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Performance of fabricated self-mounting structures on cocoon and reeling parameters of Silkworm, *Bombyx mori* L.

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Abstract
The investigation was conducted to know the performance of newly fabricated self mountages viz., spiral, square and zig-zag mountage in comparison with mountages existing at field viz., Thalaghattapura ribbon chandrike, plastic mountage and bamboo mountage by involving using two silkworm breeds *viz.*, Cross Breed (CB) and Double Hybrid (DH). The results for cocoon parameters showed that single cocoon weight was higher in bamboo mountage with DH (2.13 g) and that was least in plastic mountage with CB (1.62 g), cocoon shell weight was higher in spiral mountage with DH (0.498 g) and that was least in plastic mountage with CB (0.261 g), pupal weight was higher in DH with bamboo mountage (1.64 g) and that was least in CB with ribbon chandrike (1.27 g), floss weight highest in ribbon mountage with CB (0.329 mg) and same was least in bamboo mountage with DH (0.250 mg) and Cocoon Shell Ratio was highest and least in DH with zig-zag mountage (26.10 %) and CB with plastic mountage (16.67 %) respectively. The results for the cocoon reeling parameters indicated that, average filament length was longest in DH with bamboo mountage (1181.68 m) and shortest in CB with bamboo mountage (862.27 m), non-breakable filament length was relatively longer in DH with spiral mountage (449.57 m) and shorter in CB with plastic mountage (305.11 m), filament weight was significantly heavier in DH with square mountage (0.365 g) and it was significantly lower in CB with plastic mountage (0.252 g), raw silk percentage was highest DH on zig-zag mountage (19.60 %) and least in CB with bamboo mountage (14.71 %) and denier was significantly finer in CB with zig-zag mountage and that was coarser in CB with square mountage. The spiral and zig-zag mountages were found to give better results as that of bamboo mountage.

Keywords: cocoon shell ratio, cross breed, double hybrid, filament length, mountages

1. Introduction

The silkworms are holometabolous sericigenous insects that complete the larval stage in about 23-27 days, where they undergo four moults and complete their larval stage. The larvae attain maturity by about 7 days after fourth moult. This stage is important for satisfying silkworm physiological requirement by excreting amino acids from the body [4].

The spinning of cocoons, which is also the nest for silkworms to metamorphosize into pupa, is a crucial part of silkworm rearing, that starts with identification and collection (manually) of mature larvae and transferring them on to the cocooning structures, the process of which is defined as 'mounting'. The time and method of mounting as well as the mountage are the most important factors influencing the quality of cocoons and thereby, the raw silk yield and quality. Even if the silkworm crop is healthy, improper mounting methods, spinning conditions, mounting density, mounting of pre or over matured larvae and poor type of mountages can results in inferior quality cocoons [5]. An improper use of mounting structure and lack of care during handling and management of mature silkworms results in formation of defective cocoons accounting to a loss of about 5 to 8 percent of cocoon yield [2].

A significant portion of investment during commercial rearing of silkworm, *B. mori* involves towards the wages towards labour. Maximum numbers of labours are employed during spinning, to manually pick and mount the ripened worms on to mountages. Though several kinds of mountages are available, each one is coupled with its own disadvantages. More popularly used bamboo mountages are costly and cannot be used as self-mounting structures. At present, the available self-mounting plastic mountages are best suitable for bivoltine breeds of silkworms. Further, uniformity in shape, size and compactness of the cocoon cannot be maintained or assured in the self-mounting plastic mountages.

The reelers with improved reeling machines offer lesser price for the cocoons harvested from plastic mountages as they experienced that the cocoon shell has more moisture content which reduces the reelability and ultimately effects the raw silk quality. By considering the mentioned facts, the new self-mounting structures were fabricated and their performances on cocoon and reeling parameters were assessed over two silkworm hybrids.

2. Materials and Methods

The performance of different mountages on cocoon parameters of silkworm, *Bombyx mori* L. were studied using well established V-1 (Victory-1) mulberry plants with 90 x 90 cm spacing were used for the silkworm rearing. 50 Disease Free Layings (DFLs) of each of young age silkworms of Cross Breed (PM X CSR2) and Bivoltine Double Hybrid, Krishnaraja {FC1 (CSR6 x CSR26) X FC2 (CSR2 x CSR27)} were procured from Registered Chawki Rearing Centres for each rearing separately and they were reared by following the procedure recommended by [3].

Treatment details: Six different mountages viz., Spiral mountage (T_1), Square mountage (T_2) and Zig – Zag mountage (T_3) were newly designed and fabricated for the present study. Thalaghattapura Ribbon Chandrike (T_4), Plastic collapsible mountage (T_5) (Control 1) and Bamboo chandrike (T_6) (Control 2) were involved for analysis. Three replications were maintained for all the treatments.

The self-mounting structures (T_1 – T_5) were placed over the silkworm rearing bed for a period of one and a half hours when the silkworms were at ripening stage. After one and a half hours, mountages were removed from the rearing bed whereas in T_6 manual mounting method *i.e.,* picking of ripened worms and mounting on to the mountages was practiced. The cocoons were harvested from each mountage on fifth and seventh day of spinning in cross breed and double hybrid, respectively which ensures complete cocoon formation. Then the cocoon parameters viz., single cocoon weight (g), cocoon shell weight (g), pupal weight (g), floss weight (mg) and cocoon shell ratio (%) were recorded on the same day. The cocoon reeling parameters viz., average filament length (m), non-breakable filament length (m), filament weight (g), raw silk percentage (%) and denier were recorded and the data were statistically analysed using Factorial CRD [14].

3. Results and discussion

Influence of different mountages on various cocoon parameters of silkworm, *Bombyx mori* L.

Single Cocoon Weight (g):

Among two silkworm hybrids, a significantly maximum single cocoon weight was observed with DH (1.98 g) and minimum was with CB (1.75 g). However, different types of mountages and the interaction between the silkworm breeds and the mounting structures did not show any significant difference with respect to single cocoon weight. After regular bamboo mountage (1.97 g), the maximum single cocoon weight was recorded with spiral mountage (1.94 g) and the least was noticed with plastic mountage and Thalaghattapura Ribbon chandrike (1.79 g) among different mounting structures. The interaction effect was higher on bamboo mountage with DH (2.13 g) and the least on plastic mountage with CB (1.62 g) (Table 1).

Several studies conducted to compare the single cocoon weight of different silkworm hybrids have evidenced the maximum cocoon weight among bivoltine hybrids than cross breeds [9], which is more a breed character than the mountage. The present investigations also reflect a maximum single cocoon weight in Krishnaraja, BV double hybrid than the cross breed, PM x CSR_2. The result was further substantiated with the finding of [7], who reported the maximum single cocoon weight in double hybrids than single hybrids. Further, the non-significant difference among the six treatments and the interaction effect of mountages and silkworm breeds with respect to single cocoon weight clearly indicates that the newly fabricated self mountages did not alter the cocoon weight in both CB and DH and they can be readily utilized to mount any breed without compromising on commercially important parameter *i. e.,* cocoon weight.

Pupal weight (g)

Among the silkworm breeds, the pupal weight was significantly maximum in DH (1.48 g) and it was minimum with CB (1.38 g). The pupal weight varied significantly due to use of different cocooning frames when compared among the new mountages and the two controls. Irrespective of the hybrid, T_6 recorded significantly highest pupal weight (1.57 g) that was on par with T_1 (1.48 g), T_2 (1.45 g) and T_5 (1.42 g) and the least pupal weight was recorded on T_3 (1.33 g) followed by T_4 (1.34 g). However, the effect of interaction between different mountages and silkworm hybrids did not differ significantly with respect to pupal weight. It was relatively higher in DH on bamboo mountage (1.64 g) and that was lowest CB on ribbon chandrike (1.27 g) (Table 1).

The proteins accumulated in the larval body are diverted for accumulation of silk proteins in the silk gland as well as gonad development [15]. It is well understood by several experiments that the bivoltine silkworms consume more food than multivoltines and the multi x bi hybrids that might contribute to the higher cocoon, shell and pupal weight, which is clearly reflected at the present investigation. The pupal weight was varied accordingly with the mountages. The experiments also revealed such variation in the pupal weight in cross breeds when the cocooning frames were changed during spinning stage of the larvae [11].

Cocoon Shell Weight (g)

Except between the two silkworm breeds, neither the mountages independent of breeds nor the interaction between different mountages and silkworm hybrids differ significantly with respect to cocoon shell weight. The cocoon shell weight was significantly higher in DH (0.481 g) and it was lower with CB (0.316 g) among the two breeds. Relatively heavier cocoon shell was observed in the cocoons harvested from spiral and zig-zag mountage (0.412 and 0.411 g, respectively); which was lighter in plastic collapsible mountage (0.358 g). Among the interactions the cocoons harvested from spiral mountage with double hybrid recorded higher shell weight of 0.498 g and it was least from plastic mountage with cross breed (0.261 g) (Table1).

The cocoon shell weight is one of the components which increase the total cocoon weight in silkworms. The earlier reports clearly mentioned that the cocoon shell weight is higher in bivoltine hybrids than cross breeds [9]. This was also supported by [17], who also reported lesser cocoon shell weight in the cross breed. The non-significant influence of the interaction between mountages and the breeds may be due to maintenance of uniform recommended space of 2” in the spinning space among all the new mountages which was in conformity with [8]. Cocoon shell weight is one of the important quality parameters that is largely influenced by type, material and structure of mountages used at spinning stage of silkworms [13]. The plastic collapsible mountages if not maintained properly especially during the free time, would increase the spinning space leading to wastage of silk while cocoon is constructed by the larva leading to reduced shell weight. The present investigation where the plastic mounting frames have recorded lower shell weight for both CB and the DH corroborates the same.

Cocoon Floss Weight (mg)

The two hybrids differed significantly for floss weight, which was significantly higher in cross breed cocoons (0.362 mg) and least in double hybrid (0.261 mg). But, the different mountages and the interaction effect of breeds and mountages did not show any significant influence over floss weight. Among the mountages, irrespective of breeds, the higher floss content was observed on ribbon mountage (0.329 mg), which was lowest on regular bamboo mountage (0.303 mg). In the interaction, the least floss weight was on bamboo mountage with double hybrid (0.250 mg) and highest on ribbon mountage with cross breed (0.329 mg) (Table 1).

The quantity of floss (non reelable silk) varies according to silkworm races and design of the cocooning frame [16]. At present investigations with two silkworm hybrids, the cross breed had significantly high floss content, which is an important racial character. The non-significant effect of interaction between silkworm breeds and the type of mountage in the present investigation reflects the suitability of new mountages for both cross breed and bivoltine silkworm rearing. However, relatively higher floss content on ribbon mountage and the plastic collapsible mountage compared to other types could be due to the materials used to design the mountages which were non-absorbent.

Cocoon Shell Ratio (%)

Though the type of mountages did not have any significant influence over the cocoon shell ratio, the two silkworm hybrids exhibited difference notably. The DH recorded significantly higher cocoon shell ratio (24.41 %) than the CB (18.11%). Irrespective of the silkworm hybrid, the cocoon shell ratio was found maximum in the cocoons harvested from zig-zag mountage (22.57 %) and in plastic mountage (19.58 %). When observed the interaction effect of the silkworm hybrids and the mountages, highest and the lowest cocoon shell ratio was observed respectively on DH with zig-zag mountage (26.10 %) and CB with plastic mountage (16.67 %) (Table 1).

With respect to the silkworm breeds, similar findings were also reported by [9] where he recorded higher cocoon shell ratio of 23.57 percent for DH than and 18.98 percent for CB. Similarly, [6] also reported more than 23 percent cocoon shell ratio in double cross hybrids. A notable cocoon shell ratio were found among newly fabricated mountages over the controls among both the breeds which exhibits that these mountages may be utilized in ripening silkworm management without any compromise for cocoon quality. In line with the present observations, [12] also recorded relatively higher cocoon shell ratio of 18.34 percent for ribbon chandrike than bamboo mountage (18.22 %).

Table 1: Effect of different mountages and silkworm hybrids on various cocoon parameters

Particulars	Single Cocoon Weight (g)	Pupal Weight (g)	Cocoon Shell Weight (g)	Cocoon Floss Weight (mg)	Cocoon Shell Ratio (%)
Silkworm hybrids (H)					
H_1	1.75	1.38	0.316	0.362	18.11
H_2	1.98	1.48	0.481	0.261	24.41
F	**	**	**	**	**
S.Em±	0.027	0.021	0.007	0.007	0.381
CD @1%	0.108	0.084	0.030	0.027	1.504
Mountages (T)					
T_1	1.94	1.48	0.412	0.305	21.47
T_2	1.90	1.45	0.399	0.306	20.86
T_3	1.81	1.33	0.411	0.308	22.57
T_4	1.79	1.34	0.409	0.329	22.46
T_5	1.79	1.42	0.358	0.316	19.58
T_6	1.97	1.57	0.402	0.303	20.64
F	NS	**	NS	NS	NS
S.Em±	0.048	0.037	0.013	0.012	0.661
CD	0.188	0.145	0.051	0.047	2.606
Interaction (H x T)					
H_1x T_1	1.90	1.49	0.326	0.350	17.79
H_1x T_2	1.79	1.40	0.315	0.361	17.34
H_1x T_3	1.71	1.28	0.327	0.358	19.04
H_1x T_4	1.66	1.27	0.330	0.392	19.46
H_1x T_5	1.62	1.35	0.261	0.355	16.67
H_1x T_6	1.80	1.50	0.336	0.355	18.38
H_2x T_1	1.99	1.47	0.498	0.260	25.14
H_2x T_2	2.00	1.50	0.483	0.252	24.37
H_2x T_3	1.90	1.39	0.496	0.257	26.10
H_2x T_4	1.92	1.42	0.487	0.267	25.45
H_2x T_5	1.96	1.50	0.454	0.278	22.50
H_2x T_6	2.13	1.64	0.468	0.250	22.89
F	NS	NS	NS	NS	NS
S.Em±	0.067	0.052	0.018	0.017	0.934
CD @ 1%	0.265	0.205	0.072	0.067	3.685

- ** significant at 1%; NS- Non significant
- The values are the mean of two rearings with each case
- H_1 and H_2 indicate cross breed and double hybrid respectively

Relationship between cocoon and its parameters

Single cocoon weight in CB correlated positively and significantly with pupal weight (r=0.8182*) and non-significantly with cocoon shell weight (r=0.5624) and negatively with floss weight (r= -0.4746) and cocoon shell ratio (r= -0.0622). The cocoon shell weight correlated positively with pupal weight (r=0.1864), floss weight (r= 0.2378) and cocoon shell ratio (r= 0.7633). However, all were non-significant. Pupal weight correlated negatively and non-significantly with floss weight (r= -0.6556) and cocoon shell ratio (r= -0.4173). Floss weight correlated positively and non-significantly with cocoon shell ratio (r= 0.6213) (Table 2).

Single cocoon weight in DH correlated positively and highly significantly with pupal weight (r=0.9647**) negatively non-significant with cocoon shell weight (r= -0.3738), floss weight (r= -0.5457) and cocoon shell ratio (r= -0.6227). The cocoon shell weight correlated positively and highly significantly with cocoon shell ratio (r= 0.9372**) and negatively and non-significantly with pupal weight (r= -0.6032) and floss weight (r= -0.4222). Pupal weight correlated negatively and non-significantly with floss weight (r= -0.3400) and cocoon shell ratio (r= -0.8048). Floss weight correlated negatively and non-significantly with cocoon shell ratio (r= -0.2228) (Table 3).

The trend of relation between the breeds remain same in estimated parameters, except in cocoon shell weight, which in case of double hybrid related positively with cocoon shell ratio.

Table 2: Relationship between cocoon and its parameters for the cross breed, PM x CSR_2

Particulars	X_1	X_2	X_3	X_4	X_5
Single Cocoon Weight (X_1)	1.0000				
Cocoon Shell Weight (X_2)	0.5624^{NS}	1.0000			
Pupal Weight (X_3)	0.8182*	0.1864^{NS}	1.0000		
Floss Weight (X_4)	-0.4746^{NS}	0.2378^{NS}	-0.6556^{NS}	1.0000	
Cocoon shell ratio (X_5)	-0.0622^{NS}	0.7633^{NS}	-0.4173^{NS}	0.6213^{NS}	1.0000

- Significant at $P \leq 0.05$; NS- Non Significant

Table 3: Relationship between cocoon and its parameters for the Double Hybrid, Krishnaraja

Particulars	X_1	X_2	X_3	X_4	X_5
Single Cocoon Weight (X_1)	1.0000				
Cocoon Shell Weight (X_2)	-0.3738^{NS}	1.0000			
Pupal Weight (X_3)	0.9647**	-0.6032^{NS}	1.0000		
Floss Weight (X_4)	-0.5457^{NS}	-0.4222^{NS}	-0.3400^{NS}	1.0000	
Cocoon shell ratio (X_5)	-0.6227^{NS}	0.9372**	-0.8048^{NS}	-0.2228^{NS}	1.0000

- ** Significant at $P \leq 0.01$; NS- Non Significant

Assessment of new mountages on reeling parameters of silkworm, *Bombyx mori* L.

Average Filament Length (AFL) (m)

The interaction effect between the mountages and the silkworm hybrids found non-significant with respect to average filament length (AFL). However, the AFL was found to have significant difference only among the silkworm breeds. The filament was profoundly longest in DH (1147.10 m) and was significantly shorter in CB (877.04 m). When compared among different mounting structures, though there was no significant difference, the longest filament was observed in the cocoons harvested from bamboo mountage (1021.97 m) and it was shortest in the cocoons from ribbon chandrike (990.28 m). Similarly, the interaction between the mountages and the silkworm hybrids found no significant effect over AFL. However, the AFL was longest in DH harvested from bamboo mountage (1181.68 m) and found shortest in cross breed from bamboo mountage (862.27 m) (Table 4).

Sharanyakumar Gowda (2014) also recorded 1249.20 m of AFL in double hybrid cocoons and 989.20 m in cross breeds, which represents that, the AFL is longer in bivoltine than the multivoltine and the cross breed and the similar trend has been observed in the present investigation. Further, the results fall in line with the narrations of [1], who explained about longer filament length in bivoltine hybrids than cross breeds. The performance of bivoltine hybrids on different mountages evidenced shorter AFL in the cocoons harvested from plastic collapsible mountages [11], which is also seen in the present investigation. Further, the non-significant difference in AFL for CB between new self-mounting structures and both the controls signifies the suitability of self-mounting frames in rearing CB silkworms. The better aeration provided on self-mounting structures might have encouraged the larvae to spin more efficiently and the space maintained could also convenient for the larvae to spin the quality silk.

Non-breakable Filament Length (NBFL) (m)

The interaction between the mountage and the silkworm hybrids showed non-significant difference with respect to NBFL. However, the higher NBFL was found in DH with spiral mountage (449.56 m) followed by DH with bamboo mountage (441.28 m) and it was lower in CB with ribbon chadrike (305.11 m) (Table 4).

Considering the two silkworm hybrids, the NBFL measured significantly longer in double hybrid (436.80 m) than the cross breed (312.58m) due to the racial character. Irrespective of the hybrids, the spiral mountage recorded significantly longer NBFL (386.03 m) on par with bamboo mountage (376.87 m) and it was significantly shorter in plastic mountage (366.97 m). The interaction between silkworm breeds and different mountages exhibited no significant effect. However, a relatively longer NBFL was noticed with DH on spiral mountage (449.56 m) and shorter with cross breed on plastic mountage (305.11 m) (Table 4).

The significant difference with respect to NBFL among the two silkworm breeds probably is the racial character. The on par results of spiral and bamboo mountage with respect to the NBFL indicate that the absence of bamboo mat while fabricating the mountage does not make any difference in the quality of cocoon in terms of NBFL. The structure of cocooning frame plays a major role in quality raw silk [10], which is evidenced by the present investigation too.

Cocoon Filament Weight (g)

Among the two breeds, the DH cocoons recorded notably heavier filament (0.361 g) than the CB (0.270 g). Considering the mountages, the silk filament of the cocoons harvested from square mountage weighed heavier (0.326 g) that was on par with spiral and ribbon mountage (0.320 g). The interaction between silkworm breeds and different mounting structures found to differ significantly with respect to the weight of filament, which was significantly heavier in double hybrid on square mountage (0.365 g) and it was significantly lower in cross breed with plastic mountage (0.252 g) (Table 4).

The variation in the weight of silk filament was perhaps due to varied length of the silk filament produced by the two silkworm hybrids. The filament weighed significantly lighter when plastic mountage was used to mount the ripened silkworms, that was also observed by [11]. This perhaps would be due to the non absorbance nature of raw material used to fabricate the mountage, which hardly removes the moisture from the silk filament.

Raw Silk Percentage (%)

Except for the breeds (DH-18.68 % and CB-15.58 %), the raw silk percentage did not differ significantly among the different mountages or the interaction between the mountages and the silkworm hybrids. Among the mountages, the raw silk percentage was relatively maximum on ribbon mountage (17.75 %) and minimum on regular bamboo mountage (16.13 %). Among the interactions, the highest percentage of raw silk was in double hybrid on zig-zag mountage (19.60 %) and least in cross breed with bamboo mountage (14.71 %) (Table 4).

The lower raw silk percentage in the manually mounting cocooning frame compared to self-mounting structures was perhaps due to heavier pupa because the total cocoon weight is considered while computing the per cent raw silk recovered from the cocoon. The other reason could also be, non-wasting of the silk in self mountages compared to the regular mountages which needs further attention.

Denier

The silkworm hybrids used in the present investigation varied significantly with respect to the filament denier. Significantly finer denier was observed in CB (2.73) than the DH (2.84). Among the mountages, a significantly finer denier was observed on plastic mountage (2.72) on par with bamboo (2.74) and zig-zag mountage (2.74). The interaction of different mountages and silkworm hybrids showed also exhibited a significant difference with respect to denier. The finer denier was recorded in cross breed with zig-zag mountage (2.61) followed by the same with plastic mountage (2.62) and same was coarser in CB with square mountage (2.90) (Table 4).

Denier is a computed parameter, which considers both length and weight of the reeled filament. Though finer denier is preferred in sericulture industry, the cocoons with less NBFL is more valued than longer filament length. In the present investigation, the zig-zag and plastic mountages recorded low values for denier which is in conformity with the observations recorded by [11], where they reported 2.1 denier for plastic mountage.

Table 4: Effect of different mountages and silkworm hybrids on various reeling parameters of cocoon

Particulars	Average Filament Length (m)	Non-breakable Filament Length (m)	Cocoon Filament weight (g)	Raw Silk Percentage (%)	Denier
Silkworm hybrids (H)					
H_1	877.04	312.58	0.270	15.58	2.72
H_2	1147.10	436.80	0.361	18.67	2.84
F	**	**	**	**	**
S.Em±	5.916	1.620	0.002	0.284	0.016
CD @1%	23.332	6.388	0.006	1.119	0.061
Mountages (T)					
T_1	1020.61	386.03	0.320	16.83	2.82
T_2	1018.71	374.95	0.326	17.34	2.88
T_3	1016.41	369.99	0.309	17.43	2.74
T_4	990.28	373.34	0.320	17.75	2.80
T_5	1004.43	366.97	0.305	17.26	2.72
T_6	1021.97	376.87	0.312	16.13	2.74
F	NS	**	**	NS	**
S.Em±	10.247	2.805	0.003	0.492	0.027
CD	40.412	11.064	0.011	1.938	0.106
Interaction (H x T)					
H_1x T_1	885.58	322.50	0.276	14.85	2.80
H_1x T_2	890.51	313.80	0.287	16.40	2.90
H_1x T_3	883.70	309.71	0.257	15.26	2.61
H_1x T_4	877.65	311.92	0.287	16.38	2.71
H_1x T_5	862.51	305.11	0.252	15.84	2.62
H_1x T_6	862.27	312.46	0.260	14.71	2.70
H_2x T_1	1155.65	449.56	0.363	18.81	2.83
H_2x T_2	1146.91	436.10	0.365	18.28	2.86
H_2x T_3	1149.13	430.27	0.361	19.60	2.87
H_2x T_4	1102.91	434.75	0.353	19.11	2.88
H_2x T_5	1146.35	428.83	0.357	18.68	2.81
H_2x T_6	1181.68	441.28	0.364	17.55	2.78
F	NS	NS	**	NS	**
S.Em±	14.492	3.967	0.004	0.695	0.038
CD @ 1%	57.151	15.646	0.016	2.741	0.150

- ** significant at 1%; NS- Non significant
- The values are the mean of two rearings with each case
- H_1 and H_2 are cross breed and double hybrid respectively

Relationship between cocoon reeling parameters

Average filament length in CB correlated positively and non-significantly with non-breakable filament length (NBFL) (r=0.5542), cocoon filament weight (r=0.6540), raw silk percentage (r=0.2717) and denier (0.6120). NBFL correlated positively and non-significantly with filament weight (r=0.5432) and denier (r=0.6638) and negatively and non-significantly with raw silk percentage (r= -0.3626). Filament weight correlated positively and non-significantly with raw silk percentage (r=0.5397) and denier (r=0.8002) and raw silk percentage correlated positively and non-significantly with denier (r=0.2620) (Table 5).

Average filament length of DH (Table 6) correlated positively and non-significantly with non-breakable filament length (NBFL) (r=0.3567) and filament weight (r=0.8093). However, the same was negative and non-significant with raw silk percentage (r= -0.6171) and denier (r= -0.7712). NBFL correlated positively and non-significantly with filament weight (r=0.4751) and negatively and non-significantly with raw silk percentage (r= -0.3681) and denier (r=0.2898). Filament weight correlated negatively and non-significantly with raw silk percentage (r= -0.5027) and denier (r= -0.3351). Raw silk percentage correlated positively and non-significantly with denier (r=0.7520). In both the breeds among all the assessed parametes, all the relations were exhibited non-significant.

Table 5: Relationship between cocoon reeling parameters for the cross breed, PM x CSR_2

Particulars	X_1	X_2	X_3	X_4	X_5
Average Filament Length (X_1)	1.0000				
NBFL (X_2)	0.5542 ^{NS}	1.0000			
Cocoon filament weight (X_3)	0.6540 ^{NS}	0.5432 ^{NS}	1.0000		
Raw Silk (X_4)	0.2717 ^{NS}	-0.3626 ^{NS}	0.5397 ^{NS}	1.0000	
Denier (X_5)	0.6120 ^{NS}	0.6638 ^{NS}	0.8002 ^{NS}	0.2620 ^{NS}	1.0000

- NS- Non significant

Table 6: Relationship between cocoon reeling parameters for the Double Hybrid, Krishnaraja

Particulars	X_1	X_2	X_3	X_4	X_5
Average Filament Length (X_1)	1.0000				
NBFL (X_2)	0.3567 ^{NS}	1.0000 ^{NS}			
Cocoon filament weight (X_3)	0.8093 ^{NS}	0.4751 ^{NS}	1.0000		
Raw Silk (X_4)	-0.6171 ^{NS}	-0.3687 ^{NS}	-0.5027 ^{NS}	1.0000	
Denier (X_5)	-0.7712 ^{NS}	-0.2898 ^{NS}	-0.3351 ^{NS}	0.7520 ^{NS}	1.0000

- NS- Non Significant

4. Conclusion

The purpose of sericulture is the production of large quantity of good cocoons which in turn result in production of good quality raw silk. This cannot be obtained only by the improvement of mulberry cultivation and silkworm rearing, but also by improving the method of mounting and mountages used. Therefore, the present study was conducted to study the different cocoon and its reeling parameters obtained from newly fabricated self mountages and the results showed that, the newly fabricated mountages *viz.*, spiral and zig-zag mountages were better in comparison with bamboo, ribbon and plastic mountages in same parameters. However, further studies are required to know as which of these new mountages would be the best mountage in terms of cocoon quantity and quality through larger field trials.

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