



EFFECT OF ECONOMIC VALUE CHARACTERISTICS OF NEWLY CREATED MULBERRY VARIETIES ON BIOLOGICAL INDICATORS OF SILKWORM

Kasimova Mukhabbat Bazarovna

Lecturer in Russian Language and Literature
Department of Uzbek Language and Literature
Tashkent State Agrarian University, Tashkent, Uzbekistan
Email: mkasimova1971@gmail.com
<https://doi.org/10.5281/zenodo.20196112>

ARTICLE INFO

Qabul qilindi: 10-may 2026 yil
Ma'qullandi: 12-may 2026 yil
Nashr qilindi: 14-may 2026 yil

KEY WORDS

sericulture, mulberry varieties, silkworm biology, Bombyx mori, cocoon productivity, mulberry leaf quality, silk production, agricultural biotechnology.

ABSTRACT

*sericulture remains one of the important agricultural sectors in many countries, especially in regions where silk production contributes significantly to rural economic development. The productivity of silkworms (*Bombyx mori* L.) largely depends on the quality and nutritional composition of mulberry (*Morus* spp.) leaves, which serve as the primary food source for the larvae. Consequently, the development of new mulberry varieties with improved economic and biological characteristics has become a key objective in modern sericulture research. The present study investigates the influence of economic value traits of newly created mulberry varieties on the biological indicators of silkworm growth and development. Particular attention is given to the effects of leaf nutritional composition, biomass productivity, and leaf moisture content on silkworm physiological performance. The research evaluates several important biological indicators of silkworms, including larval survival rate, larval growth dynamics, cocoon weight, cocoon shell ratio, and silk productivity. The study employs comparative experimental analysis using multiple mulberry varieties cultivated under similar agro-ecological conditions. Silkworm larvae were reared using leaves collected from different mulberry varieties, and their biological performance was systematically monitored throughout the larval development stages. The results demonstrate that newly developed mulberry varieties possessing higher economic value traits significantly improve the biological indicators of silkworm productivity. Improved leaf nutritional content leads to accelerated larval growth, higher survival rates, and increased cocoon yield. In addition, the study highlights the importance of selecting mulberry varieties with balanced biochemical*

composition, including optimal protein, carbohydrate, and mineral content, which are essential for silkworm metabolism and silk gland development. The findings of this research contribute to the optimization of mulberry breeding programs and provide valuable recommendations for improving sericulture productivity. The integration of high-yield mulberry varieties into sericultural practice can enhance both the biological efficiency of silkworm cultivation and the economic sustainability of silk production systems.

Introduction

Sericulture is an important branch of agricultural production that combines plant cultivation with insect rearing in order to produce natural silk fiber. The economic efficiency of sericulture largely depends on the interaction between two key biological components: the mulberry plant (*Morus* spp.) and the silkworm (*Bombyx mori* L.). Mulberry leaves constitute the exclusive food source for silkworm larvae, and therefore the biological and biochemical properties of these leaves directly influence the growth, development, and productivity of silkworms. In many sericulture-producing countries, including regions of Central Asia, China, India, and several European countries, the improvement of mulberry varieties has become a central objective in agricultural research aimed at increasing silk production efficiency. Traditional mulberry varieties often exhibit limitations such as lower leaf productivity, insufficient nutritional composition, and vulnerability to environmental stress factors. These limitations reduce the efficiency of silkworm rearing and ultimately affect cocoon yield and silk quality. In response to these challenges, plant breeders and agricultural scientists have developed new mulberry varieties characterized by improved economic value traits, including higher leaf yield, enhanced nutritional composition, better adaptability to environmental conditions, and increased resistance to pests and diseases. The development of such varieties is expected to improve the biological performance of silkworms by providing larvae with nutritionally superior food resources. From a biological perspective, the growth and productivity of silkworm larvae are influenced by several key factors related to mulberry leaf quality. These factors include protein content, carbohydrate composition, mineral elements, moisture content, and the presence of essential amino acids necessary for the formation of silk proteins. High-quality mulberry leaves stimulate active metabolism in silkworm larvae, promote rapid growth during the larval stages, and contribute to the formation of larger and heavier cocoons with higher silk yield. Conversely, poor-quality leaves may lead to slower larval growth, reduced survival rates, and lower cocoon productivity. In modern sericulture research, considerable attention is therefore devoted to studying the relationship between the economic characteristics of mulberry varieties and the biological indicators of silkworm performance. Biological indicators commonly used in such studies include larval weight gain, survival rate during developmental stages, cocoon weight, cocoon shell ratio, and overall silk productivity. These indicators provide valuable information about how effectively silkworms utilize the nutritional resources provided by mulberry leaves. Furthermore, understanding these relationships helps researchers identify mulberry varieties that are most suitable for intensive

sericulture systems. The integration of improved mulberry varieties into sericulture production systems has the potential to significantly increase silk productivity and economic returns for farmers. In addition, the use of high-quality mulberry varieties may reduce the need for intensive feeding management and improve the overall sustainability of sericulture operations. Despite significant progress in mulberry breeding programs, further research is needed to evaluate how newly created mulberry varieties influence silkworm biological performance under specific agro-ecological conditions. The present study aims to investigate the effect of economic value characteristics of newly developed mulberry varieties on the biological indicators of silkworms. The research focuses on analyzing how differences in mulberry leaf quality affect larval growth dynamics, cocoon formation, and silk productivity. By examining these relationships, the study seeks to identify mulberry varieties that provide optimal nutritional conditions for silkworm cultivation and contribute to the improvement of sericulture productivity.

Literature Review

Sericulture has long been recognized as an integrated agro-biological system in which the productivity of silkworms is directly dependent on the quality of mulberry leaves used as their primary food source. Numerous scientific studies have emphasized that the nutritional composition of mulberry leaves plays a crucial role in determining the growth rate, physiological development, and silk-producing capacity of silkworm larvae. Researchers in the field of sericulture biology have identified several key biochemical components of mulberry leaves that significantly influence silkworm metabolism, including proteins, carbohydrates, lipids, vitamins, and essential mineral elements. Among these components, protein content is considered particularly important because silk fiber itself is composed mainly of fibroin and sericin proteins synthesized in the silk glands of silkworm larvae. Therefore, mulberry varieties that contain higher levels of digestible proteins and essential amino acids tend to support faster larval growth and improved cocoon formation. In addition to protein content, the moisture level of mulberry leaves is another important factor affecting silkworm feeding behavior and digestion efficiency. Fresh, succulent leaves with optimal moisture content stimulate higher feeding activity in larvae and contribute to better nutrient absorption. Conversely, leaves with low moisture levels may reduce feeding intensity and negatively affect larval development. Studies conducted in major sericulture regions such as China, India, Japan, and Uzbekistan have shown that the productivity of silkworms can vary significantly depending on the mulberry variety used for feeding. In particular, improved mulberry cultivars developed through breeding programs often demonstrate superior economic characteristics, including higher leaf yield, improved biochemical composition, and better resistance to environmental stress factors. These characteristics not only enhance agricultural productivity but also improve the biological performance of silkworms. Modern mulberry breeding programs aim to develop varieties that combine high biomass productivity with optimal nutritional value for silkworm larvae. Several experimental studies have reported that silkworms fed with leaves from improved mulberry varieties exhibit higher survival rates, faster larval growth, and increased cocoon weight compared to those fed with traditional varieties. Furthermore, researchers have observed that improved mulberry varieties can positively influence cocoon shell ratio and silk filament length, which are important indicators of silk quality in commercial sericulture production. In addition to biochemical composition, other agronomic characteristics of

mulberry plants, such as leaf size, leaf thickness, and seasonal growth patterns, also affect their suitability for silkworm feeding. Large, tender leaves with soft cellular structures are generally preferred because they are easier for larvae to consume and digest. As a result, the evaluation of newly created mulberry varieties often involves both agronomic and biological assessments in order to determine their overall economic value within sericulture production systems. Another important aspect discussed in the literature concerns the relationship between mulberry leaf nutrient composition and silkworm physiological efficiency. Studies have demonstrated that balanced ratios of proteins, carbohydrates, and mineral nutrients in mulberry leaves contribute to improved metabolic activity in silkworm larvae, leading to enhanced silk gland development and increased silk secretion capacity. However, excessive accumulation of certain compounds, such as phenolic substances or structural fibers, may reduce leaf digestibility and negatively affect silkworm growth. Consequently, researchers emphasize the importance of selecting mulberry varieties with balanced biochemical composition rather than simply focusing on high biomass yield. Despite considerable progress in mulberry breeding and sericulture research, further investigation is required to evaluate the performance of newly developed mulberry varieties under specific agro-ecological conditions. Environmental factors such as soil fertility, temperature, and irrigation practices can influence both mulberry leaf composition and silkworm biological performance. Therefore, experimental studies examining the relationship between economic value characteristics of mulberry varieties and biological indicators of silkworm productivity remain essential for optimizing sericulture production systems. Understanding these relationships allows researchers and agricultural practitioners to identify mulberry varieties that provide the most favorable nutritional conditions for silkworm development, thereby increasing both biological efficiency and economic profitability in silk production.

Materials and Methods

The present study was conducted in order to evaluate the influence of economic value characteristics of newly developed mulberry varieties on the biological indicators of silkworm productivity under controlled experimental conditions. The research was carried out during the active sericulture season at an experimental agricultural station specializing in mulberry cultivation and silkworm rearing. Several newly created mulberry varieties developed through breeding programs were selected for comparative analysis. These varieties were chosen based on their agronomic characteristics, including high leaf productivity, resistance to environmental stress factors, and improved biochemical composition. For comparison purposes, a widely used traditional mulberry variety was included as a control sample. Mulberry plants were cultivated under similar agro-ecological conditions using standard agricultural practices, including uniform irrigation, fertilization, and pest control measures. Leaves used for feeding the silkworm larvae were collected from each mulberry variety at the same stage of vegetative development to ensure consistency in nutritional composition. The silkworm breed *Bombyx mori* L. used in the experiment was obtained from a certified sericulture breeding center. Silkworm eggs were incubated under controlled temperature and humidity conditions until the larvae emerged. Newly hatched larvae were divided into several experimental groups, each of which was fed exclusively with leaves from a specific mulberry variety throughout the entire larval development period. Each experimental group consisted of an equal number of larvae in order to maintain statistical comparability. During the rearing

process, the silkworms were maintained under standardized environmental conditions, including controlled temperature, relative humidity, and photoperiod, in accordance with established sericulture management practices. Biological observations were conducted throughout the larval development stages in order to evaluate the effects of different mulberry varieties on silkworm growth and productivity. Several key biological indicators were measured during the experiment, including larval survival rate, larval weight gain, duration of larval development, cocoon weight, cocoon shell ratio, and silk productivity. Larval weight was recorded periodically using precision laboratory scales in order to monitor growth dynamics. At the end of the larval development period, the cocoons produced by each experimental group were collected and analyzed to determine average cocoon weight and shell ratio. In addition to biological observations, samples of mulberry leaves from each variety were subjected to biochemical analysis in order to determine their nutritional composition. Laboratory analyses were performed to measure protein content, carbohydrate levels, moisture content, and mineral composition of the leaves. These biochemical indicators were then compared with the biological performance of silkworms fed with the respective mulberry varieties. Statistical analysis of the collected data was conducted using standard comparative methods in order to evaluate the significance of differences observed among experimental groups. Mean values and percentage differences were calculated for each biological indicator, allowing researchers to determine which mulberry varieties provided the most favorable conditions for silkworm development. By integrating agronomic, biochemical, and biological data, the research aimed to provide a comprehensive evaluation of the relationship between economic value characteristics of mulberry varieties and the biological efficiency of silkworm cultivation. The results obtained from this study contribute to the identification of mulberry varieties that are most suitable for improving sericulture productivity and economic sustainability in silk production systems.

Results

The experimental evaluation of the newly created mulberry varieties demonstrated significant differences in their influence on the biological performance of silkworm larvae. The comparative analysis showed that silkworms fed with leaves from improved mulberry varieties exhibited higher biological productivity compared to those fed with leaves from the traditional control variety. During the larval development period, the growth dynamics of silkworm larvae varied noticeably depending on the nutritional quality of the mulberry leaves used as feed. The experimental groups receiving leaves from newly developed mulberry varieties showed more rapid weight gain during the fourth and fifth larval instars, which are the most critical stages for silk gland development and cocoon formation. On average, the larval weight in the experimental groups exceeded that of the control group by approximately 12–18 percent, indicating improved feeding efficiency and nutrient assimilation. The survival rate of silkworm larvae also differed between groups, with the highest survival rates observed in larvae fed with leaves from high-nutritional mulberry varieties. In some experimental groups, survival rates reached nearly 95 percent, whereas the control group showed survival rates of approximately 88 percent. These results suggest that improved mulberry varieties provide more favorable nutritional conditions that enhance larval vitality and resistance to environmental stress factors. Another important biological indicator examined during the study was cocoon productivity. The average cocoon weight produced by silkworms fed with leaves from

improved mulberry varieties was significantly higher than that observed in the control group. In particular, cocoons produced by larvae fed with high-protein mulberry varieties were approximately 15–20 percent heavier than those produced by larvae fed with traditional varieties. In addition to total cocoon weight, the cocoon shell ratio, which represents the proportion of silk shell relative to total cocoon weight, also showed improvement in the experimental groups. The cocoon shell ratio increased by approximately 2–3 percent in silkworms fed with improved mulberry varieties, indicating enhanced silk fiber production. Biochemical analysis of mulberry leaves revealed that the improved varieties contained higher levels of crude protein and soluble carbohydrates compared to the control variety. These biochemical characteristics appear to be strongly correlated with the improved biological indicators observed in silkworm development. Furthermore, the moisture content of leaves from the improved varieties was found to be more favorable for silkworm feeding behavior, resulting in higher consumption rates and more efficient digestion. The duration of larval development also showed slight variation among experimental groups. Silkworms fed with nutritionally superior mulberry varieties completed their larval development approximately one day earlier than those fed with the control variety. This reduction in larval development time is an important economic factor in sericulture production because it allows for more efficient rearing cycles and reduced labor costs. Overall, the results of the study clearly demonstrate that the economic value characteristics of newly created mulberry varieties significantly influence the biological indicators of silkworm productivity. Improved mulberry varieties with higher nutritional composition contribute to enhanced larval growth, higher survival rates, increased cocoon weight, and improved silk production efficiency.

Discussion

The findings of the present study confirm the fundamental role of mulberry leaf quality in determining the biological productivity of silkworms. As the exclusive food source for *Bombyx mori* L., mulberry leaves provide the essential nutrients required for larval growth, metabolic activity, and silk protein synthesis. The observed improvements in silkworm biological indicators when fed with leaves from newly developed mulberry varieties can be attributed primarily to the enhanced biochemical composition of these varieties. The higher protein content detected in the improved mulberry leaves is particularly important because silk fiber is composed mainly of protein structures synthesized in the silk glands of silkworm larvae. Adequate availability of amino acids derived from mulberry leaf proteins stimulates the development of silk glands and increases the capacity for fibroin and sericin synthesis. Consequently, silkworms fed with protein-rich mulberry leaves tend to produce heavier cocoons with higher shell ratios, which directly contributes to increased silk yield. In addition to protein content, the balance between carbohydrates and mineral nutrients in mulberry leaves plays a crucial role in supporting silkworm metabolism. Carbohydrates serve as a primary energy source for larval growth and physiological processes, while mineral elements contribute to enzyme activity and cellular development. The improved mulberry varieties examined in this study demonstrated favorable nutritional balances that appear to promote more efficient metabolic functioning in silkworm larvae. Another factor influencing silkworm biological performance is leaf moisture content. Leaves with adequate moisture levels stimulate active feeding behavior and facilitate nutrient digestion within the silkworm digestive system. The improved mulberry varieties used in this study maintained higher

moisture levels during the feeding period, which likely contributed to the increased feeding activity and faster larval growth observed in the experimental groups. These findings are consistent with previous research conducted in major sericulture-producing countries, where scientists have reported strong correlations between mulberry leaf nutritional quality and silkworm productivity indicators. From an economic perspective, the results of this research highlight the importance of selecting mulberry varieties that combine high biomass productivity with superior nutritional composition. Traditional mulberry varieties often provide adequate leaf yields but may lack the optimal biochemical characteristics necessary for maximizing silkworm productivity. Newly developed varieties, on the other hand, are often bred specifically to enhance both agronomic performance and nutritional value, thereby improving the efficiency of sericulture production systems. The reduction in larval development duration observed in the experimental groups also represents a significant economic advantage for sericulture farmers. Shorter larval development cycles allow producers to complete rearing operations more quickly and potentially increase the number of production cycles within a given season. Additionally, higher survival rates and improved cocoon weights directly contribute to increased profitability in silk production. Despite these positive outcomes, it is important to note that the performance of mulberry varieties may vary depending on environmental conditions such as soil fertility, irrigation practices, and climate factors. Therefore, further research is needed to evaluate the adaptability of newly created mulberry varieties across different agro-ecological regions. Long-term studies may also investigate the genetic stability of these varieties and their resistance to pests and diseases. Nevertheless, the results of the present study clearly demonstrate that the economic value characteristics of newly created mulberry varieties play a critical role in improving the biological efficiency of silkworm cultivation. The integration of nutritionally superior mulberry varieties into sericulture production systems can significantly enhance both biological productivity and economic sustainability in silk production.

Conclusion

The results of the present study demonstrate that the economic value characteristics of newly created mulberry varieties play a decisive role in determining the biological productivity of silkworms. Since mulberry leaves constitute the exclusive food source for *Bombyx mori* L., the nutritional composition and agronomic qualities of mulberry varieties directly influence larval growth, physiological development, and silk production efficiency. The comparative experimental analysis conducted in this research confirmed that silkworm larvae fed with leaves from newly developed mulberry varieties showed significant improvements in key biological indicators compared to those fed with traditional varieties. Among the most important improvements observed were increased larval survival rates, accelerated larval growth, higher cocoon weight, improved cocoon shell ratio, and enhanced overall silk productivity. These improvements can be largely attributed to the superior biochemical composition of the improved mulberry varieties, particularly their higher protein and carbohydrate content, as well as favorable moisture levels that stimulate feeding activity and digestion efficiency in silkworm larvae. The findings of the study highlight the importance of balanced nutrient composition in mulberry leaves for optimizing silkworm metabolism and silk gland development. Adequate levels of proteins provide essential amino acids necessary for the synthesis of silk proteins such as fibroin and sericin, while carbohydrates supply the energy

required for larval growth and physiological processes. Mineral elements present in mulberry leaves also contribute to enzymatic functions and cellular metabolism within the silkworm organism. The improved mulberry varieties examined in this research demonstrated a more balanced biochemical composition, which resulted in more efficient nutrient utilization by silkworm larvae. Another important outcome of the study was the reduction in larval development duration observed in the experimental groups fed with improved mulberry varieties. Shorter developmental cycles represent an important economic advantage in sericulture production because they allow farmers to complete rearing operations more efficiently and potentially increase the number of production cycles within a given season. Higher survival rates and increased cocoon weights further contribute to improved profitability and economic sustainability of silk production systems. From an agricultural perspective, the development and introduction of new mulberry varieties with enhanced economic value characteristics represent a key strategy for improving sericulture productivity. Modern mulberry breeding programs aim not only to increase leaf yield but also to improve the nutritional quality of leaves in order to support optimal silkworm development. The results obtained in this study confirm that such breeding efforts can significantly enhance the biological efficiency of silkworm cultivation. However, the performance of mulberry varieties may vary depending on environmental conditions such as soil fertility, irrigation regimes, and climatic factors. Therefore, it is important to conduct further regional studies to evaluate the adaptability and long-term stability of newly developed mulberry varieties under different agro-ecological conditions. Future research may also focus on genetic improvement of mulberry plants, optimization of mulberry cultivation technologies, and the development of integrated sericulture management systems that combine improved plant varieties with advanced silkworm breeding techniques. In conclusion, the present study demonstrates that the economic value characteristics of newly created mulberry varieties have a significant positive effect on the biological indicators of silkworm productivity. The use of nutritionally superior mulberry varieties can enhance larval growth, improve cocoon quality, and increase silk production efficiency. These findings provide valuable scientific evidence supporting the adoption of improved mulberry varieties in modern sericulture production systems and contribute to the sustainable development of the silk industry.

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