



The Impact Of Artificial Light On The Life Cycle Of Silkworms

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ABSTRACT:

This experiment scrutinizes the impact of artificial light on the life cycle of silkworms (*Bombyx mori*). *Bombyx mori* are broadly observed due as they are of huge economic importance in silk production and their possible usages in biotechnology. The motive of this experiment is to develop an articulated perception about how exposure to different light conditions influences the succession stages and overall life cycle of *Bombyx mori*.

To perform the experiment, silkworm larvae were settled in regulated surroundings with variation in levels of light exposure. The experiment is an eclectic combination of partial light, and complete darkness circumstances. The growth of the silkworm life cycle was observed and noted down of each and every milestone such as egg laying, larval growth, pupal formation, and emergence of adult. These preliminary findings direct that artificial light plays a delicate role in impacting the life cycle of silkworms. This study bestows to the wider perception of the influence of environmental attributes on the life cycle of silkworms and offers better perspective for improving sericulture practices and quiescent biotechnological usage.

Keywords: *Bombyx mori*, silkworm, biotechnology, light exposure, pupal formation

INTRODUCTION:

Silkworms are popularly also be named as *Bombyx mori*, placed in the order Lepidoptera. They are extensively propagated for silk production, making them economically compelling insects. Silkworms bears distinguished life cycle and also displays exclusive photo dermal sensitivity, which invokes to their competency to reciprocate to light stimuli in their environment. There are various succession in the life cycle of silkworms: egg, larva, pupa, and moth. The cycle initiates with the female moth dropping hundreds of eggs, which are extremely tiny, oval-shaped, and yellow in colour. Within a few days, the eggs hatch into larvae, commonly attributed to as caterpillars or silkworms. (Dr. H.B. Mahesha,2012)

During the larval stage, silkworms feed on huge amounts of mulberry leaves. They shed their old skin by undergoing a series of moulting and grows larger each time. The larval stage stays for approximately 4-6 weeks, and results into rapid growth of the silkworm. (Nair et al. 2013)

After the completion of final moult in their last larval stage, they reach the pupal stage. Now the process of formation of silk cocoon starts with the help of special silk glands which is located within their bodies. The cocoon functions just like a protective shield for the pupa during its change over into a moth. Within the cocoon, extremely expressive physiological changes, for instance, the development of wings, antennae, and reproductive organs occurs. (Petvok et al. 1980)

After completion of period of around two weeks, the fully mature adult moth oozes out from the cocoon. This stage depicts the final phase of the silkworm's life cycle. Adult moths are prominently short-lived, with their elementary objective being reproduction. Female moths' secrets pheromones to attract male moths for the process of mating, which usually takes place just after their emergence. (S. Janarthan, 1995)

Photo dermal delicacy is one of the most compelling aspect of silkworms' life cycle. Their behaviour, development and succession in their stages of life cycle can highly be impacted by light stimuli, and fluctuations in light circumstances. Light behaves as an important environmental attribute for silkworms, striking various physiological processes such as feeding, moulting, pupation, and metamorphosis.(S. Kumararaj,1973)

Having a better perspective in the subject of the photo dermal vulnerability of silkworms is important for making silk production and rearing exercises more efficient and fruitful practice. By negotiating light circumstances, researchers and silk farmers can affect the growth rate potentially, silk quality, and overall productivity of silkworms.

While performing this experiment, we aspire to scrutinize the impact of artificial light on the life cycle of silkworms. By analysing the rapport between light exposure and various stages in their life cycle, we can develop a better understanding into how environmental cues impact the growth and development of silkworms. This knowledge can be beneficial for developing a better perspective amongst the sericulture practitioners, and researchers trying to optimize silk production and exploit the potential usage of silkworms in different fields.

MATERIAL and METHODOLOGY

In order to determine the impact of artificial light on life cycle of silkworm, an articulated experiment was conducted in laboratory based environmental setup in the month of November. The selection of appropriate materials and the implementation of robust methods are of paramount importance. To make this experiment more reliable and efficient, the whole procedure is divided into three main steps;

- Collection
- Material Required
- Methodology
- **COLLECTION**

Silkworm larvae: For attaining accurate results, healthy silkworm larvae are needed to be selected. Using larvae from a reliable and persistent source helps ensure standardization and reduces potential genetic fluctuations that may hinder the experiment. It is also mandatory to provide the required food source, such as fresh mulberry leaves, to promote the growth and development of the silkworms throughout the experiment.

The collection of second stage larva is being done from KALPIPARA – BAHARAICH, UTTAR PRADESH, INDIA. Proper box was made to collect the live larva, proper ventilation was taken care off.



SILK FARM IN BAHARAICH



SETUP FOR THE EXPERIMENT

➤ MATERIAL REQUIRED

Controlled environments: Creating controlled environments with precise lighting conditions is vital to understanding the influence of artificial light on silkworms' life cycle. This includes the use of light sources with specific wavelengths, intensity, and photoperiods to simulate various lighting conditions. Additionally, the temperature and humidity within the rearing chambers should be controlled to mimic natural conditions and minimize any potential confounding factors. To achieve such optimistic condition, the important material required and used here are:

- WIPRO LED LIGHT (7 WATT)
- BAJAJ HEATER

Wipro LED lights are renowned for their stability and long lifespan. They provide consistent lighting output and are less susceptible to fluctuations in voltage, ensuring that the lighting conditions remain stable and reliable throughout the experiment.



BAJAJ HEATERS are designed to provide efficient heating while conserving energy. This feature is important for long-term experiments requiring extended periods of artificial heating.



➤ METHODOLOGY

To make the experiment valid, efficient and feasible, it is of outmost importance to establish controlled and regulated experiment setup. Methodology for studying the impact of artificial light on the Life Cycle of Silkworms. The larvae were reared in room disinfected with 4% formalin sprayers prior to shift the larvae. The rearing of larvae should be done at temperature ($25 \pm 2^{\circ}\text{C}$) and RH conditions ($70 \pm 5\%$)

Adequate rearing chamber with sufficient space, ventilation and appropriate substrate for silkworm larvae was provided. Controlled environmental factors such as temperature, humidity and ventilation to maintain consistent and optimal rearing conditions throughout the experiment was established.

High quality silkworm larvae from a reliable source was being used, ensuring genetic consistency and minimizing variability.

Appropriate light setup was being established to allow for precise control of lighting parameters, including intensity, colour temperature and photoperiod. Uniform distribution of artificial light throughout the rearing chambers to minimize any potential bias was maintained.

Proper thermal regulated setup was maintained by regulating room temperature with the help of Bajaj Heater, also the temperature is maintained by giving constant natural heat for 10 to 15 minutes while changing the leaves.

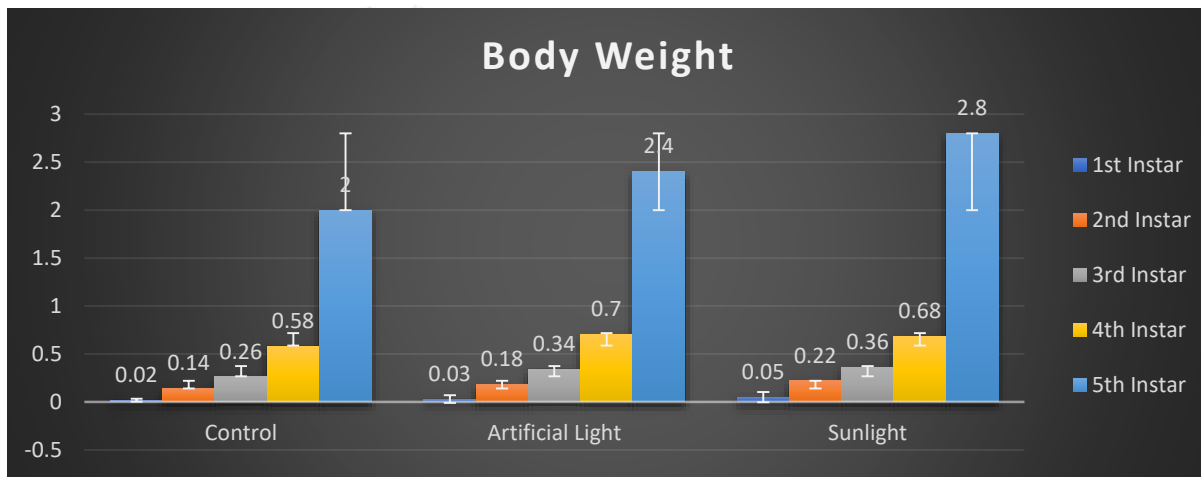
Documented the timing and duration of each developmental stages of silk and recorded the physical characteristics like weight and feeding behaviour.

STASTICAL ANALYSIS:

Impact of Light on Larval weight

Table – 1 : Effect of dark, artificial light and sunlight on larval weight during 1st Instar to 5th Instar of silkworm reared at controlled conditions of Temperature and RH

	1 st Instar	2 nd Instar	3 rd Instar	4 th Instar	5 th Instar
Control	0.02 ± 0.3	0.14 ± 0.3	0.26 ± 0.3	0.58 ± 0.3	2 ± 0.3
Artificial Light	0.03 ± 0.4	0.18 ± 0.4	0.34 ± 0.4	0.7 ± 0.4	2.4 ± 0.4
Sunlight	0.05 ± 0.5	0.22 ± 0.5	0.36 ± 0.5	0.68 ± 0.5	2.8 ± 0.5



Data shown within the same row are significantly different ($p < 0.05$ level).

Statistical comparison of life cycle of silk worm under different lights :

Table – 2 : Effect of dark, artificial light and sunlight on larval life span during 1st Instar to 5th Instar of silkworm reared at controlled conditions of Temperature and RH

Instar	Control	Artificial Light	Sunlight
I	3 ± 0.3	2 ± 0.3	3 ± 0.3
II	5 ± 0.3	4 ± 0.3	4 ± 0.3
III	2 ± 0.57	4 ± 0.57	3 ± 0.57
IV	5 ± 0.57	4 ± 0.57	3 ± 0.57
V	5 ± 0.57	4 ± 0.57	3 ± 0.57
Total	20	18	16

Data shown within the same row are significantly different ($p < 0.05$ level).

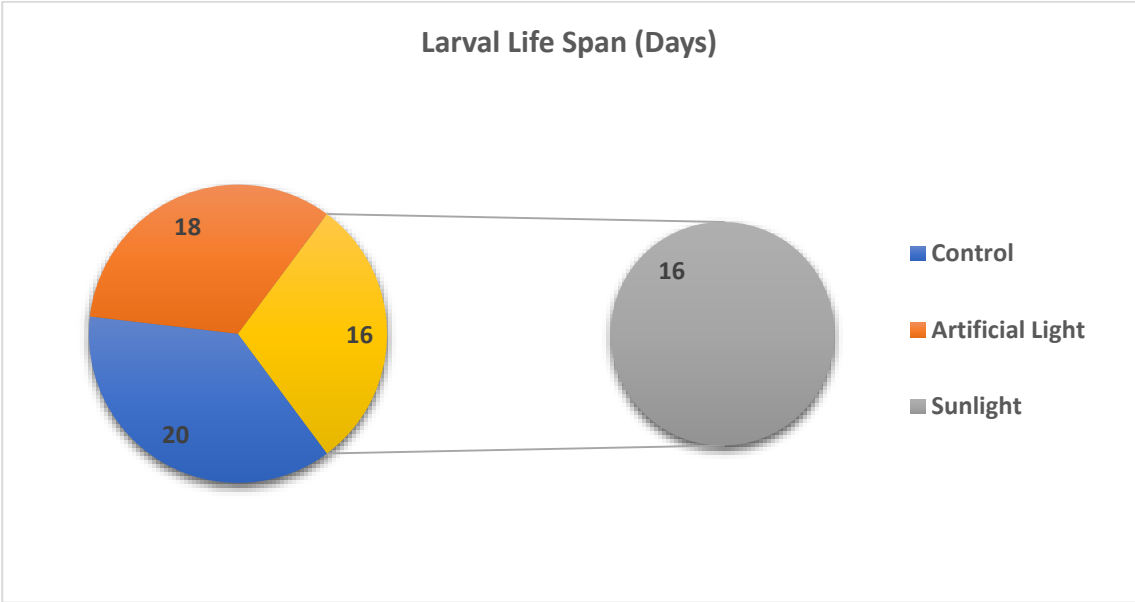
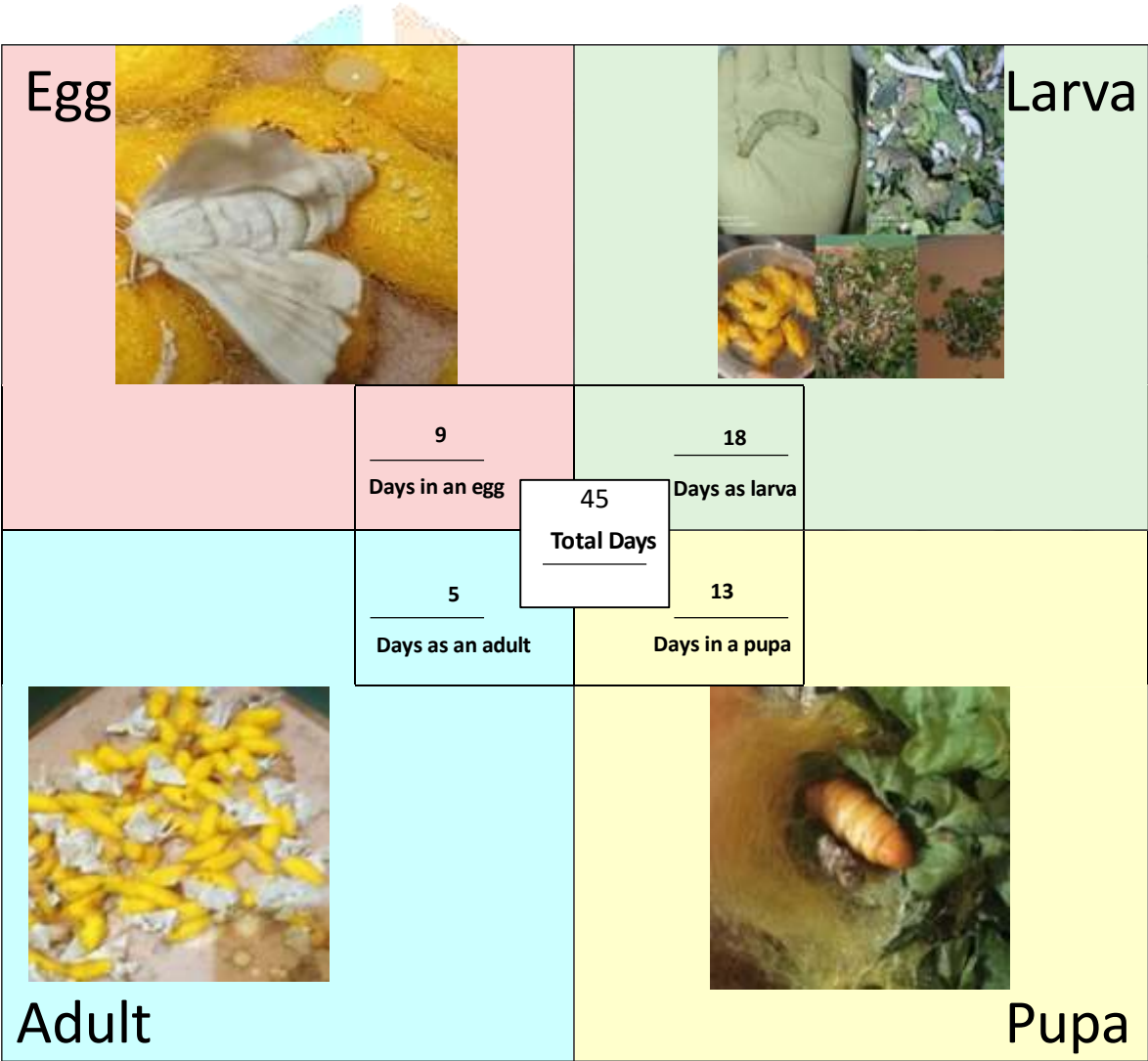


Table – 3 : Days count in completion of life cycle under the impact of artificial light.



RESULT

When we talk about life cycle of silkworm it is of huge prominence, and with this experiment a better insight is being developed of the impact of artificial light on the life cycle of silkworm. It is being noted very clearly that artificial light has stimulated and reinforced the growth and development of silkworm which in return have enormous dominant impact in the field of sericulture.

Larval Body Weight (1st Instar)

Larval weight (g) noted at the end of 1st instar not yielded significant differences in larval weight i.e. 0.02, 0.03 and 0.5 g in control, artificial light and sunlight respectively (Table 1).

Larval Body Weight (2nd Instar)

Larval weight (g) noted at the end of 2nd instar not yielded significant differences in larval weight i.e. 0.14, 0.18 and 0.22 g in control, artificial light and sunlight respectively (Table 1).

Larval Body Weight (3rd Instar)

Larval weight (g) noted at the end of 3rd instar yielded significant differences in larval weight i.e. 0.26, 0.34 and 0.36 g in control, artificial light and sunlight respectively (Table 1).

Larval Body Weight (4th Instar)

Larval weight (g) noted at the end of 4th instar showed significant differences in larval weight i.e. 0.58, 0.70 and 0.68 g in control, artificial light and sunlight respectively (Table 1).

Larval Body Weight (5th Instar)

Larval weight (g) noted at the end of 5th instar showed significant differences in larval weight i.e. 2.00, 2.40 and 2.80 g in control, artificial light and sunlight respectively (Table 1).

It is a well-known fact that silkworms are Diurnal in nature, which makes them most active during the daytime. By providing them with continuous exposure to artificial light, it is noted dominantly that the silkworms' feeding and growth rate is positively stimulated which ultimately leads to improved silk yields.

By revolutionizing the period and amplitude of light exposure, the process of moulting of larvae can be influenced, which is crucial in sericulture as it allows for synchronization of the life cycle of silkworm. The process of emergence of larvae and rearing is being well facilitated by artificial light making the rearing process efficient and cost effective.

We can also say that artificial light has a great contribution on the overall health of silkworm by making them more disease resistant, which again can prove to be of huge importance aspect when it comes to silkworms, potential usage in silkworm industry.

DISCUSSION

Artificial light has indeed a non-procrastinable impact on the life cycle of silkworm, it has indeed affected and stimulated the life cycle in a positive way by reinforcing positively their duration of moulting resulting in their rapid completion of their larval stage (Xia et al,2009). Also, it cannot be denied that their pupal stage was little bit late when it comes to a comparison with natural light. It can be taken into consideration that the intensity of artificial light exposure and its duration has a magnificent impact on their overall health. (Nwibo et al. 2015)

Artificial light if provided in regulated fashion can surely enhance the growth and development of silkworm by accelerating and optimizing their feeding pattern, better metabolism. (Yang, 2004)

Proper regulation and effective controlling of artificial light can lead into a synchronized fashion of growth amongst the population which results in uniformity in different stages of life cycle and can give a boost to sericulture practices. (Kaito and Sekimizu 2007)

Artificial light can lead to better silk production and cocoon quality. Ultimately leads into better silk harvesting process. (Mita, 2008)

One of the most important aspects that this experiment has shown that the artificial light has accelerated the pace at which silkworm undergoes changes during succession into various stages which ultimately results into shorter life cycle and increased silk production which can prove to be a boon in sericulture industry.

CONCLUSION

In conclusion, it can be said with complete conviction that the exposure of artificial light has indeed brought a vital positive affect on the life cycle of silkworms. It has accelerated the duration taken by them for completion of their life cycle also it has impacted its overall health. With all these positive impact on the life cycle, it can be clearly stated that the exposure of artificial light also has huge impact on optimizing the silk yield. It is also an undoubted fact that exposure of artificial light on silkworms have huge optimum impact not only on sericulture industry but also on biotechnology by unveiling the potential usage of silkworm in this field. Therefore, we can say that utilization of artificial light with traditional sericulture practices has tremendous impact on silk production also can contribute in its flourishing in various part of world.

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