Impact of *Annona reticulata* L. Extract Fortified Mulberry Leaves on Silk Production Parameters of *Bombyx mori* L.

ABSTRACT

The effects of several plant extracts in different quantities on *Bombyx mori* L. commercial parameters have been seen in commercial silk farming in recent years. In this study, the effects of various concentrations of chloroformic extract of *Annona reticulata* L. on *Bombyx mori* L. larvae were investigated. The overall performance of *Bombyx mori* in response to *A. reticulata* treatments were observed in the present study. According to experimental study, by utilizing concentrations of *Annona reticulata* L. at 1: 2, 1: 4, and 1: 8 resulted in an increasing trend for key commercial characteristics, such as filament length, filament weight, single cocoon weight, pupal weight, and shell weight of *B. mori* L.

Keywords: *Annona reticulata*, *Bombyx mori* L, chloroformic extract, growth rate, commercial parameters.

Introduction:

Sericulture is a popular agro-based sector that helps to rural farmers, entrepreneurs, and skilled artisans which requires minimal investment. It is a labor-intensive, farm-based, and profitable economic activity that is now being conducted as a cottage and small-scale enterprise. Although there are other commercial silkworm species but, *Bombyx mori* L. is the most widely utilized and studied. According to Ganie *et al*., (2012), sericulture has a high potential for increased returns and might greatly benefit to the rural economy.

Sericulture in India provides a consistent source of funding and employment for society regardless of caste, gender, religion, or creed (Kasi, 2013). Additional nutrients and plant extracts are needed to improve numerous elements of silk production. Artificial food provides various advantages, including reducing maintenance and operational expenses for large mulberry plantations, expanding growing capacity of *Bombyx mori* and range throughout the year, increasing economic efficiency, and lowering the cost of the final product, silk. Partially synthetic nutrient combinations are developed and used to achieve optimal development, viability, and productivity outcomes. Raising the number and quality of cocoons necessitates increasing the nutrient content of mulberry leaves, which can be accomplished by adding more nutrients to the leaves. In addition to the production of cocoons, the growth and development of larvae are significantly influenced by the nutritional value of mulberry leaves (Masthan *et*

al., 2017). For the production of more high-quality cocoons, mulberry leaves can be supplemented with more nutrients (Thangapandiyan and Daharanipriya, 2019). Silkworms require certain carbohydrates, proteins, vitamins, and amino acids to grow and develop (Sengupta *et al*., 1972). Recent research found that, in addition to mulberry leaves, additional nourishment plays an important role in regulating silkworm development. Therefore, the purpose of the current study was to investigate the efficacy of chloroformic extract of *Annona reticulata* L. on different growth parameters of *Bombyx mori* L.

Materials and Methods:

The current investigation was conducted in Chhatrapati Sambhajinagar district, Maharashtra, which is located at 20.062392^{o} N 75.505286^{o} E (Phulambri Tehsil). Plant material i.e., *Annona reticulata* Linn. (branches) were collected from local agricultural fields / gardens of the district. This plant contains nutritional elements such as vitamin C, carbohydrates, vitamin B6, iron, potassium, vitamin B2, Vitamin B, total dietary fiber, magnesium and proteins etc., The 40-gram powder obtained from these branches was subjected to extraction using 400 ml of chloroform via a Soxhlet extraction apparatus by following the methodology suggested by Lolge *et al*., (2016). The concentrations of 1:2, 1:4, and 1:8 were obtained by dissolving 1 milliliter of the crude extract in 100 milliliters of distilled water, respectively. Fifty larvae were arranged in five labeled trays (one for the control group, one for the experimental control with distilled water, and three trays according to the conc.). These solutions were then sprayed separately onto air-dried mulberry leaves using a sprayer, and the larvae were fed. During the investigation, a number of parameters, including larval weight, total mortality, cocoon weight, shell weight, pupal weight, and shell ratio, were thoroughly measured to figure out the effects of the different concentrations on the larvae. The following formulae were used for calculating specific parameters related to cocoons and silk reeling:

Cocoon shell weight = Weight of shell – Weight of pupa

Denier = Weight of raw silk reeled (g) / Length of raw silk reeled (m) x 9000

I –Mulberry Plantation

II –Rearing of silkworm larvae

III –Concentrations of extracts

IV –Experimental set up of rearing silkworm

V – Reeling of single cocoon on Epprovate

VI – Shell Weight

Plate 1:

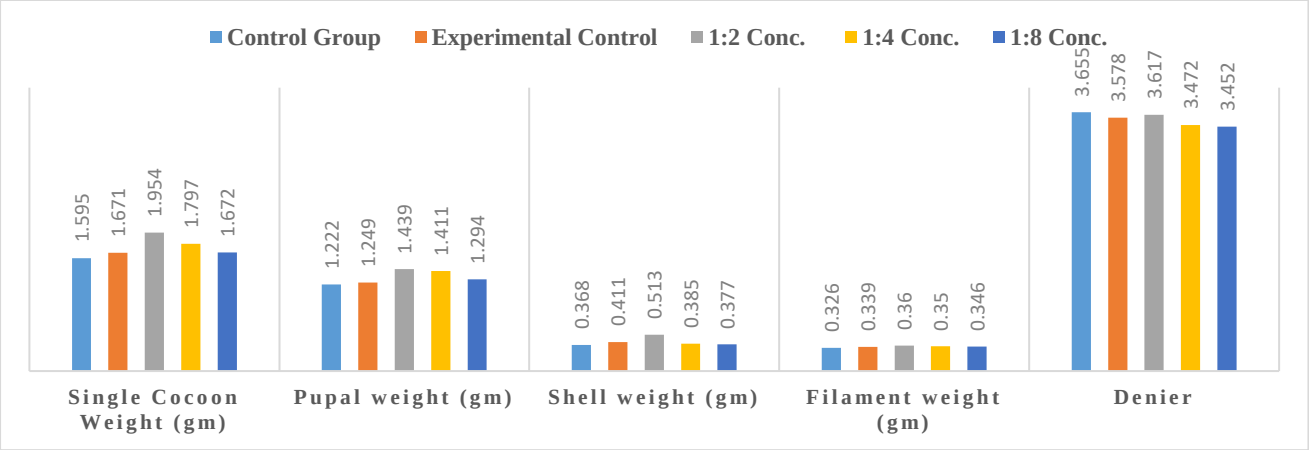
Result and Discussion:

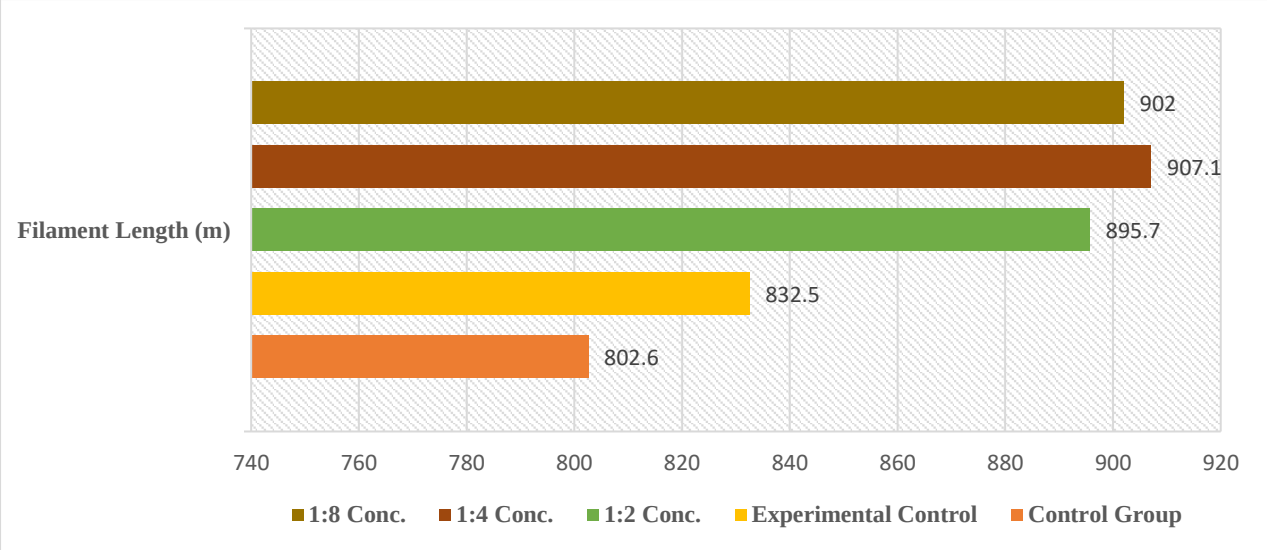
During this study, the mulberry leaves were sprayed with different concentrations of chloroformic extract (1:2, 1:4 and 1:8) of *Annona reticulata* L. (Ramphal). The effect of these concentrations on the commercial parameters of *Bombyx mori* L. such as single cocoon Weight (gm), pupal weight (gm), shell weight (gm), filament length (m), filament weight (gm), no. of breakages, total mortality and denier was also studied.

Table 1: Effect of *Annona reticulata* Linn. (1:2, 1:4 & 1:8) chlorofomic plant extract on biological characters of *Bombyx mori* L.

Sr. No.	Characters	Control group	Experimental Control with Distilled water	Experimental Group		
				A 1:2 conc.	B 1:4 conc.	C 1:8 conc.
1.	Single Cocoon Weight (gm)	1.595 ± 0.139	1.671 ± 0.274	1.954 ± 0.290	1.797± 0.202	1.672 ± 0.191
2.	Pupal weight (gm)	1.222 ± 0.112	1.249 ± 0.292	1.439 ± 0.220	1.411 ± 0.184	1.294 ± 0.163
3.	Shell weight (gm)	0.368 ± 0.075	0.411 ± 0.076	0.513 ± 0.121	0.385 ± 0.082	0.377 ± 0.066
4.	Filament length (m)	802.6 ± 40.08	852.5 ± 79.64	895.7 ± 94.56	907.1 ± 99.10	902 ± 58.88
5.	Filament weight (gm)	0.326 ± 0.028	0.339 ± 0.038	0.360 ± 0.031	0.350 ± 0.021	0.346 ± 0.013
6.	Number of breakages	01	00	00	01	00
7.	Total mortality	01	00	01	00	01
8.	Denier	3.655 ± 0.339	3.578 ± 0.679	3.617 ± 0.339	3.472 ± 0.247	3.452 ± 0.149

Graph 1: Bar graph showing role of *Annona reticulata* Linn. (1:2, 1:4 & 1:8) chlorofomic plant extract on biological, commercial parameters of *Bombyx mori* L.





Graph 2: Effect of Annona reticulata Linn. chlorofomic plant extract on filament length of Bombyx mori L.

According to table 1 and graph 1, the influence of chloroformic extract of *Annona reticulata* Linn. on silkworm larvae, *Bombyx mori* L., show an increasing pattern in major commercial parameters such as filament length, filament weight, single cocoon weight, pupal weight, and shell weight. However, some concentrations of this extract exhibit a decreasing trend in terms of certain parameters, such as denier. There were no breakages at 1:2 or 1:8 concentrations of this extract, and no mortality were reported at 1:4 concentration. Thus, it can be concluded that the chloroformic extract of *Annona reticulata* has a favourable influence on various biological and commercial characteristics of *Bombyx mori* L.

Many researchers have conducted similar studies on the effectiveness of artificial feeding and plant extracts on the growth and development of silkworms. Zannoon *et al*., (2007) investigated the biological and technological effects of mulberry types and nutritional supplements on silkworm *Bombyx mori* development and found that all tested groups exceeded the control groups significantly. Manimuthu and Isaiarasu (2010) investigated the effect of the herbal tonic *Aloe* on the overall performance of the mulberry silkworm, *Bombyx mori* L., and observed that supplementation with *Aloe vera* tonic increased the mean larval weight, relative growth rate, effective rearing rate, and larval consumption index of the final instar larvae of *B. mori*. Joyce and Sabura (2021) investigated the effect of silver nanoparticles synthesized using *Rosa rubiginosa* plant extract on the growth parameters of silkworm *Bombyx mori* L. and noticed that supplementing mulberry leaves with *Rosa rubiginosa* silver nanoparticles

improved feed efficacy, thereby improving cocoon commercial quality. Gupta *et al*., (2022) studied the impact of certain plant extracts (tulsi, neem and sindwar) on different larval and cocoon characters of *Bombyx mori* L and concluded that the extract has growth promoting effect on silkworm, which helps to enhance the commercial qualities of silk. Maqbool *et al*., (2023) studied the effect of spirulina and thyroxine fortified mulberry leaves on the rearing performance of *Bombyx mori* L, and observed that spirulina and thyroxine supplemented mulberry leaves increased economic traits in experimental groups compared to controls. Susikaran and Vijay (2024) examined the effect of mini clonal leaves on the economic aspects of mulberry silkworms, concluding that feeding silkworms with mini clonal mulberry leaves resulted in significant improvements in larval parameters. All of these studies, including the present study, indicate that the use of additional nutritional elements, plant extracts, and mulberry leaves can improve silkworm growth and lead to an increase in silk production.

Conclusion:

The commercial parameters of the silkworm, such as cocoon weight, pupal weight, shell weight, and shell ratio, as well as silk traits (filament length, filament weight, and denier), were improved by supplementing with mulberry leaves with various nutrients and botanical extracts. The current study concludes that supplementing the silkworm diet with *Annona reticulata* (Ramphal) extract at specific concentrations might be beneficial to economic features. So, it can be concluded that the usage of nutritional additives such as appropriate plant extracts together with mulberry leaves will improve silkworm growth characteristics, resulting in enhanced production and profitability for farmers.

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