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International Journal of Current Research
Vol. 5, Issue, 10, pp.3232-3237, October, 2013

INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

# STUDIES ON THE IMPACT OF AMOXICILLIN ON GROWTH RATE AND ECONOMIC PARAMETERS OF SILKWORM *Bombyx mori* (L.) (LEPIDOPTERA: BOMBYCIDAE) IN RELATION TO SILK PRODUCTION

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ARTICLE INFO

*Article History:*
Received 29th July, 2013
Received in revised form
09th August, 2013
Accepted 20th September, 2013
Published online 23rd October, 2013

*Key words:*
*Bombyx mori*,
Amoxicillin, Economic parameter,
Growth rate, Silk production.

ABSTRACT

There are many factors that influence the success of production of silk. In recent years, some antibiotic agents have been used for growth enhancement of silkworm larvae and improvement of silk production. This study regarding the effect of amoxicillin was conducted on the silkworm breed selected for the experiment was popular Indian bivoltine hybrid ($CSR_2XCSR_4$). The silkworm larvae were reared up to fifth instar without any treatment. Later the amoxicillin antibiotic solution was diluted by different concentrations (1%, 3% and 5%), each concentration were sprayed on the $MR_2$ Mulberry (*Morus sinensis*) leaves. It was fed by silkworm larvae, III, IV and V instar. Group "C" larvae received $MR_2$ mulberry leaves sprayed with distilled water, it was served as control. Groups $T_1$, $T_2$ and $T_3$ larvae received 1%, 3% and 5% antibiotic solution sprayed mulberry leaves, respectively. In this groups, the $T_3$ (5% concentration) was significantly increased the larval, pupal and cocoon parameters (length, width and weight) and economic parameters like cocooning percentage, shell weight, shell ratio, silk filament length, and denier of silk filament.



## INTRODUCTION

Sericulture essentially being an agro based cottage industry (Jolly, 1987) is known for its capacity to generate high income and employment. Silkworm is affected by several diseases and at time causes heavy crop losses. Various chemicals (antibiotics) are extensively employed to prevent the attack of diseases to the silkworm thereby, help in, increasing the productivity of silk. The beneficial action of the antibiotics has been attributed to the oral feeding of them along with mulberry leaves, which reduced significantly the incidence of flacherie and grasserie (Radha *et al.,* 1980, Anonymous, 1980). Of all constrains, silkworm diseases being the most important that inflect heavy loss to the crop. Concentration is an important factor in antibiotics, as low levels they have no effect and as the concentration is increased to cytotoxic levels, as direct relationship exists between the concentration of the antibiotics in the medium and the anti-microbial effect until a level of maximum effectiveness is reached. Dutta *et al.* (2010) have reported *in vitro* use of streptomycin sulfate @1000 ppm and successfully controlled bacterial diseases in Muga silkworm up to 52.37%. Besides streptomycin sulfate feeding of antibiotics from brushing till spinning was found to be on par with feeding only in the fifth instar (Anonymous, 1975). Antibiotics are also known to improve the growth of larvae and to certain extent help in the improvement of silk production (Verma and Kushwaha, 1970, Krishnaswamy, 1978, Radha, *et al.,* 1980). The antibiotics such as Penicillin, Ampicillin and Streptomycin were found to be effective in reducing the mortality of silkworms by 23-25% without affecting the cocoon parameters. The antibiotics such as Streptomycin, Gentamycin, Cloxacillin and Kanamycin supplemented through mulberry leaves resulted in significant reduction in the occurrence of both grasserie and flacherie diseases.

Tetracycline, Streptomycin and Penicillin treatments increased the larval weight of silkworm. The single cocoon weight and single shell weight was higher in Tetracycline, Abrimox and Cloxacillin treatments. Oral administration of Streptomycin and Penicillin increased the meterage of reelable silk (Santha, *et al.,* 2007). However the current literature is limited with regard to the application of antibiotics on the silkworm varieties. Hence the research work aims at the application of antibiotics namely Amoxicillin on the growth and economic parameters of silkworm taken up for the present investigation. In recent years, many attempts have been made to improve the quality and quantity of silk(Hiware,2006), through enhancing the leaves with nutrients, spraying with antibiotics,juvenenile hormone, plant products, with JH-minic principles or using extracts of plants. Mulberry leaves have been supplemented with various nutrients for silkworm feeding to promote silk quality and quantity. *Bombyx mori* (L.) has an economic importance because of the commercial value of its silk. Therefore, several trials for developing the biological

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processes and improving the qualitative and quantitative characters of silk yield took place (Taha, 2002). Antibiotics are widely used in sericulture industry as a component of bed disinfectants and as therapeutic applications against bacterial diseases (Subramanian *et al.,* 2009). In sericulture, the productivity and quality largely depends on the healthiness, growth of the silkworm larvae and the suitable environmental conditions. Growth and development of larvae depends on the physiological processes that take place in the silkworm. Therefore, improvement of silk quality means improvement of the feed nutrition and upkeep of the larval health. Penicillin, streptomycin, tetracycline and chloramphenicol were already tried on silkworm and found successful (Venkatesh and Srivastava, 2010). Antibiotics in silkworm are approved for four different purposes: disease treatment, disease prevention, disease control and for health maintenance or growth promotion (Phillips *et al.,* 2004). In recent years attempts have been made in sericulture with nutrient such as antibiotic, protein, vitamin, carbohydrates, amino acids, and hormones etc. for better performance of good quality of cocoons Sannappa (2000); Fuller *et al*. (1993).

When antibiotics were administered to the silkworm, there is shift in the nitrogen metabolism in favour of increasing the body weight and increased output of silk (Murthy and Sreenivasaya, 1953). Studies on auromycin and chloromycetin showed that their addition to the mulberry diet resulted in heavier caterpillars with increased nitrogen metabolism (Verma and Atwal, 1963). Shyamala and Bhatt (1961) reported that chloromycetin supplementation enhance the oxygen uptake of the gut of the silkworm. It was thought that these antibiotics exerted a beneficial influence in controlling the intestinal flora of the caterpillars. The antibiotic feed supplementation not only showed prophylactic measures to prevent bacterial infections but also enhanced the nutrition and economic parameters in *B. mori* (Sheebha *et al.,* 2008). Fortification of mulberry leaves is considered as one of the effective methods to enrich the silkworm diet. The biochemical parameters could be elevated by antibiotic supplementation in healthy larvae (Savithri and Murli Mohan, 2003). Silkworm larvae obtain nutrients from mulberry leaves to build up body, sustain life and spin cocoons. Such nutritional requirements in food consumption have direct impact on larval and cocoon weight, pupation and amount of silk production. In silkworm, *Bombyx mori*, studies were carried out by different workers after enriching mulberry leaves with small quantity of different antibiotics before feeding (Murthy *et al.,* 1951; 1954; Shyamala *et al.,* 1962, Verma and Atwal 1963). From these studies it was found that feeding of antibiotics along with mulberry leaves have increased the larval weight, growth and silk production. The growth and development of silkworms and their economic characters are influenced to a great extent by the nutritional content of mulberry leaf. Antibiotics are known to improve the growth of the larvae and to certain extent enhance the silk production (Radha *et al.,* 1980).

Rahmathulla *et al.* (2003) have observed that antibiotics administration with different concentrations significantly improved the rearing and cocoon parameters like larval duration, larval weight, growth index, single cocoon weight, single shell weight and shell ratio, average filament length, non-breakable filament length, raw silk recovery percentage, denier, reelability and neatness and the better performances were recorded with the increase of antibiotics concentration. Oral administration of antibiotics along with mulberry leaves to healthy silkworm boost the growth, fecundity and silk contents (Tayade *et al.,* 1988) as well as reduces the incidence of diseases (Radhakrishna Rai and Devaiah, 1988). The works with referent impact of Amoxicillin on *Bombyx mori* was fragmentary therefore; it has been aimed to find out the larval parameters, pupal parameters, cocoon parameters, cocoon percentage, shell weight, shell ratio, shell filament length and denier.

## MATERIALS AND METHODS

### Silkworm rearing

The eggs of silkworm *B. mori* popular Indian bivoltine hybrid ($CSR_2XCSR_4$) race were collected from farmers training centre at Jayankondapattinam, Tamilnadu, India. The eggs were placed at ambient temperature of 25±2°C and relative humidity of 70 to 80% in an incubator for hatching. After hatching, larvae were isolated from stock culture. The larvae were divided into 5 experimental groups including controls (distilled water treatment), each group consisting of 6 larvae. The larvae were reared in card board boxes measuring 22×15×5 cms covered with polythene sheet and placed in an iron stand with ant wells. The larvae were reared in the laboratory following the procedure of Krishnaswamy (1978).

### Preparation of standard stock solutions and different concentrations of amoxicillin

For preparation of standard stock solution 1g of amoxicillin was dissolved in 100ml of distilled water (1000 mg × 1000 µg/100ml) which is equivalent to10000 µg/ml. from this solution 1ml was taken and added to 99 ml of distilled water (10000 µg /100ml) which is equivalent to 100 µg/ml, known as standard stock solution. For the preparation of 3 µg/ml concentration, 3ml of standard stock solution 2 was added to 97ml of distilled water. Likewise for 5 µg/ml concentration, 5ml of standard stock solution 2 was added to 95ml of distilled water. 100ml of each of these concentrations were prepared as per the table and 50 mulberry leaves were socked in these solutions dried at room temperature till wetness is removed and were used to feed four groups of experiment larvae of 3rd, 4th and 5th instar stage for 40days.

### Antibiotic treatment

The Amoxicillin was procured from a standard drug company, 1%, 3% and 5% concentrations of antibiotic solution of them were prepared in distilled water. Fresh $MR_2$ mulberry leaves were smeared by each concentration and then dried in air for 10 minutes. The supplementary leaves were fed to silkworms (Anandakumar *et al.,* 2012).

### Experimental Groups

Group "C" larvae received mulberry leaves smeared with distilled water and served as control, group $T_1$ larvae received 1% antibiotic solution smeared mulberry leaves, group $T_2$

larvae received 3% antibiotic solution smeared mulberry leaves, group $T_3$ larvae received 5% antibiotic solution smeared mulberry leaves, respectively and they were maintained up to cocoon (Rasool, 1995).

### Mulberry (*Morus sinensis*) $MR_2$ variety

This is one of the varieties of mulberry selected from Jayamkondapattinam sericulture farm. Branches are simple, vertical, grayish leaves are darkly green, unlobed, elliptic, palmate, veined, and leathery/smooth/wrinkled. It has good agronomy characters like high rooting ability (80%). Amoxicillin antibiotic drug was diluted to 1%, 3% and 5% concentrations. Fresh mulberry leaves were soaked in each concentration for 15 minutes and then were dried in air for 10 minutes. The treated leaves were used for feeding the 3rd, 4th and 5th instar larvae of silkworm *B. mori*.

### Statistical analysis

Data were analyzed by one way analysis of variance (ANOVA) followed by Duncan's multiple range test (DMRT) using a commercially available statistics software package (SPSS® for Windows, V. 16.0, Chicago, USA). Results were presented as means ± SD. P values < 0.05 were regarded as statistically significant.

## RESULT

### Larval Parameters

Table 1 shows that the Morphometric data of length, width and weight of larval parameters of *B. mori* fed with control $MR_2$ leaves and amoxicillin antibiotic solution treated $MR_2$ leaves in III instar larvae of *B. mori*. The mean length, width and weight of III instar larvae of group 'C' were (1.35±0.187cm, 0.43±0.080cm and 0.90±0.030gm), respectively. The mean length, width and weight of III instar larvae of group $T_1$ were (1.20±0.126cm, 0.46±0.051cm and 0.57±0.052gm), respectively. The mean length, width and weight of III instar larvae of group $T_2$ were (1.38±0.132cm, 0.45±0.054cm and 1.02±0.040gm), respectively. The mean length, width and weight of III instar larvae of group $T_3$ were (2.18±0.256cm, 0.46±0.051cm and 1.26±0.051gm), respectively. In these four observations, 5% (group $T_3$) antibiotic solution treated III instar larvae length; width and weight were significantly increased than the other three groups ('C', $T_1$ and $T_2$).

**Table 1. Morphometric data of III instar larvae of *Bombyx mori* fed with control and different concentrations of amoxicillin treated $MR_2$ mulberry leaves**

| Experimental groups / Concentrations | Larval length (cm) | Larval width (cm) | Larval weight (gm) |
|---|---|---|---|
| Control (C) | $1.35±0.187^a$ | $0.43±0.080^a$ | $0.90±0.030^b$ |
| Amoxicillin ($T_1$) 1% | $1.20±0.126^a$ | $0.46±0.051^a$ | $0.57±0.052^a$ |
| Amoxicillin ($T_2$) 3% | $1.38±0.132^a$ | $0.45±0.054^a$ | $1.02±0.040^c$ |
| Amoxicillin ($T_3$) 5% | $2.18±0.256^b$ | $0.46±0.051^a$ | $1.26±0.051^d$ |

Values are Mean ± Standard Deviation of six observations. Values in the same column with different superscript letters (a, b & c) differs significantly at P<0.05 (DMRT).

Table 2 shows that the Morphometric data of length, width and weight of larval parameters of *B. mori* fed with control $MR_2$ leaves and amoxicillin antibiotic solution treated $MR_2$ leaves in IV instar larvae of *B. mori*. The mean length, width and weight of IV instar larvae of group 'C' were (5.36±0.242cm, 0.50±0.089cm and 2.53±0.168gm), respectively. The mean length, width and weight of III instar larvae of group $T_1$ were (4.51±0.299cm, 0.45±0.054cm and 1.86±0.029gm), respectively. The mean length, width and weight of III instar larvae of group $T_2$ were (5.65±0.187cm, 0.51±0.075cm and 2.57±0.151gm), respectively. The mean length, width and weight of III instar larvae of group $T_3$ were (6.53±0.186cm, 0.65±0.104cm and 3.02±0.106gm), respectively. In these four observations, 5% (group $T_3$) antibiotic solution treated IV instar larvae length, width and weight were significantly increased than the other three groups ('C', T and $T_2$).

**Table 2. Morphometric data of IV instar larvae of *Bombyx mori* fed with control and different concentrations of amoxicillin treated $MR_2$ mulberry leaves**

| Experimental groups / Concentrations | Larval length (cm) | Larval width (cm) | Larval weight (gm) |
|---|---|---|---|
| Control (C) | $5.36±0.242^b$ | $0.50±0.089^a$ | $2.53±0.168^b$ |
| Amoxicillin ($T_1$) 1% | $4.51±0.299^a$ | $0.45±0.054^a$ | $1.86±0.029^a$ |
| Amoxicillin ($T_2$) 3% | $5.65±0.187^c$ | $0.51±0.075^a$ | $2.57±0.151^b$ |
| Amoxicillin ($T_3$) 5% | $6.53±0.186^d$ | $0.65±0.104^b$ | $3.02±0.106^c$ |

Values are Mean ± Standard Deviation of six observations. Values in the same column with different superscript letters (a, b & c) differs significantly at P<0.05 (DMRT).

Table 3 shows that the Morphometric data of length, width and weight of larval parameters of *B. mori* fed with control $MR_2$ leaves and amoxicillin antibiotic solution treated $MR_2$ leaves in V instar larvae of *B. mori*. The mean length, width and weight of V instar larvae of group 'C' were (6.45±0.187cm, 0.61±0.098cm and 3.62±0.940gm), respectively. The mean length, width and weight of III instar larvae of group $T_1$ were (5.46±0.280cm, 0.53±0.103cm and 3.15±0.125gm), respectively. The mean length, width and weight of III instar larvae of group $T_2$ were (6.78±0.160cm, 0.78±0.116cm and 3.75±0.082gm), respectively. The mean length, width and weight of III instar larvae of group $T_3$ were (7.28±0.131cm, 0.88±0.116cm and 4.54±0.159gm), respectively. In these four observations, 5% (group $T_3$) antibiotic solution treated V instar larvae length; width and weight were significantly increased than the other three groups ('C', $T_1$ and $T_2$).

**Table 3. Morphometric data of V instar larvae of *Bombyx mori* fed with control and different concentrations of amoxicillin treated $MR_2$ mulberry leaves**

| Experimental groups / Concentrations | Larval length (cm) | Larval width (cm) | Larval weight (gm) |
|---|---|---|---|
| Control (C) | $6.45±0.187^b$ | $0.61±0.098^a$ | $3.62±0.940^b$ |
| Amoxicillin ($T_1$) 1% | $5.46±0.280^a$ | $0.53±0.103^a$ | $3.15±0.125^a$ |
| Amoxicillin ($T_2$) 3% | $6.78±0.160^c$ | $0.78±0.116^b$ | $3.75±0.082^b$ |
| Amoxicillin ($T_3$) 5% | $7.28±0.131^d$ | $0.88±0.116^b$ | $4.54±0.159^c$ |

Values are Mean ± Standard Deviation of six observations. Values in the same column with different superscript letters (a, b & c) differs significantly at P<0.05 (DMRT).

### Pupal Parameters

Table 4 shows that the Morphometric data of mean length, width and weight of the pupae of *B. mori* fed with amoxicillin antibiotic solution treated $MR_2$ leaves were found to be more than that of the larvae fed with control $MR_2$ leaves. The length, width and weight of the group 'C' larvae produced pupae were found to be about (2.92±0.042cm, 1.20±0.039cm and 1.09±0.056gm), respectively. The length, width and weight of the group $T_1$ larvae produced pupae were observed to be about (2.24±0.061cm, 0.95±0.100cm and 1.07±0.032gm), respectively. The length, width and weight of the group $T_2$ larvae producing pupae were observed to be about (3.21±0.088cm, 1.34±0.068cm and

1.15±0.060gm), respectively. The length, width and weight of the group $T_3$ larvae produced pupae were observed to be about (3.73±0.159cm, 1.47±0.096cm and 1.64±0.044gm), respectively. In these four observations, 5% (group $T_3$) antibiotic solution treated larvae produced pupae length; width and weight were significantly increased than the other three groups ('C', $T_1$ and $T_2$).

**Table 4. Morphometric data of control and different concentrations of amoxicillin treated $MR_2$ mulberry leaves fed larvae produced pupae**

| Experimental groups / Concentrations | Pupal length (cm) | Pupal width (cm) | Pupal weight (gm) |
|---|---|---|---|
| Control (C) | 2.92±0.042$^{b}$ | 1.20±0.039$^{b}$ | 1.09±0.056$^{ab}$ |
| Amoxicillin ($T_1$) 1% | 2.24±0.061$^{a}$ | 0.95±0.100$^{a}$ | 1.07±0.032$^{a}$ |
| Amoxicillin ($T_2$) 3% | 3.21±0.088$^{c}$ | 1.34±0.068$^{c}$ | 1.15±0.060$^{bc}$ |
| Amoxicillin ($T_3$) 5% | 3.73±0.159$^{d}$ | 1.47±0.096$^{d}$ | 1.64±0.044$^{c}$ |

Values are Mean ± Standard Deviation of six observations. Values in the same column with different superscript letters (a, b & c) differs significantly at P<0.05 (DMRT).

## Cocoon Parameters

Table 5 shows that the Morphometric data of mean length, width and weight of the cocoon of *B. mori* fed with amoxicillin antibiotic solution treated $MR_2$ leaves were found to be more than that of the larvae fed with control $MR_2$ leaves. The length, width and weight of the group 'C' larvae produced cocoon were found to be about (3.56±0.128cm, 2.47±0.053cm and 2.58±0.116gm), respectively. The length, width and weight of the group $T_1$ larvae produced cocoon were observed to be about (3.29±0.125cm, 2.18±0.066cm and 1.84±0.051gm), respectively. The length, width and weight of the group $T_2$ larvae producing cocoon were observed to be about (3.39±0.171cm, 2.18±0.067cm and 2.49±0.064gm), respectively. The length, width and weight of the group $T_3$ larvae produced cocoon were observed to be about (3.72±0.103cm, 2.55±0.060cm and 3.23±0.083gm), respectively. In these four observations, 5% (group $T_3$) antibiotic solution treated larvae produced cocoon length; width and weight were significantly increased than the other three groups ('C', $T_1$ and $T_2$).

**Table 5. Morphometric and economic parameters data of control and different concentrations of amoxicillin treated $MR_2$ mulberry leaves fed larvae produced cocoon**

| Experimental groups / Concentrations | Cocoon length (cm) | Cocoon width (cm) | Cocoon weight (gm) |
|---|---|---|---|
| Control (C) | 3.56±0.128$^{b}$ | 2.47±0.053$^{b}$ | 2.58±0.116$^{b}$ |
| Amoxicillin ($T_1$) 1% | 3.29±0.125$^{a}$ | 2.18±0.066$^{a}$ | 1.84±0.051$^{a}$ |
| Amoxicillin ($T_2$) 3% | 3.39±0.171$^{a}$ | 2.18±0.067$^{a}$ | 2.49±0.064$^{b}$ |
| Amoxicillin ($T_3$) 5% | 3.72±0.103$^{b}$ | 2.55±0.060$^{c}$ | 3.23±0.083$^{c}$ |

Values are Mean ± Standard Deviation of six observations. Values in the same column with different superscript letters (a, b & c) differs significantly at P<0.05 (DMRT).

## Cocooning Percentage

Table 6 shows that the data of control and amoxicillin antibiotic solution treated $MR_2$ mulberry leaves fed V instar larvae produced cocoon's cocooning percentage. The cocooning percentage (%) of group 'C' larvae (83.93±0.204%), group $T_1$ larvae (82.76±0.317%), group $T_2$ (85.49±0.512%) larvae and group $T_3$ (89.70±0.233%), respectively. In these four observations, the 0.4% (group $T_3$) antibiotic solution treated larvae cocooning percentage (%) was significantly increased than the other three groups ('C', $T_1$ and $T_2$).

## Shell Weight

Table 6 shows that the data of control and amoxicillin antibiotic solution treated $MR_2$ mulberry leaves fed V instar *B. mori* larvae produced cocoon's shell weight. The shell weight (gm) of group 'C' larvae (1.49±0.106gm), group $T_1$ larvae (0.77±0.081gm), group $T_2$ (1.34±0.108gm) larvae and group $T_3$ (1.60±0.057gm), respectively. In these four observations, the 5% (group $T_3$) antibiotic solution treated larvae shell weight (gm) was significantly increased than the other three groups ('C', $T_1$ and $T_2$).

## Shell Ratio

Table 6 shows that the data of control and amoxicillin antibiotic solution treated $MR_2$ mulberry leaves fed V instar *B. mori* larvae produced cocoon's shell ratio. The shell ratio (%) of group 'C' larvae (18.08±0.120%), group $T_1$ larvae (17.36±0.353%), group $T_2$ (18.51±0.351%) larvae and group $T_3$ (19.62±0.228%) respectively. In these four observations, the 0.4% (group $T_3$) antibiotic solution treated larvae shell ratio (%) was significantly increased than the other three groups ('C', $T_1$ and $T_2$).

## Silk Filament Length

Table 6 shows that the data of control and amoxicillin antibiotic solution treated $MR_2$ mulberry leaves fed V instar *B. mori* larvae produced cocoon's silk filament length. The silk filament length (meters) of group 'C' larvae (1257±17.971mts.), group $T_1$ larvae (1153±34.017mts.), group $T_2$ (1284±14.524mts.) larvae and group $T_3$ (1334±22.604mts.), respectively. In these four observations, the 5% (group $T_3$) antibiotic solution treated larvae silk filament length (mts.) was significantly increased than the other three groups ('C', $T_1$ and $T_2$).

## Denier

Table 6 shows that the data of control and amoxicillin antibiotic solution treated $MR_2$ mulberry leaves fed V instar *B. mori* larvae produced cocoon's silk filament denier (D). The silk filament denier of group 'C' larvae (2.44±0.118%), group $T_1$ larvae (2.19±0.071%), group $T_2$ (2.63±0.079%) larvae and group $T_3$ (2.89±0.148%), respectively. In these four observations, the 5% (group $T_3$) antibiotic solution treated larvae silk filament length (mts.) was significantly increased than the other three groups ('C', $T_1$ and $T_2$).

**Table 6. Economic parameters data of control and different concentrations of amoxicillin treated $MR_2$ mulberry leaves fed larvae produced cocoon**

| Experimental groups / Concentrations | Cocooning percentage (%) | Shell weight (gm) | Shell Ratio (%) | Silk filament length (Meters) | Denier (%) |
|---|---|---|---|---|---|
| Control (C) | 83.93±0.204$^{b}$ | 1.49±0.106$^{c}$ | 18.08±0.120$^{b}$ | 1257±17.971$^{b}$ | 2.44±0.118$^{b}$ |
| Amoxicillin ($T_1$) 1% | 82.76±0.317$^{a}$ | 0.77±0.081$^{a}$ | 17.36±0.353$^{a}$ | 1153±34.017$^{a}$ | 2.19±0.071$^{a}$ |
| Amoxicillin ($T_2$) 3% | 85.49±0.512$^{c}$ | 1.34±0.108$^{b}$ | 18.51±0.351$^{c}$ | 1284±14.524$^{b}$ | 2.63±0.079$^{c}$ |
| Amoxicillin ($T_3$) 5% | 89.70±0.233$^{d}$ | 1.60±0.057$^{d}$ | 19.62±0.228$^{d}$ | 1334±22.604$^{c}$ | 2.89±0.148$^{d}$ |

Values are Mean ± Standard Deviation of six observations. Values in the same column with different superscript letters (a, b & c) differs significantly at P<0.05 (DMRT).

The silkworm *Bombyx mori* rearing is a traditional industry in Asia and the life of many people is depended on it. Increase of larval growth and cocoon quality and quantity would result better economics for this industry and meet the production needs. Consequently, the enrichment of mulberry leaves by supplementary compounds with the aim of increasing the production of cocoon is a very important aspect. Many investigations have been done on this topic and various reports have been published (Eteberi, 2002; Etebari *et al.,* 2004; Islam *et al.,* 2004; Ganesh Prabu *et al*., 2012; Balasundaram *et al*., 2013). Murthy *et al.* (1951) have reported that penicillin and streptomycin when administered to the mulberry silkworm in the IV and V instars in combination with protein-hydrolysates increased the body weight of the larvae significantly compared to mulberry leaf without any supplementation. They also observed increase in meterage of reelable silk due to antibiotics. According to Murthy and Sreenivasaya (1953), antibiotics I aureomycin and chloromycetin when administered to the silkworm at the rate of 25 mg per kg larval body weight per day in the IV and V instar gave an increase of 9 to 10% both in mature larval and pupal weight but decreased the silk output by about 5 to 8% compared to control. This is because antibiotics shift the nitrogen metabolism in favour of increasing the body weight at the expense of precursors of silk. Murthy *et al.* (1954) have observed that antibiotic when administered at the rate of 50 mg Per kg larval body weight per day after III moult to the silkworm increased mature larval weight and pupal weight by about 11 and 25 %, respectively. In addition to the increase in silk gland weight and cocoon weight over that of control. However, the yield of silk was found to remain same. The antibiotic treatment increased meterage of reelable silk by about 13%. Chloromycetin did not have any adverse effect on hatchability. Chloromycetin administered at the rate of 50 mg per kg of body weight after III moult increased the transaminase activity of the intestine and haemolymph. The silk gland did not show a marked increase in transaminase activity due to chloromycetin. Silk production and egg production induced by the antibiotic chloromycetin (Syamala and Bhat, 1955; 1959 and 1961).

Sharada and Bhat (1956) have reported that chloromycetin supplementation during IV instar did not have any effect on the growth of the larvae or on the yield of silk. When chloromycetin was supplemented along with glycine the silk yield remarkably increased which was not the case when glycine was supplemented alone. Shyamala *et al.* (1956) have observed significant increase in feed utilization by the silkworm, *Bombyx mori* due to chloromycetin administration. According to them, increase in feed efficiency observed may be due to increased enzyme activity. Shyamala *et al.* (1962) have observed that under the influence of chloromycetin there was 7% more utilization of nitrogen, 28 % more efficient utilization of mineral constituents and 20 % more utilization of crude fat by mulberry silkworm. The percentage composition of the larval tissues also showed increased deposition of minerals in the larvae treated with chloromycetin. Fortification of mulberry leaves with supplementary compounds was found to increase the larval growth and economic parameters (Etebari, 2002; Etebari and Fazilati, 2003; Ganesh Prabu *et al*., 2012; Balasundaram *et al*., 2013). Verma and Atwal (1963) have reported that chloromycetin when ted to the silkworm at the rate of 25 mg per kg body weight daily in two splits, increased mature larval, pupal and cocoon weight. It also increased silk output by 5.53 % over that of control. Verma and Kushwaha (1971) studied the effect of antibiotics subamycin, aureomycin, terramycin and ledermycin on mulberry silkworm. These antibiotics were fed at the rate of 25 mg per kg larval body weight once daily. They observed that all the antibiotics including distilled water treatment gave significant growth (weight at maturity) over the control. Larval duration and pupal duration were not influenced by the antibiotics. Cocoon weight and shell weight were significantly increased due to antibiotic, whereas pupal weight and shell percentage were not affected by antibiotic treatment. The filament length was found to be significantly, increased under the influence of the antibiotics. In the present study, the treatment of amoxicillin antibiotic drug at the concentration of 0.4% may have beneficial effects on the growth of the silkworm larval and pupal length, width and weight and also increased the quantity of silk production by enhancing the economic parameters than control. So, this supplementation could be prescribed to the farmers to get more quantity of silk.

**Conclusion**

The antibiotic treatment has significantly induce the raw silk percentage by diverting most of its assimilated food towards silk protein synthesis. Thus, applications through leaf freshness technology rearing for higher yield and quality of cocoons may through ray of hope in controlling diseases in silkworm. The use of antibiotic amoxicillin enhanced the cocoon weight, the cocoon shell and the length of the thread. From the above study, it is evident that the scope to improvise the silk output by supplementing the silkworms with the selected and efficient antibiotics, so that industry will be economically viable.

**Acknowledgement**

The authors are grateful to the authorities of Annamalai University, Annamalainagar. The Special thanks to for his critical review and valuable suggestions for preparation of manuscript to and help rendered by Dr. (Mrs.) Selvisabhanayakam, U G C, SAP Sponsored & Professor, Department of Zoology Annamalai University, Annamalainagar is duly acknowledged.

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