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Influence of Maturity on the Quality Characteristics of Cocoons

Rakhimov A.YU., Kodirov Z.A., Rakhimov A.A., Parpiev S.F.

Candidate of technical sciences, associate professor. Department of Life Safety. Andijan machine-building institute, Andijan, Uzbekistan.

Base doctoral student. Department of Hydropneumonia, Andijan machine-building institute, Andijan, Uzbekistan.

Base doctoral student. Department of Life Safety. Andijan machine-building institute, Andijan, Uzbekistan.

Assistant. Department of Hydropneumonia, Andijan machine-building institute, Andijan, Uzbekistan.

ABSTRACT: This article analyzes the effect of early harvesting of raw cocoons on the amount of cocoon harvest, quality indicators, properties of cocoons and cocoon shells, moisture and silkworm cocoon.

KEY WORDS: Maturity, cocoon, caterpillar, shell, pupa, removal of a cocoon, procurement point, defect, moisture, shelf-life, length of continuously unwinding thread, standard deviation, coefficient of variation, coefficient of correlation, storage.

I. INTRODUCTION

The Republic of Uzbekistan is one of the leading countries in the world for the production and processing of silkworm cocoons. But the quality of the cocoons produced, its silkiness, the length of the continuously unwinding cocoon thread, the linear density and inequalities in this indicator, the breaking load of raw silk and other indicators do not meet the requirements of the world standard. The indicated disadvantages of the cocoon and its shell negatively affect the physical and mechanical characteristics of the produced raw silk, silk fabrics and finished products obtained from them[1].

II. LITERATURE SURVEY

Due to the low quality of the produced cocoons, the cost of the products obtained increases, the export potential of enterprises decreases, and the flow of foreign currency decreases. All this negatively affects the economic performance of the industry as a whole.

To eliminate the above-mentioned problematic issues arising in the production of cocoons, it is necessary to conduct research to improve the technology of production and processing of cocoons, which are one of the most important ways to solve this problem.

On the 8th day after the 4th molt, the silkworm caterpillar curls its cocoons for 3 days and turns into a pupa in 36-48 hours. However, the curling of cocoons does not begin at the same time, approximately in the following ratio: on the 8th day -30-35%, on the 9th day -45-50%, on the 10th day -10-12% and on the 11th day - the remaining 5 - 10% of the tracks.

It depends on the feeding conditions of the silkworm and the microclimate created in the room where the cocoons are grown. Depending on the uniformity of feeding the caterpillars and compliance with a temperature of 24-25⁰ C and a relative humidity of 60-70% under conditions of systematic ventilation, weaker lighting in sufficient quantity in the feeding room, all silkworms start perming at 2-3 days, and sometimes at 5- 6 days [2].

III. RESEARCH METHOD

The maturity of the cocoon is determined by the metamorphosis of the caterpillar into a butterfly, when the process of curling the shell is completed and the pupa is covered with a strong chitinous skin.

The removal of cocoons earlier than 7-9 days of the beginning of the mass ascent of caterpillars to cocoons leads to the fact that immature cocoons make up a high proportion of the total mass. Such cocoons distort the mass characteristics of the batches when they are accepted at the procurement points, and as a result of external influence during removal and transportation, the curling is suspended. Although during temporary storage at procurement stations and bases for primary processing of cocoons, most of the caterpillars manage to curl the shell and turn into a pupa, the suspension of the curling process does not pass without leaving a trace - hidden defects (thread breaks) form inside the



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shell, reducing its quality, in particular, the length of the continuously unwinding thread is reduced and the yield of raw silk. Thus, in most cases, the delivery of immature cocoons is caused by the desire of silkworm breeders to overestimate the physical mass of a batch of cocoons to the detriment of their quality [3, 4].

To study the degree of negative impact of the delivery of immature cocoons on mass (moisture and silkiness) and technological (length of continuously unwinding thread) characteristics, experimental studies were carried out on the basis of primary processing of cocoons of the Andijan region in Zhalalkuduk and Bulokbashi districts.

Studies of the influence of the degree of maturity of cocoons on their characteristics were carried out on 20 experimental batches, the content of immature cocoons in which ranged from 10 to 90%. The average content of immature cocoons for all the batches studied was 56.08-4.55%, the standard deviation ($\sigma = 21.2 \pm 1.04\%$ and the coefficient of variation $C = 1.86\%$, which is generally confirmed by S.D. Lavrentiev [3].

IV. THE OBTAINED RESULTS

It is known that during storage, cocoons with an immature pupa lose more weight. According to our data, as a result, in the above 20 batches, the cocoons lost in weight on average: on the first day after harvesting from $7.8 \pm 0.7\%$ to $5.1 \pm 0.3\%$, on the second day, respectively, from 6.0 ± 0.6 to $3.2 \pm 0.4\%$ and on the third day - 4.9 ± 0.5 to 3.3 ± 0.3 instead of the norm of 1.25%.

Reception - the delivery of lots with immature cocoons artificially increases the implementation of the plan and just as artificially reduces the duration of the season for harvesting cocoons. Therefore, in areas where such harvesting is allowed, there is a significantly higher coefficient of release of dry cocoons from living ones, causing an increase in the cost of air-dry cocoons.

Harvesting unripe cocoons also causes great harm by robbing and intense weight loss. At the same time, along with immature cocoons, mature ones also deteriorate.

Unpopulated caterpillars do not withstand high temperatures even during the initial processing, they burst, and the liquid flowing out of the body turns the cocoons into marriage. At the same time, the varietal cocoons lying nearby also get dirty.

The moisture content and silkiness are closely related to the content of immature cocoons in the batch. It is known that batches of cocoons after harvesting (weighing) are inevitably stored for up to one day at procurement points, and then, after delivery to the base of primary processing of cocoons, most of the cocoons are stored for another 4-5 days before launching and processing. In the early days of blanks, the cocoons are stored for accumulation, in order to be able to start up the heating units in continuous operation. Subsequently, the cocoons are forced to be kept alive, since the volume of their harvest exceeds the throughput of the units.

Research shows that whatever the reason, any storage of cocoons in a living state leads to the maturation of the pupa, a decrease in moisture and an increase in the silkiness of the cocoons. This is confirmed by the results given in table-1, characterizing changes in the statistical characteristics of cocoons in terms of maturity, moisture content of cocoons and silkiness at the time of harvesting and after storage for four days.

For the calculation, we used data on the Zhalalkuduk base of primary processing of cocoons and the Bulokbashi base of primary processing of cocoons.

Experimental studies confirm that keeping calm for several days reduces the content of immature cocoons. At the Zhalakuduk base of primary processing of cocoons for four days of storage, the number of immature cocoons decreased more than 6 times (from 54.8 ± 8.7 to $2.58 \pm 0.45\%$), and at the Bulokbashi base of primary processing of cocoons from 61.3 ± 5.0 to $9.33 \pm 2.5\%$.

It goes without saying that, according to the days of storage, the number of cocoons in which the waving and metamorphosis of the caterpillar into the pupa ends is uneven, but on average over four days the content of immature cocoons decreased by 13% per day.

Table 1

Changes in the statistical characteristics of the number of immature cocoons,
moisture and silkiness depending on the age of the cocoons

Indicators	Designation	Zhalakuduk POK base		Bulokboshinskaya base POK	
		before storage	after 4 days storage in boxes	before storage	after 4 days storage in boxes
Content of immature cocoons,%	X	54,8 ± 8,7	2,58 ± 0,45	61,3 ± 0,45	9,33 ± 2,5
	σ	23,4 ± 6,0	1,22 ± 0,31	13,31 ± 3,5	6,75 ± 1,73
	C	42,7 ± 10,6	47,0 ± 5,4	21,7 ± 5,7	72,3 ± 18,5
Moisture content of cocoons,%	W	175,6±3,52	140,5±8,15	184,8±8,84	144,3 ± 6,3
	σ	7,88±2,33	17,76±5,36	7,65±5,40	5,46 ± 3,86
	C	4,49±1,33	12,66±3,82	4,14±2,9	3,77 ± 2,66
Cladding moisture,%	W _o	16,15 ± 2,2	9,52 ± 1,46	11,96 ± 1,1	10,3 ± 1,76
	σ	5,63 ± 1,54	3,92 ± 1,01	2,96 ± 0,78	4,9 ± 1,20
	C	38,4 ± 9,54	41,17 ± 10,57	24,95 ± 0,65	30,0 ± 8,0
Silk content,%	III	19,7 ± 0,53	22,0 ± 0,83	17,9 ± 0,53	24,0 ± 1,27
	σ	1,44 ± 0,37	1,44 ± 0,37	1,44 ± 0,37	3,44 ± 0,86
	C	7,30 ± 1,9	8,00 ± 2,05	8,00 ± 2,05	13,78 ± 3,50

Simultaneously with maturation, the moisture content of cocoons and shells decreases. At the same time, the moisture content of the cocoons decreased by 35.1 and 40% (abs), and the moisture content of the shell in the first batch, respectively, by 6.63 and 1.66% (abs).

As you might expect, silkiness depends on the age of the cocoons. The older the living cocoon in age, the higher the silkiness. For the first batch, after four days of storage, the silk-bearing capacity of cocoons increased from 19.7 to 22% (by 2.3% abs., Or 11.6% rel.), And for the second batch - from 17.9 to 24% (by 6.1% abs., Or 34% rel.).

Correlation analysis of the dependence of the above parameters of cocoons on the degree of their maturity (table-2) shows that despite the low values of the paired correlation coefficients, they are significant, because in all cases, the design criteria t are greater than the tabular values and there is a linear relationship between them.



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Table 2

Correlation links between the degree of maturity of the original batch of cocoons,
their silkiness and moisture

The relationship between the degree of maturity of cocoons	Correlation coefficient
Weight loss on storage for four days	+ 0,355
Moisture of cocoons	+ 0,430
Silk-bearing cocoons	- 0,470

V. CONCLUSIONS

The result of the study "shows" the presence of immature cocoons in harvested lots negatively affects the mass and technological properties of cocoons, with an increase in the proportion of immature cocoons in a lot, the moisture of cocoons and their shells increases, weight loss during storage decreases silkiness and increases the cost of dry cocoons.

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