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Studies on evaluation and improvements of growth and economic parameters of *Bombyx mori* (L) influence under Mr2 leaves fortified with natural honey

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Abstract

Silkworm is an important economic insect and also a tool to convert mulberry leaf protein into commercially valuable silk protein. To study the influence of the dietary supplementation of honey in different concentration on the larval growth and economic traits of *Bombyx mori* (L) commercial cross breed race L×CSR2 during its fifth instar. The fresh and pure honey was collected, it was diluted to different concentrations such as 0%, 25%, 50%, 75% and 100% (without dilution). Fresh mulberry leaves (*Morus alba* L) were fortified by each concentration and were fed to 5th instar silkworm five times feeding /day. One group of larvae received MR_2 leaves sprayed with distilled water as control, the remaining groups experiment I, and experiment II, experiment III and experiment IV were fed on different concentration of honey 25%, 50%, 75% and 100%. Silkworm fed on MR_2 leaves sprayed with 25% diluted of honey (Experiment I) was significantly increased the larval growth rate of 0.457g/worm/day, cocoon weight 2.013g and Shell ratio 21.25 as compared to those fed on control and other experimental groups. Hence 25% diluted honey was fixed as effective dose. The honey has growth promoting effect on silkworm which helps to enhance the commercial values in sericulture.

Keywords: *Bombyx mori*, *Morus alba*, Honey and MR_2 leaves.

Introduction

Sericulture is an age old practice in India which high employment potential and economic benefits to agrarian families. No doubt, India is the second largest producer of mulberry silk next to china Vijaya prakash 2005. Nutritional in take has direct impact on the overall genetic traits such as larval and cocoon weight, amount of silk production, pupation and reproductive traits. The healthy growth of the silkworm and ultimately the economic traits are influenced largely by the nutritional status of leaves fed to silkworm Krishnaswami *et al.,* (1971) and Ravikumar (1986) plants are the richest source of organic chemicals on earth and phyto chemicals from plants to influence the life and behaviour of different insects Raja shenkaragowda, R. *et al.,* 1997. Recently the many attempts have been made to fortify mulberry leaves with botanical extracts so as to improve the mulberry leaves quality and fed efficiency of the silkworm which inturn helps to increase cocoon production and silk quality. (Ganesh Prabhu, *et al.,* 2012).

The honey is the natural sweetener and multi factorial nutrient produced by honey bee from floral nectar. (Council of European Union, 2002). Through the century, honey has also been used for medicinal purpose in ceremonial and in worship. Honey has been shown to possess anti-microbial and anti-viral, anti-parasitory, anti-inflammatory, anti-oxidant, anti-mutagenic and anti-tumour effect. Anti-oxidant activity of honey polyvoltine can be measured in vitro by comparing the oxygen radical absorbance capacity with the total phenolics concentration. (Gheldf, N, *et al.,* 2003). The honey contains small amount of proteins, enzymes, aminoacids, minerals, trace elements, vitamins, aromatic compound and polyphenols. It gives physiological and nutritional effects on animals.

Sometimes, it is possible that some deficiency occur due to different reasons. The supplementation of extra nutrients along with mulberry leaves results high yield because the production of superior quality and quantity of silks depends mainly on the nutritional status and healthiness of larva. Honey contains lot of proteins, vitamins and minerals are important for the health of human and it is essential for normal life and also reported that it is necessary for insects.

Taking the clue from above studies, keeping in view the provoke beneficial influence of honey on other groups of animals and an attempt has been made in the present study to make

a comprehensive examination of growth and economic traits of *Bombyx mori* under the impact of honey.

Materials and Methods

For the study, the diseases free laying of multivoltine *Bombyx mori* hybrid (L). (Race L X CSR2) were procured from sericulture unit of State Sericulture seed production centre, Nanngaram. The eggs incubated at ambient temperature of $25^0C \pm 2^0C$ and relative humidity of 70 to 80 per cent until hatching. The newly hatched worms were transferred to rearing beds and instar wise rearing of the larvae feeding them with the appropriate quantity of mulberry leaves (MR2 leaves). (Krishna Swami *et al.,* 1978). The honey was collected from Vibis natural honey bee farm at Madurai and it was diluted into different concentration 25%, 50%, 75% and 100%.

The freshly moult out 5^{th} instar larvae were replicated into five groups. Each group contains 25 worms and reared at optimum environmental conditions. The group I larvae is considered as a control fed with normal mulberry leaves sprayed with distilled water. However, the group II, III, IV and V were the experimental group and the larvae were fed with mulberry leaves fortified with four concentration of honey. The known quantity of leaves for each feeding fortified with honey solution and air dried for fifteen minutes before given to the silk worm. (Rajan *et al*., 2001). The fortification was initiated on the first day of fifth instar of larvae to final day continued upto maturation of larvae.

The morphometric characters are the length, width and weight of the larvae in each group were monitored by weighing balance. The growth rate pattern of the larvae was calculated. When the larvae started spinning they were left uninterrupted for four to five days to form the cocoons. After complete the cocoon formation, the weight of the cocoon in each group was measured.

The economic traits like single cocoon weight, Shell weight, Shell ratio, Sericin and fibroin of each group of *Bombyx mori* were measured and the data were calculated by the following formula.

$$\text{Growth Rate (g)} = \frac{\text{Final weight of the larvae} - \text{initial weight of the larvae}}{\text{Time}}$$

$$\text{Single Cocoon weight (g)} = \frac{\text{Weight of 10 male cocoon + Weight of 10 female cocoon}}{\text{Total number of cocoons}}$$

$$\text{Good Cocoon percentage (\%)} = \frac{\text{Weight of good cocoon}}{\text{Total weight of sample cocoon}} \times 100$$

$$\text{Shell ratio} = \frac{\text{Single shell weight}}{\text{Single cocoon weight}} \times 100$$

Sericin content (g) =

Initial weight of the shell – Dry weight of the shell after alkali treatment

Fibrion content = Dry weight of the shell – Sericin content

Fencundity = Number of egg laid / female moth

The data were analysed statistically by student 't' test.

TABLE 1

Morphometric Measurements of *Bombyx mori* Larvae

Fortified with Various Concentration of Honey

Groups	Length (cm)	Width (cm)	Weight (g)
Control	6.731 ± 0.248	1.121 ± 0.102	2.881 ± 0.321
Experiment I (25%)	7.227 ± 0.232	1.320 ± 0.091	3.432 ± 0.093
Experiment II (50%)	7.031 ± 0.321	1.173 ± 0.242	2.933 ± 0.147
Experiment III (75%)	6.721 ± 0.243	1.100 ± 0.091	2.732 ± 0.335
Experiment IV (100%)	6.214 ± 0.093	1.021 ± 0.381	2.432 ± 0.375

Each values represent the mean ± SD of replicates

H_0: There is no significant difference between control and Experiment I

TABLE 2

Comparison Between Control and Experiment - t Test Results

	Control and Experiment I
t Stat	-3.799
P(T<=t) one-tail	0.0314
t Critical one-tail	2.920
P(T<=t) two-tail	0.063
t Critical two-tail	4.303

As the p value is less than 0.05 ($x<p<0.05$), the null hypothesis is rejected. Hence, there is a significant difference between control and Experiment I.

TABLE 3

Morphometric Measurements of *Bombyx mori* Cocoon

Fortified with Various Concentration of Honey

Groups	Length (cm) (Mean ± SD)	Width (cm) (Mean ± SD)	Weight (g) (Mean ± SD)
Control	2.921 ± 0.113	1.841 ± 0.231	1.702 ± 0.101
Experiment I (25%)	3.425 ± 0.182	2.020 ± 0.310	2.013 ± 0.198
Experiment II (50%)	3.112 ± 0.172	1.832 ± 0.321	1.941 ± 0.121
Experiment III (75%)	2.910 ± 0.223	1.300 ± 0.083	1.724 ± 0.248
Experiment IV (100%)	2.023 ± 0.132	1.202 ± 0.910	1.623 ± 0.378

Each values represent the mean ± SD of replicates

Figure 1

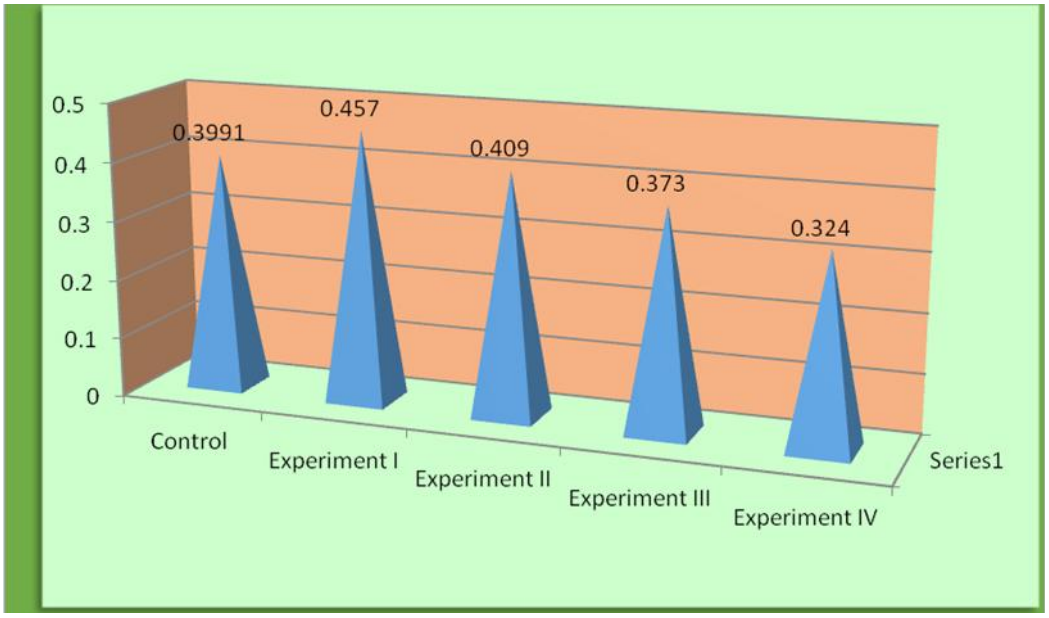

TABLE 4

Economic Traits of *Bombyx mori* under the Influence of

Various Concentration of Honey Fortified with MR2 Mulberry Leaves

Parameters	Control	Experiment I	Experiment II	Experiment III	Experiment IV
Single Cocoon weight (g)	1.721 ± 0.242	2.013 ± 0.197	1.941 ± 0.206	1.787 ± 0.129	1.323 ± 0.125
Good cocoon percentage (%)	84.8	90.1	85.1	84.7	70.3
Shell weight (G)	0.250	0.256	0.249	0.2267	0.202
Shell ratio (%)	18.01	21.28	19.82	17.72	16.15
Sericin (g)	0.067	0.059	0.062	0.052	0.068
Fibroin (g)	0.186	0.197	0.187	0.174	0.134
Fecundity (g)	597.6	626	614	609	520

Each values represent the mean ± SD of replicates

Results

The effects of honey on the Morphometric characteristics of larval and cocoon of *Bombyx mori* are presented in Table 1 and Table 2. Results showed that *Bombyx mori* larval treated *with* 25 % diluted of honey recorded increased larval and cocoon length, weight and shell ratio. The maximum values observed in 25% honey fortified mulberry leaves were larval length (cm) 7.227 ± 0.232, 1.32 ± 0.091 weight, 3.342 ± 0.193 and cocoon length (cm) 3.425 ± 0.182, width 2.02 ± 0.21, weight 2.013 ± 0.231. The corresponding control values of the Morphometric characters of the larvae were 6.731 ± 0.248, 1.121 ± 0.102 and 2.881 ± 0.321 and cocoon values were 2.921 ± 0.113, 1.841 ± 0.231 and 1.702 ± 0.101.

The growth rates of larvae are represented in Figure 1. It showed that 25% diluted honey (Experiment I) is significance difference than the control and other experimental values. The growth rate was recorded 0.457 ± 0.093 and 0.399 ± 0.042.

The economic parameters are presented in Table 3. Experiment I group 25% honey treated larvae showed significant increase of economic characters such as single cocoon weight (g) 2.013 ± 0.231, shell ratio 21.28 ± 0.132.

Discussion

The observed data from this experiment are clearly indicated that there was a significant improvement in growth of larvae, quality and quantity of cocoon and economic traits is honey treated groups. Sankar reported that the growth of silkworm increased significantly upon feeding them with mulberry leaves supplemented with different nutrients. Rajeswari and Isaiarasu suggested that leaf extracts from *Moringa oleifera* shows high larval growth. (1974 ± 53mg/larva).

Moisture content in the leaves enhances the feed efficacy of the larvae which increase the growth rate (Veda and Suzuki 1967). The present investigation revealed that the rearing performance of silkworm was significantly influenced by the leaf variety with honey. It is understood from the present investigation that the combnation of mulberry leaves and natural honey fortification with MR2 leaves shows better growth rate in silkworm and improvement of overall performance of economic traits of *Bombyx mori*. Similar kind of result was observed by the early workers (Ramadevi et.al., 1992; chenthilnayaki *et al*., 2004, Balasundaram *et al*., 2008, Ganesh Prabhu, 2012, Hassanrin and Shaarawy, 1962).

Under the impact of 2 % honey, the silk gland profiles increased during fifth instar development (Thulasi and Sivaprasad 2015).

Conclusion

Honey is a potent modulator of growth, metabolism and silk production in *Bombyx mori*. The results thus suggested that the multvoltine breed L X CSR2 hybrid, reared under 25 per cent honey in diluted from was effective concentration for growth, cocoon production and economic parameters of sericulture. At this concentration, the honey not only stimulates the growth rate, cocoon weights and economic traits of *Bombyx mori,* but also increased the disease resistance of silkworms. So, honey confers that it has two fold advantages on sericulture.

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