

SUPPLEMENTATION OF MULBERRY LEAVES WITH PROBIOTIC BIFILAC ON ECONOMIC TRAITS OF SILKWORM (*BOMBYX MORI* L.)

S.P.ANISHA¹, N.YASMIN^{2*}, E. SREE VAISHNAVA DEVI³

¹Research Scholar

Reg No. 19113092192004

P.G & Research Department of Zoology

Muslim Arts College

ManonmaniamSundaranar University, Tirunelveli, Tamilnadu.

²Assistant Professor

P.G & Research Department of Zoology

Muslim Arts College

ManonmaniamSundaranar University, Tirunelveli, Tamilnadu.

³Research Scholar

Reg No. 18213092012019

P.G & Research Department of Zoology

Muslim Arts College

ManonmaniamSundaranar University, Tirunelveli, Tamilnadu.

*Corresponding author e-mail id: nymac2010@yahoo.com

ABSTRACT

Silkworm *b.mori*. is one of the most important beneficial insects. One of the most important characteristics of the silkworm *B. mori* L. is its ability to switch plant proteins from feeding material to silk proteins. Silkworm is a typical monophagous insect and mulberry (*Morus* spp.) leaf is its sole food. Probiotic are viable, nonpathogenic microorganisms which when supplementation in adequate amounts, confer a health benefit on the host. In the present study aimed to investigating the rearing performance and economic parameters of the silkworm when the larvae supplemented with probiotic bifilac at three (1%, 2% and 3%) different concentration. Among the treatments, 2% recorded maximum larval weight (5.39 g), effective rate rearing (96.85 %), cocoon weight (1.81 g), shell weight (0.408 g), silk length (876.43 m), silk weight (0.378 g) and finer denier (3.88) besides reduced larval mortality (3.64 %) due to disease incidence compared to control. The outcome of the study indicated that, there is profound increase due to probiotic treatment in larval growth and cocoon characters than the control with enhanced and quality silk production.

Keywords: Silkworm, probiotics, bifilac, economic characters

INTRODUCTION

Silkworm *Bombyx mori* L. is a beneficial lepidopteran insects. The growth, development of larva and subsequent cocoon production are greatly influenced by nutritional quality of mulberry leaves. The fortification of mulberry leaves with supplementary nutrient and feeding silkworm is a useful modern technique increased the economic value of cocoon (Muniandy *et al.*, 2001). Supplementation of mulberry leaves by using different nutrients and feeding to the silkworms are useful modern techniques to increase economic value of cocoons (Masthanet *et al.*, 2011). Nutritional studies on silkworms are an essential requisite for its proper commercial exploitation and are sole factors which augment quality and quantity of silk (Laskar and Datta, 2000). The *Lactobacillus plantarum* improved the cocoon production

of mulberry silkworm *Bombyx mori* (Singh *et al.*, 2005). In recent years, attempts have been made in sericulture with nutrients such as protein, vitamins, carbohydrates, amino acids, vitamins, hormones and antibiotic etc. for better performance of good quality of cocoons (Sannappa *et al.*, 2002). Probiotic are the live microbial food supplements that benefits host by improving the microbial balance and enhancing the rapid cellular growth and development (Fuller *et al.*, 1993). Certain probiotic bacteria inhibit the growth of microbes. *Streptomyces noursei* are probiotic microbes which have been proved for their antibacterial activity and used as good ecofriendly management of silkworm diseases. (Subramanian *et al.*, 2009). Effect of supplementary feed such as 'Serifeed' (Narayanaswamy and Ananthanarayanan, 2006; Ananda kumar and Michael, 2011), Amway protein (Amala *et al.*, 2011a) improved the growth and development of *Bombyx mori* L. Irianto and Austin (2002) reported that probiotic might produce vitamins and detoxify the compounds in the diets or breakdown the digestible compounds, which may lead to the nutritional improvement and stimulate appetite.

MATERIALS AND METHODS

PROCUREMENT OF *BOMBYX MORI* EGG:

The disease free multivoltine silkworm *B. mori* (PM × CSR2) eggs were purchased from Nannaharam, Tenkasi District, Tamilnadu, and reared in the laboratory by following standard rearing techniques (Krishnaswami, 1978).

MAINTENANCE AND REARING PERFORMANCE:

The newly hatched larvae were reared in (50× 50cm) plastic trays (50 larvae / tray) and fed with fresh mulberry leaves. Mulberry leaves were collected every day and the larvae were fed four times daily. Optimum humidity (75-80%) and temperature (25-28 °C) were maintained throughout the study. First instar larvae were divided into four experimental groups including control. Each group consisted of 50 larvae with three replications. The mulberry leaves of V1 variety were fed 3-4 times a day. The worms fed with probiotic bifilac supplemented mulberry leaves at three (1%, 2% and 3%) different concentration on both side of leaves. A control batch was fed with untreated mulberry leaves. The treated mulberry leaves fed to the silkworm once in an alternative days from third instar to till pupated.

OBSERVATION RECORDED ;

- ❖ Larval traits : Larval length, larval weight, percentage of survival were observed
- ❖ Cocoon traits : Cocoon length, cocoon weight, shell weight and shell ratio were recorded
- ❖ Silk characters : Silk length, silk weight, silk percentage and were analysed

Shell ratio

The shell ratio of each cocoon was calculated by the following formula and expressed in percentage

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

Silk filament length

The silk filament length was calculated by the following formula

$$\text{Silk filament length (m)} = \frac{\text{Number of rotations in epprouvette} \times 9}{\text{Cocoon}} \times \text{-----}$$

Silk percentage

The silk percentage was calculated by the following formula

$$\text{Silk percentage} = \frac{\text{Weight of raw silk reeled}}{\text{Weight of cocoon shell}} \times 100$$

Denier

The denier was calculated by the following formula

$$\text{Denier} = \frac{\text{Weight of reeled silk}}{\text{Length of reeled silk}} \times 9000$$

RESULT

The mulberry leaves fortified with bifilac probiotic when fed to silkworms gained a positive effect on the economic parameter than the untreated group.

Larval characters

Significant differences were recorded on the weight of larvae when mulberry leaves were fortified with *bifilac probiotic* which recorded maximum larval weight (5.39 g), larval length (5.19cm) and the highest effective rate of rearing (96.85 %) was recorded in 2% of probiotic treated group.

Cocoon parameters

Silkworms fed with bifilac fortified mulberry leaves were effective in improved the the cocoon characters (Table 2). Silkworms exhibited considerable differences when fed with fortification with *bifilac probiotic*. The highest cocoon weight (1.81 g); shell weight (0.408 g) and shell ratio (23.08 %) was increased in 2% *bifilac* treated group when compared to control group of larvae.

Silk characters

The highest silk percentage (98.36%); silk length (876.43 m), silk weight (0.378 g) and denier (3.88) was recorded when the b.morifortified with *bifilac probiotic* at 2% treated group. (Table 3). Silkworm larvae recorded better values for cocoon-silk parameters when fed with mulberry leaves fortified bifilac probiotic compared to control which was fed only with mulberry leaves.

Table 1- Effect of probiotic supplementation on the larval characters of *b.mori*

Treatments	Larval weight (g)	Larval length(cm)	Effective rate of rearing(%)
Control	4.50±0.23	3.97±0.38	92.48±0.23
1%	4.65±0.45 (3.33)	4.56±0.52 (14.86)	93.12±0.43 (0.69)
2%	5.39±0.28 (19.77)	5.19±0.18 (30.73)	96.85±0.20 (4.72)
3%	5.33±0.45 (18.44)	5.10±0.12 (28.46)	96.49±0.32 (4.33)

Table 2: Effect of probiotic supplementation on cocoon characters of *b.mori*

Treatments	Cocoon weight(g)	Cocoon	Shell weight(g)	Shell ratio(%)
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		length(cm)		
Control	1.42±0.18	3.48±0.79	0.314±0.28	22.11±0.74
1%	1.58±0.13 (11.26)	3.61±0.51 (3.73)	0.350±0.27 (11.46)	22.15±0.68 (0.18)
2%	1.81±0.19 (27.46)	3.75±0.45 (7.75)	0.408±0.17 (29.93)	22.54±0.34 (1.94)
3%	1.59±0.20 (11.97)	3.57±0.49 (2.58)	0.367±0.35 (16.87)	23.08±0.18 (4.38)

Table - 3: Effect of probiotic supplementation on silk characters of *b.mori*

Treatments	Silk length (m)	Silk weight(g)	Silk percentage(%)	Denier
Control	779.10±5.13	0.250±0.29	79.61±5.22	2.88±0.48
1%	847.16±9.35 (8.73)	0.312±0.14 (24.8)	89.14±8.10 (11.97)	3.31±0.55 (14.93)
2%	876.43±6.43 (12.49)	0.378±0.26 (51.2)	92.64±6.81 (16.36)	3.88±0.44 (34.72)
3%	865.33±9.05 (11.06)	0.361±0.18 (44.4)	98.36±7.65 (23.55)	3.75±0.69 (30.20)

DISCUSSION

In probiotic therapy, live microbial feed supplements are improving the intestinal microbial balance of host. Nutritional contributions and the symbiotic benefits offered by insect gut-dwelling bacteria (Dillon, 2004) and (Yuan *et al.*, 2006) which can substantially modify and promote the health and silk production capacity of *B. mori*. In the present investigation, the growth and cocoon parameters of silkworm significantly increased in all the treated groups compared to control. Larval weight (5.39 g), ERR (96.85%), cocoon weight (1.81 g), silk percentage (98.36 %), silk length (876.43m), silk weight (0.378g) and denier (3.88) was registered in bifilac at 2% concentration. The present results were in accordance with the results reported by Mala and Vijila (2018), among different treatments, *Bacillus licheniformis* followed by *Bacillus licheniformis* + *Bacillus niabensis* (106 cfu/ml) recorded maximum larval weight, effective rate rearing, cocoon weight, shell weight, pupal weight, shell ratio, silk productivity and filament length. Probiotic can also stimulate the body's innate defense mechanisms, as with the increased production of the antimicrobial peptide defenses in intestines. The present findings also confirmed with results by Venkatesh Kumar *et al.* (2009) reported that blue green algae (*Spirulina*) at 300 ppm concentration recorded highest cocoon weight (1.083 g), shell weight (24.500 g), shell % (22.640) and filament length (866.605 m). (Bai and Bai, 2012) as feed supplementation to *B. mori* were found to be effective in increasing larval weight, cocoon weight, shell weight, pupal weight, shell ratio and silk filament length. According to Singh *et al.* (2005), probiotic *Lactobacillus* supplementation improved the cocoon production of mulberry silkworm *Bombyx mori*. In this experimental work concluded that the medium 2% concentration of probiotic bifilac enhanced the economic parameters of silkworm *b.mori*.

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