Comparative Analysis of Weight Performance Among Fifth Instar Silkworm Hybrids

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ABSTRACT

Sericulture remains an important agro-based enterprise that contributes to rural livelihood, employment, and the textile industry through the production of natural silk. Among the factors influencing silk productivity, the genetic potential of silkworm hybrids plays a significant role in determining larval growth and subsequent cocoon yield. Although several *Bombyx mori* hybrids are available for commercial production in the Philippines, limited information exists regarding their comparative growth performance under the environmental conditions of Nueva Vizcaya. This study evaluated the fifth instar weight performance of four silkworm hybrids reared under local conditions to identify the hybrid with the greatest growth potential.

The experiment was conducted from September to December 2025 at the Philippine Science High School Rearing House, Nueva Vizcaya, in collaboration with the Philippine Textile Research Institute (PTRI) Benguet Laboratory. Four silkworm hybrids were evaluated using a Completely Randomized Design (CRD) consisting of four treatments and three replications. The treatments included SW116 (control), SW101, JC102, and CJ102. Fifth instar larval weight was measured and analyzed using one-way Analysis of Variance (ANOVA), and treatment means were separated using Duncan's Multiple Range Test (DMRT) at a 5% level of significance.

Analysis of variance revealed a statistically significant difference in fifth instar larval weight among the hybrids ($F = 5.94$; $p = 0.0197$). SW101 produced the highest mean larval weight (18.46 g), which was significantly

greater than the remaining hybrids. SW116 (18.08 g), JC102 (17.91 g), and CJ102 (17.97 g) did not differ significantly from one another according to DMRT.

The findings indicate that SW101 demonstrated superior growth performance during the fifth instar under the prevailing environmental conditions of Nueva Vizcaya. The results provide useful baseline information for selecting appropriate silkworm hybrids for local sericulture production and may contribute to improving silk productivity in similar agroecological environments. Additional studies evaluating cocoon yield, shell ratio, survival rate, and silk quality are recommended to further validate the commercial potential of the identified hybrid.

Keywords:*Bombyx mori*, fifth instar, larval weight, sericulture, silkworm hybrid, growth performance, Nueva Vizcaya, Philippines

INTRODUCTION

Sericulture, the cultivation of silkworms for silk production, remains one of the most valuable agro-based industries worldwide because of its capacity to generate employment, promote rural development, and support textile manufacturing. The domesticated silkworm, *Bombyx mori* L. (Lepidoptera: Bombycidae), is the principal species used for commercial silk production owing to its high silk yield, ease of domestication, and adaptability to diverse environmental conditions. Globally, countries such as China, India, Thailand, and Vietnam continue to invest in sericulture as an important component of sustainable agricultural development, recognizing its contribution to household income and local economies. In the Philippines, government agencies such as the Philippine Textile Research Institute (PTRI) have promoted sericulture in suitable production areas, including Nueva Vizcaya and Benguet, where favorable climatic conditions support mulberry cultivation and silkworm rearing.

The productivity of silkworms is influenced by a complex interaction between genetic and environmental factors. Larval growth, particularly during the fifth instar, is considered one of the most critical determinants of cocoon production because this stage accounts for approximately 80% of the total food consumption of the larva and coincides with rapid silk gland development. Consequently, larval weight during the fifth instar has been widely used as an important indicator of growth performance, nutritional efficiency, and the potential for high cocoon yield. Variations in larval weight often reflect differences in hybrid vigor, feed utilization efficiency, metabolic activity, and adaptation to local environmental conditions.

The use of hybrid silkworm strains has become a common practice in modern sericulture because hybridization generally enhances economically important traits through heterosis or hybrid vigor. Numerous studies have demonstrated that different *Bombyx mori* hybrids vary significantly in larval growth, cocoon characteristics, survival rate, and silk productivity. These differences arise from genetic variation among hybrids and their interactions with environmental factors such as temperature, relative humidity, photoperiod, feeding management, and mulberry leaf quality. Identifying hybrids that perform consistently under specific environmental conditions is therefore essential for maximizing productivity and ensuring the sustainability of sericulture enterprises.

Environmental conditions during rearing likewise play a fundamental role in determining silkworm performance. Temperature and relative humidity directly affect larval metabolism, feeding activity, digestion, molting, and silk protein synthesis. Likewise, adequate nutrition through high-quality mulberry leaves is essential for achieving optimum larval growth. Because these environmental variables differ considerably across geographical locations, the performance of a particular silkworm hybrid in one region may not necessarily be replicated elsewhere. This

underscores the importance of conducting location-specific evaluations to determine the most suitable hybrids for local production systems.

Despite continuous efforts by the Philippine Textile Research Institute to promote sericulture throughout the country, relatively few peer-reviewed studies have compared the growth performance of commercially available silkworm hybrids under Philippine environmental conditions. Most recommendations currently adopted by local sericulture practitioners are based on generalized production guidelines or studies conducted in other countries with different climatic conditions. Consequently, there remains limited scientific evidence identifying which hybrids exhibit superior growth performance under the environmental conditions of Nueva

This study was therefore conducted to compare the fifth instar weight performance of four *Bombyx mori* hybrids reared under the environmental conditions of Nueva Vizcaya, Philippines. Specifically, it aimed to determine whether significant differences exist among the hybrids in terms of fifth instar larval weight and to identify the hybrid exhibiting superior growth performance under local rearing conditions. The findings of this study are expected to provide baseline information that may assist sericulture practitioners, researchers, and government agencies in selecting appropriate silkworm hybrids for improved silk production while contributing to the continued development of the Philippine sericulture industry.

MATERIALS AND METHODS

Study Area and Duration

The study was conducted at the Philippine Science High School (PSHS) Rearing House in the Municipality of Bayombong, Nueva Vizcaya,

Philippines, in collaboration with the Philippine Textile Research Institute (PTRI) Benguet Laboratory. The experimental site is situated at approximately **16.48° N latitude and 121.15° E longitude**, with an elevation of about **300 m above mean sea level (masl)**.

Bayombong experiences a **Type III tropical climate** based on the Modified Coronas Climate Classification, characterized by relatively indistinct wet and dry seasons. The area generally has an annual temperature ranging from **22°C to 32°C**, with moderate to high relative humidity. Rainfall is more frequent from **May to October**, whereas the relatively drier months occur from **November to April**. These environmental conditions are considered favorable for mulberry cultivation and silkworm (*Bombyx mori* L.) rearing under appropriate management practices.

The silkworm rearing experiment was conducted from **September 12 to October 3, 2025**. Data processing and statistical analyses were performed following the completion of the experimental period. The PSHS rearing house provided a controlled environment that minimized variations in temperature, humidity, and other environmental factors, thereby ensuring consistent rearing conditions throughout the study.

Experimental Materials

Silkworm stocks were obtained from the **Department of Science and Technology–Philippine Textile Research Institute (DOST–PTRI), Benguet Laboratory**. Approximately **10,000 silkworm larvae (½ box)**, consisting of individuals at the **third to fourth instar stage**, were delivered to the rearing facility on **12 September 2025**. Upon arrival, the larvae were acclimatized and maintained following standard sericulture management practices before allocation to the experimental treatments.

Four commercially available *Bombyx mori* L. hybrids were evaluated:

- **T1 – SW116 (Control)**
- **T2 – SW101**
- **T3 – JC102**
- **T4 – CJ102**

Fresh leaves of white mulberry (*Morus alba* L.) served as the sole feed source throughout the silkworm rearing period. The leaves were harvested daily from the experimental mulberry plantation maintained at the Philippine Science High School (PSHS), Bayombong, Nueva Vizcaya.

Experimental Design

The experiment was arranged using a **Completely Randomized Design (CRD)** consisting of four silkworm hybrids and three replications per treatment. Treatments were assigned through a random draw (lottery method) to minimize allocation bias. Each replication represented an independent experimental unit reared under similar environmental and management conditions.

Rearing Management

All silkworm hybrids were reared following the standard management practices recommended by the Philippine Textile Research Institute (PTRI). Larvae were maintained in rearing trays under identical husbandry conditions throughout the experiment to minimize management-related variation among treatments. Fresh mulberry leaves were supplied approximately four times daily at **8:00 a.m., 10:00 a.m., 2:00 p.m., and 5:00 p.m.**, with slight adjustments made when necessary, according to the developmental stage of the larvae. During the early rearing period, young mulberry leaves with tender stems were provided, whereas larger leaves and

whole branches were introduced as the larvae progressed to the later instars to meet their increasing nutritional requirements. Feeding frequency and the quantity of leaves provided were further increased during the fifth instar to accommodate the rapid growth and high food consumption characteristic of this developmental stage.

Routine sanitation procedures were implemented throughout the experiment. Leftover feed, feces, and other waste materials were removed through regular bed cleaning to maintain hygienic rearing conditions and reduce the risk of disease transmission. Larvae were also transferred periodically to clean rearing trays as needed to ensure a hygienic rearing environment throughout the experimental period.

Environmental Monitoring

Ambient environmental conditions within the rearing house were monitored daily throughout the experiment. Air temperature was measured using a **mercury-in-glass thermometer** with a measurement precision of **±0.5°C**, while relative humidity was determined using an **analog hygrometer** with a measurement precision of **±5% relative humidity (RH)**. Environmental readings were recorded **four times daily at approximately 8:00 a.m., 10:00 a.m., 2:00 p.m., and 5:00 p.m.**, coinciding with the routine feeding schedule, to ensure that all experimental treatments were maintained under comparable environmental conditions.

During the study period, recorded air temperatures ranged from **24.5°C to 29.1°C**, whereas relative humidity ranged from **76.2% to 86.6%**. Environmental observations were documented daily from the **fourth instar until cocoon harvesting** and were used to characterize the prevailing rearing conditions. These environmental measurements served as reference data to verify the uniformity of the rearing environment and were not considered experimental variables in the statistical analysis.

Disease Prevention and Colony Management

Routine health management practices were implemented throughout the rearing period to reduce disease incidence and maintain colony sanitation. Diseased larvae were identified through regular visual inspection and promptly removed from the colony to minimize pathogen transmission. Bed cleaning was conducted routinely, particularly during the late fourth instar and throughout the fifth instar.

Liming was performed during the fifth instar as part of routine sanitation, and formalin application was employed when disease occurrence was observed. Larvae were transferred to clean rearing beds following sanitation procedures to further reduce contamination. These management interventions were uniformly applied to the entire colony and were not considered experimental treatments.

The rearing records indicated that disease occurrence increased during the latter part of larval development, necessitating repeated removal of affected individuals. However, because disease incidence was documented for the colony as a whole rather than for each experimental treatment, disease-related observations were not included in the comparative statistical analysis.

Developmental Timeline

Larval development was monitored daily from the fourth instar until cocoon harvest. Upon arrival at the rearing facility, the larvae were at the third to fourth instar stage. Molting into the fifth instar occurred on 18 September 2025, after which the larvae underwent eight days of intensive feeding before entering the spinning stage. Fifth instar larval weight was measured on 23 September 2025, corresponding to the sixth day of the fifth

instar, when the larvae had reached near-maximum growth prior to spinning. Cocoon spinning commenced on 25 September 2025, followed by cocoon harvesting on 2 October 2025 and post-harvest drying on 3 October 2025. This developmental timeline was used to standardize rearing and management activities and ensure consistency across all treatment groups throughout the experimental period.

Measurement of Fifth Instar Larval Weight

Fifth instar larval weight served as one of the primary response variables of the study. On 23 September 2025, corresponding to the sixth day of the fifth instar, 10 larvae from each replicate were weighed individually using an SF-400 Digital Electronic Balance with a measurement precision of ±0.01 g. Individual larval weights were recorded in grams (g), and the mean larval weight for each replicate was calculated. The replicate means for each treatment were subsequently subjected to statistical analysis to evaluate differences among the four silkworm hybrids.

Statistical Analysis

Data on fifth instar larval weight were analyzed using **one-way Analysis of Variance (ANOVA)** under a **Completely Randomized Design (CRD)** to determine significant differences among the four silkworm hybrids. Prior to the analysis, the assumptions of ANOVA were evaluated by testing the **normality of data distribution** and the **homogeneity of variances**. When significant treatment effects were detected (**P < 0.05**), treatment means were separated using **Duncan's Multiple Range Test (DMRT)** at the **5% level of significance**. All statistical analyses were performed using **IBM SPSS Statistics Version 26**, and statistical significance was declared at **P < 0.05**.RESULTS

Environmental Conditions During the Rearing Period

The ambient environmental conditions recorded inside the rearing house throughout the experimental period are summarized in **Table 1**. Daily monitoring indicated that air temperature remained relatively stable, ranging from **24.5°C to 29.1°C**, while relative humidity varied from **76.2% to 86.6%** during the rearing period. These conditions were maintained uniformly for all experimental treatments and represented the common environmental conditions under which the four *Bombyx mori* hybrids were evaluated.

The recorded environmental conditions generally fell within the range considered favorable for late larval development and cocoon formation in *Bombyx mori*. Minor fluctuations in temperature and humidity were observed throughout the rearing period, reflecting normal daily variation within the rearing facility. Routine management practices, including regular feeding, bed cleaning, liming, and disease monitoring, were implemented concurrently to maintain suitable rearing conditions for all experimental units.

Because temperature and relative humidity were monitored as environmental descriptors rather than experimental treatments, these variables were not subjected to statistical analysis.

Table 1. Summary of Environmental Conditions During the Silkworm Rearing Period

Environmental Parameter	Value
Study period	September 12 – October 3, 2025
Minimum temperature (°C)	**24.5**
Maximum temperature (°C)	**29.1**
Approximate mean temperature (°C)*	**26.8**
Minimum relative humidity (%)	**76.2**

Maximum relative humidity (%)	**86.6**
Approximate mean relative humidity (%)*	**81.4**

**Values represent descriptive summaries of the environmental monitoring records maintained throughout the study and were not included as experimental response variables.*

Following the establishment of uniform environmental conditions throughout the rearing period, the growth performance of the four *Bombyx mori* hybrids was evaluated using fifth instar larval weight as the primary response variable.

Fifth Instar Larval Weight of Different *Bombyx mori* Hybrids

Table 2. Mean Fifth Instar Larval Weight of Four *Bombyx mori* Hybrids

Treatment	Hybrid	Replication 1	Replication 2	Replication 3	Mean Weight (g)	DMRT Group
T1	SW116 (Control)	17.76	18.31	18.18	**18.08**	b
T2	SW101	18.37	18.56	18.44	**18.46**	a
T3	JC102	17.78	18.03	17.93	**17.91**	b
T4	CJ102	17.89	18.10	17.92	**17.97**	b

Means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test (DMRT).

The fifth instar larval weight of four *Bombyx mori* hybrids reared under the environmental conditions of Nueva Vizcaya is presented in **Table 1**. Significant differences were observed among the evaluated hybrids ($P < 0.05$). The mean larval weights ranged from **17.91 g** to **18.46 g**, indicating variation in growth performance among the tested silkworm hybrids.

Among the four hybrids, **SW101 (Treatment 2)** exhibited the highest mean fifth instar larval weight (**18.46 g**) and was significantly superior to the remaining treatments based on Duncan's Multiple Range Test (DMRT). Conversely, **JC102 (Treatment 3)** recorded the lowest mean larval weight (**17.91 g**). The control hybrid, **SW116 (Treatment 1)**, produced a mean weight of **18.08 g**, while **CJ102 (Treatment 4)** attained a mean weight of **17.97 g**. Statistical grouping indicated that SW101 was classified separately (superscript "a"), whereas SW116, JC102, and CJ102 belonged to the same statistical group (superscript "b"), indicating no significant differences among these three hybrids.

Although the numerical differences among treatments were relatively small, the statistical analysis demonstrated that the observed variation was sufficient to detect significant differences among the evaluated hybrids. These findings suggest that genetic differences among the silkworm hybrids influenced larval weight during the fifth instar stage under the prevailing environmental conditions of the study.

Table 3. Analysis of Variance for Fifth Instar Larval Weight

Source of Variation	**Sum of Squares**	**df**	**Mean Square**	**F-value**	**P-value**
Treatment	0.5373	3	0.1791	**5.94**	**0.0197**
Error	0.2412	8	0.0302		
Total	0.7785	11			

Significant at P < 0.05.

The results of the one-way Analysis of Variance (ANOVA) are summarized in **Table 2**. The analysis revealed that silkworm hybrid significantly affected fifth instar larval weight (**F = 5.94, P = 0.0197**), indicating that at least one hybrid differed significantly from the others with respect to mean larval weight. Since the probability value was lower than the predetermined significance level of 0.05, the null hypothesis stating that no differences existed among treatments was rejected.

The treatment sum of squares accounted for **0.5373** of the total variation in larval weight, while the residual (error) sum of squares was **0.2412**. These results indicate that the observed differences in larval weight were primarily attributable to variation among silkworm hybrids rather than random experimental error.

Graphical Presentation of Results

Figure 1 illustrates the comparative mean fifth instar larval weights of the four silkworm hybrids. Among the evaluated hybrids, SW101 consistently recorded the highest mean weight, whereas JC102 exhibited the lowest. The graphical presentation further emphasizes the superior growth performance of SW101 relative to the remaining hybrids under the environmental conditions of Nueva Vizcaya.

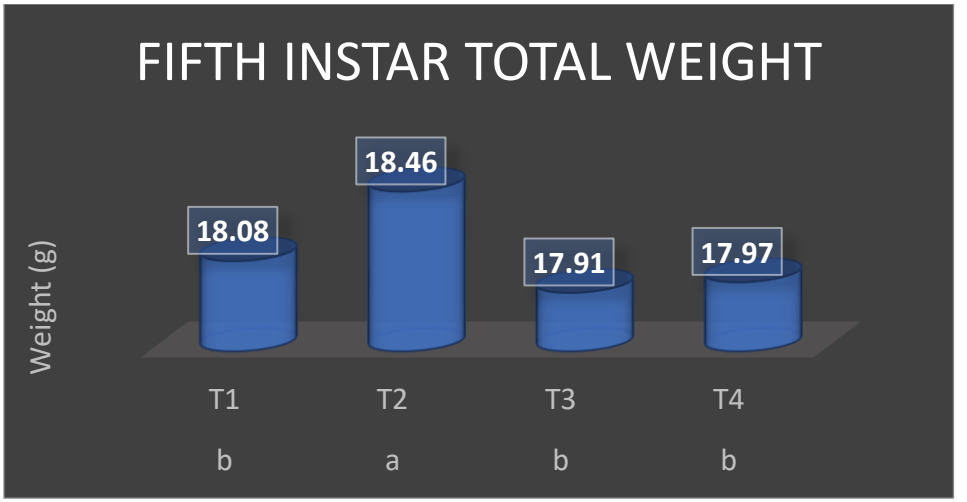

Figure 1. Comparative mean fifth instar larval weights of the four silkworm hybrids.

DISCUSSION

The present study demonstrated that significant differences existed in the fifth instar larval weight among the four *Bombyx mori* hybrids evaluated under the environmental conditions of Nueva Vizcaya. Among the tested hybrids, SW101 consistently produced the highest mean larval weight and was significantly superior to SW116, JC102, and CJ102. These findings indicate that the genetic background of the hybrid plays a substantial role in determining larval growth performance during the fifth instar, a developmental stage recognized as the period of maximum nutrient intake and rapid silk gland development. Because larval weight during this stage is closely associated with cocoon production potential, the superior performance of SW101 suggests that this hybrid possesses favorable growth characteristics under the prevailing environmental conditions of the study.

The superior performance of SW101 may be attributed to differences in genetic constitution and the expression of hybrid vigor (heterosis). Hybrid vigor has long been recognized as one of the principal advantages of hybrid silkworm breeding because it enhances economically important traits such as larval growth, feed conversion efficiency, disease tolerance, cocoon weight, and silk yield. A genetically superior hybrid is capable of utilizing available nutrients more efficiently, resulting in greater biomass accumulation during larval development. Since the fifth instar accounts for the majority of total mulberry leaf consumption and silk protein synthesis, even modest improvements in nutrient assimilation can translate into measurable increases in larval weight and ultimately improve cocoon productivity.

Although the numerical difference between SW101 and the remaining hybrids appears relatively small, statistical analysis confirmed that the observed variation was significant. In biological systems, particularly in sericulture, relatively small differences in larval weight can have considerable economic importance when multiplied across thousands

of larvae reared in commercial production. Increased larval biomass is often associated with larger silk glands, greater cocoon shell weight, and improved silk filament yield. Therefore, the superior larval weight exhibited by SW101 may have practical implications for enhancing silk production, although additional measurements are necessary to verify whether this advantage extends to cocoon weight, shell ratio, and silk quality traits.

The observed differences among hybrids are consistent with the understanding that larval growth is influenced by genotype–environment interactions. Although all treatments were reared under identical management conditions, each hybrid possesses unique genetic characteristics that determine its physiological response to the surrounding environment. Environmental factors such as temperature, relative humidity, mulberry leaf quality, ventilation, and sanitation influence feeding behavior, digestive efficiency, metabolic rate, and silk protein synthesis. Consequently, hybrids with superior physiological adaptability may exhibit enhanced growth even under the same rearing conditions.

Environmental conditions play a fundamental role in silkworm development because temperature and relative humidity directly regulate feeding activity, metabolism, molting, and silk gland development. Throughout the experimental period, ambient temperature ranged from 24.5°C to 29.1°C, while relative humidity ranged from 76.2% to 86.6%. These conditions generally fall within the environmental range considered favorable for the late larval stages of *Bombyx mori* and likely supported normal physiological development throughout the experiment. Since all four hybrids were maintained under the same environmental conditions, the observed differences in fifth instar larval weight are more reasonably attributed to inherent genetic variation rather than differences in environmental exposure.

Although the recorded environmental conditions were generally suitable for silkworm rearing, minor daily fluctuations in temperature and

humidity may still have influenced feeding behavior and nutrient utilization. Previous studies have demonstrated that departures from optimal environmental conditions can alter larval metabolism, digestive efficiency, and silk protein synthesis, thereby affecting larval growth and cocoon production. Because temperature and relative humidity in the present study were monitored only to characterize the common rearing environment and were not treated as experimental variables, their independent effects on hybrid performance could not be statistically determined. Nevertheless, documenting these environmental conditions provides valuable context for interpreting the observed differences in larval growth.

An important observation during the rearing period was the occurrence of disease within the silkworm colony. Routine colony management involved regular inspection and removal of diseased larvae, accompanied by sanitation measures such as bed cleaning, liming, formalin application, and transfer of larvae to clean rearing beds to minimize pathogen transmission. Despite these interventions, the colony records indicated that more than 70% of the silkworm population died between the fourth instar and cocooning stages, demonstrating that disease represented a substantial challenge during the experiment.

The high mortality observed during the study may have affected the overall productivity of the colony. Disease outbreaks are known to reduce feed intake, impair nutrient absorption, delay larval development, and decrease cocoon production, ultimately reducing the biological and economic performance of sericulture systems. Consequently, the growth performance observed in surviving larvae should be interpreted within the context of the disease pressure experienced throughout the rearing period.

However, because mortality and disease incidence were recorded collectively for the entire colony rather than separately for each hybrid, it was not possible to determine whether one hybrid exhibited greater disease resistance or susceptibility than the others. Therefore, although SW101

produced the highest fifth instar larval weight, the present study cannot conclude whether its superior growth performance was associated with improved survival, greater disease tolerance, or other physiological characteristics. Future studies should quantify mortality, survival rate, effective rate of rearing (ERR), and disease incidence separately for each hybrid to provide a more comprehensive evaluation of hybrid performance.

The results of the present study agree with previous investigations demonstrating significant variation in larval growth among different *Bombyx mori* hybrids. Kumar et al. (2019) reported that hybrid genotype significantly influenced larval growth performance and cocoon productivity, emphasizing that genetically superior hybrids consistently produced heavier larvae and improved economic traits. Likewise, Rahman et al. (2021) observed significant differences in larval weight among commercially available silkworm hybrids and suggested that hybrid selection should be considered an important component of sericulture management. Similarly, Singh and Sinha (2017) attributed improvements in larval growth and cocoon characteristics to heterosis, highlighting the importance of hybrid breeding in increasing silk productivity. These studies collectively support the present findings that genetic variation among hybrids contributes substantially to differences in larval weight.

Conversely, some investigations have reported inconsistent responses of silkworm hybrids under different environmental conditions. Zhang et al. (2022) and Li et al. (2023) observed that although genetic factors strongly influence larval growth, environmental variables such as temperature, humidity, feeding regime, and mulberry leaf quality may modify the expression of economically important traits. Such findings suggest that the superior performance of a particular hybrid in one location may not necessarily be reproduced under different agroecological conditions. This highlights the importance of conducting region-specific evaluations before recommending hybrids for commercial production. In the context of Philippine sericulture, the present study provides valuable

baseline information regarding the performance of four commercially available hybrids under the environmental conditions of Nueva Vizcaya.

The findings of this study also have practical implications for sericulture development in the Philippines. The superior fifth instar larval weight exhibited by SW101 suggests that this hybrid possesses favorable growth potential under the environmental conditions encountered during the study. However, the substantial colony-wide mortality observed during the rearing period demonstrates that hybrid selection alone is insufficient to ensure successful silk production. Sustainable sericulture requires the integration of genetically superior hybrids with effective environmental management, rigorous sanitation practices, disease surveillance, and the consistent provision of high-quality mulberry leaves. For institutions such as the Philippine Textile Research Institute (PTRI) and local sericulture extension programs, these findings emphasize the need to integrate hybrid evaluation with comprehensive colony health management. Future hybrid assessment programs should therefore include not only larval growth and cocoon characteristics but also indicators of disease resistance, survival rate, environmental adaptability, and economic performance to provide more comprehensive recommendations for commercial silk production.

Despite the significant findings, several limitations should be considered when interpreting the results. The present study evaluated only one production parameter—fifth instar larval weight—which provides an incomplete assessment of overall hybrid performance. Commercial sericulture relies not only on larval growth but also on cocoon weight, cocoon shell ratio, pupal weight, silk filament length, filament quality, survival rate, and effective rate of rearing. Furthermore, although disease occurrence and substantial mortality were documented during the rearing period, these observations were recorded only for the colony as a whole and were not quantified separately for each treatment. Consequently, the influence of disease on the comparative performance of individual hybrids could not be statistically evaluated. Future investigations should incorporate

treatment-specific measurements of survival, disease incidence, cocoon production, and economic traits to provide a more comprehensive assessment of hybrid performance.

Additionally, the experiment was conducted during a single rearing season under one set of environmental conditions. Seasonal fluctuations in temperature, humidity, and mulberry leaf quality may influence hybrid performance; therefore, the findings should be interpreted within the environmental context of the study period. Multi-season and multi-location evaluations involving larger experimental populations and continuous environmental monitoring would provide stronger evidence regarding the stability, adaptability, and commercial suitability of the evaluated hybrids.

Overall, the present findings suggest that SW101 exhibits superior growth performance during the fifth instar stage under the environmental conditions of Nueva Vizcaya. The results provide preliminary evidence supporting the potential use of this hybrid for local sericulture production. However, comprehensive evaluations encompassing cocoon production, silk quality, feed conversion efficiency, disease resistance, survival, and economic return are necessary before definitive recommendations can be made for large-scale commercial adoption.

This study evaluated the fifth instar larval weight of four *Bombyx mori* hybrids reared under the environmental conditions of Nueva Vizcaya, Philippines. Significant differences in larval weight were observed among the evaluated hybrids, indicating that hybrid genotype influenced larval growth performance during the fifth instar stage. Among the four hybrids, SW101 consistently produced the highest mean larval weight and was significantly superior to SW116, JC102, and CJ102, suggesting that this hybrid possesses favorable growth characteristics under the rearing conditions employed in the present study.

Throughout the rearing period, ambient temperature and relative humidity remained within ranges generally considered suitable for late larval development, providing a common environmental condition for all treatment groups. Because the hybrids were maintained under identical rearing management, the observed differences in larval weight were more likely attributable to genetic variation than to environmental differences. However, routine colony records also documented substantial disease occurrence, resulting in more than 70% mortality between the fourth instar and cocooning stages despite the implementation of sanitation measures such as bed cleaning, liming, and formalin application. Although these observations were recorded at the colony level and therefore could not be statistically compared among hybrids, they emphasize the importance of effective colony health management in addition to hybrid selection.

The present findings indicate that SW101 is a promising hybrid for sericulture production under environmental conditions similar to those of Nueva Vizcaya. Nevertheless, the superiority of this hybrid should be interpreted cautiously because the study evaluated only fifth instar larval weight. Additional production traits, including survival rate, effective rate of rearing (ERR), cocoon weight, shell ratio, silk filament quality, and economic performance, should be evaluated before recommending SW101 for large-scale commercial adoption.

Overall, this study provides valuable baseline information on the comparative growth performance of commercially available *Bombyx mori* hybrids under Philippine rearing conditions. The findings contribute to the growing body of knowledge supporting evidence-based hybrid selection while emphasizing that successful sericulture depends on the combined effects of genetic potential, favorable environmental conditions, and effective disease management.

STUDY LIMITATIONS

The findings of this study should be interpreted in light of several limitations.

First, the experiment assessed only one production parameter, namely fifth instar larval weight. Although larval weight is an important indicator of growth performance and potential cocoon productivity, it does not provide a comprehensive evaluation of silkworm performance. Other economically important production traits, including cocoon weight, cocoon shell weight, shell ratio, pupal weight, silk filament length, filament quality, feed conversion efficiency, effective rate of rearing (ERR), and economic profitability, were not evaluated.

Second, although daily temperature and relative humidity were monitored throughout the rearing period, these measurements served only to characterize the common environmental conditions within the rearing house and were not incorporated as experimental variables in the statistical analysis. Consequently, the independent effects of environmental factors on larval growth could not be quantified.

Third, a substantial disease outbreak occurred during the experiment, with colony records indicating that more than 70% of the silkworm population died between the fourth instar and cocooning stages despite routine sanitation and disease management practices. However, mortality and disease incidence were documented only for the colony as a whole and were not recorded separately for each hybrid. Therefore, the influence of disease on the comparative performance and potential disease resistance of the evaluated hybrids could not be statistically assessed.

Finally, the experiment was conducted during a single rearing season at one location under a specific set of environmental conditions. Hybrid performance may vary under different climatic conditions, mulberry

cultivars, and management systems. Consequently, the findings should not be generalized beyond environmental conditions similar to those of the present study without further validation through multi-season and multi-location evaluations.

RECOMMENDATIONS

Based on the findings of the present study, the following recommendations are proposed:

For Sericulture Farmers

SW101 may be considered a promising *Bombyx mori* hybrid for rearing under environmental conditions similar to those of Nueva Vizcaya because of its superior fifth instar larval weight. However, hybrid selection should not rely solely on larval growth performance. Farmers should also adopt good sericulture management practices, including strict sanitation, regular monitoring of colony health, timely removal of diseased larvae, proper environmental management, and the provision of high-quality mulberry leaves to maximize productivity and reduce disease-related losses.

For the Philippine Textile Research Institute (PTRI)

The Philippine Textile Research Institute is encouraged to conduct multi-location and multi-season evaluations of SW101 and other commercially available hybrids to determine their adaptability across different agroecological zones in the Philippines. Future hybrid evaluation programs should integrate measurements of larval growth, survival rate, effective rate of rearing (ERR), cocoon yield, silk quality, disease resistance, and economic performance to provide more comprehensive recommendations for sericulture farmers.

For Researchers

Future investigations should incorporate a broader range of biological, production, and economic parameters, including:

- larval survival rate;
- disease incidence and mortality by treatment;
- effective rate of rearing (ERR);
- cocoon weight;
- cocoon shell weight;
- shell ratio;
- pupal weight;
- silk filament length;
- filament denier and quality;
- feed conversion efficiency;
- economic profitability.

In addition, future studies should record environmental variables, disease occurrence, and management interventions separately for each treatment to better understand genotype × environment interactions and hybrid-specific responses to disease.

For Future Studies

Future research should:

- evaluate hybrid performance across multiple production seasons and geographic locations;
- investigate genotype × environment interactions under varying temperature and humidity conditions;
- assess the effects of different mulberry cultivars and feeding regimes on larval growth and cocoon productivity;

- evaluate disease resistance among commercially available *Bombyx mori* hybrids through treatment-specific health monitoring;
- incorporate molecular and genetic characterization of hybrids to identify traits associated with superior growth and environmental adaptability; and
- perform cost–benefit and profitability analyses to determine the commercial feasibility of recommended hybrids under Philippine sericulture production systems.

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