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### RESEARCH ARTICLE

## INFLUENCE OF CHLORELLA AND SCENEDESMUS ALGAL EXTRACTS ON THE ECONOMIC TRAITS OF SILKWORM, *BOMBYX MORI* L.

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### Abstract

Silkworm *Bombyx mori* L. feeds on the leaves of mulberry tree which is only the host plant for silkworm. The improvement of larval feeding is enrichment of mulberry leaves with supplementary nutrients. The present study has been aimed at investigating various economic traits of the silkworm cocoon, when fed on mulberry leaves fortified with *Chlorella* and *Scenedesmus* algal extracts. The algal extracts was diluted by different concentrations 2%, 4%, 6% and 8% fed once a day from 3rd instar onwards, respectively. It was significantly increased the larvae, economic traits like cocoon weight, shell weight, pupa weight, shell percentage, filament length, fibroin, sericin and denier of silk filament.

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### Introduction:-

According to Chinese records, the discovery of silk production from *B.mori* occurred about 2700BC, making the start of the history of silk. *Bombyx mori* is the common mulberry silkworm that can be easily domesticated. Sericulture depends on mulberry leaves as the sole natural food of the silkworm *Bombyx mori* L., and the quality of the mulberry leaves has a direct bearing on the normal growth of the larvae and the quality of the cocoon (Horie *et al.*, 1967). Masthan *et al.*, (2011) found the growth and development of larvae, and subsequent cocoon production, are greatly influenced by the nutritional quality of mulberry leaves. Nutrition is the single most factor that influences the growth and development of *B. mori* (Laskar and Datta, 2000; Kanafi *et al.*, 2007). Nutritional supplements include vitamins, amino acids, proteins and probiotics when added to larval feed tend to increase nutritional efficiency and economic traits of silkworm (Etebary and Matindost, 2005; Amalarani *et al.*, 2011; Singh *et al.*, 2005).

Recently many attempts have been made to fortify mulberry leaves with botanical extracts so as to improve the mulberry leaf quality and feed efficiency of silkworm, which in turn help to increase cocoon production and silk quality. The *Xanthium indicum* plant extract influenced the larval and cocoon characteristics of silkworm, *Bombyx mori* (Pardeshi and Bajad, 2014). A commercial herbal tonic 'logen' having the extracts of some selected medicinal plants reflected into better response from the larvae of *Bombyx mori* (L) (Balamurugan and Isaarasu, 2007). The silkworm larvae fed on mulberry leaves treated with *Coffea arabica* leaf extracts at 1:25 concentration recorded significantly higher shell weight (0.296g) than control (Jeyapaul *et al.*, 2003). The reserpine of *Rauwolfia serpentina* plays a stimulative role in an increase in the length of cocoon (Sujatha and Rao, 2002). Mulberry leaf supplemented with *Spirulina* as a feed to *Bombyx mori* L. (Lepidoptera: Bombycidae) orally found to be effective in enhancing the larval and cocoon characters (Venkataramana, 2003).

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*Chlorella pyrenoidosa* is a species of the freshwater green algae genus *Chlorella*. The species name *pyrenoidosa* refers to the presence of a prominent pyrenoid within the *Chlorella* chloroplast. It has the highest content of chlorophyll of any known plant and also contains high concentration certain vitamins, proteins, minerals, dietary fiber, nucleic acids, aminoacids, enzymes and other substances. *Scenedesmus dimorphus* is a freshwater unicellular green algae in the class Chlorophyceae. The name means "having two forms" (Guiry and Guiry, 2011). The *Scenedesmus dimorphus* contains proteins, carbohydrates and lipids.

In recent many attempts have been made in sericulture with nutrient such as protein, vitamin, carbohydrates, amino acids, vitamins etc for better performance of good quality of cocoons (Sanappa *et al.*, 2002). In addition to mulberry leaves feed supplements are also given to silkworm to enhance economic characteristics (Jayapaul *et al.*, 2003, Sheeba *et al.*, 2006). The present study is an attempt to evaluate the influence of *Chlorella* and *Scenedesmus* algal extracts on the economic traits of Silkworm, *Bombyx mori* L.

### Materials and Method:-

The diseased free eggs of silkworm *B. mori* bivoltine hybrid (CSR2XCSR4) race were procured from district sericulture office, Konam, Nagercoil.

### Silkworm Rearing:-

In the present investigation rearing operations were carried out according to (Krishnaswami, 1978). Silkworms were reared under standard recommended condition at 26±2°C temperature, 75% relative humidity. They were fed with MR2 variety of Mulberry leaves.

### Algal extracts Treatment:-

The *Chlorella* and *Scenedesmus* algal extracts were cultured from Gideon research lab, Nagercoil. Freshly moulted III instar larvae were divided into five group of 50 worms each. One group served as control and the others were used for experimental trails with 2%, 4%, 6% and 8% of algal extracts fed to III, IV and V instar larvae, once in a day.

### Economic traits of cocoons:-

The cocoons were matured at 7 to 10 days, after the 5<sup>th</sup> instar was completed. Some important economic traits of sericulture, such as the cocoon weight, shell weight, pupal weight, shell ratio and silk characters like fibroin content, sericin content, filament length and denier were recorded and the data were calculated by the following formulas. Data were analyzed as means ± SD. P values < 0.05 were regarded as statistically significant.

Cocoon shell ratio (%)	=	$\frac{\text{Cocoon shell weight}}{\text{Cocoon weight}} \times 100$	
Fibroin %	=	$\frac{\text{Weight of fibroin}}{\text{Weight of shell}} \times 100$	
Sericin %	=	$100 - \text{fibroin\%}$	
Denier	=	$\frac{\text{Weight of the single cocoon filament (g)}}{\text{Length of single cocoon filament (m)}} \times 9000$	

### Results and Discussion:-

The influence of *Chlorella* and *Scenedesmus* algal extracts supplementation on the mulberry leaves were analyse of four treatments showed significant changes in the values against control batch. The economic traits are summarized in Table 1.

**Table 1:-** Influence of *Chlorella pyrenoidosa* and *Scenedesmus dimorphus* on the economic traits of the silkworm, *Bombyx mori*.

Concentration %	Traits							
	Cocoon Weight (mg)	Pupal Weight (mg)	Shell Weight (mg)	Shell ratio (%)	Filament length (m)	Sericin (%)	Fibroin (%)	Denier
<i>Chlorella pyrenoidosa</i>								
Control	1360±61.20	1138±57.20	220±18.80	16.17±0.92	794.90±28.84	25.60±1.70	74.40±2.30	2.45±0.06
2%	1545±48.50**	1284±49.62**	260±23.54*	16.82±1.20	835.40±24.74*	23.34±2.42	76.66±2.62	2.78±0.06**
4%	1630±54.65**	1351±52.40**	278±20.21**	17.05±0.72	870.20±32.62**	20.58±1.68**	79.42±2.10**	2.84±0.07**
6%	1615±56.36**	1371±46.28**	242±10.06*	14.98±0.64*	885.25±25.32**	21.26±1.85**	78.74±1.96*	2.45±0.10
8%	1522±52.42**	1290±51.34**	231±17.46**	15.17±1.02	840.50±30.10*	22.85±2.04*	77.15±2.24	2.44±0.08
<i>Scenedesmus dimorphus</i>								
2%	1450±54.08*	1152±49.60	232±23.82	16.00±1.40	810.50±34.35	24.00±1.64	76.00±1.86	2.54±0.11
4%	1470±48.56*	1240±43.75*	228±15.28	15.51±0.88	860.25±35.96*	21.78±1.90*	78.22±2.60*	2.36±0.06*
6%	1602±54.39**	1336±56.34**	264±21.08**	16.47±0.81	865.00±36.40*	21.00±1.84**	79.00±2.94*	2.71±0.09**
8%	1586±62.46**	1323±45.90**	262±24.15*	16.51±1.00	862.50±25.86	22.50±1.98*	77.50±2.04	2.70±0.10**

Mean±S.D

\*Significant \*\*Highly Significant at P≤0.05

All other deviations are not significant.

**Table 1** shows that the data of control and algal extract treated MR2 mulberry leaves fed III, IV and V instar *B.mori* larvae. The economic traits of control *B.mori* larvae fed with *Chlorella pyrenoidosa* was Cocoon weight 1360±61.20 mg, pupal weight 1138±57.20 mg, shell weight 220±18.80 mg, shell ratio 16.17±0.92%, filament length 794.90±28.84 m, fibroin 74.40±2.30% and denier 2.45±0.06. The maximum cocoon weight, shell weight, shell ratio, fibroin and denier was 1630±54.65 mg, 278±20.21 mg, 17.05±0.72 %, 79.42±2.10 % and 2.84±0.07, When larvae fed with 4 per cent *Chlorella pyrenoidosa* extract and Pupal weight, filament length, was 1371±46.28 mg and 885.25±25.32 m was observed larvae fed with 6 per cent. Minimum cocoon weight, shell weight and denier was 1522±52.42 mg, 231±17.46 mg and 2.44±0.08 were decreased, when the larvae fed with 8 per cent of *Chlorella pyrenoidosa* extract.

The maximum cocoon weight, pupal weight, shell weight, filament length and fibroin percentage was 1602±54.39 mg, 1336±56.34 mg, 264±21.08 mg, 865.00±36.40 m, 79.00±2.94 per cent and denier 2.71±0.09, respectively, When larvae fed with 6 per cent *Scenedesmus dimorphus* extract. Minimum cocoon weight, pupal weight, filament length and fibroin was 1450±54.08 mg, 1152±49.60 mg, 810.50±34.35 m and 76.00±1.86 per cent were decreased, when the larvae fed with 2 per cent, respectively.

Enriching the silkworm diet (mulberry leaves) with exogenous nutrients such as proteins, carbohydrates, amino acids, vitamins, minerals, hormones, antibiotics and assessing their impact on larval growth, metabolism and silk production has become the order of traditional research in sericulture (Sanappa *et al.*, 2002; Etebari *et al.*, 2004; Bhattacharya and Kaliwal, 2004, 2005). According to Sundararaj, *et al.* (2000) silkworm reared on the leaf supplemented with soyabean flour to record significantly higher larval weight on the account of the additional protein supplemented.

Kumar *et al.* (2009) investigated the effect of blue green algae (*Spirulina*) on cocoon quantitative parameters (cocoon weight, shell weight, pupal weight, shell percentage and silk filament length) of silkworm. The plant

extracts could benefit sericulture by improving the silk yield of *B. mori* and commercial silk production (Rajaeshekaragouda *et al.*, 1997). Murugan *et al.* (1998) noticed a strong correlation between the growth of silkworm and the silk production in the silkworm after the treatment with plant extracts and attributed the growth promoting effect of the plant extracts to the stimulation of biochemical processes leading to protein synthesis.

The present study are comparable with the results of Kuntamalla Sujatha *et al.* (2015), Jeyapaul *et al.*, (2003) and Kumar *et al.* (2009). Silkworm diet supplemented with *Chlorella* and *Scenedesmus* algal extracts at certain concentration their influence improve growth and economic traits. The economic traits of the silkworm such as cocoon characters (cocoon weight, pupal weight, shell weight, shell ratio, silk characters (filament length, fibroin and denier), were enhanced by extracts. So, this algal supplementation to be beneficial to the farmers to get more quality and quantity of silk yield.

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