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EFFECT OF FEEDING SILKWORM *Bombyx mori,* L. ON FRESH AND STORED MULBERRY LEAVES ON SOME BIOLOGICAL, MORPHOMETRICAL AND REELED FILAMENT CHARACTERS

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ABSTRACT

The effect of feeding silkworm larvae (chines hybrid) on mulberry leaves (Balady variety) stored under room and cooling (refrigerator) condition for 1,2 and 3 days, beside fresh (control) mulberry leaves on some biological and productivity characters were studied.

(A) Biological studies:

Larval duration period values and percentage of mortality of larval stage tended to increase with increasing storage period of mulberry leaves under room or cooling conditions. The lowest values were recorded for larvae fed on fresh mulberry leaves (control). On the other hand, the cocooning percentage was not affected by such treatments; while, pupation percentage reached to its maximum (97.23%) and to the minimum (85.87%) in larvae fed on mulberry leaves stored under room temperature for one and three days, respectively.

Pupal period of male and female and pupal weight significantly increased in larvae fed on fresh leaves than those larvae fed on storage leaves under room and cooling conditions, respectively.

Adult emergency percentage, longevity of male and female fertility (%) were not affected with fresh or stored mulberry leaves. However, female longevity, fecundity and hatchability percentage were increased significantly (in most cases) by storing mulberry leaves.

(B) Morphometerical studies:

Weight (g.) of full grown larvae and body weight of pupae (g.), in addition to length and weight of silkgland (g.) were significantly increased when larvae fed on fresh mulberry leaves than those fed on stored ones.

(C) Technological studies:

Determined technological parameters such as mean weight of fresh cocoon (g.) and mean weight of cocoon shell (g.) significantly increased also in larvae fed on fresh mulberry leaves than those fed on stored mulberry ones.

INTRODUCTION

The nutritional value of mulberry leaves is directly reflected on the larval growth and cocoon characters of *Bombyx mori,* L. (Qader et al. 1995). The contents of mulberry leaves of food stuff vary greatly according to many factors. Yet, storage of mulberry leaves was considered as an important factors which affects the biological and economic characters in silkworm. Many investigators (Mostafa and El-Sayed 1993) proved that storage of mulberry leaves until the fourth day in the fridge (7ºC) fed to 5th instar larvae of silkworm gave insignificant differences concerning fitness components of silkworm. In addition, El-Sheakh et al. (1994) reported that a clear differences was found between larval fed on fresh and stored leaves concerning GPT and GOT and enzymes activity. In this concern, Zannoon

(1994) found that the biology, silk production and relable filament characters of *B. mori,* clearly affected when reared on stored mulberry leaves under cooling conditions up to 5 days.

Accordingly, the present work was therefore, under taken to investigate feeding effects of Balady mulberry leaves variety stored in the refrigerator and under room temp. for 1,2 and 3 days on the biological and technological parameters of silkworm.

MATERIALS AND METHODS

Seven groups of newly hatched larvae in each 800 (distributed in four replicates) of the Chinese hybrid silkworm were used in this study. These groups were distributed as follows:

-Larvae of groups: A,B, and C were fed allover their larvae life on stored mulberry leaves in refrigerator for 1,2 and 3 days, respectively.

-Larvae of groups D, E and F were fed on mulberry leaves stored under room temperature (25±5ºC & 75±5 R.H%) for 1,2 and 3 days respectively.

-Control group larvae were reared on freshly collected mulberry leaves.

All the tested groups were fed on mulberry leaves of Balady variety.

The biological parameters were determined as: larval duration (days), percentage of larval mortality, percentage of cocooning, percentage of pupation, pupal duration (male & female) in days, pupal weight (g.), percentage of adult emergency, longevity of moth (male & female) in days, fecundity of adult moth (total No. of eggs laid per female), percentage of fertility and percentage of hatchability.

To evaluate some morphometrical parameter, ten full grown larvae at the onset of cocooning were taken randomly from each treatment to measured: weight of each larvae (g.), length (cm) and weight (g.) of the silkgland of dissected larvae and Technological parameters, cocoon indices: fresh coccon weight (g.), cocoon shell weight (g.) , silkcontent

ratio = $\frac{b}{a}$ x 100 (Tanaka , 1964) and reelable silk filament parameters.

The weight (mg) and length (m) of reeled silk filament were measured . The size of the reeled filament (denier) was estimated according to Tanaka (1984) formula:

Denier (dn)= weight of silk filament /length of filament (m.) x 9000

Data obtained were statistically analyzed according to Snedecor and Cochran (1976).

RESULTS AND DISCUSSION

Biological studies:

Larval duration:

As shown in Table (1) the obtained data revealed that the longest duration was achieved with feeding larvae on stored leaves under room conditions followed by those stored under cooling ones, where the larval duration of fifth instar were, 8.15 and 9.34, 9.49, 11.92 and 9.32, 9.57 and 9.49 days for larvae fed on fresh and those fed on leaves stored under room conditions for 1,2 and 3 days those stored under cooling , respectively.

Also, the total duration averaged: 27.35, 28.60, 29.03 and 30.95 days for larvae fed on fresh leaves and those fed on stored leaves for 1,2 and 3 days under room conditions; 28.48 and 29.48 days for larvae fed on leaves stored under cooling and room conditions, respectively. The differences in this concern were statistically significant between all treatments.

The obtained herein results are in partial accordance with those of Alvarez (1993); Silayach and Khokhar (1995) found that the total duration period of larvae stage was affected by different mulberry leaves treatments. For instance, the variety of mulberry leaves (Pillai and Jolly , 1985); stored of freshly mulberry leaves (Zannon, 1994) age of collected leaves (Gabried and Rapusas , 1976) and leaf composition (Li and Sang , 1984 ; Fouseca et al., 1972 and Petkov and Perkov, 1976).

Percentage of larval mortality:

Data recorded in Table (2) show that mortality percentage in larvae fed on fresh leaves of first and second instars recorded 13.00 and 13.81% . Mean while, it ranged between : 16.50 to 24.25% and 29.62 to 36.75% with average of 15.96 and 27.87% for 1st instar larvae fed on stored leaves under room and cooling conditions, respectively. Analysis of data indicated that storing mulberry leaves for 3 days under room and cooling conditions in 1st and 2nd instar caused significantly increased in larval mortality percentage than mulberry fresh leaves. Anyhow percentage of mortality tended to decrease in 3rd, 4th and 5th instars in face of 1st & 2nd instars which reached to 6.85, 31.19 and zero % in larvae fed on stored leaves under room conditions and colling in 3rd instar and decreased also in both fourth and fifth instars.

Accordingly, total percentage of larval mortality reached to 25.25% in the control against 30.87, 61.25 and 54.25% for larvae fed on stored leaves under room conditions and 35.87, 43.62 and 54.75% for those fed in stored leaves under cooling condition for 1,2 and 3 days, respectively. In this concern, Zannoon (1994) found that feeding larvae (4 to 5 instars) on mulberry leaves stored more than 4 days at 4-7ºC increased larval mortality ratio.

Percentage of cocooning:

Obtained data (Table 3) show that the percentage of cocooning slightly differed in larvae fed on mulberry leaves stored under room and cooling conditions as compared with larvae fed on fresh leaves. Where the cocooning percentage were 95.50, 96.25, 93.00 and 86.50 under room condition and 93.75, 87.00 and 94.25 under colling storing for fresh and storing one, two and three days, respectively. The same tread was also reported by Gabriel and Rapusas (1976) ; Li and Song (1984) and Hafiz (1992) found that mulberry variety and leaf protein content play an important role in cocooning values.

T1-2

Percentage of pupation:

Data in Table (3) show that feeding larvae on stored leaves for 1 days increased percentage of pupation to the maximum (97.23% under room condition while it was to (85.87%) when larvae fed on stored leaves for 3 days. However, pupation (%) slightly affected with the other treatments.

Pupal period:

Obtained data show that the mean period of male pupa of larvae fed on fresh mulberry leaves reached to (9.06 days) and significantly longer than other treatments.

As shown in Table (3) the mean period of female fed on fresh mulberry leaves was (9.70 days) and significant longer than other tested treatments. In addition, differences between stored leaves under room conditions and cooling ones were statistically significant .

The results obtained by many investigators Alvarez 1994; Silayach and Khokhar, 1995 clear that the duration of female pupae recorded 15.4 and 11.96 to 13.6 days for period of pupae. This variation could be attributed to many factors such as silkworm races and or mulberry variety.

Pupal weight:

Recorded data in Table (3) show that the weight of pupa resulted from larvae fed on fresh mulberry leaves significantly increased weight of pupa in most cases than those fed on stored mulberry leaves for 1,2 and 3 days (1.1127 against 1.0334, 0.887 and 0.9889g.) under room temperature and leaves fed on mulberry leaves stored under cooling conditions (1.1127 against 1.0208, 0.9248 and 0.935g.). In addition, differences between stored leaves concerning pupal weight were statistically significant.

The obtained herein results disagreed with findingy Mostafa and El-Sayed (1993) reported that storage of mulberry leaves in fridge (7.0ºC) had no effect in pupal weight with larvae fed on fresh leaves .

Adult emergence (%):

As shown in Table (4) the percentage of adult emergence ranged between 91.45 to 97.82, 97.86 to 98.59% for the moths arised from larvae fed on stored leaves under room and cooling conditions, respectively, compared to 96.39% recorded for control.

The above mentioned results concerning range of adult emergency (%) is nearly similar to that reported by Silayach and Khokhar (1995) they recorded a range of 95 to 98% .

Adult longevity:

Data recorded in Table (4) show that the longevity of male moth arised from silkworm larvae fed on fresh and stored leaves (1,2 and 3 days) under room conditions with averages of 4.81, 4.93 and 4.88 days regardless of the time of storage respectively . The corresponding figures for female moth were 10.90, 11.70 and 12.34 days . The differences between treatments are significant in case of female moth only.

T3-4

It is obvious that the longevity of female moth is markedly longer than that of male moth . The same trend was also reported (Silaych and Khokar, 1995) who found that longevity of male moth ranged between 5.48 to 6.98 days; however, it reached to 6.50 to 7.80 days for female moth under similar condition.

Female fecundity:

As shown in Table (4) the mean fecundity of control moth resulted from larvae fed on fresh leaves recorded 552.37 eggs / female being significantly higher than that mean of the fecundity for female moth resulted from larvae fed on mulberry leaves stored for 2.0 and 3.0 days under room temp. (552.37 eggs/ female) as they recorded 464.56 and 417.56 eggs / female, respectively. Other calculated differences are insignificant in this concern. This statement is in parallel with those reported by (Pillai and Jolly, 1985; Punitham et al. 1987; Narayanswamy and Gowda, 1989; Jayaswal et al. 1991; Shaheen et al. 1992) reported that the fecundity of female moth not only affected by fresh or stored (under different conditions) mulberry leaves but also affected by other factors such as weight of female pupae; variety of mulberry leaves and mating time.

Percentage of fertility:

Data in Table (4) show that the mean percentage of egg fertility was not affected either for egg resulted from moth arised from silkworm larvae fed on fresh mulberry leaves or those fed on stored mulberry leaves for 1,2 and 3 days under room or cooling conditions.

Percentage of hatchability:

The mean percentage of hatchability recorded 98.02% for eggs of moths results from silkworm larvae fed on fresh mulberry leaves (control) being significantly higher as that of female moth arised from larvae fed on stored mulberry leaves for 3 days under both room and cooling conditions, which recorded: 94.01 and 94.72% , respectively. However, other treatments caused a slight insignificant effect.

The obtained results are in agreement with those reported by Silayach and Khakhar (1985) who stated that the mean rate of hatchability of *B. mori* , L. eggs recorded 97.50%. In addition, the weight of female pupae positively effect percent hatchability (Narayanswany and Gowda, 1989). Moreover, Raju et al. (1990) stated that both silkworm breeds and mulberry variety had aclear effects on the percent of viable eggs. However, Bheemanna et al. (1989b) stated that neither the silkworm races nor the mulberry varieties caused any effects on percentage of hatchability.

Morphometrical studies:

Weight of larval body:

Data recorded in Table (5) show that the weight of full grown larvae is very sensitive parameter. For instance, this parameter recorded 3.267g. for larvae fed on fresh leaves (control) meanwhile, it decrease significantly when larvae was fed on stored leaves even for one day. Moreover, the reduction in this parameter is in parallel with the time of storage. The highest weight (2.807 and 2.900 g. were recorded in the larvae fed on stored leaves for 2 and 3 days under room temp.; 2.870 and 2.880 g. for larvae fed on mulberry leaves stored for 2 and 3 days under cooling.

Many reports in this concern proved that the development and weight of full- grown larvae in liable to be affected by many factors such as age of mulberry leaves (its content of moisture and food stuffs) (Li and Sang , 1984 and Qader et al., 1992) proved that tender and mid – mature mulberry leaves induced the highest body weight; while, old or tough leaves caused the inverse. However, Giridhar and Reddy (1991a) and Harcharan Singh et al. (1986) found that rainy season and early spring and autumn rearing seasons showed the heaviest larval body weight. However, Mostafa and El-Sayed (1993) reported that the stored mulberry leaves in fridge until the fourth day to 5th instar larvae did not effect on the fitness components of silkworm; while a slight effect has been found from the leaves stored for 5 or 6 days.

Weight of silk gland:

As shown in Table (5) it is clearly that mean weight of silk gland of silkworm larvae fed on fresh and stored mulberry leaves under room and cooling conditions recorded : 0.9271, 0.8238 and 0.8879 g. , respectively, regardless of storing time. Differences between control and other treatments are significant in all cases.

It can be concluded that storing mulberry leaves under room temperature or cooling conditions decrease silkgland weight specially as the time of storing was increased. In this concern, Zannon (1994) came the same results. While, Li and Saing (1984) reported that storing reduce the nutrional value of the mulberry leaves. However, Mostafa and El-Sayed (1992) stated that storing mulberry levels for 5 and 6 days under cooling condition caused a slight effect on silk gland weight.

Length of silkgland secretory canal:

As shown in Table (5) the mean length of silkgland secretory canal of larvae fed on mulberry leaves stored for 1,2 and 3 days under room and cooling conditions manifested significant reduction in the length as compared with those fed on fresh leaves (control), yet , differences between length of silkgland secretory canal of larvae fed stored leaves under room or cooling conditions were statistically insignificant .

Length of silkgland reservoir:

Data in Table (5) show that length of silk gland reservoir of larvae fed on fresh mulberry leaves (control) increased than in larvae fed on stored mulberry leaves for 1,2 and 3 days under room and cooling conditions.

Length of silkgland excretory duct:

The obtained data revealed that larvae fed on mulberry leaves stored for 2 and 3 days under room condition and for 3 days under cooling storage significantly reduced the length of the excretory duct of silkgland than larvae fed on fresh mulberry leaves. However, leaves stored for one day showed insignificant differences as compared with larvae fed on fresh leaves concerning length as silkgland excterior duct.

Data of the present work concerning length of silkgland are generally in accordance with those reported Shaheen et al (1992).

Technological parameters:

Cocoon indices:

Weight of fresh cocoon:

Data presented in Table (6) show that storing mulberry leaves fed to silkworm larvae under room and cooling conditions decreased significantly the weight of the resulted fresh cocoon as compared to that of larvae fed on fresh leaves even for one day and the highest significant effect was recorded in the cocoons of larvae fed on mulberry leaves stored for 3 days under room temp.

It can be concluded that storing mulberry leaves could be attributed with the reducing in nutritive value of leaves.

Weight of cocoon shell:

It is obvious that (Table 6) feeding silkworm larvae on stored mulberry leaves for 1, 2 and 3 days under both room (0.2883 for control against 0.2464, 0.2464, 0.2207 and 0.1903 g.) and cooling (0.2883 for control against 0.2583, 0.2387 and 0.2385 g.) conditions respectively significantly decreased mean weight of cocoon shell as compared with silkworm larvae fed on fresh (control) mulberry leaves.

In connection (Gabriel and Rapusas, 1976; Qader et al., 1992; Sarkar and Fujita, 1994; Qader et al., 1995 and Basavarajappa and Savanurmath, 1996) found that fresh cocoon and cocoon shell weights were greatly influenced by the nutritive value of different mulberry leaves and leaf age seemed to be ineffective on shell weight. In addition, Zannoon (1994) reported that feeding mature silkworm larvae on stored leaves for 5 days in refrigerator decreased significantly the weight of fresh cocoon and cocoon cortex. However, Mostafa and El-Sayed (1993) reported that storing mulberry leaves in fridge (7ºC) until the fourth day had no effect on weight of cocoon sell; while, gave a slight effect when larvae fed on mulberry leaves stared for 5 and 6 days under the same conditions.

Silk content ratio:

Data in Table (6) clear that the silk content ratio recorded : 20.75% for control cocoons resulted from larvae fed on fresh leaves. The mean respective values for the cocoons spum by larvae fed on stored leaves under room and cooling conditions were: 20.12 and 20.50%, regardless of the storing time. The differences between tested treatments are mostly significant. In connection, Qader et al. (1992) stated that the nutritive value for mulberry leaves affects seriously this parameter. Yet, the obtained results are in partial accordance with those of Zannoon (1994) and Mostafa and El-Sayed (1993) who found that storing mulberry leaves in fridge (7ºC) until the fourth day had a negative effect on the ratio of silk content of fresh cocoon.

Reeled silk filament parameters:

The reeled silk filament characters of the cocoons spum by silkworm larvae fed on fresh and stored mulberry leaves room and cooling conditions for 1,2 and 3 days are given in Table (6) .

T5-6

Length of reeled silk filament:

Data presented in Table (6) show that the mean length of silk filament of the cocoon spum by silkworm larvae fed on fresh and stored mulberry leaves under room and cooling conditions recorded: 1201.87, 980.15 and 1032.46m., respectively, regardless of the time of storing .

It can be concluded that, the longer period of storage gave the shorter length of reeled silk filament. Generally, the differences between control (fresh leaves) and other tested treatments were statistically significant in most cases.

Weight of silk filament:

The mean weight of silk filament attained 0.2411 g. for cocoon resulted from silkworm larvae fed on fresh mulberry leaves (control) while, it recorded : 0.2303, 0.1977 and 0.1395 gm. and 0.2345, 0.1870 and 0.1852 g. for stored mulberry leaves under room temp. and cooling conditions for 1, 2 and 3 days, respectively. Analysis of data indicated that mulberry leaves under room and cooling conditions caused significant reduction in the weight of silk filament.

Obtained results are in accordance with results found by Zannoon (1994) who reported that raising grown larvae reared on cool- stored leaves for 4-5 days affected significantly the weight of reelable silk filament by decreasing it. It the same direction, Hanif and Islam (1987) reported that the amino acids content of mulberry leaves played a noticeable role on the weight of silk filament and the amino acids increased with leaf age.

Size of silk filament (dn)

It is obvious that (Table 6) the mean size of reeled silk filament for the cocoons arisen from silkworm larvae fed on fresh mulberry leaves (1.97dn.) was increased as compared with larvae fed on mulberry leaves stored under room temp. (1.79, 1.98 and 1.61 dn.) or larvae fed on mulberry leaves stored under cooling condition (1.95, 1.79 and 1.80 dn.) up to 3 days . The same results were reported by Zannoon (1994) and Qader et al. (1995).

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تأثير تغذية ديدان الحرير على أوراق التوت الطازجة والمخزنة على بعض الصفات البيولوجية والمورفومترية وخيط الحرير

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***معهد بحوث وقاية النبات بالزقازيق**

أجرى هذا البحث بهدف التعرف على بعض التأثيرات البيولوجية والإنتاجية وصفات خيط الحرير لديدان الحرير (Chinese hybrid) عند تغذيتها على أوراق التوت البلدى (Balady var) الطازجة والمخزنة تحت ظروف المعمل أو فى الثلاجة لمدة 24، 48، 72 ساعة ، وذلك بمعامل قسم بحوث ديدان الحرير التابع لفرع معهد بحوث وقاية النبات بالزقازيق (محافظة الشرقية) أما القياسات الخاصة بحل الشرانق والدراسات التكنولوجية فقد أجريت فى معامل قسم بحوث الحرير بالدقى وذلك فى موسمى (1998، 1999) ولقد أوضحت النتائج المتحصل عليها مايلى:

أ- الدراسات البيولوجية:

كانت القيم الخاصة بطول فترة النمو اليرقى (يوم) ، ونسبة الموت الكلية بهذا الطور (%) تميل إلى الزيادة مع فترة تخزين الأوراق سواء تحت ظروف المعمل أو التبريد ، وكانت أقل القيم فى هذا الصدد فى اليرقات التى تتغذى على أوراق التوت الطازجة0

فيما يتعلق بطور العذراء لم تتأثر النسبة المئوية للتشرنق بعاملات أوراق التوت ، بينما تأثرت النسبة المئوية للتعذر ووصلت إلى أعلى القيم فى اليرقات التى تم تغذيتها على أوراق التوت المخزنة لمدة يوم تحت ظروف المعمل ، بينما كانت أقل القيم فى اليرقات التى تم تغذيتها على أوراق التوت فى المعمل لمدة 3 أيام0

كما أوضحت النتائج فيما يتعلق بطول فترة حياه العذراء (الذكر) وكذا (الأنثى) ووزن العذراء حدوث زيادة معنوية للعذراى التى تغذت يرقاتها على أوراق التوت الطازجة وذلك عند مقارنتها باليرقات التى تغذت على أوراق التوت المخزنة تحت ظروف المعمل أو التبريد ويكون التأثير واضحاً مع مدة التخزين الأطول0

وفى طور الحشرة الكاملة لم يتأثر كلاً من النسبة المئوية لخروج الحشرات الكاملة ، وطول فترة حياة الفراشة الذكر وكذلك النسبة المئوية لعدد البيض المخصب فى الأنثى الواحدة تأثراً معنوياً بتغذية اليرقات على الأوراق الطازجة أو مخزنة ، بينما تأثر طول فترة حياة الفراشة الأنثى ، الخصوبة (عدد البيض التى تضعة الأنثى الواحدة) وكذلك النسبة المئوية للفقس فى البيض تأثراً معنوياً عند مقارنة اليرقات التى تغذيت على أوراق التوت الطازجة (كنترول) والمخزنة تحت ظروف المعمل والتبريد وذلك فى معظم المقارنات 0

ب- الدراسات المورفومترية:

حدوث انخفاض معنوى فى وزن جسم اليرقة الناضجة وكذا وزن جسم العذراء بالإضافة إلى وزن غدة الحرير (المخزنة) وطول غدة الحرير (المفرزة) ووزن غدة الحرير (المفرزة) وذلك عند تغذية اليرقات على أوراق التوت المخزنة (فى المعمل أو الثلاجة) وذلك عند مقارنتها باليرقات التى تغذت على الأوراق الطازجة (كنترول) وكانت معظم هذه المقارنات معنوية

ج- الدرسات التكنولوجية (قياسات الشرانق وخيط الحرير):

أوضحت النتائج حدوث نقص معنوى فى كلاً من : متوسط وزن الشرنقة الطازجة (جم) ومتوسط وزن قشرة الشرنقة ، وذلك فى الشرانق الناتجة من يرقات تغذت على أوراق التوت المخزنة (فى المعمل أو الثلاجة)0

فيما يتعلق بقياسات خيط الحرير أوضحت النتائج المتحصل عليها أن كلا من طول الخيط الحريرى (متر ، ووزنة (جم) ينقص معنوياً بتغذية اليرقات الناتجة منها هذه الشرانق على أوراق مخزنة ويكون هذا النقص كبير بطول مدة التخزين لأوراق التوت تحت ظروف المعمل أو الثلاجة ، بينما لم تتأثر سمك خيط الحرير (دنير .dn) بمعاملات أوراق التوت تحت هذه الدراسة0

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Table (1): Larval duration (days) of instars of silkworm *B. mori* larvae affected by feeding on fresh and stored mulberry leaves Balady var. under room and cooling conditions for 24 , 48 and 72 hours after plucking.

Larval instar	1st			2nd			3rd			4th			5th			Total larval stage		
Storing condition / Storing period	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean
Fresh leaves (control)	5.19		5.19	4		4	4		4	6		6	8.15		8.15	27.35		27.35
24 hr.	5.30	5.23	5.26	4	4	4	4	4	4	6	6	6	9.34	9.32	9.32	28.65	28.55	28.60
48 hr.	5.45	5.30	5.50	4	4	4	4	4	4	6	6	6	9.49	9.57	9.54	28.93	29.12	29.03
72 hr.	6.87	5.47	6.17	4	4	4	4.82	4	4.41	6	6	6	11.29	9.44	10.36	32.98	28.91	30.95
Mean	5.71	5.36		4	4		4.20	4		6	6		9.56	9.12		29.48	28.48	
LSD time	0.1552**			N.S.			0.0765**			N.S.			0.1607**			0.3209**		
LSD temp.	0.1115**			N.S.			0.0820**			N.S.			0.1879**			0.3580**		
LSD time x temp.	0.2195**			N.S.			0.1082**			N.S.			0.2273**			0.4539**		

Table (2): Larval mortality percentage of different instars (days) as affected by feeding silkworm *B. mori* larvae on fresh and stored mulberry leaves Balady var. under room and cooling conditions for 24 , 48 and 72 hours after plucking.

Larval instar	1st			2nd			3rd			4th			5th			Total larval stage		
Storing condition / Storing period	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean
Fresh leaves (control)	13		13	13.81		13.81	-		-	-		-	-		-	25.25		25.25
24 hr.	16.50	29.62	18.06	15.75	17.55	13.61	6.85	-	3.42	0.567	-	0.280	-	0.132	0.066	30.87	35.87	33.37
48 hr.	20.12	36.75	28.43	19.77	15.82	15.79	31.19	-	15.59	13.33	-	6.66	0.382	-	0.199	61.35	43.62	52.43
72 hr.	24.25	32.12	28.18	39.28	32.50	35.89	-	-	-	-	-	-	-	-	-	54.25	54.75	54.57
Mean	20.20	32.83		24.75	21.95		12.68	-		4.36	-		0.127	0.044		48.79	44.74	
LSD time	9.5047**			9.8004**			6.7296**			3.5063**			N.S.			9.5440**		
LSD temp.	N.S.			N.S.			N.S.			3.1381*			N.S.			N.S.		
LSD time x temp.	N.S.			N.S.			9.5175**			4.9589**			N.S.			N.S.		

Table (3): Biological aspects of pupal stage as affected by feeding silkworm *B. mori* larvae on fresh and stored mulberry leaves Balady var. under room and cooling conditions for 24, 48 and 72 hours after plucking.

Pupal parameters	Cocooning (%)			Pupation (%)			Pupal duration period						Pupal weight (g)		
							Male			Female					
Storing condition / Storing period	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean
Fresh leaves (control)	95.50		95.50	92.73		92.73	9.06		9.06	9.70		9.70	1.1127		1.1127
24 hr.	96.25	93.75	95.00	97.23	91.01	94.12	8.65	8.20	8.42	9.20	8.70	8.95	1.0334	1.0083	1.0208
48 hr.	93.00	87.00	90.00	94.86	86.67	90.04	8.55	7.95	8.25	8.90	8.55	8.52	0.8874	0.9623	0.9848
72 hr.	86.50	94.25	90.37	85.87	92.35	98.11	8.35	8.00	8.17	8.95	8.60	8.79	0.9889	0.9350	0.8619
Mean	92.81	92.62		92.31	90.69		8.65	8.30		9.48	8.88		0.9556	1.0045	
LSD time	N.S.			3.3737*			0.2669**			0.2913**			0.0530**		
LSD temp.	N.S.			N.S.			N.S.			0.2831*			0.0302*		
LSD time x temp.	N.S.			4.7713**			N.S.			N.S.			0.0749*		

Table (4): Biological aspects of emerged adult moths as affected by feeding silkworm *B. mori* larvae on fresh and stored mulberry leaves Balady var. under room and cooling conditions for 24, 48 and 72 hours after plucking.

Adult parameters	Emergence (%)			Male longevity (days)			Female longevity (days)			Fecundity (eggs/female)			Fertility (%)			Hatchability (%)		
Storing condition / Storing period	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean
Fresh leaves (control)	96.39		96.39	4.81		4.81	10.90		10.90	552.37		552.37	95.84		95.84	98.02		98.02
24 hr.	97.82	95.59	96.70	4.93	5.12	5.02	12.42	12.31	12.36	494.31	506	500.15	96.74	92.72	94.73	97.58	97.44	97.51
48 hr.	97.27	97.06	97.16	5.38	4.81	5.09	12.07	12.52	12.29	464.56	500.37	482.46	96.47	95.03	95.73	96.86	96.95	96.90
72 hr.	91.45	97.27	94.36	4.62	4.81	4.71	11.41	13.64	12.03	417.56	482.37	449.96	95.89	93.22	94.55	94.01	94.72	94.36
Mean	95.73	96.58		4.93	4.88		11.70	12.34		462.32	514.65		96.89	94.28		96.61	96.78	
										0.953	0.876		0.874	0.928				
LSD time	N.S.			NS			0.9379**			60.7200**			N.S.			2.1903*		
LSD temp.	N.S.			NS			0.2791**			N.S.			N.S.			N.S.		
LSD time x temp.	N.S.			NS			N.S.			85.8756*			N.S.			N.S.		

Table (5): Biological aspects of full – grown larvae as affected by feeding silkworm *B. mori* larvae on fresh and stored mulberry leaves Balady var. under room and cooling conditions for 24, 48 and 72 hours after plucking.

Full grown larvae parameters	Larval body weight (gm)			Silkgland weight (gm)			Length of secretory canal (cm)			Length of reservoir (cm)			Length of exterior duct (cm)		
Storing condition / Storing period	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean
Fresh leaves (control)	3.267		3.267	0.9271		0.9271	20.30		20.30	7.43		7.43	3.35		3.35
24 hr.	3.103	2.971	3.030	0.8702	0.8993	0.8847	19.65	19.35	19.50	7.20	6.98	7.09	3.27	3.30	3.28
48 hr.	2.900	2.845	2.870	0.7814	0.8882	0.8347	20.25	19.53	19.89	6.94	6.60	6.77	2.78	3.29	3.03
72 hr.	2.807	2.937	2.880	0.7169	0.8374	0.7772	18.00	18.50	18.25	6.94	6.28	6.18	2.74	2.96	2.85
Mean	3.020	3.010		0.8238	0.8879		19.55	19.42		6.91	6.82		3.03	3.22	
LSD time	0.1016**			0.0203*			0.4706*			0.2183			0.1236**		
LSD temp.	N.S.			0.0117**			N.S.			N.S.			0.1606*		
LSD time x temp.	N.S.			2.8756**			N.S.			N.S.			0.17487**		

Table (6): Cocoons and reeled silk filament characters as affected by feeding silkworm *B. mori* larvae on fresh and stored mulberry leaves Balady var. under room and cooling conditions for 24, 48 and 72 hours after plucking.

Parameters	Cocoon indices									Reelable silk filament parameters								
	Fresh cocoon weight (g)			Shell cocoon weight (gm)			Silk content ratio (%)			Silk filament length (m)			Silk filament weight (gm)			Silk filament size (dn)		
Storing condition / Storing period	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean	Room	Cool.	Mean
Fresh leaves (control)	1.4010		1.4010	0.2883		0.2883	20.75		20.75	1201.87		1201.87	0.2411		0.2411	1.79		1.79
24 hr.	1.2425	1.2669	1.2547	0.2464	0.2583	0.2524	20.02	20.60	20.31	1044.37	1084.06	1064.21	0.2303	0.2345	0.2324	1.79	1.95	1.96
48 hr.	1.1114	1.2011	1.1547	0.2207	0.2387	0.2297	20.19	20.10	20.14	896.87	934.37	915.65	0.1977	0.1870	0.1923	1.98	1.79	1.88
72 hr.	0.9792	1.1730	1.0761	0.1903	0.2385	0.2144	19.54	20.53	20.04	777.50	911.56	844.53	0.1395	0.1852	0.1624	1.61	1.80	1.70
Mean	1.1827	1.2605		0.2364	0.2498		20.12	20.50		980.15	1032.96		0.2021	0.2119		1.84	1.83	
LSD time	0.0415**			0.0200**			N.S.			34.2960**			0.0368**			N.S.		
LSD temp.	0.0166**			N.S.			0.3482			27.0070**			N.S.			N.S.		
LSD time x temp.	0.05867**			2.8396			N.S.			48.5037**			N.S.			N.S.		