Certain Materials as Beds and Covers During Rearing The Young-Age Silkworm, *Bombyx mori* L. (Lepidoptera: Bombycidae)

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ABSTRACT

Use of banana leaf, aluminum foil and paraffin paper as rearing beds and covers during the young age silkworm, *Bombyx mori* L. rearing were studied in order to determine and provide the suitable percentage limits of humidity for healthy rearing. The use of banana leaf as a rearing bed was always the utmost efficient material, which significantly increased the larval weight by 79.057, 75.560, 23.509 and 43.049 percent increase over control for 2^{nd}, 3^{rd}, 4^{th} and 5^{th} instars, respectively.

Banana leaves increased also the mean weights of silk gland, pupa, fresh cocoon and cocoon shell by about 67.44, 21.784, 25.974 and 19.658% over control, respectively. All of the studied parameters were somewhat decreased, when aluminum foil was used as a bed and cover. Meanwhile, the treatment of paraffin paper was always less effective indicating lower parameters than those of the other used materials, but it still significantly more than the control.

INTRODUCTION

Since silkworms have been domesticated for many centuries, they are by nature quite delicate and very sensitive to environmental conditions. Among the various environmental factors that influenced the silkworm, *Bombyx mori* L. productivity of silk and eggs, the most important are atmospheric temperature and humidity that prevailed at the time of rearing (Krishnaswami *et al*., 1973). Intensive studies on the growth and production of silkworms in relation to the hygrothermic factors have shown that the response to these factors varies with the different larval stages. It has well been established that young-age silkworm larvae are reared in a comparatively higher temperature and humidity conditions of 28ºc and 85 – 90% R.H., respectively (Krishnaswami *et al*., 1973; Jolly, 1987; Sengupta, 1989 and Datta *et al*., 1996)

Benchamin and Nagaraj, (1987) stated that if bed humidity falls below 70%, fast drying of mulberry leaves takes place, thus leaves become unsuitable for food consumption and the larvae growth slows down. Retarded growth of young-age larvae makes them weak and easily susceptible to diseases. For regulating humidity box type of rearing with paraffin paper as a bed was recommended (Krishnaswami, 1978). Recently, Singh *et al*., (2001) used banana leaf as a rearing bed during young-age larvae in order to regulate the suitable humidity for them.

However, the reares in developmental countries such as Egypt usually rear young silkworms in carton boxes and bamboo trays, with somewhat unsuitable humidity % for rearing.

Therefore, this study was conducted to find out the effects of certain materials such as banana leaf, paraffin paper and aluminum foil as rearing beds and covers for young-age silkworm *B. mori* L. in order to determine and provide the suitable percentage of humidity for healthy rearing.

MATERIALS AND METHODS

The experiment was performed on the mulberry silkworm *Bombyx mori* L. Chinese F1 hybrid 9F7X under the room hygrothermic conditions of 26.32 ± 1.5ºc and 71.30 ± 2% R.H.. The newly hatched larvae were reared as usual in carton boxes until the third molt. To regulate the suitable humidity for the young age larvae, the chosen materials as rearing beds and covers e.g. banana leaves, paraffin paper, and aluminum foils were used. Each material was replaced as bed and cover in the carton boxes in course of rearing young age (1^{st}, 2^{nd} and 3^{rd} larval instars). So, the experiment was designed on the basis of three treatments and control. The larvae of control treatment were reared in carton boxes without any bed sheet or cover. Each treatment as well as the control was replicated three times and each replicate was contained 500 larvae. The larvae were fed four times daily on chopped mulberry leaves up to the third molt, after that, the larvae were transferred into the conventional trays. Along the period of the experiment, bed spacing, feeding quantum, feeding frequency, bed cleaning …..etc. were followed and maintained as advocated by Krishnaswami *et al*. (1973).

The room temperature and bed relative humidity of all treatments and control were daily recorded. To estimate the moisture content in banana leaf, 20 centimeter length was daily weighed for a period of five days. At last day the leaf was oven dried at 60ºc for 24 hrs. according to Singh *et al*., (2001) and the moisture percentage for every day was calculated, in order to check the loss of moisture, by using the following standard formula:

$$\text{Percentage of moisture} = \frac{\text{Fresh leaf weight - Dry weight}}{\text{Fresh weight}} \times 100$$

The initial weights of larvae after the 1st, 2nd, and 3rd molt were recorded for all treatments and control. Percentage of larval mortality after each molt and larval duration were also considered. As the hygrothermic condition during rearing the young age of silkworm larvae affected the late

age as well as the silk production (Krishnaswami, 1986), so, the weights of the mature (5^{th}) instar larvae, silk glands, fresh cocoons, pupae and cocoon shells were recorded.

Data were statistically analyzed to check the significance among the treatments using "F" test and L.S.D. at P = 0.05 (Sendecor, 1956.).

RESULTS AND DISCUSSION

Percentage of moisture content:

The maximum moisture percentage in banana leaf (84.87%) was recorded on the first day followed by second day (83.37%), third (81.44%), forth (77.61%) and fifth day (73.11%). Accordingly, the banana leaf was daily replaced with another fresh one in each replicate. The average percentages of humidity in the other two treatments of aluminum foil and paraffin paper were 81.75% and 77.33% respectively, while it was 72.11% in the control treatment.

Effect of used materials as beds and covers during young-age *B. mori* rearing on the weights of larval instars.

Results in Table 1 revealed that the mean weights of experimental larvae during all evaluated instars were significantly different in relation to the different adopted treatments. It is shown that the treatment of banana leaf gave the heaviest weight of 100 second instar larvae (0.664 g) whereas, the rate of increase was about 79.057% more than the control treatment (0.371 g). it was followed by the treatment of aluminum foil since the percent increase over control was about 34.394%. The lightest weight of larvae was obtained from paraffin paper treatment (0.440 g) but it still significantly more than the control.

Concerning the effect on the 3^{rd}, 4^{th} and 5^{th} instars, the same trend of results was attained since the treatment of banana leaf increased the larval weights by about 75.560%, 23.509% and 43.049%, respectively more than the control (4.383, 17.652 and 1.711g., respectively). It was also followed by aluminum foil treatment and the least effective one was the paraffin paper treatment (Table, 1).

The improvement in larval growth using banana leaf bed might be due to the optimum relative humidity which was higher than that of either aluminum foil or paraffin paper rearing materials. The present findings confirmed the earlier results of Sharada and Bhat (1957) who observed a remarkable improvement of larval body weight under the optimum relative humidity (85 – 90%). Benchamin and Nagaraj (1987) reported that paraffin paper was effective to keep chopped mulberry leaves in fresh condition as a rearing bed, but it is not available everywhere, and the repeated use of

paraffin paper may cause contamination of silkworms by pathogens of various diseases (Jolly, 1986).

Furthermore, Singh *et al* (2001) suggested that the higher relative humidity in banana leaf rearing bed might keep chopped mulberry leaves fresh to be fed to silkworms, which enable better growth of larvae.

Effect of the used materials as rearing beds and covers during young- age of *B. mori* on the weight of silk glands and pupae:

Statistical analysis of data proved a significant effect on the weights of both silk glands and pupae (Table, 2). The mean weight of fresh silk glands exhibited a picture similar to that of larval weights in relation to the different treatments. The results presented in Table, 2 showed that the treatment of banana leaf was always the best, since it gave the heaviest silk gland s well as pupal weights of 0.456 and 1.547 g, respectively in comparison to control (0.273 and 1.210 g, in respect). The lowest silk glands and pupal weights of 0.369 and 1.290 g., respectively had been attained in case of treatment of paraffin paper.

It is worth noting that the larval and pupal durations as well as percentages of larval mortality were similar in all used materials as beds rearing and control.

Effect of the used materials as beds and covers during young age of *B. mori* rearing on silk production:

Similarly, the treatment of banana leaf gave also the most pronounced effect on mean weights of fresh cocoons and their shells (1.843 and 0.280 g, respectively), which were increased by 25.974 and 19.658% over the control. The mean weights of both fresh cocoons and their shells were 1.664, 1.560 and 1.463g; 0.265, 0.246 and 0.234 g, respectively for the other treatments of using aluminum foil, paraffin paper and control. The corresponding percentages of increase over control were 13.738 and 6.630; 13.248 and 5.128 for fresh cocoons and their shells, in case of the aluminum foil and paraffin paper treatments, respectively. The aforementioned results assured that banana leaf treatment resulted in producing higher silk product compared with the other treatments.

Tanaka (1964), Datta (1992) and Anonymous (1995) confirmed that young age silkworm larvae were more resistant to high humidity (85 – 90%) and they indicted better survival, maximum growth and cocoon characters. As recommended by Sengupta (1989) and Datta (1992) successful silkworm crop and regulation of temperature and humidity % would be necessary for rearing young-age silkworms.

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Table (1) : Effect of the used materials as beds and covers during young-age *B. mori* rearing on the mean weights of larval instars.

Larval instars / Treatments	* 2nd instar (g) A	* 3rd instar (g) B	* 4th instar (g) C	* 5th instar (g) D	Percent increase over control (%)			
					2nd instar	3rd instar	4th instar	5th instar
Banana leaf	a 0.664 ± 0.03	a 7.695 ± 0.024	a 21.802 ± 0.558	a 2.448 ± 0.114	79.057	75.560	23.509	43.049
Aluminum foil	b 0.499 ± 0.021	b 5.742 ± 0.115	b 20.714 ± 0.733	b 2.148 ± 0.106	34.394	31.015	17.344	25.542
Paraffin paper	c 0.440 ± 0.018	c 5.023 ± 0.181	c 19.487 ± 0.638	c 2.017 ± 0.078	18.598	14.602	10.396	17.881
Control	d 0.371 ± 0.025	d 4.383 ± 0.159	d 17.652 ± 0.446	d 1.711 ± 0.131				
L.S.D	0.022	0.162	0.658	0.066				

- **There are no significant differences among the mean with the same small letters.**
- *** = Each value represents the mean ±S.D. of 25 records, each record contains 100 larvae for A, 25 larvae for B and C and 1 larva for D.**

Table (2): Effect of the used materials as beds and covers during young age *B. mori* rearing on the weight of pupae and silk gland.

Treatments	** Weight of silk gland (g)	* Weight of pupa (g)	Percent increase over control (%)	
			Wt. of silk gland	Wt. of pupa
Banana leaf	a 0.456 ± 0.020	a 1.547 ± 0.069	67.440	21.784
Aluminum foil	b 0.413 ± 0.021	b 1.381 ± 0.045	51.520	14.132
Paraffin paper	c 0.369 ± 0.020	c 1.290 ± 0.049	35.450	6.611
Control	d 0.273 ± 0.015	d 1.210 ± 0.071		
L.S.D.	0.023	0.046		

- **There are no significant differences among the means with the same letters.**
- *** Each value represents the mean ± S.D. of 25 records.**
- **** Each value represents the mean ± S.D. of 5 records.**

Table (3): Effect of the used materials as beds and covers during young age *B. mori* rearing on silk production.

Treatments	* Weight of fresh cocoon (g)	* Weight of cocoon shell (g)	Percent increase over control (%)	
			Wt. of fresh cocoon	Wt. of cocoon shell
Banana leaf	a 1.843 ± 0.071	a 0.280 ± 0.014	25.974	19.658
Aluminum foil	b 1.664 ± 0.073	b 0.265 ± 0.017	13.738	13.248
Paraffin paper	c 1.560 ± 0.048	c 0.246 ± 0.019	6.630	5.128
Control	d 1.463 ± 0.065	d 0.234 ± 0.008		
L.S.D.	0.077	0.010		

- **There are no significant differences among the means with the same letters.**
- *** Each value represents the mean ± S.D. of 25 records.**

الملخص العربى
استخدام بعض المواد كمهاد و أغطية اثناء تربية الاعمار الصغيرة من ديدان حرير القز

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تم دراسة تأثير استخدام بعض المواد (كمهاد) و اغطية اثناء تربية الأعمار الصغيرة من ديدان حرير القز بهدف توفير درجة الرطوبة المناسبة لهذه الأعمار و التى من المتفق عليه انها قد تؤثر تاثيرا إيجابيا فى التربية و التى تنعكس فى النهاية على المنتج من الحرير. و كانت هذه المواد هى أوراق الموز و رقائق الألومنيوم و أوراق البرافين. أوضحت النتائج أن استخدام أوراق الموز كمهد للتربية أعطت أعلى النتائج بالنسبة لأوزان اليرقات فى أعمارها من الثانى إلى الخامس و أيضا بالنسبة لأوزان غدد الحرير و العذارى و كذلك للمنتج النهائى من الحرير و المتمثل فى أوزان الشرانق الطازجة و المحتوى الحريرى لها. و كان أستخدام رقائق الألومنيوم تأتى فى المرتبة الثانية من حيث إيجابية تأثيرها على الصفات المدروسة بينما أعطت معاملة ورق البرافين أقل القيم و لكنها فى نفس الوقت تفوقت على معاملة الكنترول و التى تم تربية الأعمار الصغيرة فيها فى علب من الكرتون بدون اى مهد أو غطاء،