

# EFFECTS OF AMLA EXTRACT (*PHYLLANTHUS EMBLICA*) ON BIOLOGICAL AND ECONOMICAL CHARACTERISTICS OF THE SILKWORM, *BOMBYX MORI*

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## ABSTRACT

The effect of amla extract on food intake and utilization were studied in Cross Breed race of Silkworm *Bombyx mori*. Mulberry leaves *Morus alba* treated with amla extract at (25°C) and constant relative humidity (75-80%). It has been observed that the amla treated group plays a significant role with an increase in growth and better food intake as compared to the control group. During silkworm *Bombyx mori* rearing, larvae frequently acquire various infections leading to mortality. Growing infection needs to be controlled in order to increase the silk production. In a view, an induced flacherie by *Bacillus subtilis* infection was controlled by amla extract showing antibacterial action in both in vitro and in vivo experiments. Suggestively, 10% amla extract in an intermittent period during rearing resulted in an improved defensive mechanism as evidenced from the study to improve silk productivity.

**Keywords:** *Bombyx mori*, Amla extract, *Bacillus subtilis*, Flacherie, *Morus alba*, Silkworm.

## INTRODUCTION

Nutrition plays an important role in improving the growth and development of the silkworm. One of the important nutrients that play a significant role in this field is amla extract, which is a water soluble micronutrient and acts as a powerful antioxidant and potential phago-stimulant<sup>1</sup>. The amla extract increases the growth and silk production in silkworm<sup>2</sup>. **Therefore, the present study was taken to determine the effects of amla extract on the larval development and silk production of CSR2 × CSR4 silkworm larvae at constant temperature (25°C) and humidity (75-80%).**

## MATERIAL AND METHODS

### Study Area

Present work was carried out at Government Resham Kendra, Ashoknagar and Mhow (M.P.)

### Experimental Species

Productive bivoltine silkworm hybrid (CSR2 × CSR4) is obtained from Central Sericulture Research and Training Institute (Mysore, India) was used as a study material. This hybrid is suitable to rear during favourable season (August–February).

### Rearing method

*Bombyx mori* larvae (CSR2 × CSR4 strain) were reared in laboratory conditions under constant temperature (25°C) and relative humidity (75-80%).

### Dietary supplementation of silkworm (*Bombyx mori*) with Amla extract

The experiment was designed to determine amla extract had a positive effect on the growth and health of *B. mori*. Amla extract was given to fifth instar larvae, the fifth instar being the most important stage for silk production. The mulberry leaves were dipped in amla extract and air dried before giving them as feed to the silk larvae. Paraffin sheets were laid, and the larvae were reared in cardboard boxes. The fecal matter was removed to provide hygienic conditions for healthy growth. For the purpose of comparative analysis, the larvae were divided into 2 groups. Each group contained 50 larvae. Group 1 was fed with fresh mulberry leaves throughout the fifth instar and was considered as the control group. Group 2 was fed with mulberry leaves dipped in amla extract on alternate days (days 1, 3, and 7) of the fifth instar. On the other days (days 2, 4, and 6), larvae were fed with fresh mulberry leaves. The weights of the larvae in the 2 groups were recorded daily from day 1–7 of the fifth instar until cocoon formation. Cocoon weights were also recorded, as cocoon weight is an important parameter in determining the amount of silk that can be produced.

## RESULTS

In the present experiment, larvae were given amla extract treated mulberry leaves to feed at optimum temperature and relative humidity i.e. 25°C and 75-80% respectively.

### Weight analysis of amla extract treated mulberry leaves and fresh mulberry leaves (control) on 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity:

In the present investigation the results of weight analysis of amla extract treated mulberry leaves and fresh mulberry leaves are summarized in table 1. Silkworms were treated with mulberry leaves dipped in amla extract and fresh mulberry leaves (control). Maximum larval weight of **3.1 gms** was observed with amla extract treated mulberry leaf (ATL) on the 6<sup>th</sup> day of 5<sup>th</sup> instar larval stage and minimum **0.9 gms** was observed on the 1<sup>th</sup> day of 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity i.e. 25 °C and 75-80%. Larval weight of **2.3 gms** was observed with fresh mulberry leaf (FML) on the 6<sup>th</sup> day of 5<sup>th</sup> instar larval stage whereas **0.5 gms** was observed on the 1<sup>th</sup> day of 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity.

**Table- 1: Weight analysis of amla treated mulberry leaves and fresh mulberry leaves (control) on 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity:**

Larvae	Temperature (°C)	Humidity (RH %)	Treatments	Day's of 5 <sup>th</sup> instar	Weight of larvae (grams)
50	25°C	75-80%	Amla Treated Mulberry Leaf (ATL)	1	0.9 ±0.02
				2	1.4 ±0.991
				3	1.6 ±1.52
				4	2.5 ±1.905
				5	3.2 ±0.574
				<b>6</b>	<b>3.1 ±0.65</b>
50	25°C	75-80%	Fresh Mulberry Leaf (FML) <b>CONTROL</b>	1	0.5 ±0.851
				2	0.8 ±1.64
				3	1.1 ±1.442
				4	1.6 ±1.01

				5	2.1 ±1.890
				6	2.3 ±2.49

**Length analysis of amla treated mulberry leaves and fresh mulberry leaves (control) on 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity:**

In the present investigation the results of Length analysis of amla treated mulberry leaves and fresh mulberry leaves are summarized in table 2. Maximum larval length of **6.5 cms** was observed with amla extract treated mulberry leaf (ATL) on the 6<sup>th</sup> day of 5<sup>th</sup> instar larval stage and **4.2 cms** was observed on the 1<sup>th</sup> day of 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity i.e. 25°C and 75-80%. Larval length of **5.3 cms** was observed with fresh mulberry leaf (FML) on the 6<sup>th</sup> day of 5<sup>th</sup> instar larval stage whereas **3.1 cms** was observed on the 1<sup>th</sup> day of 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity.

**Table-2: Length analysis of amla treated mulberry leaves and fresh mulberry leaves (control) on 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity:**

Larvae	Temperature (°C)	Humidity (RH %)	Treatments	Day's of 5 <sup>th</sup> instar	Length of larvae (cm)
50	25°C	75-80%	Amla Treated Mulberry Leaf (ATL)	1	4.2 ±1.840
				2	4.4 ±0.376
				3	4.8 ±1.98
				4	5.4 ±0.34
				5	6.1 ±1.41
				<b>6</b>	<b>6.5 ±0.871</b>
50	25°C	75-80%	Fresh Mulberry Leaf (FML) CONTROL	1	3.1 ±1.556
				2	3.4 ±1.687
				3	3.9 ±0.793
				4	4.2 ±0.021
				5	4.6 ±1.537
				<b>6</b>	<b>5.3 ±0.548</b>

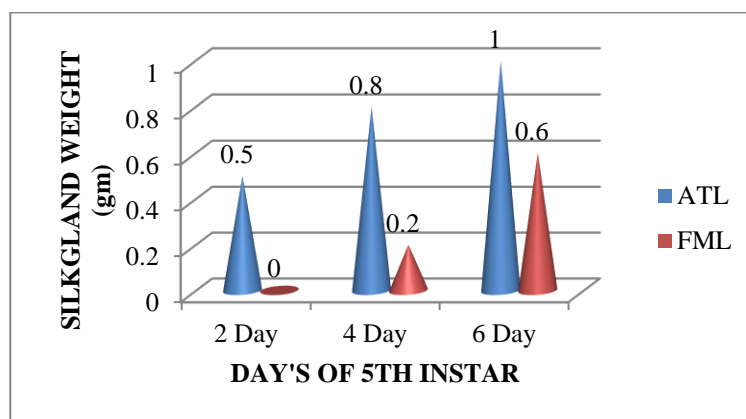
**Analysis of silk gland weight in amla treated mulberry leaves and fresh mulberry leaves (control) on 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity:**

In the present investigation the results of silk gland weight of amla treated mulberry leaves and fresh mulberry leaves are summarized in table 3 and figure 1. The maximum silk gland weight was found to be **1.00 gms** with amla treated mulberry leaf (ATL) on the 6<sup>th</sup> day of 5<sup>th</sup> instar larval stage and **0.5 gms** on the 2<sup>th</sup> day of 5<sup>th</sup> instar larval stage at optimum temperature (25°C) and relative humidity (75-80%) whereas **0.6 gms** with fresh mulberry leaf (FML) on the 6<sup>th</sup> day of 5<sup>th</sup> instar larval stage and **0.0 gms** on the 2<sup>th</sup> day of 5<sup>th</sup> instar larval stage at optimum temperature (25°C) and relative humidity (75-80%).

**Table-3: Analysis of silk gland weight in amla treated mulberry leaves and fresh mulberry leaves (control) on 5<sup>th</sup> instar larval stage at optimum temperature and relative humidity:**

Larvae	Temperature (°C)	Humidity (RH %)	Treatment	Day's of 5 <sup>th</sup> instar	Weight of silk gland (grams)
50	25°C	75-80%	Amla Treated Mulberry Leaf (ATL)	2	0.5 ±0.465
				4	0.8 ±1.093
				6	<b>1.00 ±1.670</b>
50	25°C	75-80%	Fresh Mulberry Leaf (FML) <b>CONTROL</b>	2	0.00 ±0.576
				4	0.2 ±0.879
				6	<b>0.6 ±1.576</b>

**Figure-1: Shows the weight of silk gland in amla treated mulberry leaf and fresh mulberry leaf at 5<sup>th</sup> instar larvae silkworm.**



**Evaluation of economic parameters in amla extract treated mulberry leaf and fresh mulberry leaf:**

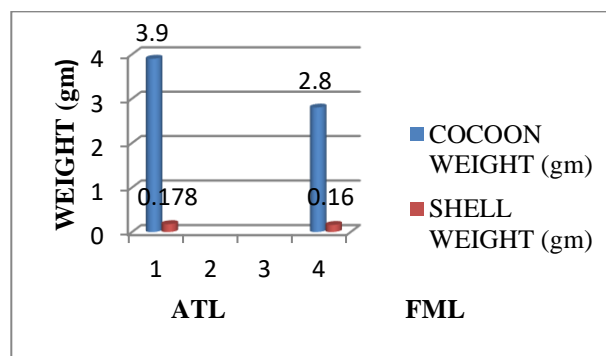
In the present investigation the results of Cocoon weight and shell weight of amla treated mulberry leaves and fresh mulberry leaves are summarized in table 4 and figure 2.

**Cocoon weight:** The results showed that cocoons formed by larvae treated with mulberry leaves dipped in amla extract weighed more than those formed by larvae fed with fresh mulberry leaves. The maximum cocoon weight and shell weight was found **3.9 gms** and **0.178 gms** with amla extract treated mulberry leaf (ATL) and **2.8 gms** and **0.16 gms** respectively with fresh mulberry leaf (FML) at optimum temperature (25°C) and relative humidity (75-80%).

**Table- 4: Effect of Amla Treated Mulberry Leaf (ATL) and Fresh Mulberry Leaf on weight of cocoon, weight of shell at optimum temperature and relative humidity:**

Larvae	Temperature (°C)	Humidity (RH %)	Treatment	Average weight of cocoon (grams)	Average Weight of shell (grams)
50	25°C	75-80%	Amla Treated Mulberry Leaf (ATL)	<b>3.9±1.899</b>	<b>0.178±1.56</b>
50	25°C	75-80%	Fresh Mulberry Leaf (FML) <b>CONTROL</b>	<b>2.8 ±0.75</b>	<b>0.16 ±1.40</b>

**Figure-2: Shows the effect of amla treated mulberry leaf (ATL) and fresh mulberry leaf (FML) on weight of cocoon and weight of shell.**



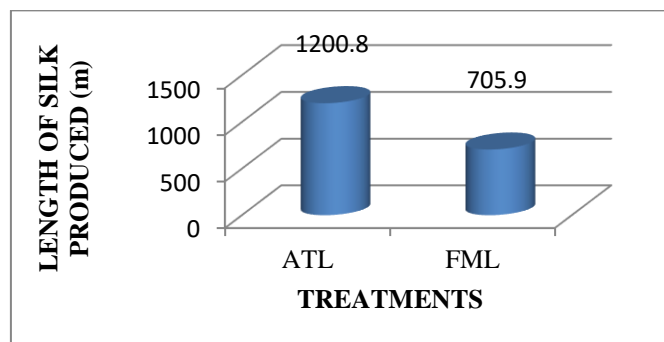
**Length of silk produced:**

In the present investigation the results of silk production of amla treated mulberry leaves and fresh mulberry leaves are summarized in table 5 and figure 3. The maximum amount of silk produced was **1200.8 meters** with amla extract treated mulberry leaf (ATL) at optimum temperature (25°C) and relative humidity (75-80%) and **705.9 meters** with fresh mulberry leaf (FML) respectively at optimum temperature (25°C) and relative humidity (75-80%).

**Table-5: Effect of Amla Treated Mulberry Leaf (ATL) and Fresh Mulberry Leaf (FML) on length of silk at optimum temperature and relative humidity:**

Larvae	Treatments	Length of silk produced (meters)
50	Amla Treated Mulberry Leaf (ATL)	<b>1200.8 ±1.892</b>
50	Fresh Mulberry Leaf (FML) <b>CONTROL</b>	<b>705.9 ±2.897</b>

**Figure-3: Shows the effect of amla treated mulberry leaf (ATL) and fresh mulberry leaf (FML) on length of silk produced.**



### DISCUSSION

The control and prevention of bacterial infection during silkworm rearing helps to increase the silk productivity by preventing the mortality to a great extent. Various treatments in practice are of synthetic chemicals but no natural product has been commercialized yet. In a view, use of amla extract improves the productivity of the silk if proper dose (10% aqueous extract) were set as per our study. The use of amla in improving the silk productivity was also reported earlier<sup>3</sup>. Further use of amla in combinations of several plants extracts may improve the efficacy of treatment by combined effect. Use of 10% amla in aqueous solution and its intermittent spraying during rearing improves the larval survival by preventing the bacterial infection without affecting the silk production capability due to herbal treatment<sup>4</sup>.

In the present study the silkworm were treated with amla extract for curing various bacterial, fungal, viral diseases and cause increase in larval weight, larval length, silk gland weight, cocoon weight, extension of the fifth instar larval period and silk length. The maximum larvae weight, larval length, silk gland weight, cocoon weight and length of silk obtained was **3.1 gms, 6.5 cms, 1.0 gms, 3.9 gms, 1200.8 meters** respectively with amla extract treated mulberry leaf (ATL) whereas minimum larvae weight, larval length, silk gland weight, cocoon weight and length of silk obtained was **2.3 gms, 5.3 cms, 0.6 gms, 2.8 gms, 705.9 meters** respectively with fresh mulberry leaf (FML).<sup>5</sup> reported that amla extract treated silkworms resulting in higher cocoon and pupal weights and better survival. <sup>6</sup> studied the spraying of aqueous amla extract on silkworm during third, fourth and fifth instars resulted in higher cocoon and shell weights, silk productivity and shell ratio. <sup>7</sup> reported that the application of amla extract on 24, 48, 72, 90 and 120 h old fifth instar multivoltine larva resulted in increased cocoon and shell weight, shell ratio and silk filament length. **Our study showed that the amla extract have a positive effect on the body weight and cocoon weight of *B. mori* larvae. The present study indicates that the treatment of silkworm with the amla treated mulberry leaf affects the growth, health, development of silkworm and silk productivity.**

### CONCLUSION

The control and prevention of various infections during silkworm rearing helps to increase the silk productivity by preventing the mortality to a great extent. In a view, use of amla extract during rearing improves the larval survival by preventing the infections and also improves the productivity of the silk.

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