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STUDIES ON EFFECT OF STIFLING AND STORAGE ON SINGLE COCOON CHARACTERISTICS AND REELING PERFORMANCE OF DABA ECO-RACE

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ABSTRACT

This study was carried out to assess the change of single cocoon quality characteristics and reeling performance due to stifling as well as one year storage after stifling for Daba eco- race. Cocoon weight reduces significantly due to stifling as compared to green/harvested cocoons whereas it remains at par afterwards during storage. No difference was noted for shell weight as well as filament length after stifling and storage. Non- broken filament length (NBFL) reduces significantly after 1 year storage of stifled cocoons but this characteristic remains same between green and stifled varieties. Statistical term "skewness" represents the asymmetry in distribution of data. For green, stifled as well as one year stifled stored tasar cocoons, the mode values of filament length and NBFL are lower than average revealing maximum frequencies lie in the lower range as compared to average values and so the estimated skewness values are positive. After stifling and one year storage, increase of skewness value depicts the occurrence of maximum frequencies towards further lower range as compared to green and stifled varieties. No deviation of single fibre denier was noted between three types of cocoons, In case of reeling performance, significant reduction of reelability (%) was observed but raw silk recovery (%) remains almost same after one year storage with marginal reduction of yield/1000 cocoons (g).

***Keywords* :** Epprouvette, fibroin, non- broken, reelability, sericin.

Introduction

Tropical tasar cocoons are produced twice (bi- voltine) or thrice (tri- voltine) in a year by the silkworms *Antheraea mylitta Drury* species under order *Lepidoptera* and family *Saturnüdae*. The cocoons harvested during winter season are commonly used for reeling (Jolly et. al., 1979). Since the total quantum of cocoons is produced during these durations, so it is quite difficult to convert yarn by reeling process within limited period. Also, if the cocoons are preserved in same condition, the moth will emerge depending upon the weather conditions which cannot be taken for reeling due to excessive breaks during yarn withdrawal. So, the cocoons need to be stifled/hot air dried at about 90^{o}C for 5 to 7 hours to dry pupae totally so that moths' emergence can be restricted (Sonwalkar, 1993). After hot air drying, cocoons are preserved in netted rack to avoid rat cut damages which can be taken for reeling as and when required. As per the information received from tasar silk sectors, reeling performance in terms of reelability and raw silk recovery of tasar cocoons deteriorate due to prolonged storage. Since no attempt was taken in this aspect, this study was initiated to evaluate the alteration of single cocoon quality characteristics and reeling performance due to stifling and one year storage after stifling for Daba eco- race.

Reeling parameters in terms of reelability and raw silk recovery of mulberry cocoons were found significantly better spun under low temperature and low humidity as compared to high levels. Yarn quality in terms of neatness, cleanness, tenacity and breaking elongation also better in lower level of temperature and humidity. The effect of humidity and temperature on reeling performance and yarn quality may be attributed to structural changes in sericin due to high humidity levels during cocoon spinning (Naik & Somashekar, 2004; Naik & Somashekar, 2008 and Singh *et al.*, 2011). Reelability (%) significantly depends on water content of cocoon layer which should be as low as 20% in order to obtain good quality raw silk and better performance with reelability more than 70%. Due to rapid drying of fluid from shell during cocoon spinning, the sericin remains in random coil structure and hence stripping resistance i.e., adhesive strength of sericin is less (Akahane & Tsubouchi, 1994 and Zhu *et al.*, 1995). From assessment of absorption peak by Fourier Transform Infrared (FTIR) spectroscopy for amide 1, 2 and 4 of sericin; it was found that the β- structure is difficult to dissolve. The formation of β- structure of sericin due to delay in drying because of higher humidity in atmosphere. Sericin I of random coil structure absorbs moisture and thus the intra molecular hydrogen bonds got snapped due to the adhering water molecules. So, the folded structure becomes unfolded into extended form followed by shifting to β- structure. Due to release of moisture at higher temperature, α- structure is partially retained which forms new intermolecular hydrogen bonds. So, the structure becomes fixed and crystallized. Even after reabsorption, the water molecules do not adhere to the part forming the crystal structure. Thus, the structure is retained and only the intermolecular bonds in the state of random coil get swapped and parts of it transform to β- structure and crystallized. So, solubility of sericin reduces which affect the cooking efficiency as well as reeling performance of mulberry cocoons (Komatsu, 1980). When temperature as well as humidity are at higher side, the duration of drying of liquid silk gets delayed. So, the sericin molecules in solution transform from random coil to β- structure enhances the increase of sericin crystallinity (Kataoka, 1977). This enhances adhesive strength of sericin resulting in low solubility during degumming (Tanaka *et al*., 1980).

Preservation of tropical tasar cocoons in cold storage instead of hot air drying/stifling followed by netted rack storage facilitates reeling performance at par in comparison of green/harvested variety (Gahlot & Khan, 2015). Descending trend of raw silk recovery was found with increase of storage period of muga cocoons and about 15% reduction due to 6 months preservation (Mishra *et al*., 2020). No significant change of yarn tenacity was observed by drying of tasar and muga cocoons between 80 to 140°C besides loss in moisture content as evaluated by x- ray diffraction and scanning electron microscopy assessment (Das, 2020). Eri cocoon formation is better when temperature and humidity remains 25 to 30°C and 60 to 75% respectively (Sarkar, 1988).

From the review of literature, it is revealed that studies reported about deterioration of reeling performance for mulberry cocoons due to long storage after hot air drying/stifling. Also, from tasar silk sectors, information was received that raw silk recovery as well as productivity reduced for stifled and stored cocoons more than six months durations. Commercial crops of tropical tasar cocoons are produced during November to January months which need to be stifled and stored for yarn production. Hence, the study was carried out to assess the single cocoon quality characteristics and reeling performance after stifling/hot air drying and one year storage of dried cocoons in comparison with green/harvested variety.

Materials and Methods

Materials

Daba eco- race (*Antheraea mylitta D.*) of tropical tasar cocoons of green/harvested, stifled and stored for one year after stifling were used in this study. Total 1500 green cocoons were taken for this study from Central Tasar Research and Training Institute, Ranchi, India. Among these, 500 green cocoons were taken for assessment and remaining 1000 cocoons were subjected to stifling process. The chemicals used in this study are sodium carbonate (Na_2CO_3) and sodium bicarbonate ($NaHCO_3$) of laboratory reagent grade from Merck Life Science Private Limited, Mumbai for softening of tasar cocoons.

Methods

Stifling and storage of tasar cocoons

Tasar green/harvested cocoons of 1000 nos were stifled using laboratory hot air drier of 350 liter capacity, single phase 3 KW from M/s Hi- Tech Instrument, Chandigarh, India as per standard procedure (Jolly *et al*., 1979 and Sonwalkar, 1993). Tasar cocoons were inserted in hot air oven and after closing the door and exhaust windows; temperature was raised to 90°C in one hour time along with circulation of inside air by fan. Same condition was maintained for further two hours. After two hours the exhaust windows were opened and maintained for another three hours by which moisture and pupae fluid can be evaporated from drying chamber. After six hours drying, the heater is put off and air circulation by fan was continued so that temperature can be reduced to near about ambient condition. Then cocoons were taken from drying chamber and preserved in net rack to avoid rat cut damage.

Assessment of cocoon and shell weight

Cocoon and shell weight for green/harvested, stifled and stored (one year after stifling) varieties were carried out as per standard procedure. At first cocoon weight was measured after eliminating peduncle using precision electronic balance. Then the cocoon was cut by stainless steel blade precisely and removed the pupa and other impurities exist inside the shell. After removal, shell weight was taken using same balance. Total 50 observations were done for each cocoon variety.

Cooking/softening of Daba tasar cocoons

Cooking/softening of Daba tasar cocoons were carried out following new developed non- peroxide technique using sodium carbonate and sodium bi- carbonate (Khan *et al*., 2019). Total 100 cocoons were softened for each replication and five replications were carried out for green, stifled as well as stored varieties. About 3 liters water was taken considering material to liquor ratio 1:30. Sodium carbonate and sodium bicarbonate of each 5 g/l was added to water with proper stirring for uniform dissolution. The cocoons were kept in nylon net cloth immersed in degumming solution which were boiled for 20 min without pressure. Then pressurized steaming for another 30 min keeping over same solution was done using a perforated plate with covering in pressure cooker. After cooking, the cocoons were taken out subjected for single cocoon reeling and reeling performance assessment.

Single cocoon reeling assessment

After softening of tasar cocoons, filament was withdrawn from single cocoon under semi- moist condition by using a device "Epprouvette" and simultaneously breaks were noted. The total length of yarn from single cocoon was estimated from the number of revolutions noted from counter meter of Epprouvette multiplied by 1.125 m (circumference). Total 40 readings were taken for green, stifled and stored stifled cocoons for each replication and total five replications were performed. After drying in hot air dryer for 20 min at 105±3°C (BS4784- 1973, 1974), yarn weight was measured using precision electronic balance. Denier and non- broken filament length (NBFL) were estimated as per the standard procedures (Sonwalkar, 1993) using following expressions.

$$\text{Filament length (m)} = \text{Revolution in Epprouvette} \times 1.125 \quad ....(1)$$

$$\text{Non - broken filament length (NBFL) (m)} = \frac{\text{Total filament length (m)}}{\text{No. of cocoons + No. of breaks}} \quad ....(2)$$

$$\text{For single cocoon, NBFL (m)} = \frac{\text{Total filament length (m)}}{1 + \text{No. of breaks}} \quad .... (3)$$

$$\text{Yarn denier} = \frac{\text{Weight of yarn (g) x 9000}}{\text{Length of yarn (m)}} \quad .... (4)$$

Reeling performance assessment

Reeling performance for each experimental trials was carried out using Motorized Reeling cum Twisting Machine (MRTM). The yarn withdrawal was carried out following dry reeling technique from semi- moist cocoons with reeling speed of about 30 m/min. Breakages during yarn withdrawal were noted and 50 cocoons were used for each experimental trials and 6 replications were carried out. Yarns as well as wastes generated during reeling were dried using hot air drier at 105±3°C (BS 4784- 1973, 1974). The reelability (%), raw silk recovery (%) and yield/1000 cocoons (g) were estimated by following standard method and expressions (Sonwalkar, 1993).

$$\text{Reelability(\%)} = \frac{\text{No. of cocoons taken for reeling X 100}}{\text{No. of cocoons taken for reeling + No. of breaks during reeling}} \quad ....(5)$$

$$\text{Raw silk recovery (\%)} = \frac{\text{Yarn weight (g) x 100}}{\text{Yarn weight (g) + waste weight (g)}} \quad ...(6)$$

$$\text{Yield/ 1000 cocoons (g)} = \frac{\text{Yarn weight (g) x 1000}}{\text{No. of cocoons reeled}} \quad .... (7)$$

Conditioning of yarn and waste samples

The yarn as well as waste samples kept under standard atmospheric conditions that is 65±2% relative humidity and 27±2°C temperature for 24 hours (ASTM D 1776/1776M-15, 2015).

Analysis of experimental data

The experimental data were analysed for parameters i.e., filament length, non- broken filament length (NBFL), filament denier, reelability (%), raw silk recovery (%) and yield/1000 cocoons (g) using MS- Excel software. The statistical parameters i.e., average (mean), median, mode, standard deviation, skewness etc. were estimated as per standard procedures (Das, 1986; Das, 1988 and Booth, 1968).

Results and Discussion

Cocoon and shell weight

The cocoon and shell weight of Daba BV cocoons for green, stifled and one year stored after stifling varieties are given in Table 1. Significant reduction (about 53%) of cocoon weight was found after stifling which due to loss in moisture from cocoons' shells and evaporation of body fluid from pupae. No significant difference for shell weight was estimated between green/harvested, stifled and one year stored stifled cocoons. Some marginal reduction of shell weight was found after stifling which may be due to elimination of moisture from cocoons' shell. Also, there is little increase due to storage as the shells absorbs moisture from atmosphere. The results are in accordance to the earlier studies conducted for mulberry, tasar and muga (Sonwalkar, 1993; Khan *et al*., 2019; Das, 2020 and Mishra *et al*., 2020).

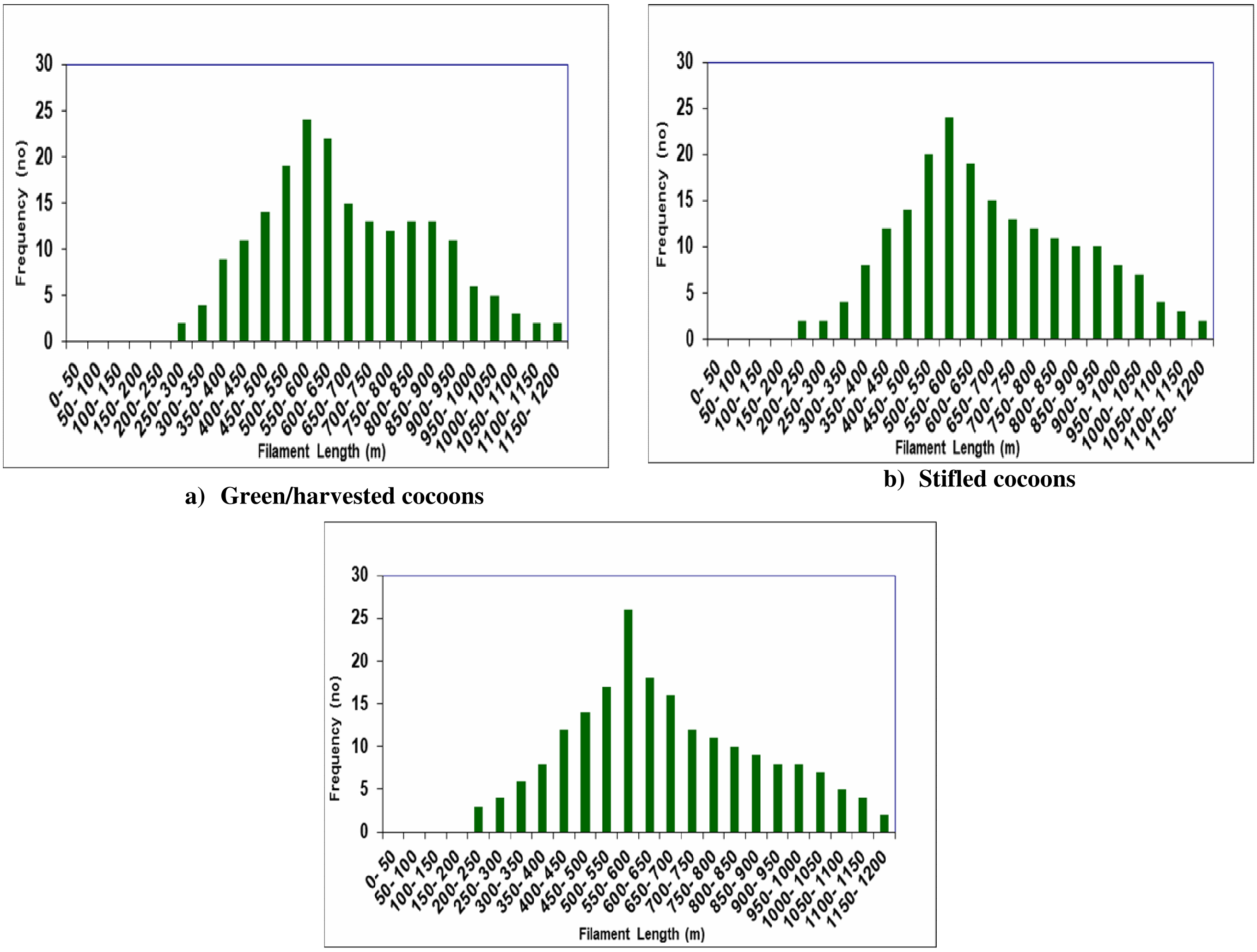
Table 1: Cocoon and shell weight of Daba ecorace

Parameters	Type of cocoons		
	Green/Harvested	**Stifled/Hot air dried**	**1 year stored (stifled)**
Cocoon weight (g)	7.72	3.64	3.82
Standard deviation (g)	2.84	0.80	0.44
Coefficient of variance (CV) (%)	36.80	21.98	11.52
Standard error (SE) (±) (g)	0.78	0.22	0.12
Shell weight (g)	1.45	1.32	1.43
Standard deviation (g)	0.33	0.28	0.30
Coefficient of variance (CV) (%)	22.75	21.20	20.98
Standard error (SE) (±) (g)*	0.09	0.08	0.08

*at 5% level of statistical confidence; No of observations: 50
S.E: Standard Error at 5 % level of statistical confidence = Std.dev./$N^{0.5}$X 1.96

Single cocoon reeling characteristics

The filament length of green/harvested stifled and one year stored stifled cocoons are illustrated in Figure 1 and statistical parameters in Table 2. It was found from Figure 1 and Table 2 that no change of filament length for Daba tasar cocoons after stifling/hot air drying and one year storage after stifling process. Since the mode values for filament length is lower as compared to average (mean), the skewness is positive. Positive skewness values indicate the maximum frequencies occurred towards the lower range against average values of filament length frequency distributions. Similarly, no alteration of median and mode were noted for three types of tasar cocoons of Daba eco- race. Earlier study reported positive skewness of filament length for Daba BV cocoons both for 1st and 2nd crop besides significant improvement in 2nd crop cocoons (Chattopadhyay & Khan, 2018). Estimated standard error also confirms no difference between three Daba cocoon varieties except little reduction of filament length after one year storage (Khan *et al*., 2019).



a) **Green/harvested cocoons**

b) **Stifled cocoons**

c) **One year stored stifled cocoons**

Fig. 1 : Filament length of Daba tasar cocoons

Table 2 : Statistical parameters for filament length of tasar cocoons

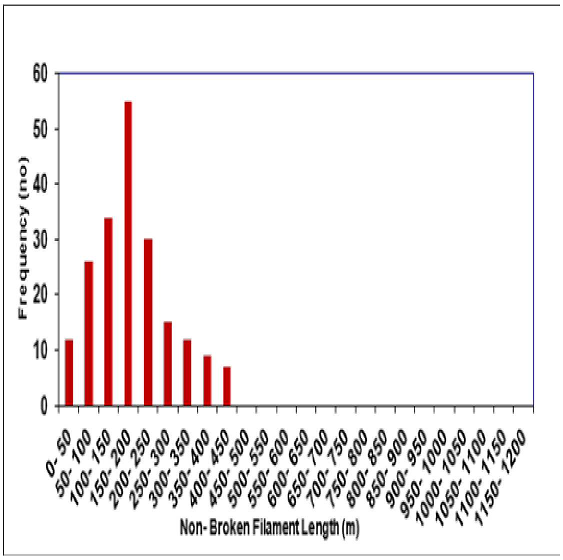
S. No.	Type of tasar cocoons	Filament length					
		Average (m)	Std dev (m)	S. E (±) (m)	Median (m)	Mode (m)	Skewness (-)
1	Daba BV green	670.00	197.20	27.33	588.64	585.71	0.427
2	Daba BV stifled	670.75	208.91	28.95	586.84	572.22	0.471
3	Daba BV stifled &stored 1 year	651.75	218.83	30.33	577.78	576.47	0.390

No of observations (N): 200; Std. dev. Standard deviation

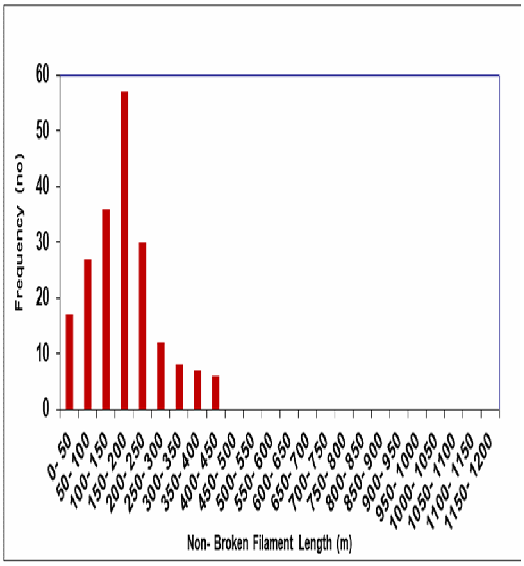
S.E: Standard error at 5 % level of statistical confidence = Std.dev./$N^{0.5}$X 1.96

Non- broken filament length (NBFL)

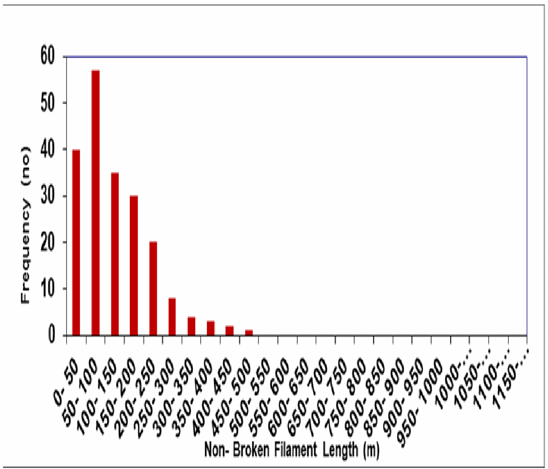
Non- broken filament length (NBFL) of green/harvested, stifled and one year sored stifled cocoons are shown in Figure 2 along with statistical parameters in Table 3. It is revealed from Figure 2 that there is significant reduction of non- broken filament length after one year storage of stifled cocoons. But after stifling/hot air drying of green cocoons, the NBFL remains at par. Table 2 depicts the similar trend as estimated by standard error. Statistical term "skewness" represents the asymmetry of distribution of data (Das, 1986). For green, stifled as well as one year stifled stored tasar cocoons, the mode values of NBFL are lower than average revealing maximum frequencies lie in the lower range as compared to average values and hence the estimated skewness values are positive. In case of mulberry cocoons, the skewness values for both filament length and non- broken filament length are negative which indicates the maximum frequencies exist in higher side facilitates less breakages during reeling. For muga cocoons due to lesser filament length with 3 to 4 breaks/cocoon, the NBFL is lower with positive skewness value (Chattopadhyay *et al*., 2018). Both mode and median values become lower substantially after storage with maximum positive skewness. Maximum positive skewness value establishes the fact that the maximum frequencies of NBFL lie towards further lower range as compared to green and stifled cocoons. The frequency distribution of NBFL for tropical tasar silks are positively skewed and it is not normal distribution population. Gamma distribution provides best fit of NBFL in the case of tropical tasar whereas temperate tasar follows lognormal distribution (Das & Ghosh, 2007 and Das & Ghosh, 2009).



a) **Green/harvested cocoons**



b) **Stifled/hot air dried cocoons**



c) **One year stored stifled cocoons**

Fig. 2 : Non- broken filament length (NBFL) of Daba tasar cocoons

Table 3: Statistical parameters for non- broken filament length (NBFL) of tasar cocoons

S. No.	Type of tasar cocoons	Non- broken filament length					
		Average (m)	Std dev (m)	S. E (±) (m)	Median (m)	Mode (m)	Skewness (-)
1	Daba BV green	186.25	97.00	13.44	125.45	172.83	0.138
2	Daba BV stifled	173.75	94.13	13.05	117.54	171.88	0.020
3	Daba BV stifled &stored 1 year	126.75	90.74	12.58	54.29	71.79	0.606

No of observations (N): 200; S.E: Standard Error at 5 % level of statistical confidence = Std. Dev./$N^{0.5}$
Std. dev. Standard deviation

The significant reduction of NBFL after one year storage of stifled tasar cocoon was due to excessive breaks occurred during yarn withdrawal. Reelability (%), raw silk recovery (%) as well as yarn quality characteristics (in terms of neatness, cleanness, tenacity and elongation) were found significantly better for cocoons spun under low temperature and low humid conditions as compared to the cocoons formed at high temperature and humidity levels. The effect of humidity and temperature on reeling performance and quality of silk may be attributed to the structural transformation of sericin at higher humidity level during cocoon formation (Naik & Somashekar, 2004 and Naik & Somashekar, 2008). Studies reported that reelability (%) significantly depend on water content in the cocoon layer which should be as low as 20% in order to obtain good quality raw silk and more than 70% reelability (Akahane & Tsubouchi, 1994). Assessment of Fourier Transform Infrared (FTIR) spectroscopy for amide I, II and IV of sericin revealed that β- structure is difficult to dissolve which forms due to delay in drying because of higher humidity in atmosphere. Sericin I of random coil absorbs moisture and thus the intra molecular hydrogen bonds got snapped due to the adhering water molecules whereby the folded structure becomes unfolded into extended structure and then shifted to β- structure. Due to release of moisture at higher temperature, α- structure is partially retained which forms new intermolecular hydrogen bonds.

So, the structure becomes fixed and crystallized. Even after re- absorption, the water molecules do not adhere to the part forming the crystal structure. Thus, the structure is retained and only the intermediate bonds in the state of random coil get snapped and parts of it transform to β- structure and crystallized. So, solubility of sericin reduces which affect the cooking efficiency as well as reeling performance of mulberry cocoons (Komatsu, 1980). Similarly, it was also found that both filament and non- broken filament length (NBFL) of tasar cocoons produced during rainy seasons i.e., 1st crop of Daba bi- voltine and Daba tri-voltine are significantly lower as compared to 2nd crop of Daba bi-voltine and 3rd crop of Daba tri-voltine respectively produced during winter seasons. Same trend was observed for Raily eco- race (Chattopadhyay & Khan, 2018). The transformation of sericin structure may be the reason for excessive breaks after one year storage of Daba tasar cocoons. No significant change of single cocoon characteristics as well as reeling performance between green and stifled cocoons as revealed from research studies for tasar and muga (Khan *et al*., 2019; Das, 2020 and Mishra *et al*., 2020).

Single filament denier

The denier of tasar silk filament yarn is depicted in Table 4 for green, stifled and stored varieties.

Table 4: Denier of tasar silk filament yarn

Parameters	Type of cocoon		
	Green /Harvested	Stifled	Stifled & 1 year stored
Average	10.57	10.95	10.68
Std. dev. (S.D.)	0.90	1.34	1.09
C.V. (%)	8.48	12.26	10.17
Minimum	8.40	9.15	9.17
Maximum	12.57	14.61	13.83
S.E. (5%) (±)	0.25	0.37	0.30

No of observations N = 50
Std. dev. (S.D.): Standard deviation
C.V. (%): Co- efficient of variance
S.E. (5%): Standard error at 5% statistical confidence level = S.D. * $1.96/N^{0.5}$

It was found that no difference of single filament denier between three types of cocoons. Earlier studies also reported the similar trend for tasar Daba eco- race (Khan *et al*., 2019). So, it can be opined that change of structural characteristics occurred for sericin only without affecting fibroin. During drying only moisture of cocoons' shells along with pupae fluid are evaporated. Within optimum temperature, no deterioration of silk fibre denier as well as tensile characteristics happened (Das, 2020). No change of molecular confirmation for silk even after degumming indicates the occurrence of surface phenomenon assessed by FTIR spectroscopy (Chakraborty *et al*., 2015). This may be the reason for no change of denier after stifling and storage.

Reeling performance

Reelability (%)

The reelability (%) of green/harvested, stifled and one year stored stifled cocoons are given in Table 5.

Table 5: Reeling performance of Daba BV cocoons

Parameters	Type of cocoons		
	Green /Harvested	Stifled	Stifled /stored 1 year
Reelability (%)			
Average	35.25	32.10	23.21
Std. dev. (S.D.)	1.41	2.29	2.18
C. V. (%)	3.99	7.14	9.41
S. E. (5%) (±)	1.47	2.40	2.28
Raw silk recovery (%)			
Average	52.81	56.15	49.04
Std. dev. (S.D.)	2.47	7.59	1.48
C. V. (%)	4.68	13.51	3.03
S. E. (5%) (±)	2.59	7.96	1.55
Yield/1000 cocoons (g)			
Average	614.11	673.42	527.44
Std. dev. (S.D.)	75.10	112.89	59.62
C. V. (%)	12.23	16.76	11.30
S. E. (5%) (±)	78.83	118.50	62.58

No of observations N = 6
Std. dev. (S.D.): Standard deviation
C.V. (%): Co- efficient of variance
S.E. (5%): Standard error at 5% statistical confidence level = S.D. * $2.571/N^{0.5}$

It was observed that no difference occurred for reelability (%) between green and stifled tasar cocoons. Due to stifling/hot air drying, only moisture present in cocoons' shells along with pupae fluid are evaporated. Hence, only significant reduction of cocoon weight was observed (Khanet. al., 2019; Das, 2020 & Mishra et. al., 2020). So, no change of reelability was noticed. But in long storage of stifled and dried cocoons, due to transformation of structure, the crystallinity of sericin increases. So, solubility of sericin reduced during softening process for mulberry, tasar as well as muga cocoons (Komatsu, 1980; Naik Somashekar, 2004, Naik & Somashekar, 2008 & Akane & Tsubouchi, 1994). In addition, tropical tasar cocoons contain maximum quantum of mineral calcium oxalate and natural colour tannin (Gheysens et. al., 2011). So, a composite structure is formed in cocoons shells which becomes difficult to soften uniformly even in alkaline pH. Also, the tenacity of tasar silk fibre is comparatively less as compared to temperate tasar, muga, eri and mulberry silks (Munshi *et al*., 2015; Chattopadhyay *et al*., 1997 and Mitra *et al*., 2013). Hence, excessive breaks are occurred during withdrawal of reeling process results inferior reelability of tasar cocoons as noticed for NBFL.

Raw silk recovery (%)

The raw silk recovery (%) of three cocoon varieties is shown in Table 5 which revealed no difference. From single cocoon reeling assessment, it was found that no significant difference of filament length between green, stifled and one year stored stifled tasar cocoons. Also, fineness (denier) of single filament remains at par. This may be the reason for no difference of raw silk recovery. Studies reported about no alteration of raw silk recovery of tasar cocoons due to stifling and storage for different eco- races (Gahlot & Srivastava, 2003 and Mazumdar & Kar, 2012). Marginal reduction of silk yarn production due to increase of waste during reeling at breaks.

Yield/1000 cocoons (g)

The yield/1000 cocoons of three varieties are depicted in Table 5. Although, no significant difference exists for yarn produced between three types, but substantial reduction of yarn was noticed for one year stored stifled cocoons. During reeling of silk filament, three different types of wastes are eliminated i.e., deflossing, reeling and basin/pelade. Deflossing waste is separated after softening from cocoons to find out the single end for reeling. During withdrawal of filament, breaks are occurred and some quantum of silk fibres need to be extracted from cocoon to find single end followed by mending. The basin/pelade waste is the transparent layer of silk fibres adhered to pupa from which continuous filament withdrawal is not possible. Assessment of the different wastes depicted that significant increase of reeling waste for one year stored stifled cocoons besides no difference between green and stifled varieties (Figure 3). Deflossing and pelade wastes remain at par between three types of cocoons. Due to excessive breaks during reeling significant reduction of NBFL as well as reelability occurred. Hence, the reeling waste also increased simultaneously yield less silk yarn production. For mulberry cocoons, the quantum of silk yarn also reduced for long storage due to change of sericin characteristics (Kataoka, 1977; Naik & Somashekar, 2004; Naik & Somashekar, 2008 and Zhu *et al*., 1995). This may be the reason for lower quantum of yield in case of one year stored stifled cocoons.

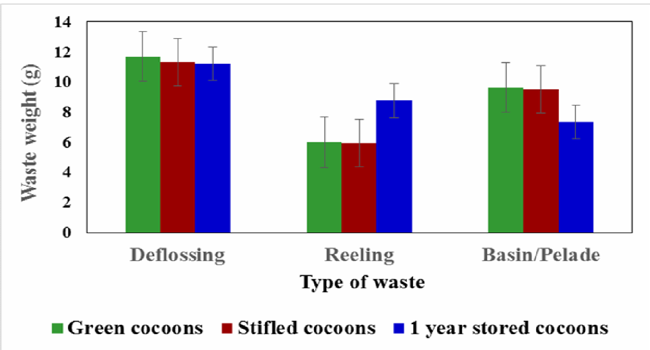


Fig. 3 : Wastes eliminated during reeling of Daba tasar cocoons

Conclusions

Cocoon weight reduces about 55% due to stifling/hot air drying as compared to green/harvested Daba tasar cocoons. No change of filament length, non- broken filament length (NBFL) and filament denier was found due to stifling process. Reeling performance in terms of reelability, raw silk recovery and yield/1000 cocoons remains at par between these two varieties. But after one year storage of stifled cocoons, significant reduction of NBFL was noticed due to excessive breaks during reeling. Similar trend was found for reelability (%). Filament length, single filament denier, raw silk recovery (%) and yield/1000 cocoons parameters remain same for stored cocoons. Due to excessive breaks during filament withdrawal from cocoons in reeling process, increase of reeling waste was estimated and thus there are some reduction of raw silk recovery and yield/1000 cocoons found for stored variety. The reduction of NBFL as well as reelability occurs may be due to increase of sericin crystallinity in long duration storage as found for mulberry. Tropical tasar cocoons contain mineral calcium oxalate and natural colour tannin. So, softening of tasar cocoons becomes very difficult due to inferior solubility of sericin as crystallinity increases during long storage. So, attempt may be taken to evaluate the change of sericin characteristics due to long storage of tasar cocoons.

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