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## Investigations on dynamics of serimore in relation to cellular catalase activity and economic traits of the silkworm hybrid

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### Abstract

In the present investigation, the FC<sub>1</sub> x FC<sub>2</sub> silkworm hybrid was utilized and analyzed the role of hemolymph and midgut catalase activity and the expression of the performance of the economic traits of the mulberry silkworm hybrid. The research data in relation to an investigation related to the influence of Serimore, a JH analog on hemolymph and midgut catalase of fifth instar silkworm and economic characters of FC<sub>1</sub> X FC<sub>2</sub> double hybrid are presented two different intervals of time of topical administration. In silkworm, the hemolymph catalase activity major is decreased in the order of day 1 to day 6 in control, T<sub>1</sub>, and T<sub>2</sub> batches. The order of decrease is due to the progressive development of the larval period but the quantum of changes is on par with T<sub>0</sub>, T<sub>1</sub>, and T<sub>2</sub> batches and all the sixth days of fifth instar larvae. The midgut catalase activity of FC<sub>1</sub> x FC<sub>2</sub> silkworm hybrid showed relatively more compared to the hemolymph catalase activity at T<sub>0</sub>, T<sub>1</sub>, and T<sub>2</sub> batches. It is because of the continuous food consumption, the enzyme profile exhibits profusely the activity of the enzyme. The quantum of expression of economic characters in terms of percent change is attributed to the expression of better performance of cocoon weight, shell ratio, filament length, filament weight, and denier except for renditta at T<sub>2</sub>(48h) and T<sub>1</sub>(24h) followed by T<sub>0</sub>(untreated control) were obtained in the present experimental approaches. Serimore is a bioactive synthetic formulation designed and developed for the improvement of breed performance and their evaluation, therefore it has been chosen for understanding the role/dynamics of the synthetic compound in the present investigations.

**Keywords:** Serimore, catalase enzyme, hemolymph, midgut, economic traits

### 1. Introduction

Sericulture is an art and science of rearing to produce a cocoon. The silkworm, *Bombyx mori*, L. is an important insect for the production of raw silk. The silk production in India needs an improvement in quantity as well as quality compared to other major silk-producing countries. The strategies for the success of the sericulture industry is primarily depending on the successful harvest of the cocoon crops. Silkworm growth regulators (SGRs) such as juvenile and moulting hormones and their analogs (juvenoids and ecdysoids) when it is used judiciously have been found to be useful in the sericulture industry. The silkworm, *Bombyx mori* is known to exhibit a stimulatory effect on the administration of exogenous JH analogs in minute quantities which leads to enhancement in commercial traits such as cocoon weight, shell weight, and silk filament length (Akai *et al.*, 1985; Mamatha *et al.*; 2006; 2008) [4, 15, 14]. The process of the event of moulting and metamorphosis are two characteristic features of growth and development in insects is regulated by circulating hormones like a prothoracic tropic hormone (PTTH), juvenile hormone (JH), and ecdysterone. The pattern of insect development can be altered to a certain extent by exogenous administration of mimics or analogs of these circulating hormones (Sakurai, *et al.*, 1989) [24]. This principle has been exploited in the sericulture industry in which the silkworm rearing and the production of cocoons can be managed effectively or manipulated positively depending on the requirement by administering bioactive compounds mimicking the circulating hormone regardless of the source. JH analogs or mimics have been a celebrated option for Seri culturists as these can control silk gland function and indirectly cause an increase in silk production (Sehna and Akai, 1990) [26]. Earlier it was made clear that exogenous JH delays the silkworm larval

maturation and the increase in silk yield was mainly because of this phenomenon (Akai *et al.*, 1988). Some of the synthetic JH analogs/mimics popular elsewhere were later on experimented sparingly in India to observe their effects on silkworm and reported improvement in the expression of economic traits (Magadam and Hooli, 1991; Trivedy *et al.*, 1993, 1997) [13, 29, 30]. In silkworm, *Bombyx mori* L., an exogenous dose of a minute quantity of JHA elicits a positive response in terms of the growth and increased silk production (Nair *et al.*, 2003) [21]. The enhancement is dependent on the dose of the compound, time of application, and the number of applications (Miranda *et al.*, 2002) [17]. The enzymes provide an energy needed for all the metabolic reactions in an organism. Catalase is one of the antioxidant enzymes involved in regulating the cellular level of active oxygen species. Accumulation of hydrogen peroxide and declines in catalase activity is associated with the aging process. Living organisms require mechanisms regulating reactive oxygen species (ROS) such as hydrogen peroxide and superoxide anion. In insects, catalase is recognized as the key enzyme to be solely responsible for the entire scavenger (ROS), which plays an important role in the innate immune system of an insect. It stimulates signal transduction and mediates different responses such as cellular growth and apoptosis.

## 2. Materials and Methods

**Silkworm rearing:** Disease-free layings of popular and high yielding bivoltine silkworm double hybrid namely, FC<sub>1</sub> x FC<sub>2</sub> utilized in the present study. Silkworms are reared following standard recommended conditions at a temperature of 29±1°C and 75±5% relative humidity under 12:12 (light: dark) photoperiod. Victory-1 mulberry variety leaves harvested from a frequently irrigated mulberry garden were fed to silkworm three times a day. After the completion of the fourth moult, larvae were counted and divided into three different groups and continued the rearing in ventilated plastic rearing trays measuring 90x60 cm.

**Topical Administration of Serimore:** Serimore is a synthetic growth promoter most commonly used for the substantial improvement in larval growth and quantitative and qualitative traits of the silkworm procured from Sericare, division of health care private limited. KHB Industrial Area, Yelahanka New town, Bengaluru-06. Serimore was administered during the fifth instar at 24h and 48h of intervals at a concentration of 0.1 microliter/silkworm larvae (5ml Serimore dissolved in 2.5 liters potable water and sprayed on the healthy silkworm) and utilized for day to day changes in the catalase activity of hemolymph and midgut tissue. The control batches were maintained to compare the results obtained. The mixture of serimore was then topically applied to different batches of fifth instar silkworm at 24 and 48h of intervals. The silkworm larvae were left on the bed for 30 min and then fed with fresh mulberry leaves. An untreated control was maintained in parallel to compare the results. Each treatment was replicated into 3 times with 250 healthy silkworm larvae per replication were maintained.

**Tissue preparation for enzyme assay:** The tissue preparations were made on 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> days of the fifth instar silkworm larvae both in control and serimore treated batches. To prepare the tissue homogenate for

enzyme estimations, hemolymph samples were collected from 6 to 7 larvae by random selection. The abdominal legs of the larvae were amputated and placed in the pre-chilled centrifuge tube. The larvae were dissected in 0.9% saline at pH 6.5 on a chilled dissection tray. The midgut tissues were collected and stored at -20°C. 0.5 ml hemolymph was extracted to avoid the activity of prophenol oxidized followed by the melanization of hemolymph, 1mg phenylthiourea was added while the collection of hemolymph samples and samples were centrifuged for 10 minutes at 4000 rpm at -4°C. The supernatant was transferred to pre-chilled tubes and kept at -20°C till the commencement of experimentation.

### Enzyme Assay: Catalase (CAT) activity (EC: 1.11.1.6)

Measurement of catalase activity: 0.1 ml stored hemolymph and 100 mg of midgut were homogenized in 10 ml distilled water at -4°C as a test solution. Total CAT activity was spectrophotometrically measured by the method of Aebi *et al.*, 1984 [1]. The decrease in absorbance at 240 nm was monitored at 30°C. To examine the distribution of the activity, the test solution was prepared by the following methods, frozen tissues were homogenized in 70 mM solution of potassium phosphate buffer (pH 6.5) containing 0.1% Triton X-100, and insoluble substances were centrifuged out. Tissue protein concentrations were measured according to Lowry's *et al.* method (1951) [11]. Each measurement was considered with three separate observations.

**Data collection:** Weight of ten healthy fifth instar silkworm larvae were recorded daily and the same was plotted in a line graph to monitor the growth of larvae under the influence of serimore. The duration of the fifth instar was calculated in the treated batches and also in control. On maturation, the larvae were transferred onto mountages and all the cocoons were harvested on the 6th day. The total number of good cocoons, cocoon weight, and cocoon shell weight (average of 10 males and 10 females per replication) were recorded. Further, survival, yield per 10000 larvae, and the shelling percentage were calculated using standard formulae.

**Larval weight (g):** Ten healthy silkworm larvae were randomly selected in each replication of every treatment and weighed just before spinning and the average single larval weight was computed.

**Cocoon weight (g):** The cocoons were randomly selected from each treatment replication-wise, weighed individually and the average single cocoon weight was completed.

**Shell weight (g):** After removing the pupae and larval exuvium from cocoons the individual shell weight was recorded.

**Shell ratio (%):** The shell ratio was calculated using the formulae.

$$\text{Shell ratio} = \frac{\text{Shell Weight (g)}}{\text{Cocoon Weight (g)}}$$

**Filament Length (m):** Ten cocoons were randomly selected from each batch was reeled to find out the single filament of

the cocoon using epprouvette and was determined by adopting the formulae.

$L = R \times 1.125$  (R= Number of revolutions recorded by an epprouvette in a meter)

**Filament weight (g):** Ten cocoons were randomly selected from each batch and reeled the average filament weight was recorded.

**Denier (d):** This denotes the thickness of filament, 9000 meters of the silk filament weighing 1g is considered as 1 denier. It was calculated using the following formulae.

$$\text{Denier} = \frac{\text{Weight of the filament(g)}}{\text{Length of the filament(m)}} \times 9000$$

**Renditta:** This is a measure of actual silk available from the cocoons. The renditta was expressed as the numbers of cocoons required to obtain a kg of raw silk.

$$\text{Renditta} = \frac{\text{Cocoon Weight (g)}}{\text{Raw silk Weight (g)}}$$

**Statistical analysis:** The data were subjected to statistical analysis employing one way ANOVA to ascertain the significance of the results at 5 and 1% level using 'Analyse-it' statistical package.

### 3. Results and Discussion

The experimental design is made to carry out by utilizing  $FC_1 \times FC_2$  silkworm hybrid treated with active growth promoter namely, Serimore during fifth instar larval stage with the concentration of 0.2 ml prepared by using 5 ml of Serimore dissolved in 2.5 liters of distilled water and mixed thoroughly for the uniform concentration and same has been used as a spray on the 250 healthy silkworm larvae on rearing trays in two different intervals of 24h and 48h with three replications were maintained for the evaluation of hemolymph and midgut catalase of  $FC_1 \times FC_2$  silkworm hybrid at the same time the untreated control was maintained for the comparison of larval weight and cocoon parameters/ characters. The larval weight of  $FC_1 \times FC_2$  silkworm hybrid was treated with 0.2 ml of Serimore in two different intervals after 24h and 48h of fifth instar silkworm. The larval weight is considered an average of ten healthy silkworm larvae from day 1 to day 6. The larval weight is increased in day to day larval development in untreated control and treated batches until the day of the spinning period. The treatment intervals of 24 and 48h are represented as  $T_1$  and  $T_2$  batches in comparison with untreated control designated as  $T_0$ . The percent changes are 5.17 on the second day, 5.68 on the third day, 6.81 on the fourth day, 11.65 on the fifth day, 9.15 on the sixth day in  $T_1$  batches. Similarly, the percent change is also calculated for  $T_2$  (48h of an interval) is 9.89 on the third day, 10.03 on the fourth day, 11.89 on the fifth day, and 12.74 on the sixth day were recorded in  $FC_1 \times FC_2$  silkworm hybrid and statistically significant at 0.5% level through ANOVA. The serimore is an active growth promoter utilized during the larval stage in order to increase the growth parameter and larval biomass which is essential for the improve the silk content obtained ultimately in the cocoon stage. It has been depicted in Table.1 and Fig.1 clearly showed a consistent improvement in the 24h and 48h of treatment of serimore.

The  $T_2$  batch showed a consistent increase of the larval weight compared to  $T_1$  and  $T_0$  batches and data were recorded. Besides the larval weight, the hemolymph and midgut catalase activity of  $FC_1 \times FC_2$  silkworm hybrid is also measured by Aebi *et al* method (1984)<sup>[1]</sup>. The catalase is an important cellular enzyme that helps in protecting the cells from oxidative stress as the result of an imbalance between the pro-oxidant species and the level of defense from the reactive oxygen species such as hydrogen peroxide and superoxide anion. Catalase is an oxidoreductase (EC 1.11.1.6) It is observed in all the living cells. In silkworm, the hemolymph catalase activity major is decreased in the order of day 1 to day 6 in control,  $T_1$ , and  $T_2$  batches. The order of decrease is due to the progressive development of the larval period but the quantum of changes is on par with  $T_0$ ,  $T_1$ , and  $T_2$  batches and all the sixth days of fifth instar larvae. The percent change in hemolymph catalase is 19.87 on the second day, 21.53 on the third day, 23.72 on the fourth day, 19.96 on the fifth day, and 18.66 on the sixth day. In  $T_1$  at 24h intervals, subsequently 34.30 on the third day, 36.37 on the fourth day, 34.93 on the fifth day, and 33.97 on the sixth day. In  $T_2$  at 48h interval of treatment of serimore were recorded and depicted in Table 2 and Fig 2.

The midgut catalase activity of  $FC_1 \times FC_2$  silkworm hybrid showed relatively more compared to the hemolymph catalase activity at  $T_0$ ,  $T_1$ , and  $T_2$  batches. It is because of the continuous food consumption, the enzyme profile exhibits profusely the activity of the enzyme. The midgut catalase revealed the percent change as 14.28 on the second day, 14.66 on the third day, 15.12 on the fourth day, 16.20 on the fifth day, and 16.51 on the sixth day in  $T_1$  compared to  $T_0$  batches were expressed in  $\mu$ moles. Similarly, the percent change was observed at 24.74 on the third day, 26.27 on the fourth day, 25.27 on the fifth day, and 27.49 on the sixth day in  $T_2$  compared to  $T_0$  as an untreated control expressed in  $\mu$ moles and the values depicted in Table.3 and Fig.3 revealed significant differences at 0.5% level of variance. The serimore is the most active biologically important synthetic growth promoter influences profusely on the pattern of expression of economic characters during the late age silkworm rearing. As a result, the performance of  $FC_1 \times FC_2$  silkworm hybrid was assessed at 24 and 48h of treatments in the larval period. Therefore, the quantitative and qualitative traits of the silkworm hybrid were determined in order to analyze the statistical data. The percent change in cocoon weight is 0.19g, shell weight 2.00g, shell ratio 0.33%, filament length 1.12m, filament weight 1.92g, denier 0.12d, and renditta 2.14kg were obtained in  $T_1$  at 24h of intervals over  $T_0$  as an untreated control. The percent change in cocoon weight 0.78g, shell weight 2.59g, shell ratio 0.55%, filament length 2.07m, filament weight 3.78g, denier 1.19d, and renditta 2.49kg in  $T_2$  at 48h of intervals were recorded compared to  $T_0$  batch and treated  $T_1$  and  $T_2$  batches respectively. Therefore, Table.4 and Fig.4.1 to 4.7 were depicted in the support of the table except for renditta all other characters are achieved positive responses with special reference to the treatment of active growth promoter namely, serimore. The serimore is the most commonly used synthetic compound recommended for the utilization during the late stage of the silkworm, *Bombyx mori* to ensure the manifestation and expression of all the economic characters. In the present study, the  $FC_1 \times FC_2$  silkworm hybrid was utilized and analyzed the role of hemolymph and midgut catalase activity and the expression

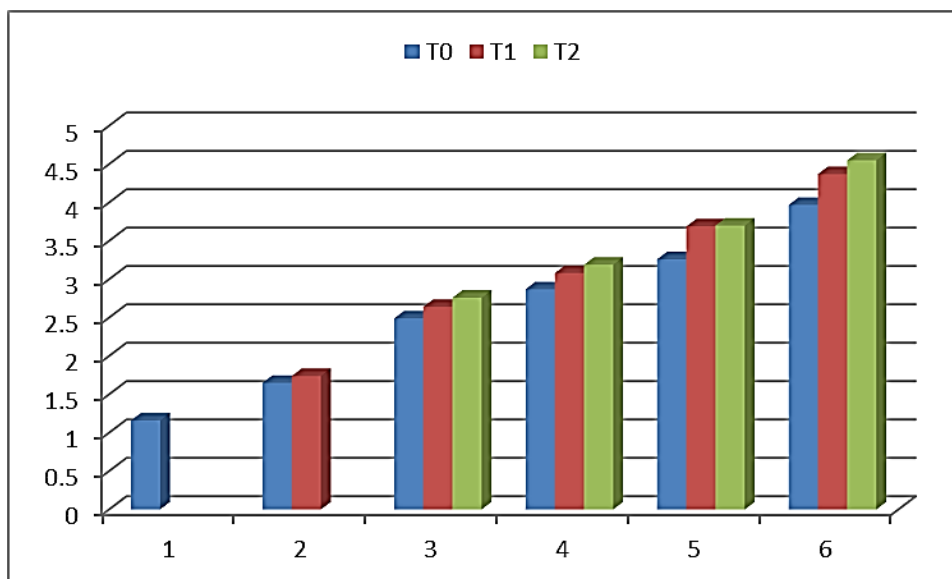
of the performance of the economic traits of the mulberry silkworm hybrid. The research data in relation to an investigation related to the influence of Serimore, a JH analog on hemolymph and midgut catalase of fifth instar

silkworm and economic characters of FC<sub>1</sub> X FC<sub>2</sub> double hybrid are presented two different intervals of time of topical administration.

**Table 1:** Larval weight of FC<sub>1</sub> X FC<sub>2</sub> larvae treated with 0.2 ml of serimore after 24h and 48h of duration in fifth instar silkworm (Average of three observations ± SD)

Treatments	Fifth instar (Days)					
	1	2	3	4	5	6
T <sub>0</sub> Control	1.16 ± 0.23	1.65 ± 1.44	2.49 ± 2.66	2.87 ± 2.86	3.26 ± 4.80	3.97 ± 0.59
T <sub>1</sub> (24h)		1.74 ± 0.13	2.64 ± 0.54	3.08 ± 2.80	3.69 ± 1.20	4.37 ± 1.66
Percent change		5.17**	5.68**	6.81**	11.65**	9.15**
T <sub>2</sub> (48h)			2.76 ± 0.38	3.19 ± 1.77	3.70 ± 1.84	4.55 ± 1.26
Percent change			9.89**	1 0.03**	11.89**	12.74**

\* Non-Significant \*\* Significant at (0.5% level)

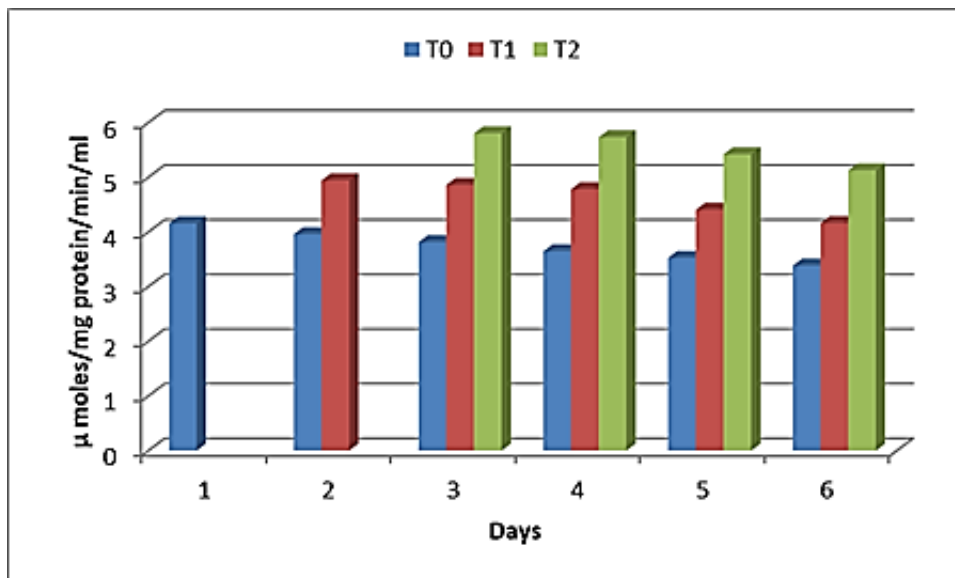


**Fig 1:** Larval weight of FC<sub>1</sub> X FC<sub>2</sub> larvae treated with 0.2 ml of serimore after 24h and 48h of duration in fifth instar silkworm

**Table 2:** Haemolymph catalase activity of FC<sub>1</sub> X FC<sub>2</sub> larvae treated with 0.2 ml of serimore after 24h and 48h of duration in fifth instar silkworm (Average of three observations ± SD) (μ moles/mg protein/min/ml)

Treatments	Fifth instar (Days)					
	1	2	3	4	5	6
T <sub>0</sub> Control	4.158 ± 0.23	3.962 ± 1.44	3.815 ± 2.66	3.649 ± 2.86	3.528 ± 4.80	3.386 ± 0.59
T <sub>1</sub> (24h)		4.945 ± 1.90	4.862 ± 0.38	4.784 ± 1.77	4.408 ± 1.84	4.163 ± 1.26
Percent change		19.87**	21.53**	23.72**	19.96**	18.66**
T <sub>2</sub> (48h)			5.807 ± 0.38	5.735 ± 1.77	5.422 ± 1.84	5.128 ± 1.26
Percent Change			34.30**	36.37**	36.37**	33.97**

\* Non-Significant \*\* Significant at (0.5% level)

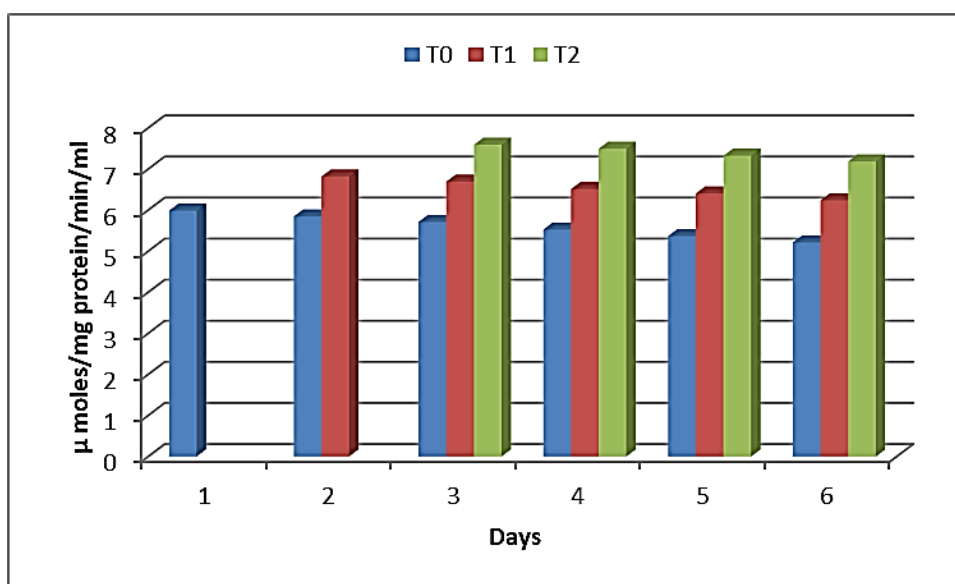


**Fig 2:** Haemolymph Catalase activity of FC<sub>1</sub> X FC<sub>2</sub> larvae treated with 0.2 ml of serimore after 24h and 48h of duration in fifth instar silkworm

**Table 3:** Midgut catalase activity of FC<sub>1</sub> X FC<sub>2</sub> larvae treated with 0.2 ml of serimore after 24h and 48h of duration in fifth instar silkworm (Average of three observations ± SD) (µ moles/mg protein/min/ml)

Treatments	Fifth instar (Days)					
	1	2	3	4	5	6
T <sub>0</sub> Control	5.985 ± 0.23	5.846 ± 1.44	5.714 ± 2.66	5.528 ± 2.86	5.369 ± 4.80	5.210 ± 0.59
T <sub>1</sub> (24h)		6.820 ± 1.90	6.696 ± 0.38	6.513 ± 1.77	6.407 ± 1.84	6.241 ± 1.26
Percent change		14.28**	14.66**	15.12**	16.20**	16.51**
T <sub>2</sub> (48h)			7.593 ± 0.38	7.498 ± 1.77	7.324 ± 1.84	7.186 ± 1.26
Percent change			24.74**	26.27**	25.27**	27.49**

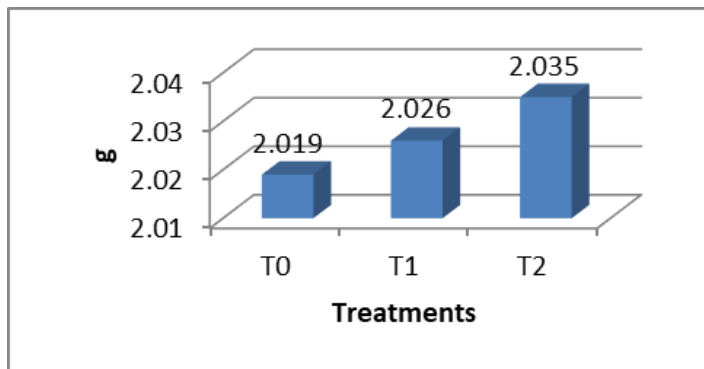
\* Non-Significant \*\* Significant at (0.5% level)



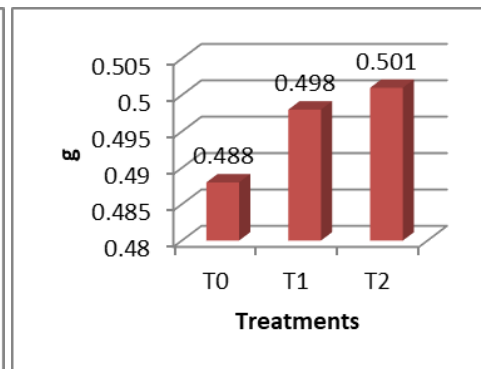
**Fig 3:** Midgut Catalase activity of FC<sub>1</sub> X FC<sub>2</sub> larvae treated with 0.2 ml of serimore after 24h and 48h of duration in fifth instar silkworm

**Table 4:** Economic parameters of FC<sub>1</sub> X FC<sub>2</sub> larvae treated with 0.2 ml of serimore after 24h and 48h of duration in fifth instar silkworm (Average of three observations ± SD)

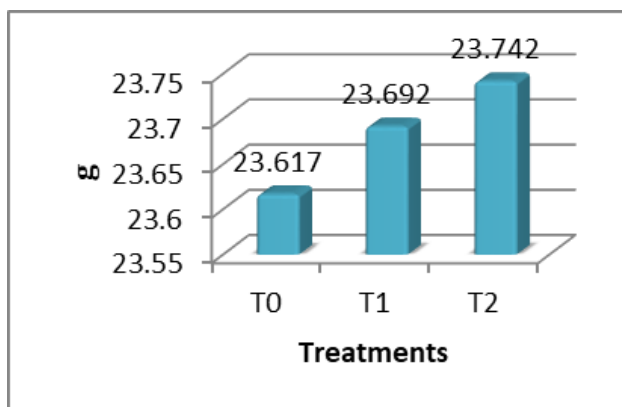
Treatments	Economic traits						
	Cocoon weight (g)	Shell weight (g)	Shell ratio (%)	Filament length (m)	Filament Weight (g)	Denier (d)	Renditta (kg)
T <sub>0</sub> control	2.019 ± 0.01	0.488 ± 0.018	23.61 ± 0.14	1,116.00 ± 2.646	0.305 ± 0.001	2.817 ± 0.018	6.123 ± 0.09
T <sub>1</sub> (24h)	2.026 ± 0.015	0.498 ± 0.027	23.69 ± 0.045	1,128.67 ± 2.737	0.311 ± 0.004	2.823 ± 0.021	6.085 ± 0.061
Percent change	0.19*	2.00**	0.33*	1.12**	1.92**	0.21*	2.14**
T <sub>2</sub> (48h)	2.035 ± 0.015	0.501 ± 0.027	23.742 ± 0.045	1,139.67 ± 2.737	0.317 ± 0.004	2.851 ± 0.021	5.97 ± 0.031
Percent change	0.78*	2.59**	0.55*	2.07**	3.78**	1.19**	2.49**



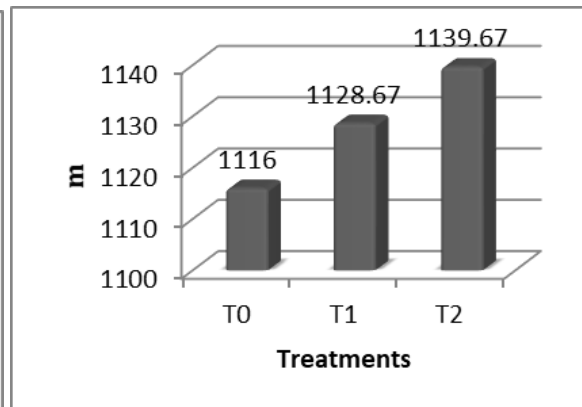
**Fig 4.1:** Cocoon weight



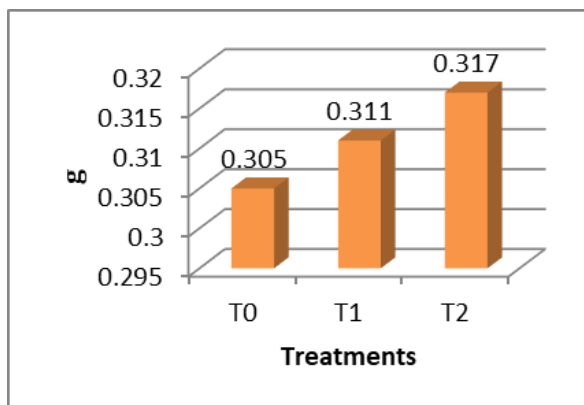
**Fig 4.2:** Shell weight



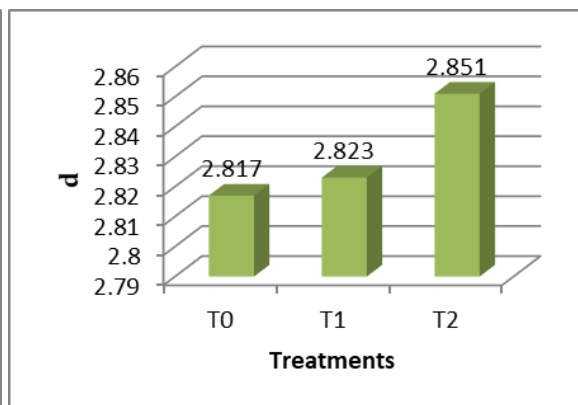
**Fig 4.3:** Shell ratio



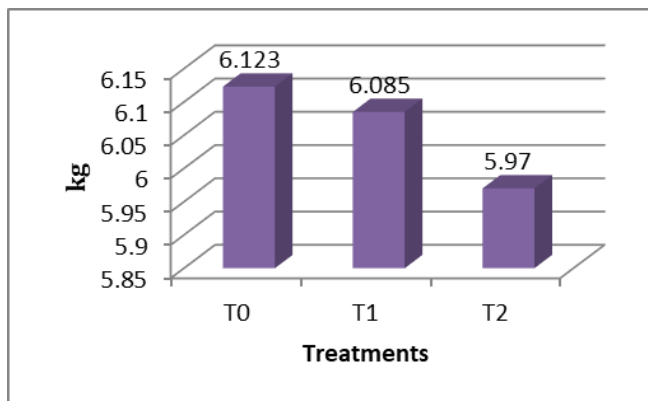
**Fig 4.4:** Filament length



**Fig 4.5:** Filament weight



**Fig 4.6:** Denier



**Fig 4.7:** Renditta

**Fig 4:** Economic parameters of FC<sub>1</sub> X FC<sub>2</sub> larvae treated with 0.2 ml of serimore after 24h and 48h of duration in fifth instar silkworm



**Plate 1:** Untreated control batch of the silkworm larvae and cocoons



**Plate 1:** Untreated control batch of the silkworm larvae and cocoons.



**Plate 3:** Silkworm larvae treated with Serimore after 48h and their harvested cocoons.

**Larval traits:** The effect of JH hormone on the larval characters namely larval weight, the larval duration is significantly contributed to a positive response during the

late larval stage. The JH mimics are potential active biomolecules that could trigger the cellular functions of the

silk gland and proliferation of silk synthesis and increase silk production (Sehna and Akai, 1990) [26].

**Catalase activity:** Cytosolic enzyme catalase is a component of the antioxidant defense system that reduces hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) to water and protects the cell from oxidative damage (Bandopadhyay *et al.*, 1999) [6]. H<sub>2</sub>O<sub>2</sub> is normally eliminated from the cells by the activity of catalase and peroxidase. The role of Catalase activity in insect defense has been explained by Wu Xiaofeng and Xu Junliang (1998) [31]. In insects, Catalase is recognized as the key enzyme to be solely responsible for the Scavenger of ROS. Accumulation of hydrogen peroxide and decline in catalase activity is associated with the aging process of organisms. Living organisms require mechanisms regulating Reactive Oxygen Species (ROS) H<sub>2</sub>O<sub>2</sub> and superoxide anion. Felton and Summers (1995) [7] highlighted the role of catalase activity in defense mechanisms in insects.

**Cocoon characters:** The cocoon characters are assessed and evaluated in selected silkworm hybrid as important quantitative traits namely, cocoon weight shell weight and shell ratio. The JH compound was tested and justified in respective to increase of the rate of silk protein, cocoon weight, shell weight was reported by Nair *et al.* (2002) [20] and screened many JH mimic compounds for the purpose of understanding the effect on silkworm growth and silk yield.

**Post Cocoon Characters:** The increased shell weight represents the converted silk content in the form of bave which is indicated as a qualitative parameter. The role of JH mimics for the stimulation and conversion of silk protein synthesis at the molecular level and elicits substantially an improvement in the filament characters including the denier. It is believed that the conversion of an additional quantity of leaf consumed during an extended period and stimulatory effect of the compound on protein synthesis and silk gland is suggested by Kajiura and Yamashita (1989) [9]. These changes attributed to founding at the molecular level might be the result of alterations in the ratio of circulating hormone. The economic characters of the silkworm hybrid exhibited a positive response in juvenoid treated breeds without any difference in the developmental simultaneity as reported by Muroga (1975) [18]. JH analogs in minute quantities which lead to enhancement in commercial traits such as cocoon weight, cocoon shell weight, and silk filament length (Akai *et al.*, 1985; Mamatha *et al.*, 2008) [4, 14]. The synthetic active functional JH mimic is potential for the benefit of the sericulture industry and registered a prominent exogenous hormone for enhancing the activity of the feeding and silk production. The results revealed in the present investigation is clearly pointed out that, the synthetic and natural JH can be presently tested on silkworm, *Bombyx mori*, and subsequently the content of the silk is exploited in the order of increasing the 10-20% of the raw silk content for the benefit of the industry. It is noteworthy that the JH hormonal mimic is a bioactive compound is formulated in such a way for the third generation and employed for the improvement of all most all the commercial traits especially larval weight, shell weight, shell ratio, filament length, filament weight are phenomenal achievements of the goal in the sericulture industry. Akai and Kobayashi (1971) [2] reported that the juvenile hormones or their derivatives and analogs can be used as growth regulators on the expression

of the commercial silkworm rearing. Juvenile hormone analogs prolonged the larval duration in silkworm. Akai *et al.* (1973) [3] reported that topical application of juvenile hormone mimics induced prolongation of the last instar without any signs of the spinning of the cocoon. At lower Juvenile hormone dosage (0.1µg/larva), the larval growth was prolonged by two or three days. Kobayashi and Akai (1978) [10] studied that, treatment with the JH analogs including Manta increased larval duration. Shibukawa and Akai (1981) [27] studied that, treatment with JH analogs including Manta increased larval duration. Sohn (1986) [28] reported that an increase in larval weight is invariably accompanied by the larval period. Akai *et al.* (1988) [5] reported prolonged larval duration and resultant enhanced bodyweight on exogenous JHA administration. Magadum and Hooli (1989) [12] reported that the topical fourth instar, at 36<sup>th</sup> hour the second and third moult significantly increased the larval duration but significantly decreased moth emergence rates. Nair *et al.*, (2004) [22] studied the influence of juvenoids on silkworm larvae and found that the larval feeding period was extended by a day when the treatment was done at 48 or 72h intervals after the fourth moult compared to untreated control. There was a significant increase in larval body weight. Marghitas *et al.*, (2007) [16] studied the expression of quantitative characters of the silkworm after topical application of methoprene and fenoxycarb. They reported that both positively influenced the duration of the fifth instar silkworm. Gangwar (2009) [8] carried out the experiment on the effect of JH mimic R394 applied topically on the abdominal tergum of the silkworm and reported that a more effective dose was 0.01µl/larvae when applied at 48h and 72h intervals after the resumption of the last moult. It was observed that, the developmental increase due to an increase in the feeding period without any significant increase in raw silk and silk ratio. He found that an increase in the larval period from 1-10 days at different concentrations of JHA. Naseema Begum *et al.*, (2011) [23] studied the influence of juvenile hormone analog methoprene on the silkworm and found that administration of methoprene influenced prolongation of the fifth instar larval period by 24h in PM X CSR<sub>2</sub> and 30h CSR<sub>2</sub> X CSR<sub>4</sub> hybrid. They also reported a significant increase in cocoon weight (6.45 and 10.30%), shell weight (9.25 and 14.53%), and shell ratio (2.56 and 3.80%) in both the silkworm hybrids respectively. Nair *et al.*, (2011) [19] studied the effect of JH analog SB-515 on healthy silkworm and noticed that the larval feeding period was extended from 6-48h depending on the concentration of the compound and the time of administration. The larval weight and larval duration have significantly positive response during the late larval stage. Santhy (2015) [25] found that the application of Manta JHA resulted in the prolongation of a late age larval period.

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### Conclusion

In the present experimental plan and design is confined to serimore is an active synthetic compound used throughout the present investigation. The serimore is a solution is prepared by using 5ml of serimore dissolved in 2.5litre of distilled water for the topical application of serimore on FC<sub>1</sub>x FC<sub>2</sub> hybrid during the fifth instar. The serimore is influenced on the larval weight from the day-1 to day-6 of the fifth instar for the order of an increase of larval weight and exhibited relatively more in T<sub>2</sub>(48h) compared to T<sub>1</sub>(24h) and T<sub>0</sub>(control). The hemolymph catalase activity is declined during the progressive larval period in all the T<sub>0</sub>, T<sub>1</sub>, and T<sub>2</sub> batches but the quantum of differences noticed is relatively more when compared to T<sub>2</sub> and T<sub>1</sub> followed by T<sub>0</sub>(untreated control). The midgut catalase exhibits the activity profile is comparatively more than the hemolymph catalase activity but in the trends is in the order of increase at T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub> were noticed during the fifth instar larval period. The quantum of expression of economic characters in terms of percent change is attributed to the expression of better performance of cocoon weight, shell ratio, filament length, filament weight, and denier except for renditta at T<sub>2</sub>(48h) and T<sub>1</sub>(24h) followed by T<sub>0</sub>(untreated control) were obtained in the present experimental approaches. Serimore is a bioactive synthetic formulation designed and developed for the improvement of breed performance and their evaluation, therefore it has been chosen for understanding the role/dynamics of the synthetic compound in the present investigations.

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