season because of less productivity and poor quality cocoon crops.

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Fortification of leaves by supplementing nutrients and using them for feeding the silkworm is a useful technique to increase their economic value. Several attempts have been made to enhance the cocoon yield and silk content through supplement of amino acids on mulberry leaf. However supplement of amino acids on mulberry leaf may not be economical and is not easily assessable to farmers. Silkworm, *Bombyx mori* L., is a monophagous insect that drives all required nutrients for its growth and development from mulberry leaf. Hence the present study was undertaken to study the efficacy of fortification of spring leaf extract of Goshorami on growth and commercial traits of double hybrid FC1 (CSR₆×CSR₂₆) × FC2 (CSR₂×CSR₂₇) of silkworm *Bombyx mori* L. during second commercial rearing. The results showed, that application of aqueous extract of spring mulberry leaf affed silkworm larvae shows significantly higher in terms of body weight, cocoon weight, shell weight, yield and silk filament length.

Comment [KV2]: Reduce the abstract size and add more results and one light about future work

Key words: Silkworm, Second crop, Goshorami and Fortification.

Comment [KV3]: Give values of the result

Introduction:

Sericulture is a cottage industry, par excellence with its agriculture base, industrial super structure and labour intensive nature. It is remarkable for its low investment, quick and high returns, which make it an ideal industry or enterprise which fits well in to the socio-economic fabric of Jammu and Kashmir state and Kashmir State. Therefore, Sericulture is highly recommended as one of the most effective tools for rural reconstruction with development of rural society. It is mainly due to its comparatively high profitability when compared to many other competing Crops. The commercialization of only a single crop during spring rearing makes sericulture less remunerative at farmer's level. Over the years attempts are made and to commercialize the second cocoon crop (summer/autumn season) but have not been established on large scale because of less production, which is not economically viable during summer 10-15 percent farmers take up sericulture in temperate regions of Kashmir (Sahaf *et al.* 2016). As there is scope for second crop at commercial level during autumn season (Farooq *et al.* 2006, Malik *et al.* 2009, Shivkumar *et al.* 2018), it is true to say that, non availability of desirable

region/season specific silkworm breeds and adequate amount of mulberry leaf is also a constraint (Qadri et al., 2010). After pruning of mulberry in the month June the ~~Goshoeram~~ ~~the Goshoeram~~ ~~variety has~~ ~~variety higher~~ ~~has higher~~ values of growth parameters and survival under rainfed ~~conditions and~~ ~~conditions and~~ could be recommended for mass multiplication in the rearing zones of Kashmir valley for popularization of the summer/ autumn ~~crop~~ ~~crop~~ (Qadri et al., 2010, Qadri et al., 2011). Apart, it is a ~~well-known~~ ~~well-known~~ fact that growth and development of silkworm and the economic characters of cocoons are influenced to a great extent by the nutritional contents of the leaves as food for silkworm.

The quality of food directly influences the growth and development of the silkworm and in turn quality and quantity of silk produced by them. Better the quality of leaves, greater are the possibilities of obtaining a good cocoon ~~crop~~ ~~yield~~. The most important physiological factor in silkworm growth and silk production is nutrition. Normally, food plants contain all the biochemical constituents for the insects and their influence on the quality and quantity of silk fiber is considered to be very important. Supplement of nutrient is a recent technique and silkworms have ability to switch plant proteins to silk proteins for which number of artificial food can be supplied such as royal jelly, dietary proteins, amino acids, vitamin-B3 and these supplement helps in improving the qualities of silk fibre which can be used for yield enhancement in sericulture industry (Aparupa 2015). Sengupta *et al.* (1972) showed that *Bombyx mori* requires sugars, amino acids, protein and vitamins for its normal growth, survival and also for the growth of silk gland. Nutritionally imbalanced diet reduces growth rate by imposing metabolic load. Silkworm is a monophagous insect that derives almost all the nutrients required for its growth and development from the mulberry leaf itself (Nasreen *et al.*, 1999). Though the nutrients are balanced in mulberry leaf, the quantity available is not sufficient for the larval growth during second commercial crop due to ~~non-availability~~ ~~non-availability~~ of adequate moisture ~~contents, nutrients~~ ~~contents, nutrients~~, variation in mulberry plant and its management

Among many other limiting factors for successful second cocoon crop, the poor quality of leaf is more important one which vary in accordance with the mulberry variety and the leaf yield considering the above facts and factors, the cocoon productivity during second commercial silkworm rearing is much below the economic feasibility level in Kashmir Valley. Therefore, to ensure the stable second crop, it is very pertinent that fortified mulberry leaves with some economically viable supplementing nutrients can be used successfully under poor rearing conditions of the farmers to increase cocoon yield and silk production during summer/autumn rearing. Hence, present experimental study has been designed to know the influence of fortification of spring mulberry leaf extract on second commercial silkworm rearing under temperate climatic condition of Kashmir.

MATERIALS AND METHODS:

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The Bivoltine silkworm double hybrid FC1 (CSR₆×CSR₂₆) × FC2 (CSR₂×CSR₂₇) was used in this study. After incubation of eggs at 25 ± 1 temperatures and relative humidity of 80 ± 5%, The mass silkworm rearing was conducted as per package of practices of college of temperate Sericulture, SKUAST-Kashmir up to 3rd moult. After III moult, 1500 worms were randomly selected and distributed into six treatment groups of three replicates with 250 worms in each in a Completely Randomized Design (CRD). During the course of the present study the mulberry leaf used for second commercial rearing were supplemented with the aqueous extracts obtained from spring leaf and fed to the silkworms as per the following treatment combinations:

T1: Goshorami leaf Extract @ 5%, T2: Goshorami leaf Extract @ 10%, T3: Goshorami leaf Extract @ 15%, T4: Goshorami leaf Extract @ 20%, T5: cheek only distilled water was used, T6: cheek without any treatment. The mulberry leaves supplemented with the above concentrations were fed to silkworms every day in first feed during 4th and 5th instars

Collection and preparation of spring leaf extracts: The Goshorami leaves were harvested from the mulberry garden of college of Temperate sericulture SKUAST-kashmir. Freshly collected leaves were washed with running tap water and rinsed with distilled water. The extracts were prepared by crushing in an electrically operated mixer by adding known quantity of distilled water on weight by volume basis (1:10 proportion). The crushed material was filtered through double layered muslin cloth and the filtrate was maintained as the stock solution. The stock solution was maintained in refrigerator and every time fresh dilution was prepared and sprayed on chopped mulberry leaves and fed to silkworms.

Observations recorded:

The data was recorded as per the standard method for selected economic characters of silkworm *Bombyx mori* such as, larval weight (g), yield by number, Effective rate of rearing, single cocoon weight (g), single shell weight (g), shell ratio (%) and filament length.

RESULTS AND DISCUSSION



Pic 1. 5th age silkworm Larvae



Pic 2. Cocoon Formation on Rearing Trays

Table 1. Seasonal variation of some chemical composition of mulberry leaf (Goshorami).

Comment [KV5]: Already mulberry leaf and again mulberry leaf extract, what is the reason, explain clearly?

Comment [KV6]: why u selected mulberry leaf, you can use any other sources, and already you are mention, for second crop leaf availability is less and again selection of mulberry leaf, how its possible, study is not clear

Comment [KV7]: add extract picture and application methods

s.no.	Attributes	Percentage
1	Moisture content Spring	72.93
2	Moisture content Summer	60.21
3	Total protein Spring	18.50
4	Total protein Summer	13.60
5	Total sugars Spring	4.15
6	Total sugars Summer	2.30
7	Carbohydrates Spring	11.20
8	Carbohydrates Summer	9.88

Values represent mean of triplicate determination

The results of chemical compositions of mulberry leaf are presented in Table -1. The values obtained of spring mulberry Composite leaf samples comprising of coarse, medium and tender leaves for moisture, total protein, total sugars and total carbohydrates were 72.93%, 18.50%, 4.15%, 11.20% and 60.21%, 13.60%, 2.30% 9.88% for spring and summer leaf respectively .. The seasonal variation of moisture, total protein, total sugars and total carbohydrates are in harmony with the results of Shivashankar ^{M.} (2015) who reported maximum moisture content in fresh leaf during spring season of different mulberry varieties compared to autumn season. Higher moisture content in mulberry leaves is known to increase the amount of ingestion and digestion ability of silkworm as moisture acts as olfactory and gustatory stimulant (Ito, 1963). High leaf moisture content have a positive influence on the growth and development of silkworm. The present investigation clearly indicates that the less moisture percentage during summer seasons is one of the factor for poor crop.

Table 2 Mean performance of different treatment (data pooled over same seasons of 2019,2020 and 2021)

Treatments	Larval wt. of	No. of cocoons	ERR%	Av. Single	Av. Single Shell.Wt	SR %age	Filament length(mt)

Comment [KV8]: whether study as conducted on three years?

Comment [KV9]: include SEd value and mention the grouping

	10 mature larvae (g)	harvested		Cocoon Wt. (g)	(g)		
T1: Goshoerami leaf Extract @ 5%	42.740	242.667	97.467	1.893b	0.417 ^b	21.981b	1,032.111c
T2: Goshoerami leaf Extract @ 10%	44.143	245.333	98.133	1.967	0.471	23.921	1,159.66
T3: Goshoerami leaf Extract @ 15%	44.104	246.333	98.533	1.961	0.460	23.442	1,109.333
T4: Goshoerami leaf Extract @ 20%	41.339	244.667	97.867	1.892	0.407	21.402	1,014.778
T5: Control without any treatment	40.233	239.667	95.867	1.869	0.400	21.354	1,008.778
T6 Control with distilled water	40.561	240.000	96.000	1.874	0.404	21.736	1,025.444
C.D.	0.994	1.199	0.757	0.030	0.013	0.577	15.589

Comment [KV10]: ?

The average Larval weight of 10 mature larvae (g) of different treatments *i.e.*, T1, T2, T3, T4, T5 and T6 were found to be 42.740g, 44.143g, 44.104g, 41.339g, 40.233g and 40.561g during summer season. Significant differences were found among the different treatment groups. The larval weight of 10 mature larvae of T1 showed significantly ($p \leq 0.05$) higher body weight compared to T3, T4, T5 and T6 treatment groups. The larval weight of 10 mature of T4 and T5 did not differ each other. However the T6 was at par with the T5. In the present study the fortification of silkworm diet during summer season with aqueous extract of spring leas has improved the growth up to 10% level. The significant increase in larval weight when compared to control might be attributed to the enhancement of bio-availability of nutrients for digestion and conversion resulting in robust growth of the silkworm larvae. The present findings are in pipeline with the findings of (Radjabi *et al.* 2009), who reported that the fortifications of silkworm

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diet with certain levels may be effective for improved growth, but a higher level of supplementation does not have positive effect on silkworm growth and development.

Supplementation of silkworm diets during summer season with spring leaf aqueous extract of Goshwerami mulberry leaves significantly ($p \leq 0.05$) increased the cocoon yield, Effective Rate of Rearing (ERR) cocoon weight, shell weight and shell ratio percentage (table 2). The highest Cocoon yield and Effective Rate of Rearing (ERR %) were found in T3 i.e at 15% fortification and the lowest cocoon yield and ERR % were observed in T5 i.e control without any treatment. The data presented in table 2 clearly indicated that, the cocoon weight (**1.967g**), shell weight (**0.471g**) and shell ratio percentage (**23.921 %**) were found maximum in T3 i.e at 10% fortification and minimum in T5 (control without any treatment) i.e. **1.869g, 0.400g and 21.354%** of cocoon weight, shell weight and shell ratio percentage respectively.

The significant improvement in cocoon traits could be due to improved nutrition of leaf due to fortification which is utilized by worms, silkworms becoming stronger and tolerant to diseases.

These results are in line with the findings of, Gayathri *et al.* (2006), Sridevi (2003), Jeyapaul *et al.* (2003). Who reported better ERR, cocoon weight, pupal weight, shell weight and cocoon shell ratio from fortification of silkworm diet with different medicinal botanical plant extracts.

Significantly ($p \leq 0.05$) the longest silk filament length (1,159.66m) was recorded at Treatment 2 (containing 10% fortification of aqueous extract of spring mulberry leaf) followed by T3 (1,109.333m) and the lowest (1,008.778m) filament length was recorded in treatment 5 (control without any treatment). The results clearly indicated, that supplementation of spring leaf extract have direct influence on the cocoon productivity and silk content during summer season under temperate climatic conditions of Kashmir. The positive effects of nutritional supplementation on the economic traits of silkworm were very well documented by few researchers viz. Kabila *et al.* (1994), Nirwani and Kaliwal (1998), Etebari (2002), Radjabi *et al.* (2009). Rajashekaragouda *et al.* (1997) reported longest silk filament of 873 m due to supplementation of 20% *Parthenium* leaf extract. This has been further confirmed by Murugan *et al.* (1999) who found an increased filament length when mulberry leaves fortified with aqueous extracts of botanicals.

Conclusion:

The present findings, evaluated clearly demonstrated the significant role of aqueous extract of spring leaf supplemented on mulberry leaf in increasing the yield attributing parameters of popular Bivoltine double hybrid FC1 (CSR₆ × CSR₂₆) × FC2 (CSR₂ × CSR₂₇) of silkworm *Bombyx mori* L., maximum at 10% fortification. Hence this cheap, easily assessable to farmers fortification of spring mulberry leaf aqueous extract need to be popularize in the field for economically viable summer/ autumn crop.

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