Comparative Study of Biological Characters of Silkworm Eggs

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Abstract

The silkworm Bombyx mori L. is a domesticated insect considered as a reference in several domains (Mauchamp et al., 2008). The theoretical and practical importance of the silkworms are shown in many studies (Nagaraju et al., 1996; Kipriotis et al., 2000; Sudhakara et al., 2003; Vassileva et al., 2004; Petkov et al., 1998; Matei et al., 2002; 2005). This study was conducted to compare four monovoltine breeds of Romanian silkworm, hatching in specific conditions, in different years (2001 and 2008), to see if there is a major difference between the biological characters of eggs belonging to those breeds in time. For both 2001 and 2008 years, four breeds AC29, AC, B1 and AB of Bombyx mori (eggs) were obtained from SC SERICAROM (Bucharest, Romania) and the same microclimate conditions were assuring. In total, per data set of each year were 16 variants because each of the breed was hatch in four variants, for more complete results of analyzed samples. The evaluation was made on the base of indices used for classified biological characters of silkworm eggs, comparative data shows that, between the same breeds hatching in different years, there is no significant difference. According to biological characteristics, the study allowed us to make a classification of the analyzed breeds. In the present research, we demonstrated that biological characters of silkworm eggs were well preserved and there are no significant variations between both set of data taken in study.

Keywords: biological character, Bombyx mori, breeds, monovoltine, silkworm

INTRODUCTION

Mulberry silkworm Bombyx mori L. is a well-known lepidopteran with a long history especially for commercial extraction of the silk in sericulture industry and has lost some features through many years of breeding under artificial conditions and the domestication process.

Unfortunately silkworms are no longer observed in nature and are totally dependent on human intervention for their survival. Genetic stocks of this species are found only in germplasm banks. Silkworm germplasm banks are important reserve of biodiversity and a source of alleles that can be easily retrieved for the genetic enhancement of popular strains.

The growth and development of silkworm is greatly influenced by environmental conditions such as biotic and abiotic factors. Among the abiotic factors, temperature plays a major role on growth and productivity of silkworms, as silkworms are cold-blooded animals, temperature will have a direct effect on various physiological activities (Rahmathulla, 2012). Another abiotic factor is represented by humidity which interacts
with the availability of free water and with the water content of the food and it mostly shows indirect effect on growth and development.

Those abiotic factors play an important role on the consumption and utilization of food. Also in literature it is well known that the majority of the economically important genetic traits of silkworms are qualitative in nature and that phenotypic expression is greatly influenced by environmental factors such as temperature, relative humidity, light, and nutrition (Chatterjee et al., 1993, Thiagarajan et al., 1993; Ramesha et al., 2009).

In present Bombyx mori L., comprises a large number of breeds and synthetic inbreed line, which represent high degree of divergence with respect to geographical origins and quantitative and qualitative traits (Srivastava et al., 2005).

The aim of this study is to compare four monovoltine breeds of Romanian silkworm, hatch in separated years (2001 and 2008), to see if there is a major differences of biological characters of eggs of those breeds in time.

MATERIALS AND METHODS
Silkworm eggs were obtained from SC. Sericarom SA from Bucharest, Romania who represents bank germplasm, after that eggs was put for hatching at University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. The biological material was represent by four monovoltine breeds AC29, AC, B1 and AB. For both 2001 and 2008 years, the same microclimate conditions were assured, such as temperature, relative humidity, light.

Experimental hatching of silkworm were conducted in May for both 2001 and 2008 years, using specific inventory. Before beginning the research experimental laboratory and entire inventory for this purpose, have been disinfected with Virkon.

Incubation is the period required to complete the development of the embryo in the egg, for which purpose they are kept in optimal conditions of temperature, humidity, light and ventilation. Start of date for hatching series was established according to the evolution of mulberry vegetation, so that on the day of hatching larvae, mulberry had 3-5 leaves. As breeding material, eggs of Bombyx mori, are named “seed” and the efforts of a single female is called “ponta.”

Regarding the silkworms, eggs incubation was realized using the gradual raising of the temperature. This method is used especially for incubating eggs kept in the refrigerator and proceed as follows: after removing the eggs from the fridge, they stay three days at +15°C, two days at +18°C and 20°C, four 23° days at +18°C and +24° C, and the balance between +25°C and +26°C. Gradual increase in temperature is best, because it corresponds to physiological processes during incubation. In room in which incubation of silkworm eggs was performed was set a thermo-hygrometer which served to monitor incubation regime like temperature and humidity.

Light used during the incubation was natural, but supplemented with artificial until the eggs bleaching, after which they were provided 36 hours dark and then went back to lighting regime. This method was used to obtain a higher percentage of grouped hatching, this increase depending on the further experiments. In total per data set of each year were 16 variants because each of the breed was hatch in four variants, for more complete results of analyzed samples. Biological indices of the eggs (number of eggs/hatching and hatching percents results are expressed as the average of four different pontes within the same breed.

Our research was focus on follow characters: color of eggs, number of eggs, hatching percent, and number of days of interval for hatching.

RESULTS AND DISCUSSION
The evaluation of qualitative traits helps as to characterize and differentiate between different strains from SC Sericarom SA, Bucharest, Romania. In addition to help to maintaining the germplasm bank, these analyses are crucial in choosing the parents involved in the production of superior hybrids in breeding programs. Moreover, the biological performance of B. mori can reflect on maximum final silk production potential (Porto et al., 2004).

In this period optimum microclimate parameters were ensured in the hatching of eggs of the silkworm, for a high percentage of hatching.

Incubation period was influenced by of temperature, humidity and lightness. Eggs average days for hatching in the experiment were 13 days.

We analyzed several biological characteristics of four B. mori strains two of Chinese and two Japanese origin, the breeds of Japanese origin
Comparative Study of Biological Characters of Silkworm Eggs

Comparative Study of Biological Characters of Silkworm Eggs has dark metallic gray and elliptical-shaped eggs (AB, B1); and those of Chinese origin (AC, AC29) have gray-green and oval-shaped eggs. The color of chorion is white to Japanese breed and yellow to those of Chinese breed. Both color of embryo and the egg chorion represent characters used for selection of silkworms.

From Table 1, the average of Romanian breeds 597±45.5 eggs in terms of prolificacy and 90.46±42.05 of hatching percent % are above the mean (567±45.5) eggs that of other breeds used in industrial growth.

Egg size, is a character of breed, with the longitudinal axis of 1.5 mm and 1 mm transverse axis; these dimensions are correlated with the number of eggs in a gram (between 1300 to 2000...
eggs). Regarding number of eggs/hatching from Figure 1 can be observed that is a slight decrease of the total number of eggs deposited by a female butterfly in year 2008 compared to 2001 year. Regarding the number of hatching eggs (Fig. 2), for silkworms breed AC and AB in 2008 has a slight increase in the number of eggs hatched.

A very important character is the percentage of hatching (Fig. 3), the lowest percentage of hatching was recorded at breed AC 29 (93.05%), a higher value than that obtained for the same breed by Bențea et al. 2003 (90.71%), while the maximum value for this characters has been found at breed AC (96.62%).

The values obtained are comparable with those reported in literature Trag et al. (1992), which found for the parental breeds, a number of 520-630 eggs/hatching, others authors as Bentea (2006) obtained the following values: 505-660 eggs/hatching, Vassileva et al. (2004) reported a total of 506-560 of number of eggs/hatching and Rao et al. (2003), 415-458 of eggs/hatching. The study also allowed as performing a classification of the analyzed breeds according to biological characteristics, the best conserved over the time was one breed of Japanese origin (B1) and one of Chinese origin (AC).

**CONCLUSION**

In this study, we demonstrated that biological characters of silkworm eggs were well preserved in time and we didn’t find any significant variations between both set of data taken in study. In the number of eggs/hatching we found a slight decrease in the total number of eggs deposited by a female butterfly in 2008 compared to the year 2001. The breeds AC and AB in 2008 had a slight increase in the number of hatched eggs compared with 2001. The percentage of hatching was comparable with the data found in literature. In our research, in the characters evaluated (color of eggs, number of eggs, hatching percent, and number of days between hatching), we didn’t found an significant difference between the two different years when the research was conducted.

**REFERENCES**


**Tab. 1. Biological parameter of eggs. Average values of biological characters in Bombyx mori, genetic germplasm, egg phase (Cristina Bojan, 2008).**

<table>
<thead>
<tr>
<th>No.</th>
<th>Breeds origin</th>
<th>Prolificacy</th>
<th>Hatching percent %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>China</td>
<td>517.5 ± 24</td>
<td>90.15 ± 0.90</td>
</tr>
<tr>
<td>2.</td>
<td>Japan</td>
<td>586 ± 24.5</td>
<td>88.86 ± 2.26</td>
</tr>
<tr>
<td>3.</td>
<td>Romania</td>
<td>597 ± 45.5</td>
<td>90.46 ± 42.05</td>
</tr>
<tr>
<td>4.</td>
<td>Average</td>
<td>567 ± 31.33</td>
<td>89.82 ± 15.07</td>
</tr>
</tbody>
</table>


