

# Certain Factors Affecting The Emergence of The Mulberry Silkworm *Bombyx mori* L. and The Fecundity of Male Ones

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## ABSTRACT

The aim of this study is to evaluate the effects of cold storage (7°C) and its exposure period (5, 10, 15 or 30 days) on some biological parameters of the mulberry silkworm *Bombyx mori* L. fresh cocoons, as well as, the effect of exposing the male moths to different temperature regimes (7, 18, 25 or 34°C) on the fertility and fecundity of mated females. The obtained results indicated that *Bombyx mori* L. could be safely stored as fresh cocoons up to 10 days at the temperature of 7°C. While, fecundity and fertility could be affected by exposing male moths to different temperature regimes.

**Key words:** Mulberry silkworm, temperature, emergence, fecundity.

## INTRODUCTION

Although there are several commercial hybrid eggs of the mulberry silkworm *Bombyx mori* L. and some parental races vary in their duration, it is necessary to make accurate calculations of the period from the start of rearing through the duration of feeding period, up to moth emergence. Krishnaswamy *et al* (1973) showed that care must be taken to ensure that the moths emerge simultaneously. That could be achieved by rearing the parental races of *B. mori* which have the same larval duration that all moths emerge at about the same time. In spite of the care taken, there are differences in the emergence of moths of parental races. Bogach *et al* (1966) stated that temperature is one of the basic factor affecting the pupal period, mating, fertilization and oviposition.

Singh and Samson (1999) stated that the reproductive characters of silkworm were greatly influenced by different temperature regimes.

Sugai and Ashoush (1968) reported that male silkworm moths almost became sterile when kept at 32°C for 4 days after spinning even though pupae were preserved at moderate temperature of 23°C throughout the remaining period.

Sugai and Hanoaka (1972) stated that 19 hr. continuous exposure to high temperature induces sterility in male of silkworm.

The present study was carried out to study the effects of different periods of cold storage of fresh cocoons on the reproductive ability of *B. mori* as well as, the study of different temperature regimes on the fertility of male moths and its effect on female egg production.

## MATERIALS AND METHODS

The eggs of the mulberry silkworm *Bombyx mori* L. were reared in the laboratory according to

the standard rearing technique as advocated by Krishnaswamy (1973) under the hygrothermic conditions of  $25 \pm 1.5$  °C and  $75 \pm 5$  % R.H. The larvae were fed on fresh clean mulberry leaves variety Romi until 5<sup>th</sup> instar. For spinning purposes mature larvae were transferred to mounting frames for cocoon building. Cocoons were harvested on the eighth day of spinning and kept in the fridge at temperature of 7°C for 5, 10, 15, 20 and 30 days. A group of 50 cocoons were taken off from the fridge at the aforementioned days and left for moth emergence. The duration of the pupae for different treatments as well as control (15 days) was recorded. The studied biological parameters were the percentage of moth emergence, number of deposited and the fertilized eggs per female.

Fertilized eggs percentage was calculated according to the following equation:

Fertilized eggs % =

$$\frac{\text{number of deposited eggs} - \text{non fertilized eggs}}{\text{number of deposited eggs}} \times 100$$

On the other hand, after the emergence of silkworm moths from a natural rearing, freshly emerged male moths were taken and divided into four groups. Each group was exposed to certain temperature of 7, 18, 25 or 34 °C and taken after 24, 48 or 72 hrs. to mate with freshly female moths. Each couple was kept in a perforated paper bag till the end of egg deposition. The deposited and fertilized eggs per female moth were counted and recorded.

Statistical analysis of data was performed on the basis of the mean values plus or minus standard deviation. Data were statistically analyzed and compared using "F" test and the Least Significant Difference (L.S.D.) at 5% probability level, (Sendecor, 1956) and "T" test.

## RESULTS AND DISCUSSION

1-Effect of different period of cold storage (in days) on some biological parameters of *Bombyx mori* L.

The results presented in Table, 1 indicate that there was no difference among the pupal duration of the 5 days treatment when compared with the control one (15 days), then the pupal duration somewhat decreased till it reached 13 days on the 30 days treatment. El-Karaksy and Hosny (1988) proved that the pupal duration decreased as the storage period increased.

As shown in Table, 1 the percentages of moth emergence from fresh cocoons previously exposed to 7°C in the pupal stage for 5, 10 or 15 days were nearly the same to those obtained from the control pupae, while those stored up to 20 and 30 days, the percentages of emergence were decreased (42 and 6 % respectively). Identical results were obtained by Hosny (1982) on Eri-silkworm *Philosamia ricini* Boisid who stated that either increasing temperature or decreasing the exposure time during the pupal stage led to an increase in the emergence percent. Similarly, El-Karaksy and Hosny (1988) proved that the emergence percent was decreased when the pupal stage of *B. mori* was exposed to certain low temperatures for a long time.

The statistical analysis of data on Table, 1 indicate that there were no significant differences between both the number of eggs and the fertility of female moths emerged from stored pupae at 7°C for 5 and 10 days compared with the control. There were significant differences between the both characters and the control when the exposure period of the pupal stage was prolonged to 15 days (447.8 eggs/female and 88.628% in respect). While, exposing the pupal stage to 20 and 30 days caused the loss in the mating ability. Identically, Bogach *et al.* (1966) and Hosny (1982) stated that temperature is the basic factor affecting mating, fertilization and oviposition. Mahmoud and Yehia (2009) proved that there were insignificant differences in the

counted numbers of deposited eggs between the normal mated couples (control) and the female moths which were mated with cold stored male moths till the 5<sup>th</sup> day of storage at 7°C. Takemura *et al.* (1999) showed that moths lost their mating ability when they were stored up to 2 months at 5°C.

2- Effect of exposing male moths to different temperature regimes on the fecundity of *Bombyx mori* L. female moth.

The results presented in Table, 2 indicate that there were insignificant differences between the counted numbers of deposited eggs laid by female moths which were mated with male moths exposed to certain temperatures of 7, 18, 25 or 34°C and were taken for mating after 24 hrs. as well as the male moths exposed to 25 and 34°C and taken after 48 hrs. A significant decrease was recorded for the number of eggs laid by mated females with stored males which exposed to 7 or 18°C and taken for the mating purposes after 48 hrs (401.8 and 416.8 eggs / female respectively).

Concerning, mating male moths after 72 hrs. of exposure to the above mentioned temperatures, the number of deposited eggs was significantly decreased except for the male moths exposed to 25°C that kept its normal fecundity (428.6 eggs/female).

The included results in Table, 2 also indicate that the inspected eggs fertility percentage showed insignificant results between most treatments except those male moths exposed to 34°C which gave the lowest fertility percentage and caused the mortality of 40 % of the male moths after the exposure to 48 hrs.

These results are in accordance with Mathur *et al.* (1988) who stated that the maximum ovulation and fecundity of the mulberry silkworm were observed at temperature  $25.36 \pm 0.17^\circ\text{C}$  and any fluctuation from this level decreased ovulation, oviposition fecundity and increased retention of eggs.

Table 1: Effect of different period of cold storage (in days) on some biological parameters of *Bombyx mori* L.

storage (days)	parameters	Pupal duration (days)	Emergence %	No. of deposited eggs	Fertility %
Control		15	78.5	518 a $\pm$ 43.64	97.539a $\pm$ 1.304
5		15	82	534.4 a $\pm$ 27.014	99.01a $\pm$ 0.823
10		14	76	566a $\pm$ 31.685	99.356a $\pm$ 0.25
15		14	78	447.8 b $\pm$ 52.504	88.628b $\pm$ 4.94
20		14	42	--	--
30		13	6	--	--
L.S.D.					
"F" calculated		--	--	7.810884**	19.10812**

Each value represents the mean  $\pm$  S.D. of 5 replicates.

No significant difference among the means with the same letters.

\*\* = highly significant.

**Table 2: Effect of exposing male moths to different temperature regimes on the fecundity of *Bombyx mori* L. female moth.**

temp. + hrs.	parameters	No. of deposited Eggs	Fertility %
7°C	24	445.4 ab ± 24.203	99.5ab ± 0.168
	48	401.8c ± 42.346	99.292abc ± 0.508593
	72	362.6d ± 48.967	98.615 abcd ± 1.049
18°C	24	441.8 ab ± 13.255	99.048 abc ± 0.662
	48	416.8 bc ± 13.773	98.671 abcd ± 0.773
	72	332.4 d ± 52.098	98.300 bcd ± 0.652
25°C	24	461.4 a ± 16.257	99.944 a ± 0.125
	48	461 a ± 11.789	99.518 ab ± 0.295
	72	428.6 ab ± 37.105	99.092 abc ± 0.744
34°C	24	453.4 ab ± 26.726	97.863 cd ± 1.047
	48	441.6 ab ± 24.785	97.271 d ± 2.093
	72	357.2 d ± 17.049	89.728 e ± 2.824
L.S.D		10.33023 **	26.4029 **
"F" calculated			

Each value represents the mean ± S.D. of 5 replicates

\*\* = highly significant

No significant difference among the means with the same letters.

Also, Singh and Samson (1999) stated that the reproductive characters were greatly influenced by different temperature regimes. On the other hand, Sugai and Ashoush (1968) reported that male silkworm moths almost became sterile when kept at 32°C for 4 days, while, Sugai and Hanoaka (1972) stated that 19 hr. continuous exposure to high temperature induces sterility in male silkworm.

From the abovementioned results it could be concluded that for producing industrial hybrid, the cocoon of *B. mori* could be safely stored up to 10 days at the temperature of 7°C since the studied biological parameters were normal. Furthermore, female moths could keep their fecundity when mated with male moths which were exposed to certain temperatures for a time period up to 48 hrs and male moths could keep their fertility except when exposed to high temperatures of 34°C.

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## الملخص العربى

### بعض العوامل المؤثرة على خروج فراشات ديدان حرير القز وخصوبة الذكور

منى ماهر محمود

معهد بحوث وقاية النبات- مركز البحوث للزراعة- اسكندرية- مصر

يهدف هذا البحث إلى دراسة تأثير التخزين البارد على  $7^{\circ}\text{C}$  للشرانق الطازجة لفترات معينة (5، 10، 15، 20 أو 30 يوم) على بعض الصفات الحيوية لديدان حرير القز. وايضا تأثير تعرض ذكور الفراشات لدرجات حرارة مختلفة (7، 18، 25 أو  $34^{\circ}\text{C}$ ) على عدد البيض وخصوبة الإناث المتزاوجة معها. ولقد اوضحت النتائج انه من الممكن تخزين شرانق ديدان حرير القز بأمان على درجة  $7^{\circ}\text{C}$  لفترة تصل إلى 10 ايام. بينما تأثر كل من عدد البيض الموضوع والخصوبة عند تعرض ذكور الفراشات لدرجات حرارة مختلفة.