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INCUBATOR DESIGN FORREVIVALS SILKWORM SEEDS

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Abstract
This article analyzes the effectiveness of a new incubator design for reviving silkworm eggs. In the course of the study, an incubator based on a rotating disk was created to control the parameters of the microclimate and ensure uniform development of eggs. In this system, temperature, humidity and CO2 levels are monitored using the SCD 41 and other sensors. The results showed that using the new incubator, silkworm eggs were revived 4.1% faster than using traditional methods, and the cocoon yield increased by 5.8%. Thanks to the high efficiency of the new construction, the economic efficiency of silk production will increase and the possibility of producing high-quality silk will expand. Thus, the construction of an innovative incubator opens up opportunities for using new approaches in sericulture.

Keywords Silkworms, Incubator design, Microclimate control, Rotating disk, Sensors, Temperature control, Humidity level, Water level CO2, Viability, Cocoon yield, Innovative approach, Cost-effectiveness.

INTRODUCTION

Sericulture plays an important role in the national economy, especially the result of the silkworm breeding process is crucial for the production of high-quality silk fibers. For successful silkworm rearing, it is first of all important to properly organize the incubation period of eggs. [2] By precisely controlling the microclimatic conditions during incubation, it is possible to ensure healthy development and even growth of eggs. [7] In this context, providing ideal conditions for the revival of silkworm eggs by creating efficient and modern incubator systems shows its relevance.[3,8,10]

Traditional methods of incubating silkworm EGGs are time-consuming and often difficult to maintain an optimal microclimate. There are shortcomings in controlling important factors such as temperature, humidity, and air circulation that can hinder egg development. [5] Therefore, there is a need to improve the design of incubators using innovative methods and mechatronic systems. In this study, a new incubator system with microclimate control based on a rotating disk is proposed, which allows for more efficient organization of egg development conditions. [1,4]

The main goal of the presented research is to create a modern incubator for the uniform development of silkworm eggs. This incubator creates precise temperature and humidity control

using a rotating disk and other mechatronic components. It also aims to continuously monitor and manage the microclimate conditions inside the incubator by installing cooling, heating and ventilation systems. In this way, the process of regeneration of silkworm eggs is optimized and the soil for growing high-quality silk fiber is created.[3]

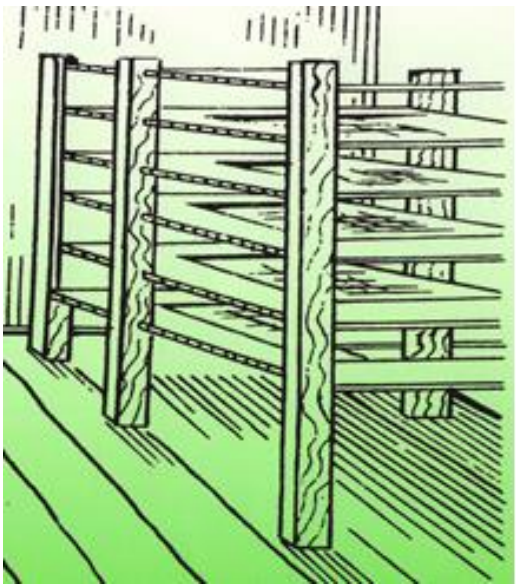

Fig. 1. Traditional hatchery design

So, this article will show you how to design an incubator based on the size of the turntable to successfully incubate silkworm eggs. The incubator, equipped with cooling, heating and ventilation systems, serves to improve the growth of silkworm eggs by regulating the microclimate. The results of this study will help create practical solutions to improve the efficiency of sericulture and high-quality silk production.

METHODS

In this study, an incubator system based on a rotating disk was developed for the uniform development of silkworm eggs. During the design process, the size and speed of rotation of the disk were taken into account as the main factors. It is expected that the rotation of the disk will create a uniform microclimate around the eggs, so that the eggs will have the same temperature and humidity level.[6] The radius, thickness, and materials of the rotating disk were selected, and the location of components inside the incubator and the distance between moving parts were determined.

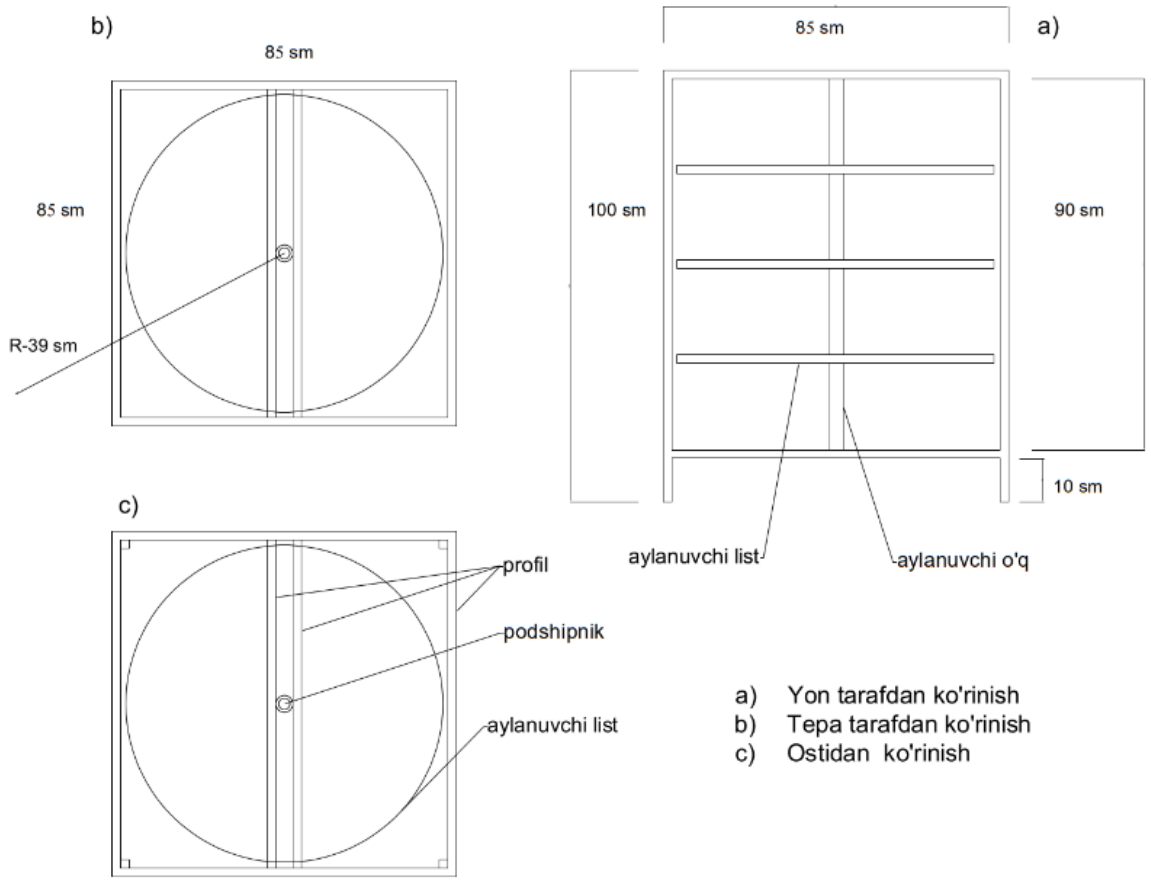

Fig. 2. Design drawing of the new hatchery

Various sensors for monitoring microclimate parameters were used in the design of the incubator system. In this system, the SCD 41 sensor was selected to monitor the humidity level, and the CO2 sensor was selected to monitor the carbon dioxide level. The information received by the sensors is used to control the movement of the rotating disk and other mechatronic systems.[9] The location of sensors is also an important factor, since they track and evenly distribute the microclimate conditions in each layer inside the incubator.

An electric heater has been installed at the bottom of the incubator to ensure optimal system temperature. The electric heater starts automatically when the temperature does not reach the desired level, and turns off when the set temperature is reached. This serves to maintain an optimal temperature for the eggs inside the incubator. Since the temperature level is constantly monitored, this helps to avoid unnecessary cooling or heating of the eggs during development, resulting in a uniform incubation environment.[10]

Another important part of the incubator is the cooling system, which keeps the internal temperature at a normal level when the heat level increases. The refrigerator starts when the outside temperature is high or the ventilation system is not cooling enough. This helps prevent overheating inside the incubator and ensures that eggs develop in stable conditions. The location and efficiency of the refrigerator allow for a safe and efficient

microclimate for eggs.

RESULTS

By building the incubator in a new design, significant improvements were made in the revival of silkworm eggs. With the help of sensors and control systems, microclimate factors, including temperature, humidity and air circulation, were maintained at an optimal level. According to the results obtained, the stability of these indicators had a great impact on the uniform development of eggs. This allowed silkworm eggs to survive in uniform and stable conditions, providing better performance than traditional methods.

During the experiment, the results of reviving silkworm eggs were compared with traditional incubation methods. According to the study, thanks to the new design of the incubator, the egg survival rate increased by 4.1%. This difference depends on the content of eggs in optimal conditions as a result of precise control of the microclimate parameters. It is due to the control of temperature and humidity that eggs develop in the same conditions and achieve high survival rates.

Fig. 3. 3D- view of the design of the new incubator.

As a result of controlling the microclimate inside the incubator, the cocoon yield also significantly improved compared to traditional methods. As a result of research, it was noticed that the yield of cocoons increased by 5.8%. This is due to the creation of conditions that ensure the uniform development and healthy growth of eggs. The optimized microclimate has promoted the growth of silkworms, promoted the production of high-quality silk fibers, and improved overall productivity.

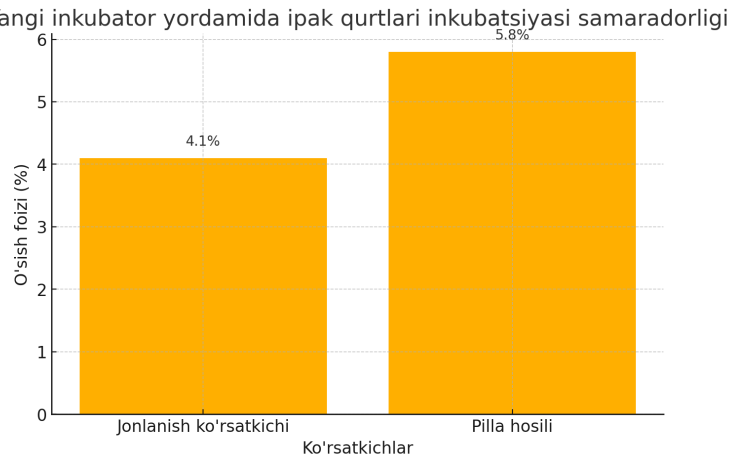

Fig. 4. Efficiency of silkworm incubation using a new incubator

Full control of microclimatic conditions by means of control systems ensured an even distribution of temperature and humidity inside the incubator. Thanks to the rotation of the disk and mechatronic control, temperature and humidity were evenly distributed in the layers where the eggs were located, which ensured healthy egg development. As a result, the microclimate was optimally controlled and distributed evenly, which had a positive effect on the egg recovery process.

DISCUSSION

This study demonstrated the benefits of controlling the microclimate with a new incubator design when incubating silkworm eggs. Compared to traditional methods, thanks to the rotating disk of the incubator, eggs were always kept at the same temperature and humidity, as well as ensuring their uniform development. This resulted in healthy egg development and increased overall survival. This technological approach opens up great opportunities for improving the efficiency of silk production and may be further developed in the future.

The use of control systems has shown its effectiveness in precise control of the microclimate. In particular, continuous monitoring of temperature and humidity parameters using sensorsSCD 41 and CO2 created stable conditions for eggs. The data collected by these sensors is processed by an automatic control system that maintains a balance of temperature, humidity and air flow. The results showed that thanks to the use of sensors, egg survival was high, which confirms the effectiveness of the new system.

The cooling and heating systems installed to control the microclimate in the incubator also successfully coped with their task. These systems helped maintain optimal conditions inside the incubator, especially when the outside temperature was too high or too low. These components provided a stable microclimate inside the incubator and contributed to the uniform development of eggs. Studies have shown that the use of cooling and heating systems significantly reduces external factors affecting the development of silkworm eggs.

The ventilation system used in the study played an important role in ensuring the necessary air circulation for the eggs. When the CO2 level rises, the ventilation system automatically starts refreshing the air inside the incubator. This, in turn, created conditions that ensured healthy egg development and preserved the microclimate. At the same time, due to the uniform distribution of

air circulation, eggs developed in the same microclimatic conditions, productivity and quality indicators improved. This study confirmed the effectiveness of the ventilation system.

Brief content

This study demonstrated the advantages of a modern incubation system for successfully growing silkworm eggs. Stable egg development was ensured by constant monitoring of the microclimate parameters using a rotating disk and control systems. This incubator design has produced superior results compared to traditional methods and created new opportunities to increase productivity in sericulture. The new system provided the conditions necessary for the development of silkworm eggs.

The results of the study showed that the survival rate of silkworm eggs increased by 4.1%, and the yield of cocoons increased by 5.8%. These indicators confirmed the effectiveness of the new incubator and its advantage over traditional methods. By controlling the microclimate conditions, the eggs developed at optimal temperature and humidity. This makes it possible to get high-quality products in silk production. Using this system, it is possible to increase the economic efficiency of sericulture.

Due to the combination of control systems and a rotating disk, caviar development was ensured in the same conditions. The temperature, humidity and CO2 levels inside the incubator were constantly monitored by sensors and ventilation systems. This system has proven to be effective in controlling the microclimate, resulting in a high-quality silkworm crop. It has been shown that this method of managing microclimatic conditions is an important factor in the successful cultivation of silkworms.

CONCLUSION

In conclusion, it should be noted that the incubator equipped with a rotating disk and a mechatronic system turned out to be a modern and effective solution for the successful incubation of silkworm eggs. This research has opened up new opportunities for achieving higher quality and efficiency in sericulture. In the future, this incubator design can be further developed and applied to other sericulture technologies to improve yield and production efficiency.

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