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EFFECT OF USING MECHATRONIC MULTILAYER SILKWORM FEEDER ON PRODUCTIVITY

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Abstract
In this study, a mechatronic system was developed for the care of silkworms in multi-layer feeders. This system allows you to monitor and monitor the humidity and temperature in each layer using the DHT11 sensor. The results showed that humidity and temperature were kept stable by a mechatronic system, which positively affected the growth of silkworms and the production of high-quality silk. Compared to traditional methods, the system has made it possible to use resources more efficiently and save energy. The mechatronic system allows you to make the process of growing silkworms efficient and stable. This suggests that the method has great prospects in the development of the silk industry.

KEYWORDS: Silkworms, mechatronic system, multi-layer feeders, humidity control, DHT11 sensor, microclimate conditions, automated control, Silk quality, energy efficiency, Silk industry, care technologies, optimal weather conditions.

INTRODUCTION

For successful maintenance of silkworms and obtaining high-quality silk from them, it is important to ensure optimal microclimatic conditions.[1] Factors such as temperature, humidity, and air renewal affect healthy silkworm growth and good silk weaving.[2] traditional silkworm feeding methods are usually carried out outdoors, which limits the ability to constantly monitor the microclimate. Under these conditions, it is becoming increasingly difficult for silkworms to produce silk of the same quality and quantity. Therefore, the use of new technologies, in particular mechatronic systems, becomes a necessity.[3]

The technology of growing silkworms in multi-tiered feeders allows you to effectively organize the care process. The multi-layer system creates conditions for simultaneous care of mulberry

silkworms in large quantities, which allows for more efficient use of the territory. However, in a multi-layer system, maintaining uniform humidity and temperature on each floor is a challenge. On different floors, climatic conditions can be different, which can affect the growth of worms. Therefore, it is important to independently control the humidity for each floor.[4,10]

An excellent solution in this regard is Mechatronic systems, which make it easier to ensure an optimal microclimate in each layer.[5] Mechatronic systems include various sensors and actuators that allow you to monitor and control conditions by sharing them. For example, humidity and temperature sensors such as DHT11 can be used to monitor and analyze air humidity.[6] These sensors allow automatic control of the system in case of excessive or low humidity. This gives silkworms more advantages over traditional feeding methods to ensure optimal humidity.[7]

Mechatronic control systems based on the DHT11 sensor allow you to effectively control the humidity between the rack floors.[8,9] using this technology, humidity is constantly monitored on each of the floors where silkworms feed, and changes according to their needs. Thus, the climate in each layer is maintained the same, which allows silkworms to grow optimally and produce high-quality silk. Thanks to this control mechanism, the silkworm rearing process provides more stable and high-quality results than before. [11]

METHOD

In the course of the study, a mechatronic system was developed for the care of silkworms in multi-layer feeders. The main purpose of this system is to provide optimal microclimatic conditions for worms and ensure their constant monitoring. Succulents consist of several layers, and humidity and temperature must be controlled separately in each layer. DHT11 humidity and temperature sensors, a ventilation system, and controllers were installed as components of the system. This system ensures the same climatic conditions in each layer.

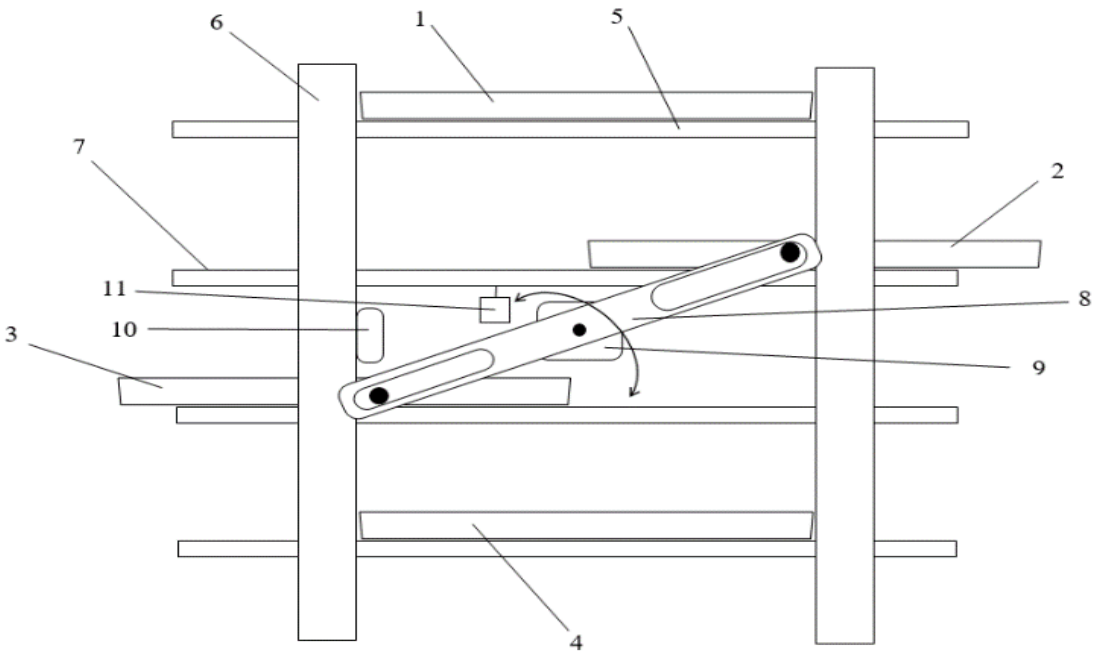

Figure 1. Arduino plus DHT-11 temperature and humidity sensor

DHT11 sensors are used to detect humidity and air temperature, which allows you to constantly monitor the climatic conditions on each floor. Each layer contains a DHT11 sensor connected to the system. Sensors constantly collect information and transmit it to the central control unit. The control unit analyzes incoming information and determines the required level of humidity and temperature for each floor. If the humidity or temperature deviates from the set level, appropriate measures are taken.

To control the humidity level, a special humidifying device was built into the system. This allows the device to automatically raise the humidity when necessary. Based on data from the DHT11 sensors, the system decides whether to increase or decrease the humidity level. For example, if there is not enough moisture between floors, the system starts the humidifier. Thus, maintaining an optimal level is achieved by constantly monitoring the humidity in each layer.

The ventilation system is also an important part of the mechatronic system. To ensure air circulation between floors, the ventilation system is turned on. DHT11 sensors monitor air quality, and humidity and temperature are maintained at the same level in the layers due to air circulation. The ventilation system can be controlled separately for each floor, creating suitable conditions for silkworms. Air exchange is essential for maintaining a worm-friendly climate.

RESULTS

The results obtained using the mechatronic system showed significant improvements in the care of silkworms. This system helped maintain a stable air humidity and temperature, which contributed to the healthy growth of silkworms. According to the results of measurements using DHT11 sensors, the humidity in each layer was maintained at the level of 60-70%, and the temperature-in the range of 25-28°C. These optimal microclimatic conditions were suitable for silkworms and had a positive effect on their growth and development.

The results of humidity monitoring showed that the humidity level in each layer was maintained more stable than with traditional methods. In multi-layer feeders, almost no changes in humidity were observed in each layer, and the same humidity level was maintained between these layers. Based on the results obtained, it was observed that proper operation of the humidifier and ensuring the sensitivity of the system helped to create better conditions for worms. This stability has helped to improve silk quality and increase productivity.

Table 1. The need of silkworm in air humidity at different ages

Age period	Optimal air humidity (%)
1st age	85-90
2nd age	80-85
3rd age	75-80
Age 4	70-75
Age 5	65-70

Experimental results showed that the mechatronic system also effectively controls the temperature. The system constantly monitored the temperature and turned on the ventilation system if necessary. Thanks to temperature control, adverse conditions

harmful to the development of silkworms were prevented. Tests have shown that the temperature control mechanism has a positive effect on the development of worms and the production of high-quality silk. The temperature stability allowed more silk to be produced.

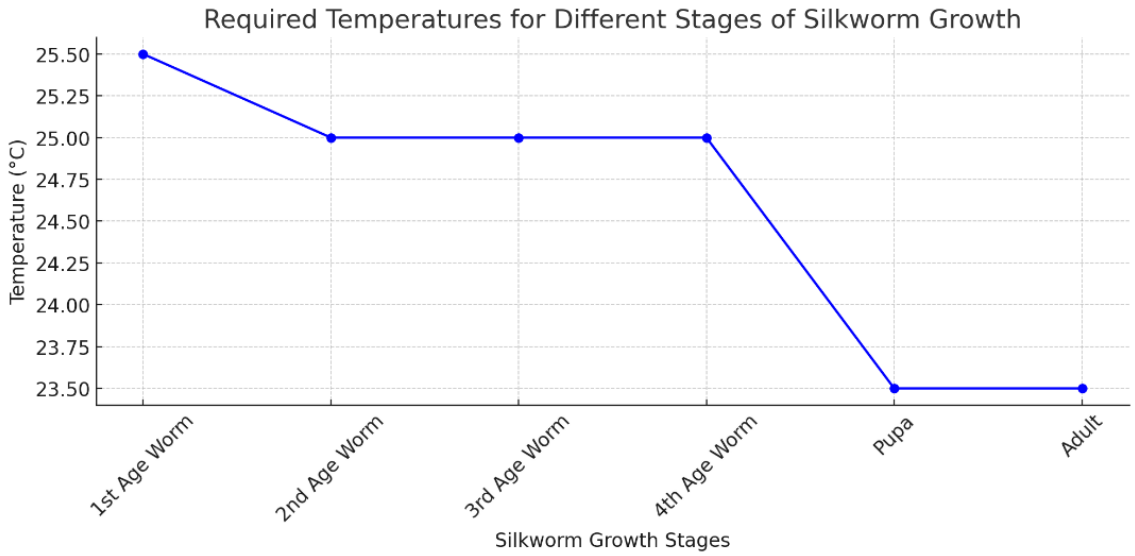

Figure 2. Silkworm demand for air humidity at different ages

Qualitative indicators of silkworm growth also showed significant improvements. Since the worms grown using the mechatronic system were less stressed during the growth process, the length and quality of the silk fibers obtained from them were higher than with traditional methods. It was also noticed that more silk fibers were obtained and the quality of silk improved. These results show that the mechatronic system is effective in growing silk in multi-layer feeders.

DISCUSSION

The results of this study demonstrated the effectiveness of mechatronic systems in the care of silkworms. Compared to traditional methods of growing silkworms, it was easier to keep the air humidity and temperature at the same level with the help of a mechatronic system. The creation of stable conditions by this system has led to an improvement in the development of silkworms. The automated system management function made it possible to make the maintenance of silkworms more efficient and stable.

The results showed that the mechatronic system is able to maintain the same humidity and temperature on each floor. This condition, in turn, had a positive effect on the growth of silkworms, as silkworms are less stressed when kept in constant conditions of the same humidity and temperature. It is also established that using this method, it is possible to obtain silk of constant and uniform quality during the care process. These results confirm the advantages of the mechatronic system over traditional methods.

Although the study found that changes in humidity and temperature have a significant impact on the development of silkworms, the mechatronic system made it easy to control these factors. The data obtained with the DHT11 sensor laid the foundation for automatic control of the system. Since optimal conditions were created in each layer, a stable climate was ensured in the process of growing silkworms. This management system has played an important role in improving the efficiency of silkworm cultivation.

It has also been shown that the use of energy and resources can be made more efficient by using a mechatronic system. Thanks to automatic control

in the system, humidity and temperature are adjusted only when necessary, which saves energy. This is especially important for economical use of resources in multi-storey cottages. While traditional methods required more use of resources, overall costs were reduced by effectively managing and controlling resources with a mechatronic system.

CONCLUSION

This study proved the effectiveness of the mechatronic system in growing silkworms on multi-layer feeders. Compared to traditional methods of care, this technology allows you to create more comfortable conditions for silkworms. With the help of a mechatronic system, air humidity and temperature were kept stable, which allowed silkworms to be less stressed during the growth process. This creates the necessary conditions for improving the development of worms and obtaining high-quality silk.

It has been shown that the DHT11 sensor can solve the problem of ensuring optimal humidity and temperature in each layer. These sensors made it possible to constantly monitor and monitor the environment in which mulberry silkworms were cared for. The system is equipped with a mechanism that automatically increases it when the humidity level decreases, which serves to eliminate the difference in humidity between layers. Thanks to this process, stable conditions are provided, which has a positive effect on the sustainable growth of the silkworm.

The results showed that the mechatronic system not only improves the quality of silk cultivation, but also increases economic efficiency. Due to the constant monitoring of climatic conditions in each layer, resources can be used sparingly. For example, a humidifier works only when it is needed, which reduces energy consumption. Thus, the process of growing silk using a mechatronic system was efficient and cost-effective.

Thus, the use of a mechatronic system in the care of mulberry silkworms proved to be an innovative solution that provides stable and effective results. The system ensured the creation of favorable conditions for the growth of silkworms, economical use of resources and the possibility of obtaining high-quality silk. In the future, through the development and wider application of this technology, the silk industry can be further improved and higher efficiency can be achieved. However, the results of this study provide a solid scientific basis for other studies.

REFERENCES

1. Akhmadzhonov, S., & Murodov, K. (2019). Silkworm care technologies. Tashkent: Publishing house of the National Encyclopedia of Uzbekistan.
2. Бекмуродова, З. (2021). "The importance of humidity and temperature control in feeding silkworms," Journal of Agricultural Sciences, 12(3), 67-72.
3. Kim, H., and Park, S. (2018). "Applying Mechatronics to Agriculture: Improving productivity with automation." Journal of Mechatronics and Agricultural Engineering, 25(4), 234-242.
4. Mardonov, Yu. (2020). Creating microclimatic conditions in the silk industry. Tashkent: Vostok Publishing House.
5. Nazarov, B., & Holmatov, S. (2017). "Mechatronic Systems for Environmental Control in Sericulture." Sericulture Journal of Environmental Science, 15 (2), 102-109.
6. Park, J., And Lee, M. (2016). "Humidity and temperature control in multi-layer silkworm transfer racks." International Journal of Sericulture Research, 19(1), 58-66.
7. Rakhmanov, F. (2018). "The advantages of automated systems in the care of silkworms."Scientific And Practical Agricultural Journal, 10(2), 85-91.
8. RAO, P. S., And Kumar, M. (2020).Mechatronic Approaches to Precision Agriculture. New York: Springer.
9. Smith, L., & Wong, T. (2019). "DHT11 Sensors in Agricultural Applications: Case Study in Humidity Control." Journal of Agricultural Sensors and Control, 27(4), 148-155.
10. Tursunov, I., & Karimov, A. (2019). "Theoretical

foundations of mechatronic systems for the care of multilayer silkworms." Agriculture And Technology, 7(5), 123-130.

11. Wang, Yu., & Chen, H. (2017). Temperature and humidity monitoring systems for silkworm treatment. Beijing: Agricultural University Press.

12. Zhang, H., & Liu, R. (2021). "Advances in Mechatronic Systems for Climate Control in Insect Rearing." Journal of Mechatronic Systems, 36(1), 200-210.