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Study of Sub-optimal Dosages of Bed Disinfectants on Rearing Performance of Double hybrid ($FC_1 \times FC_2$) Silkworm, *Bombyx mori* L. under Sub-Tropical condition of Jammu

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ABSTRACT
The double hybrid ($FC_1 \times FC_2$) was reared on S-146 variety of mulberry during spring (2018). The experiment trial was conducted to know the performance of double hybrid with suboptimal dosage of bed disinfectants under subtropical condition of Jammu. There was non significant variation in the third, fourth, fifth instar and total larval duration and also statistically non-significant w.r.t larval weight in 3rd, 4th and 5th instar. The ERR by number recorded among different treatments were significant. The treatment T_1 (9825) recorded more ERR followed by T_2, T_3, T_4 and least in T_5 (8458). The ERR by weight was recorded highest in the treatment T_1 (20.99 Kg) and showed significant followed by T_2, T_3 & T_4 respectively & lowest was observed in T_5 (18.24 Kg). The single cocoon weight was found significant T_1 recorded highest cocoon weight 2.22 g and higher shell weight was observed 0.48 g in T_1 followed by T_2 (0.46 g). There was no significant variation in the shell ratio among the treatments. There was no significant variation in the defective cocoon but highest per cent was recorded in T_5 (8.36%) followed by T_3 (8.25%). The lowest defective cocoon was recorded in T_2 (3.22%). The pupation rate recorded significant difference with high 95.50 per cent in T_2 followed by T_1 (95.00 %). The lowest pupation was recorded in T_5 (84.00 %). The filament length was found significant T_3 recorded highest filament length of about 1095 m followed by T_1 (1086 m). The denier varied significantly among different treatments, T_1 recorded lowest denier 2.83. Significantly varied reelability among different treatments, T_4 recorded highest reelability having 90 per cent followed by T_1 and T_2 (86 %) respectively. The renditta observed significant T_1 & T_2 recorded lowest renditta 2.55 & 2.53 respectively. Finally, the application of recommended dosages of Vijetha and Lime of 100 and 75 per cent of bed disinfectant resulted better results compared to other treatments (50, 25 and 0 %) in terms of larval weight, ERR by No., ERR by weight, Pupation rate, cocoon weight, shell weight, shell ratio, filament length, denier, renditta and reelability interms of both pre-cocoon and post cocoon parameters of double hybrid ($FC_1 \times FC_2$) which was reared during spring (2018).
Key words: Double hybrid, Sub-optimal dosages, Bed disinfectants, pre cocoon parameters, post cocoon parameters

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INTRODUCTION

The silkworm, *Bombyx mori* (L.) exhibit holometabolous metamorphosis through the life stages like: egg, larval instars, pupa within the cocoon and adult moth. There are five larval instars. They feed voraciously on the mulberry leaves. Silkworm domesticated over centuries has become very delicate and susceptible to various diseases caused by microsporodia, bacteria, viruses and fungi [10] and in spite of strict adherence to rearing techniques, it is difficult to obtain desirable cocoon yield if diseases affect the silkworm. Diseases in silkworm are the major constraints in achieving high silk productivity. During rearing, silkworm larvae possibly get infected either through contaminated leaf or through other sources of contamination [2].

The infection by various pathogens and crop losses due to diseases is prevalent in all leading silk producing countries and is estimated to be about 15-20 Kg per unit of 100 disease free layings which accounts for about 30 *per cent* of total loss [27]. Unless, some curative/ preventive measures are adopted during rearing, the infection built may lead to increase in the disease incidence and thus resulting in

heavy crop loss. But so far no curative methods have been found feasible to control the diseases in silkworms and hence the prophylactic measures are the only way to control the diseases. As a routine prophylactic measure, the usage of bed disinfectants has been in regular practice in almost all the countries where sericulture is being practiced. Adoption of proper and effective methods of disinfection and stepwise maintenance of hygiene helps to achieve the best results. Various bed disinfectants *viz*., Vijetha, lime, Captan, Dithane M-45, RKO (Resham Keet Oushad), Ankush, Vijetha green, Resham jyothi, Labex and Formalin chaff are used in silkworm rearing. Among these, the most commonly used bed disinfectants by the farmers are lime, hydrated lime and Vijetha which are being used in large quantities without any justification.

Besides being costly, the rare availability of bed disinfectants and lack of awareness regarding its use among the farmers and sericulturists is affecting the process of silkworm rearing. In spite of self defense mechanism, silkworms still get infected by various pathogens such as bacteria, viruses, fungi, and microsporidia, which ultimately prove fatal. The larval skin consists of the cuticle and the hypodermis, which provide protection to the silkworm larvae from physiological and chemical damages, pathogen attacks, and water loss from the body. Still, these silkworms come into contact with the pathogens through integument, and oral and trans-ovum/ovarian infection. Bed disinfectants help in controlling the secondary contamination and improve the hygiene during silkworm rearing. Whereas slaked lime as bed disinfectant help to regulate rearing bed humidity and is antiviral in its property.

Management of silkworm disease is one of the vital components of successful silkworm rearing for higher yield and quality of cocoons. Proper disinfection of the rearing room, rearing appliances and rearing bed prevent and control the silkworm diseases and maintains hygiene by creating pathogen free environment for cocoon production [26] & [3]. It is more important to disinfect the silkworm body and rearing bed with bed disinfectant for containing secondary contamination and to improve the hygiene during rearing. However, silkworm disease management by bed disinfectants was evaluated by different workers *viz*., [16] [17] [33] [23] [5] [11] [25] [35] [18] [28] [7] [10] [20] [24] [32] & [36].

Considerable research work on the bed disinfectants dosage on larval and cocoon characteristics of double hybrid (FC_1× FC_2) *B. mori* L. was not done in subtropical conditions of North West India. Hence, the study was taken to determine the dosage level of bed disinfectants by rearing double hybrid on S - 146 variety of mulberry.

MATERIAL AND METHODS

The double hybrid (FC_1×FC_2) was reared on S-146 variety of mulberry during spring, 2018. The experiment trial was conducted to know the performance of double hybrid with suboptimal dosage of bed disinfectants under subtropical condition of Jammu.

Before the commencement of silkworm rearing, the rearing room and appliances were thoroughly cleaned and the floor was washed using 5 *per cent* bleaching powder solution and 2.5 *per cent* serichlor solution. Then the whole room was disinfected with 2 *per cent* formalin at the rate of 1.5 ml/m^2 by using rocker sprayer for effective disinfection has been reported [9]. The rearing room was kept air tight for 24 hours. After 24 hours, the room was kept open and used for rearing.

Methodology

Laboratory experiments were conducted to study the performance of double hybrid (FC_1×FC_2) with suboptimal dosage of bed disinfectants under subtropical condition of Jammu during 2018-2019 at Regional Sericultural Research Station (RSRS), Miran Sahib, Jammu. It is the winter capital of the J & K state of India. The Jammu city is a hilly area and is surrounded by snowcapped mountains. The Jammu city is located at an altitude of 327 m Above Mean Sea Level (AMSL) and has a latitude and longitude of 32.73 North and 74.87 East. Jammu city is also surrounded by Shivalik range & Trikuta range. It is 600 Km from New Delhi, the capital of India. Most of the annual rain fall in the district is observed between the month of June to September. Jammu the Northern most part of India experiences a sub-tropical climate that features to major seasons, a very hot summer and a chilly winter. During the summer month, the temperature in Jammu climb to 45° C, although the season gets a great level of rain fall. It hardly helps to reduce the heat. On the other hand winter remains chilly. Temperature often drops due to 4°C and it fluctuates between 14 - 18°C.

Brushing and Rearing

Mulberry leaves were cut into small squares of 0.25 cm^2 and sprinkled over the brushing net covered on hatched loose eggs. The neonate larvae crawled over the tender leaves and started feeding. Later, the brushing net along with neonate larvae was separated into the rearing bed to collect the remaining worms. Another paraffin sheet was used to cover the bed to maintain required relative humidity and

temperature and to keep the leaves fresh and turgid. The larvae were fed four times a day with suitable quality leaves [9]. During rearing, the recommended temperature and relative humidity was maintained.

Performance of double hybrid with suboptimal dosage of bed disinfectants

The five treatments with four replications of suboptimal dosages of bed disinfectants *viz*., Vijetha and Lime has been utilized in the experiment and details mentioned in Table 1.

Rearing performance of double cross hybrid with suboptimal dosage of bed disinfectants at laboratory level

Location

The experiment trial was undertaken Regional Sericultural Research Station (RSRS), Miran Sahib, Jammu. The rearing was conducted in lab to know the performance of double cross hybrid reared on S-146 mulberry with suboptimal dosage of bed disinfectants during the month of Feb - Mar (2018-19).

Collection of data

Suitable treatment dosages of bed disinfectants *viz*., Vijetha and Lime were used for the study and collected the data to know the rearing performance of double hybrid of silkworm from five treatments with four replications, each replication having 300 worms. The rearing performance of silkworms was collected at the stage of third instars onwards. For each treatment details the following economic parameters were recorded *viz*., Larval duration, larval weight, cocoon weight, shell weight, shell ratio, silk filament length and denier.

Statistical analysis

The experimental data collected on various economic and yield parameters were subjected to Fisher's method of analysis of variance (ANOVA) as per methods outlined [12]. Critical difference (CD) was calculated wherever the 'F' test was found significant. The data are presented with the level of significance at 5 *per cent*.

RESULTS

Pre-cocoon parameters:

Third instar larval duration (h)

The third instar larval duration was non significantly varied among different treatments and was recorded as 3 days 5 h for all the treatments (Table 2).

Fourth instar larval duration (h)

Non significantly varied among different treatments of fourth instar larval duration and was recorded as 3 days 14 h for all the treatments (Table 2).

Fifth instar larval duration (h)

The fifth instar larval duration was non significantly varied among different treatments and was recorded as 5 days 13 h for all the treatments (Table 2).

Total larval duration (h)

There was non significant variation in the total larval duration due to hybrid ($FC_1 \times FC_2$) performed well during rearing recorded lower total larval duration of 23 days (Table 2).

III Instar larval weight (g)

Third instar larval weight for different treatments of the hybrid ($FC_1 \times FC_2$) performed well during rearing which was recorded about maximum larval weight of 2.24 g/10 larvae for T_2 followed by T_5 (2.21 g/10 larvae). The lowest larval weight was recorded in T_1 & T_4 (2.19 g/10 larvae) and all the treatment groups showed non significant among each other (Table 3).

IV Instar larval weight (g)

All the treatment groups showed non significant among each other and the maximum larval weight was recorded is about 12.73 g/10 larvae for T_1 followed by T_2 & T_5 (12.1 & 12.04 g/10 larvae) respectively. The lowest larval weight was recorded in T_3 & T_4 (11.90 & 11.77 g/10 larvae) respectively and (Table 3).

V Instar larval weight (g)

Fifth instar larval weight for different treatments of the hybrid ($FC_1 \times FC_2$) performed well during rearing which was recorded maximum larval weight of 56.40 g/10 larvae for T_1 followed by T_2 & T_5 (55.85 g/10 larvae) respectively. The lowest V instar larval weight was recorded in T_4 (55.70 g/10 larvae) and all the treatment groups showed non significant among each other (Table 3).

Effective Rate of Rearing (ERR)

The ERR by number recorded among different treatments were significant. The treatment T_1 (9825) recorded more ERR by No. followed by T_2 (9566.75), T_3 (9341.5), T_4 (8883.5) and least in T_5 (8458) (Table 4).

The ERR by weight was recorded highest in the treatment T_1 (20.99 Kg) and showed significantly from other treatment groups followed by T_2, T_3 & T_4 respectively & lowest was observed in T_5 (18.24 Kg) (Table 4).

Pupation rate (%)

The pupation rate was obtained from the treatments on bed disinfectants of double hybrid recorded significant differences with higher pupation rate was recorded about 95.50 *per cent* in T_2 followed by T_1 (95.00 %). The lowest pupation was recorded in T_5 (84.00 %) respectively (Table 4).

Single cocoon weight (g)

The single cocoon weight was found significant differences among treatments, T_1 performed well during rearing which recorded highest cocoon weight 2.22 g followed by T_2 (2.16 g), T_3 (2.12 g) & T_5 (2.09 g). The lowest cocoon weight was recorded in T_4 (2.06) (Table 4).

Single shell weight (g)

The cocoon obtained from the silkworm treatments of double hybrid recorded significant difference with higher shell weight was observed 0.48 g in T1 followed by T_2 (0.46 g). The lowest shell weight was recorded in T_4 and T_5 (0.44 g) respectively (Table 4).

Shell ratio (%)

There was no significant variation in the shell ratio among the treatments, however the hybrid performed better during rearing for the treatment groups which recorded highest shell ratio in T_1 (21.51 %) followed by T_3 (21.38 %). The lowest shell ratio was recorded in T_5 (20.98 %) (Table 4).

Defective cocoon (%)

There was no significant variation in the defective cocoon among all the treatments, however the treatments were recorded defective cocoons during rearing for the treatment groups with highest *per cent* was in T_5 (8.36 %) followed by T_3 (8.25 %). The lowest defective cocoon was recorded in T_2 (3.22 %) (Table 4).

Post cocoon parameters:

Average Filament length (m)

The filament length was found significantly among different treatments, T_3 performed better during rearing which was recorded highest filament length 1095 m followed by T_1 (1086 m). The lowest filament length was recorded in T_5 (1015 m) (Table 5).

Reelability (%)

Significantly varied reelability among different treatments, T_4 observed better performance during rearing which recorded highest reelability having 90 *per cent* followed by T_1 and T_2 (86 %) respectively. The lowest reelability was recorded in T_5 (80 %) (Table 5).

Raw silk (%)

The raw silk was significantly varied among different treatments, T_2 observed better performance during rearing which recorded highest raw silk having 39.87 *per cent* (T_2) followed by T_1 (39.44 %). The lowest raw silk *per cent* was recorded in T_5 (38.20 %) and T_4 (37.08 %) respectively (Table 5).

Renditta

The renditta varied significantly among different treatments, T_1 & T_2 performed better during rearing which recorded lowest renditta 2.55 & 2.53 respectively followed by T_3 (2.60) and T_5 (2.64). The highest renditta recorded in T_4 (2.72) respectively (Table 5).

Denier

The denier varied significantly among different treatments, T_1 performed better during rearing which recorded lowest denier 2.83 followed by T_4 (2.96) and T_3 (2.97) respectively. The highest denier recorded in T_2 (3.05) and T_5 (3.03) respectively (Table 5).

DISCUSSION

Sericulture occupies a unique place in India's economy because of its dual role of income and employment generation. Breakthrough in sericulture can be achieved by the introduction of new silkworm breeds, high yielding mulberry varieties and adoption of improved crop production and crop protection technologies. The need of the hour is to increase the cocoon and silk productivity by reducing the production costs without affecting the quality of yarn and fabric. In this respect, silkworm breeds play vital role by proper disinfection during before, after and raring period for effective control of silkworm diseases.

Crop loss due to the presence of silkworm diseases has been a regular feature of Indian sericulture. Diseases caused by various infectious pathogens *viz*., viruses, fungi, bacteria and microsporidia take a heavy toll of cocoon crops in the field every year. Improper disinfections, unhygienic rearing conditions result in wide spread contaminations due to various silkworm diseases. Therefore use of the bed

disinfectants became a novel tool in the recent time to arrest this contamination in the rearing beds. To minimize the crop loss due to disease farmers are using various bed disinfectants *viz*., vijetha hydrated lime, bundh powder, active lime, captan, dithane M-45, RKO, ankush, vijetha supplement, resham jyothi, labex and formalin chaff. Among these most commonly used bed disinfectants by the farmers are active lime, hydrated lime, bundh powder, vijetha which are being used in large quantities without any justification. In addition to provision of good quality leaves, good aeration, sufficient spacing, required number of feedings, proper bed cleaning and proper disposal of bed refuse and dead worms during disease occurrence are considered as prime factors. However there was variation in application of bed disinfectants 2-4 Kg/100 dfls which was found to be common in silkworm rearing areas. In order to test its suitability for suboptimal dosages of bed disinfectants by rearing double hybrid on S - 146 variety of mulberry under subtropical conditions of Jammu, the investigations were carried out at Regional Sericultural Research Station (RSRS), Miran Sahib, Jammu. The results obtained are discussed here under.

Economic and yield parameters of different hybrids of silkworm, *Bombyx mori* L.

Larval duration (h)

Larval duration was found to be similar in all the treatments during 3rd (3D:05h), 4th (3D:14h) and 5th (5D: 13h) instar stage with total duration of 23 days and all treatments showing non-significantly different each other. The results were non - agreement with results reported that the larval duration was longer in race M-5 (24.17) [15] and the larvae reared on S -1635 recorded 19.66 days [6]. Under ideal conditions it has been reported that the total larval duration is 25-30 days for selected JAM breeds. The results were justified with work done and reported similar results on JAM breeds, the larval duration which ranges between 23.22-26.16 days with recommended use of disinfectants [1]. It was also not agreement with work reported on double hybrid ($FC_1 \times FC_2$) [29].

Larval weight (g)

Ten larval weight was insignificantly slightly higher in treatment group T_1 (56.4 g) than rest of the treatments and lowest was observed in T_4 (55.7 g). It was not agreement with work done on double hybrid ($FC_1 \times FC_2$) with recommended dosage of bed disinfectants [29]. The larval weight was non agreement with results *i.e.* 40.54 g which were reared on S - 1635 and other breeds which are reared on variety M - 5 and breeds having larval weight ranges between 29.69 g (PAM -108) to 40.39 g (PAM - 109) [6]. Similar results were recorded; the larval weight was ranges from 33.77-40.67 g [22].

Effective rate of rearing (ERR)

The effective rate of rearing was higher in group where recommended dosage of bed disinfectants (Lime and Vijetha) were given *i.e.* T_1 (20.99 Kg) followed by reducing treatment groups as T_2 (19.85 Kg), T3 (19.85 Kg) and T_4 (19.85 Kg) least effective rate of rearing was found in group T5 (18.24 Kg) where none bed disinfectant dosage was given. 30-40 *per cent* crop loss was due to disease which could be reduced by use of effective bed disinfectant, which was found to be factor behind ERR difference between different treatment groups [8]. The results were agreement with where there is no bed disinfectant was used with cocoon yield per 10, 000 larvae brushed varied in the range of 16.59 to 18.66 Kg [6].

Pupation rate (%)

Pupation rate was found to be highest in treatment group T_2 (95.50 %) followed by T_1 (95 %), T_3 (92.5%) and T_5 (84 %) least in treatment group T_4 (87 %). The results were justified where pupation rate was recorded as highest 91.00 *per cent* (PAM - 101, PAM - 105 and PAM - 108) where 75 *per cent* application of bed disinfectants and less 90.00 *per cent* (PAM - 111 and PAM - 109) where the no application of bed disinfectants were used but the results were non agreement with 100 *per cent* usage of bed disinfectants [19].

Cocoon weight (g), shell weight (g) and shell ratio (%)

Single cocoon weight was highest in treatment group T_1 (2.22 g) followed by T_2 (2.16 g), T_3 (2.12 g) and T_5 (2.09 g) least in T_4 (2.06 g). Shell weight was highest in treatment group T_1 (0.48g) following same trend as that of cocoon weight having least in treatment group T_4 (0.44 g). Shell ratio was highest in treatment group T_1 (21.51 %) followed by T_3 (21.38 %), T_2 (21.28 %) & T_4 (21.08 %) with least in T_5 (20.98 %) however non significant. All cocoon parameters as mentioned were found to be good in treatment group T_1 and T_2 which were provided with 100 and 75 *per cent* of recommended bed disinfectant dosage whereas minimum values were from treatment groups T_4 & T_5 with 25 *per cent* & none of the bed disinfectant dosages were given. Similar results were also found by the treatment of hydrated lime [30] & [4]. It was not agreement with work done on double hybrid ($FC_1 \times FC_2$) with recommended dosage of bed disinfectants for single cocoon weight, shell weight and shell ratio but the results were better in the 100 *per cent* bed disinfectant was used [29].

Defective Cocoon (%)

Defective cocoon *per cent* was found highest in T_5 (8.36 %) followed by T_3 (8.25 %), T_4 (5.11 %), T_1 (4.83 %) and T_2 (3.22 %) treatment groups, most of the defective cocoons were inside dead pupa or mute cocoons. As evident gestation of pathogens were started from 3rd instar onwards as treatment followed and disease claimed larvae just after they spun their cocoon and formed mute cocoons. Treatment groups having optimum (100 %) and 75 *per cent* of recommended dosage of bed disinfectants showed mostly double and mountage pressed cocoons and least mute cocoons, bed disinfectant as recommended, is essential & most important to disinfect the silkworm body and rearing seat for better harvest of silk crop [34].

Post cocoon parameters by using suboptimal dosage bed disinfectants

Actual filament length was highest in treatment group T_1 (1086 m) followed by T_3 (1095 m), T_4 (1062 m), T_2 (1036 m) and T_5 (1015 m), similar results where significantly higher filament length recorded by applying formalin chaff and Lime + dithane M-45 application [21] & [14]. Reelability percentage was found to be highest in treatment group T_4 (90 %) followed by T_1 (86 %), T_2 (86 %), T_3 (84 %) and T_5 (80 %). Raw silk percentage was highest in group T_2 (39.87 %) followed by T_1 (39.44 %), T_3 (38.74 %), T_5 (38.2 %) & T_4 (37.08 %). Average denier was obtained highest in treatment group T_2 (3.05) followed by T_5 (3.03), T_3 (2.97), T_4 (2.96) & T_1 (2.83). Renditta was obtained highest for treatment group T_4 (2.72) followed by T_5 (2.64), T_3 (2.6), T_1 (2.55) & T_2 (2.53 Kg), which shows that treatment groups having optimum or about optimum bed disinfectant dosage provide with good quantity and quality of silk from cocoon obtained as compared to other treatment groups. As stated Vijetha has claim for its efficiency against all the four diseases Pebrine, Grasserie, flacherie and Muscardine [31]. The results were stated to have control over multiplication & accumulation of pathogen in rearing bed use of slaked lime is recommended [13]. It was agreement with work reported on double hybrid ($FC_1 \times FC_2$) with recommended dosage of bed disinfectants for filament length, denier were better in the 100 *per cent* bed disinfectant or recommended bed disinfectant was used [29].

Table 1. Showing five treatments with suboptimal dosages of bed disinfectants *viz*., Vijetha and Lime

Treatments	Slaked Lime applied in grams (Rearing bed size in Sq. ft. area)		Vijetha applied in grams (Rearing bed size in Sq. ft. area)		
	Before 3rd moult (1 sq. ft.) (g.)	Before 4th moult (3.4 sq. ft.) (g.)	After 3rd moult (1sq. ft.) (g.)	After 4th moult (4 sq. ft.) (g.)	4th day of 5th instar (7 sq. ft) (g.)
T_1 (100 %)	5.00	17.00	5.00	20.00	35.00
T_2 (75 %)	3.75	13.00	3.75	15.00	27.00
T_3 (500 %)	2.50	9.00	2.50	10.00	17.50
T_4 (25 %)	1.25	5.00	1.25	5.00	8.75
T_5 (0 %)	NIL	NIL	NIL	NIL	NIL

Table 2. Larval parameters in different treatments of silkworm, *Bombyx mori* L. in different instars for larval duration

Treatments	Larval duration (D:h)			
	3rd instar	4th instar	5th instar	Total larval duration
T_1	03:05	03:14	05:13	23:00
T_2	03:05	03:14	05:13	23:00
T_3	03:05	03:14	05:13	23:00
T_4	03:05	03:14	05:13	23:00
T_5	03:05	03:14	05:13	23:00

Table 3. Larval parameters in different treatments of silkworm, *Bombyx mori* L. in different instars for larval weight

Treatments	Larval weight (g.)		
	3rd Instar	4th instar	5th instar
T_1	2.19	12.73	56.40
T_2	2.24	12.10	55.85
T_3	2.20	11.90	55.80
T_4	2.19	11.77	55.70
T_5	2.21	12.04	55.85
C.D @ 5%	-	-	-
SE.m±	0.03	0.23	0.31
C.V (%)	3.41	3.90	1.14

Table 4. Economic parameters in different treatments of bed disinfectants on double hybrid ($FC_1 \times FC_2$) silkworm, *Bombyx mori* L.

Treatments	ERR/10000 Larvae		PR (%)	SCW (g.)	SSW (g.)	SR (%)	DC (%)
	By No.	By wt. (Kg)					
T_1	9825.00 (99.12)	20.99	95.00 (77.21)	2.22	0.48	21.51 (27.62)	4.83 (12.11)
T_2	9566.75 (97.81)	19.85	95.50 (77.82)	2.16	0.46	21.28 (27.46)	3.22 (9.89)
T_3	9341.50 (96.62)	19.85	92.50 (74.12)	2.12	0.45	21.38 (27.53)	8.25 (15.14)
T_4	8883.50 (94.23)	19.85	87.00 (68.89)	2.06	0.44	21.08 (27.32)	5.11 (12.44)
T_5	8458.00 (91.97)	18.24	84.00 (66.43)	2.093	0.44	20.98 (27.25)	8.36 (16.67)
C.D @ 5%	3.21	1.46	2.87	0.07	0.02	-	-
SE.m±	1.06	0.48	0.94	0.02	0.01	0.16	2.6
C.V (%)	2.2	4.86	2.59	2.15	3.21	1.15	39.17

Table 5. Post cocoon parameters in different treatments of double hybrid ($FC_1 \times FC_2$) silkworm, *Bombyx mori* L.

Treatments	AFL (m)	ANBFL (m)	Denier	Reelability (%)	Raw Silk (%)	Renditta
T_1	1086.00	904.00	2.83	86.00 (68.03)	39.44 (38.88)	2.55
T_2	1036.00	1036.00	3.05	86.00 (68.03)	39.87 (39.14)	2.53
T_3	1095.00	912.00	2.97	84.00 (66.42)	38.74 (38.48)	2.60
T_4	1062.00	1062.00	2.96	90.00 (71.59)	37.08 (37.5)	2.72
T_5	1015.00	1015.00	3.03	80.00 (63.43)	38.2 (38.16)	2.64
C.D @ 5 %	2.78	-	0.05	0.75	0.867	0.13
SE.m±	0.91	34.26	0.02	1.07	0.29	0.04
C.V (%)	0.17	7.02	1.1	2.24	1.48	3.27

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