International Journal of Early Childhood Special Education (INT-JECSE)
DOI: 10.48047/INT-JECSE/V15I3.9 ISSN: 1308-5581 Vol 15, Issue 03 2023

INFLUENCE OF MOISTURE IN DETERMINING QUALITY INDICATORS OF COCOONS

Mirsaatov Ravshanbek Muminovich -doctor of technical sciences, professor,
Tashkent State Transport University, Republic of Uzbekistan, mirsaatov61@mail.ru
Khudoyberganov Sardorbek Baxodirovich – junior research fellow,
Research Institute of Silk Industry,Republic of Uzbekistan, sarrux@inbox.ru

Abstract

This article aims to develop and improve the methods of acceptance of cultivated cocoons according to quality indicators, determination of cocoon shell mass and silkiness, to determine the quality indicator of received cocoons, including the influence of cocoon moisture on cocoon silkiness. Based on the results of the experiment, using the mathematical statistics method, the mass of the samples of mulberry silkworm cocoons, the mass of the shell of the cocoons, and the silkiness of the cocoons samples, as well as the mass of the cocoons, the mass of the shell of the cocoons, and the silkiness of the cocoons samples were determined. Equations for calculating the values of cocoon moisture (W) of the corrections to be made in the determination have been found.

Keywords: cocoon, silkiness, cocoon moisture, cocoon mass, cocoon shell mass.

INTRODUCTION

Currently, special attention is being paid to the rapid development of the silk industry in the Republic of Uzbekistan, as well as to the production of raw silk and silk products with high quality indicators and competitive in the world market. In this regard, research has been conducted for several years to determine the quality indicators of cocoons, including silkiness, with a precise and quick method, as well as to improve its quality. Silkiness of cocoons depends on several external factors, one of which is humidity. Humidity affects the geometric dimensions of the living cocoon. The main thing is to change the size of the cocoon. The cocoon and the cone are fundamentally different from each other in terms of origin and physical properties. According to the results of the conducted research, the quality indicators of cocoons depend on the humidity of the environment. A change in the humidity of the environment leads to a change in the quality indicators of the cocoons.

So, we need to take into account the moisture content when determining the mass of mulberry silkworm cocoon samples, the shell mass of cocoon samples, and the silkiness of cocoon samples[1,2].

Methods

In this work, a complex systematic approach to solving the problem, based on the methods of researching complex systems, methods of cause and effect analysis of various factors affecting the quality indicators of living cocoons were chosen. Research and analysis methods such as random numbers (results of observations in tests and measurements), analytical and experimental methods, measurement errors and uncertainties, statistical methods and comparative analysis are used in conducting research[3].

At the time of delivery of grown cocoons to reception points, cocoons may have different moisture content due to natural conditions or subjective factors or sorption properties. The silkiness determined by cutting cocoons with different moisture content in one batch of cocoons can vary significantly, therefore, determining the quality parameters of cocoons is one of the most important tasks, because the high moisture content of the delivered cocoons leads to overpayments to cocoon growers at the receiving points.

Therefore, it is necessary to take into account the effect of humidity when determining the amount of real silk in a living cocoon and the mass of the cocoon. We determine the dependence of cocoon mass, cocoon shell mass and cocoon silkiness on moisture content of cocoon samples using the following expressions:

$$M_{qob.} = a \cdot W + b \quad (1)$$

$$M_{pil.} = a \cdot W + b \quad (2)$$

$$Sh = \frac{M_{qob.}}{M_{pil}} \cdot 100\% \quad (3)$$

here:M_{qob}–the mass of the cocoon shell [g]; M_{pil}–cocoon mass [g]; Sh– silkiness of cocoons [%];W – moisture content of cocoon samples [%]; a – is a correction factor that depends on the size of the cocoon, the mass of the shell, the geometric dimensions of the measuring container and is determined by experiment during each cocooning season;b – free term.

In order to determine the silkiness of live cocoons, the cocoon mass and the cocoon shell mass depending on the humidity, 250 g of cocoon samples are selected from the submitted batch and experiments are carried out until the moisture content of the cocoons reaches the conditioned humidity, i.e. 11%[5,6] .

Cocoon moisture is determined by the following expression:

$$W = \frac{m_1 - m_2}{m_2} \cdot 100\% \quad (4)$$

here: m_1 – mass of cocoon samples, g;
m_2 – post-hatching mass of cocoon samples, g.

Results

Based on the experiments, the results of determining the mass of cocoon samples, the mass of the cocoon shell and the dependence of the silkiness of the cocoons on humidity are presented in Table 1.

Table 1. The dependence of the mass of cocoon samples, the mass of the cocoon shell and the silkiness of cocoons on humidity

W, %	11	20	30	40	60	80	100
M_{pilla}, g	26,67	44,44	66,67	88,89	133,33	200,00	250,00
ΔM_{pilla}, g	0	17,77	40,00	62,22	106,66	173,33	223,33
$M_{qob.}$, g	5,87	9,86	14,97	20,43	31,59	49,01	62,50
$\Delta M_{qob.}$, g	0	3,99	9,1	14,56	25,72	43,14	56,63
Sh, %	22,00	22,18	22,45	22,98	23,69	24,50	25,00
ΔSh,%	0	0,18	0,45	0,98	1,69	2,50	3,00

W – moisture content of cocoon samples, [%];
M_{pilla} – mass of cocoon samples, [g];
ΔM_{pilla} – the difference in the mass of the cocoons by the percentage of moisture of the samples of cocoons, [g];
$M_{qob.}$ – shell mass of cocoon samples, [g];
$\Delta M_{qob.}$–the difference in the mass of the cocoon shell according to the percentage of moisture of the cocoon samples, [g].

We determine the coefficients "a" and "b" in the equation y = a·x+$b$by the method of least squares using the following formulas:

$$a = \frac{n \cdot \sum W \cdot M_{qob.} - \sum W \cdot \sum M_{qob.}}{n \cdot \sum W^2 - (\sum W)^2} \quad (5)$$

$$b = \frac{\sum W^2 \cdot \sum M_{qob.} - \sum W \cdot M_{qob.} \cdot \sum W}{n \cdot \sum W^2 - \sum W \cdot \sum W} \quad (6)$$

in this, n – number of measurements (n=7), x=W –moisture in the cocoon (%), y= Sh – silkiness value of cocoon samples (%), y= M_{pilla} – value of mass of cocoon samples (g), y= $M_{qob.}$ – value of shell mass of cocoon samples (g).

Based on the results presented in Table 1, the formulas of the dependence of the mass of cocoon samples, the mass of the shell of cocoon samples and the silkiness of cocoon samples, found by the method of small squares, are as follows:

$$M_{pil} = 2.401 \cdot W + 3.516 \quad (7)$$

$$M_{qob} = 0.610 \cdot W - 0.754 \quad (8)$$

$$Sh = 0.034 \cdot W + 21.66 \quad (9)$$

Based on the results presented in Table 1, graphs of the mass of cocoon samples, the mass of the shell of cocoon samples, and the silkiness of cocoon samples are shown in Figures 1, 2, and 3.

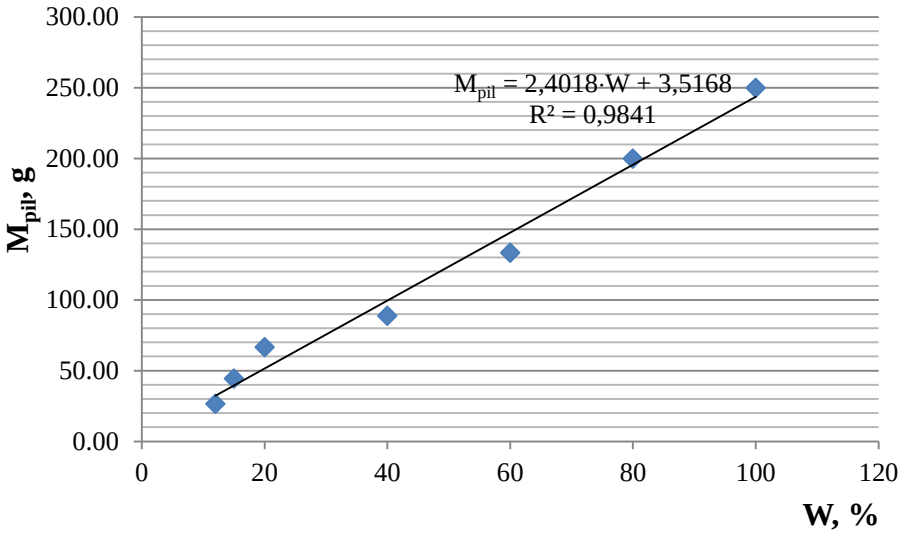

Figure 1. Dependence of mass of cocoon samples on humidity.

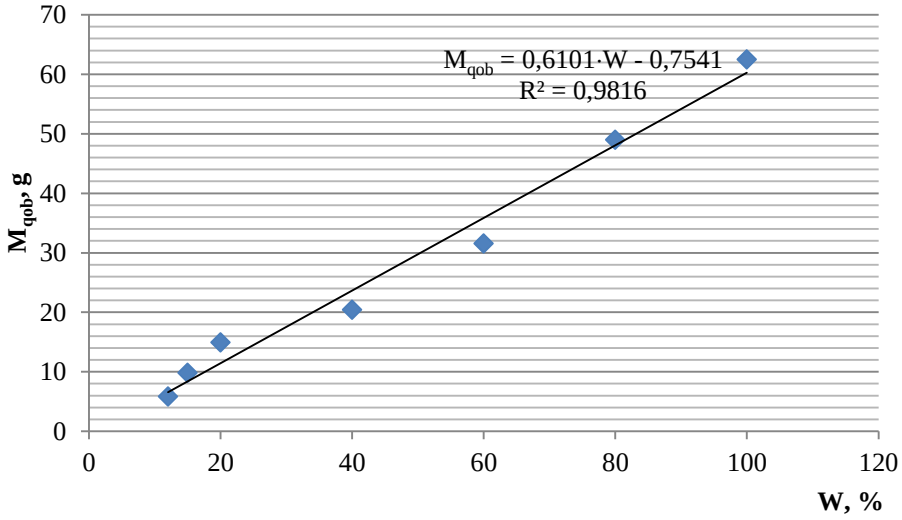

Figure 2. Dependence of the shell mass of cocoon samples on humidity.

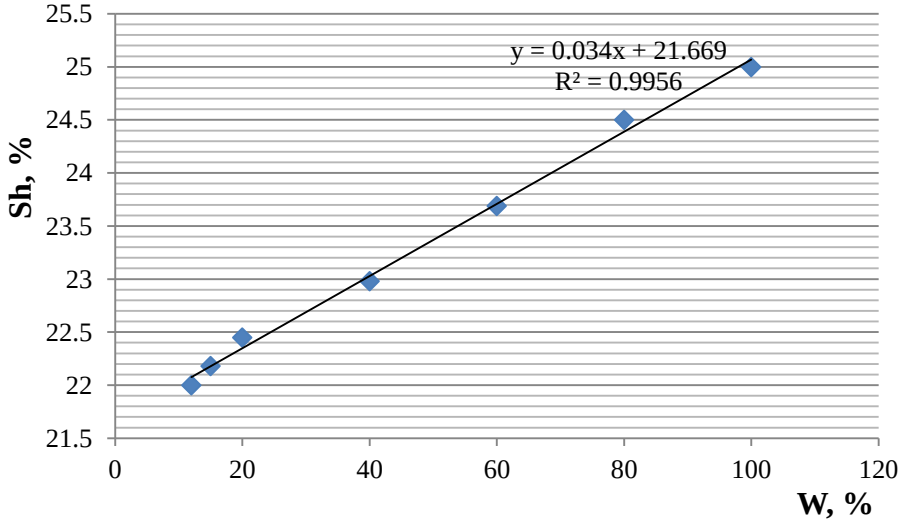

Figure 3. Dependence of cocoon silkiness on humidity.

As expected, the mass of the cocoon samples, the mass of the shell of the cocoon samples and the silkiness of the live cocoon samples were directly proportional to the moisture content.

According to the results of the conducted research, when the humidity of the delivered cocoons changes from 11% to 100%, the mass of the cocoons is 26.67 g. to 250 g, the mass of the cocoon is 5.87 g. to 62.5 g, and silkiness of cocoons was found to change from 22% to 25%. It can be seen from this that silkiness was 25% at 100% humidity of cocoons, and silkiness was 22% when cocoons humidity reached the conditioned humidity of 11%.

Based on the results presented in Table 1, the corrections to be made in determining the mass of cocoon samples, the mass of the shell of cocoon samples, and the silkiness of cocoon samples, i.e. ΔM_{pilla} (g), ΔM_{qob} (g) and ΔSh (%) cocoon moisture (W) graphs of connection to are presented in the 4th, 5th, and 6th pictures.

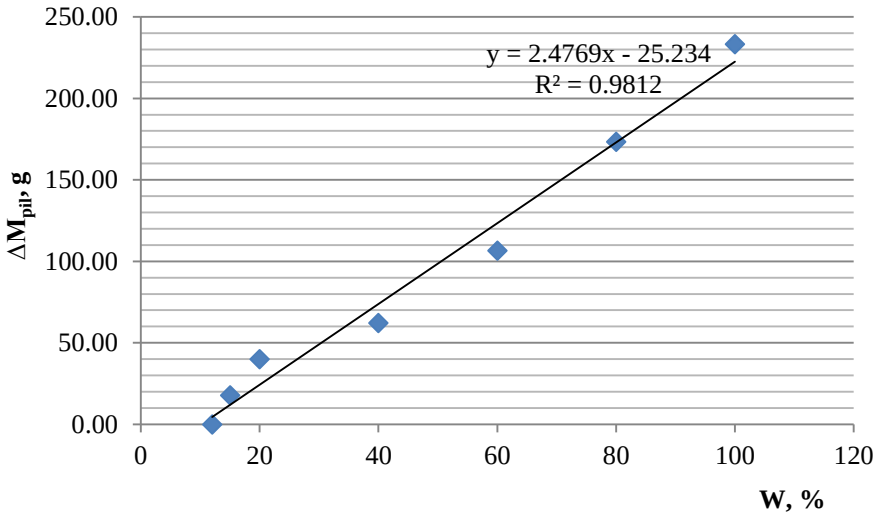

Figure 4. Correction to be made when determining the mass of cocoon samples ΔM_{pilla} (g) versus moisture (W) graph

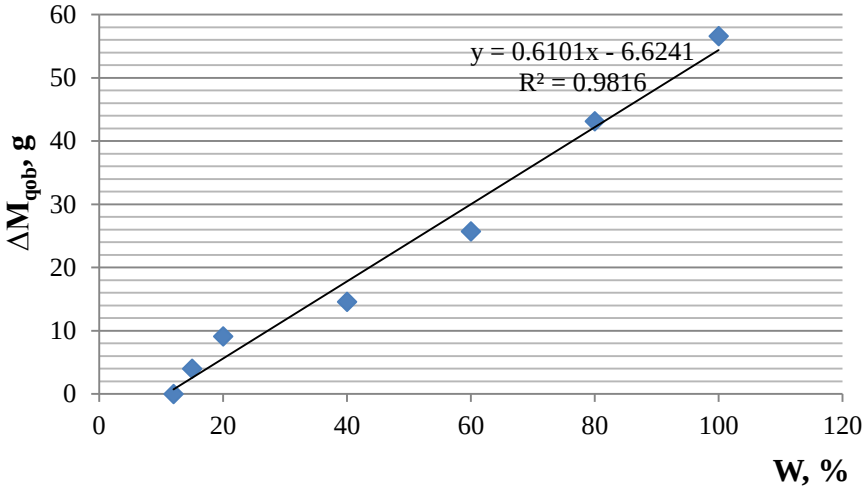

Figure 5. Correction for the determination of the mass of the shell of cocoon samples Graph of relation of ΔM_{qob}(g) to humidity (W)

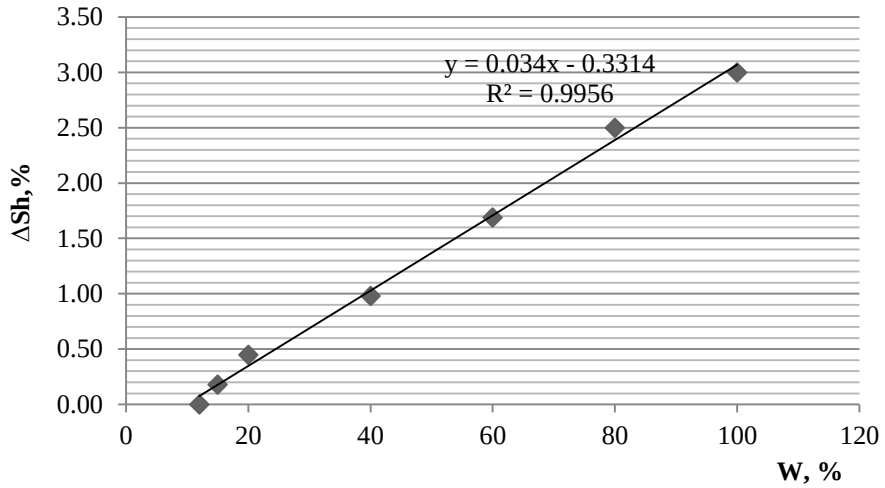

Figure 6. A correction to be made when determining the silkiness of cocoon samplesΔSh (%) vs. humidity (W) graph

Corrections to be made in determining the mass of cocoons, the mass of the cocoon shell and the silkiness of the cocoons by determining the coefficients "a" and "b" by the method of least squares, i.e. ΔM_{pilla} (g), ΔM_{qob}(g) and ΔSh (%) depending on the moisture content of the cocoons (W) We create the equation of straight lines:

$\Delta M_{pill} = 2.476 \cdot W - 25.23$ (10)

$\Delta M_{qob} = 0.610 \cdot W - 6.626$ (11)

$\Delta Sh = 0.034 \cdot W - 0.331$ (12)

Using equations (10), (11) and (12), we determine the values of ΔMpilla (g), ΔMqob(g) and ΔSh (%) for an arbitrary percentage of moisture in live cocoons at the cocoon reception points, and calculate the actual values of cocoon quality parameters 2- can be determined using the table.

Table 2. Values of cocoon moisture (W) corrections for cocoon sample mass, cocoon shell mass and cocoon silkiness

W (%)	11	15	19	21	23	25	35	45
ΔM_{pilla} (g)	4,482	11,91	21,814	26,766	31,718	36,67	61,43	86,19
ΔM_{qob}(g)	0,694	2,524	4,964	6,184	7,404	8,624	14,724	20,824
ΔSh (%)	0,077	0,179	0,315	0,383	0,451	0,519	0,859	1,199

The calculated values of cocoon moisture (W) of the corrections to be made in determining cocoon mass, cocoon shell mass and cocoon silkiness for the delivered cocoon batches are entered into the computer and determined by correcting the actual values of cocoon mass, cocoon shell mass and cocoon silkiness.

Conclusion

Thus, in order to reduce the proportion of cocoons that cause significant economic damage to the sericulture industry, it is proposed to determine the silkiness of a cocoon sample of 250 g of constant mass, designed to determine the silkiness of live cocoons without cutting. In this case, the difference in silkiness was -3% when cocoon moisture and cocoon moisture reached the conditioned moisture, i.e. 11%.

According to the results of the conducted research, when the humidity of the delivered cocoons changes from 11% to 100%, the mass of the cocoons is 26.67 g. to 250 g, the mass of the cocoon is 5.87 g. to 62.5 g and silkiness of cocoons was found to change from 22% to 25%.

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