

APPLICATION OF ARGININE, HISTIDINE AND THEIR MIXTURE ON ECONOMIC TRAITS OF THE SILKWORM, *BOMBYX MORI* L.

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ABSTRACT

Oral supplementation with 50, 100 and 150 µg/ml arginine to the silkworm larvae resulted in a significant increase in the larval weight, silk gland weight in only 150 µg/ml, cocooning percentage in all the fed groups, female cocoon weight, cocoon shell weight, cocoon shell ratio, male cocoon weight, cocoon shell weight and shell ratio is increased in all the treated groups, filament length were significantly increased in all the treated groups and denier is increased in only 150 µg/ml treated group. The moth emergence percentage, fecundity and hatching percentage were significantly increased in all the treated groups, number of eggs per ovariole and length of the ovariole were significantly increased in all the treated groups. The dietary supplementation with 50, 100 and 150 µg/ml histidine resulted in a significant increase in larval weight, silk gland weight and survival rate in all the treated groups, female cocoon weight was increased, but cocoon shell weight only in 150 µg/ml fed groups, female cocoon shell ratio also increased in all the fed groups, male cocoon weight and shell weight and shell ratio was increased in all the treated groups, filament length and weight and denier were significantly increased in all the treated groups. The moth emergence percentage, fecundity, hatching percentage and length of the ovariole, number of eggs per ovariole were significantly increased in all the fed groups. The oral supplementation with 100 and 150 µg/ml mixture of arginine and histidine to the silkworm larvae resulted in a significant increase in the larval weight, silk gland weight, survival rate, cocoon weight, shell weight and its ratio, male cocoon weight, cocoon shell weight and shell ratio were increased in all the fed groups, but filament length was increased only in 100 and 150 µg/ml treated groups, but weight and denier were significantly increased in all the treated groups. The moth emergence percentage, hatching percentage and fecundity number of eggs per ovariole and length of the ovariole were significantly increased in all the treated groups.

KEY WORDS: Arginine, Histidine, Economic parameters *Bombyx mori*.

INTRODUCTION

The silkworm, *Bombyx mori* is a monophagous insect derives almost all the nutrients required for its growth from the mulberry leaf only. It has been well established that the silkworm requires certain essential sugars, proteins, amino acids, fatty acids, vitamins and micronutrients for its growth and higher production of good quality of silk. The low productivity is mainly attributed to low mulberry yield and poor quality of leaf (Chamundeswari and Radhakrishnaiah, 1994). Feed with various food additives was found to increase the economic characters and play a vital role in the larval development (Kochi and Kaliwal, 2005). The addition of amino acids in low concentrations gave best results regarding weights of larvae, percentage of silk gland, crude protein, cocoon and cocoon shells (Moustafa and Elkaraksy, 1990). The supplementation with a mixture of glycine, alanine, sugar, potassium iodide salt, vitamins, soymilk, sugar, potassium iodide salt, vitamins and milk powder, sugar, potassium iodide salt and vitamins significantly improved the larval weight, silk gland weight, chemical composition of silk gland and cocoon characters of *Bombyx mori* (Sarkar *et al.*, 1995). Fortification of mulberry leaves with extra nutrients like Glucose, glycine, egg albumin, molasses etc., was found to increase the larval growth and improve cocoon characters (Verma and Atwal, 1963; Sengupta *et al.*, 1972). Gridhar and Radha (1986) have reported that supplementation with 10 ppm glycine resulted in higher larval weight, shell weight, and filament length. Babu *et al.*, (1992) and Zaman *et al.*, (1996) have demonstrated that mulberry leaves enrichment with 2% nitrogen increases the weight of the silkworm larvae. Therefore, the present investigation was undertaken to study the effect of amino acids arginine, histidine and their mixture on economic parameters of the silkworm, *B. mori*.

MATERIALS AND METHODS

Animals

In the present study the commercially exploited bivoltine crossbreed silkworm race CSR2 x CSR4 was selected.

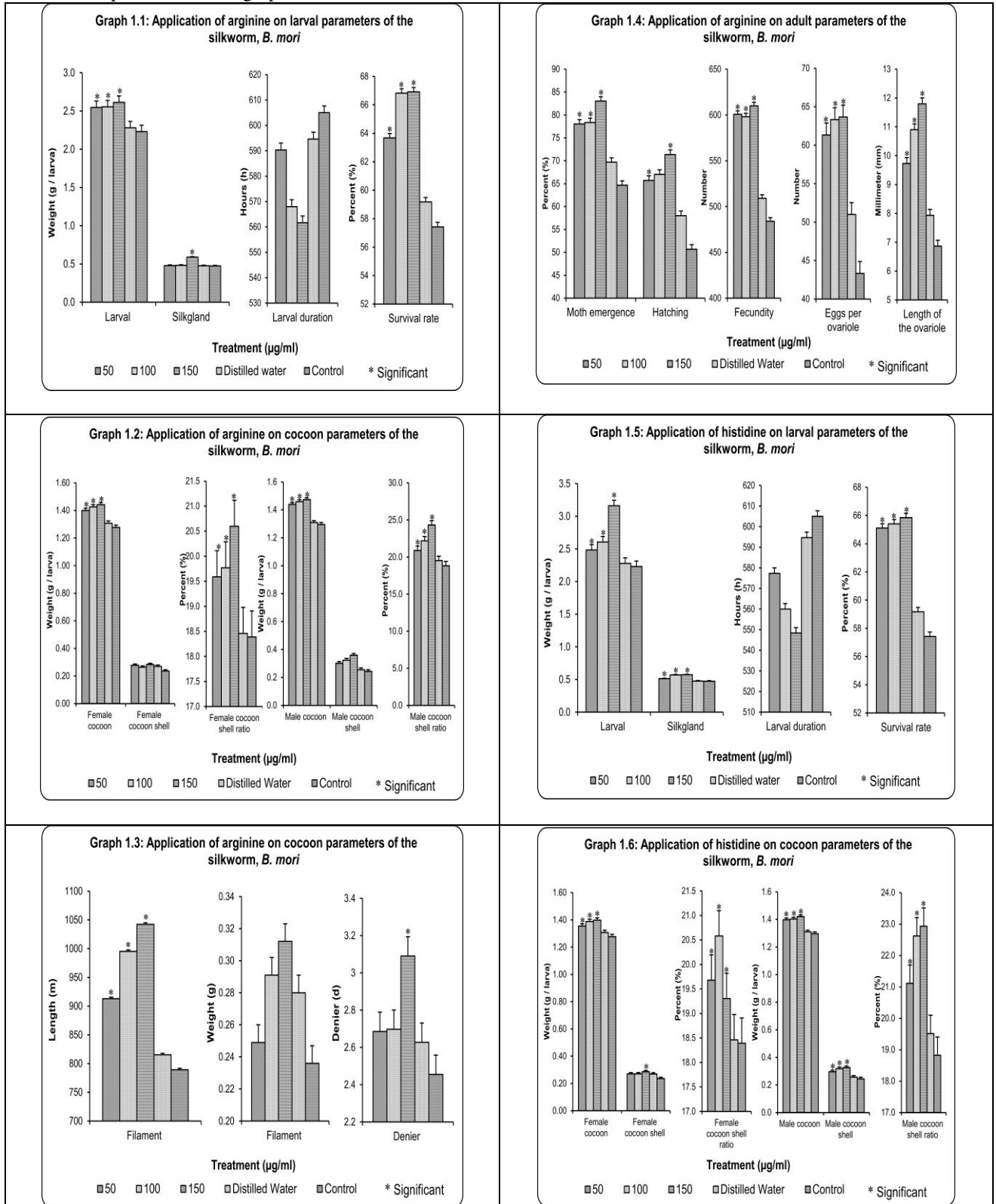
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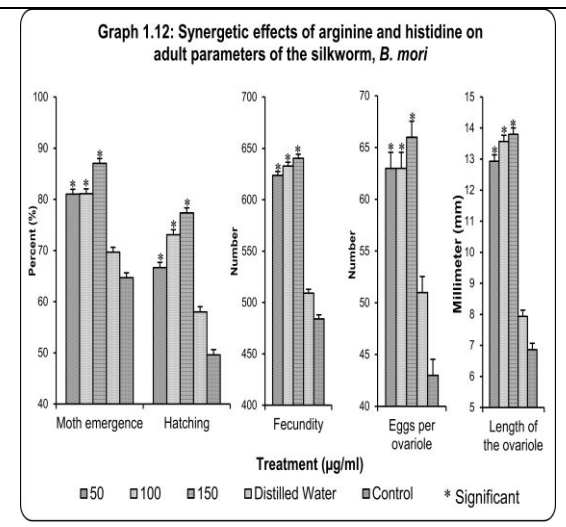
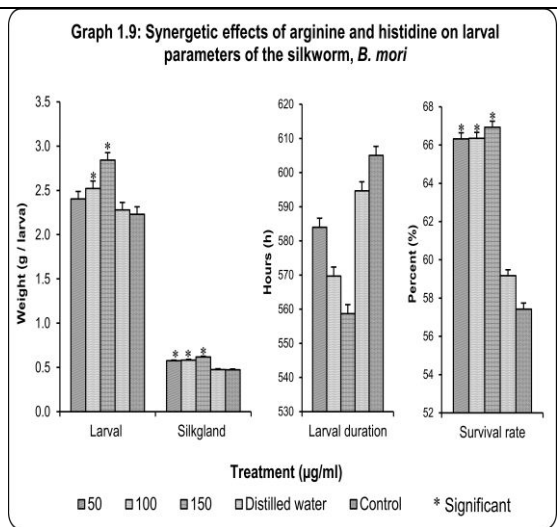
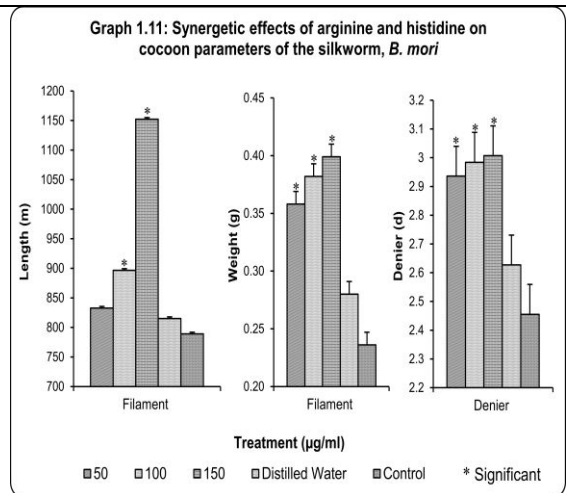
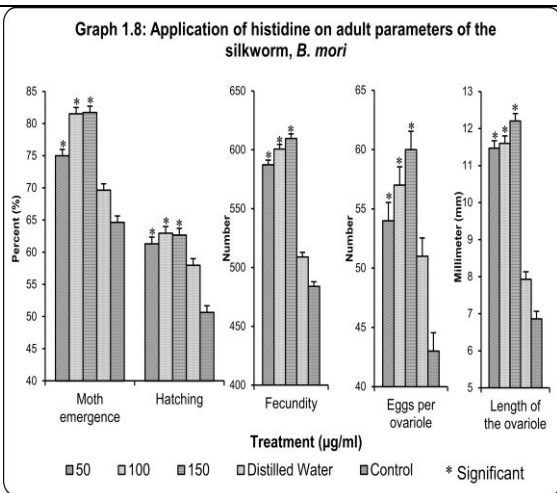
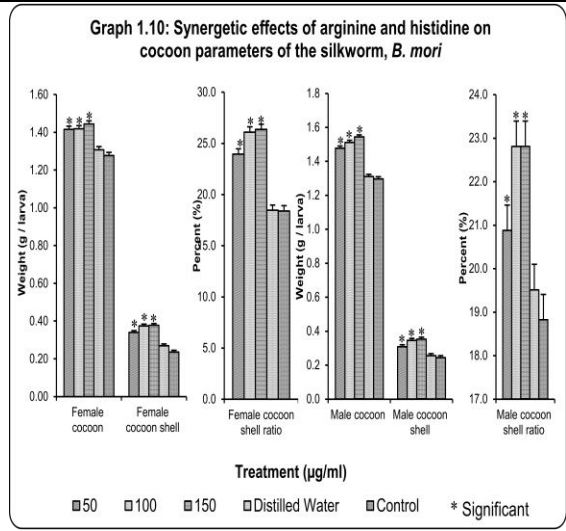
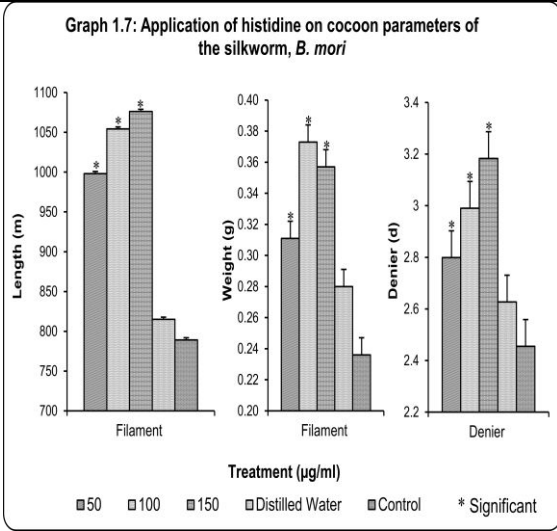
The chemicals arginine and histidine were procured from Sd. Fine- Chem Limited, Mumbai – 400 025, India, Sisco Research Laboratories Private Limited, Bombay- 400 093, India. These amino acids were dissolved in distilled water and diluted viz. 50, 100 and 150 µg/ml. The dietary supplementation of these amino acids was started from the beginning of the V instar to the spinning stage of the V instar to the spinning stage of the silkworm larvae. One kg of

mulberry leaves dipped in 500 ml of solution. Among the four feeding per day, a feeding of treated leaves was followed by three feedings of untreated leaves. The carrier controls were fed with mulberry leaves soaked in distilled water and the normal control were fed with normal leaves. and were subjected to statistical analysis.

RESULTS AND DISCUSSION

The data on the effect of arginine, histidine and their mixture on larval, cocoon and adult parameters of the silkworm, *B. mori* are presented in the graphs 1.1 to 1.12.





Larval weight

The results of the present study showed that the larval weight was significantly increased in all the treated groups with arginine, histidine and their mixture. Similar results have been reported by many scientists Kabila *et al.*, (1994) have described that adding aspartic acid with 1 and 2% concentrations to leaves increases the economic traits in silkworm. Sarkar *et al.*, (1995) have demonstrated that with utilizing alanine (0.5%) and glycine (0.5%) observed more than 14% weight increase in 5th instar larvae. It has been reported that 0.5% glycine if treated from beginning of 5th instar larvae could cause maximum of 12.3% weight increase (Etebari, 2002). Supplementation of glutamic acid with 1% concentration was also able to increase larval weight by 10% and from 4.21 in control it reaches to 4.64 g. In the present study the significant increases in the larval weight with arginine, histidine and their mixture treated groups may be due to the stimulatory effect or enhancement of food consumption of those amino acids on the larval growth.

Silk gland weight

The results of the present study showed that silk gland weight was significantly increased in the group treated with arginine 150 µg histidine and their mixture in all the treated groups. Similar to our findings the addition of amino acids in low concentration gave the best results regarding weights of larvae, percentage of silk gland, crude protein, cocoons and cocoon shells (Moustafa and Elkaraksy, 1990). Oral supplementation with a mixture of glycine, alanine, sugar, potassium iodide salt and vitamins significantly improved the larval weight, silk gland weight, chemical composition of silk gland and cocoon characters of the silkworm, *Bombyx mori*. These might be due to the presence of increased amounts of protein/ amino acids and other nutrients in mulberry leaves which contributed to the extra growth of the silkworm, there by increasing the weight of the larvae and silk gland and improving the cocoon characters of the silkworm, *Bombyx mori* (Sarkar *et al.*, 1995) and might be due to the stimulatory effect on the protein synthesizing machinery of the silk gland cells.

Larval duration

The present results indicate that there was no change in the larval duration in all the arginine, histidine and mixture treated groups. It could be suggested that the concentration applied the larvae, may not have any effect on the hormonal level, juvenile hormone and moulting hormone which control moulting and metamorphosis in insects. Similar results have been reported in the polyvoltine breed of the silkworm, *B. mori* where larval duration did not show any significant change (Magadam and Magadam, 1993).

Survival rate

The results of the present study showed that the survival rate was significantly increased in all the groups treated with arginine, histidine and their mixtures. This indicated that the oral supplementation with arginine, histidine and their mixtures with used concentration have stimulatory effect on survival rate of the silkworm, *B. mori*.

Cocoon weight, cocoon shell weight and cocoon shell ratio

The results of the present study showed that dietary supplementation with arginine, histidine significantly increased the female and male cocoon weight, male cocoon shell weight, female and male cocoon shell ratio but there was no significant change in female cocoon shell weight. Oral supplementation with mixture of arginine and histidine significantly increased the female cocoon weight, shell weight and its shell ratio.

Filament length, filament weight and denier

The present results showed that there was a significant increase in the filament length, filament weight and denier in all the arginine, histidine and their mixture treated groups. The increase in length of the filament may be due to stimulatory activity on silk gland by these amino acids in the silkworm, *B. mori*. The significant increase in the denier may be due to fineness of the silk filament.

Moth emergence percentage

In the present study, there was a significant increase in the moth emergence percentage in arginine, histidine and their mixtures groups. The present results suggest that the used concentrations of arginine, histidine and their mixture have stimulatory effect on the cocoon crop of the silkworm, *B. mori*.

Fecundity

In the present study the fecundity significantly increased in all the treated groups fed with arginine, histidine and their mixtures.

Hatching percentage

In the present study the results suggest that there was a significant increase in the hatching percentage in all the amino acids treated groups with arginine, histidine and their mixture.



Number of eggs per ovariole and length of the ovariole

The results of the present study showed that there was a significant increase in the number of eggs per ovariole and length of the ovariole.

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