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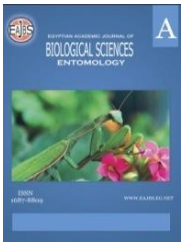

Impact of Delzosin Antibiotic on Productivity and Parameters of Silkworm, *Bombyx mori* L.

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ABSTRACT

The observation data in this study refer to improve in parameters of silkworm, *Bombyx mori* L. Three concentrations (0.1, 0.2, and 0.3 mg/ml of distilled water) of delzosin antibiotic tested on silkworm *Bombyx mori* parameters. Larval mortality rates were 34.66, 30.00, 26.66 and 35.00 % for 0.1, 0.2, 0.3 mg/ml and control respectively. Durations of larvae were 37.40 day for 0.1 mg/ml, 35.50 day for 0.2 mg/ml, 34.4 day for 0.3 mg/ml and 37.50 day for control. Cocooning percentage in the present study were 93.03%, 93.82%, 95.02% and 91.99 % for 0.1 mg/ml, 0.2 mg/ml, 0.3 mg/ml and control respectively. Cocoons weights were 1.024, 1.090, and 1.165, 1.000g for 0.1, 0.2, 0.3% and control respectively. Cocoons shell weight ranged between 0.169g for control and 0.231g for 0.3 mg/ml concentration of antibiotic. Cocoon shell ratio ranged from 16.90 to 19.82 % for control and 0.3 mg/ml of antibiotic concentration, respectively. Effective rate of rearing in the present study were 80.00, 82.00, 85.00, 77.00%for for 0.1, 0.2, 0.3% and control respectively. Silk productivity ranged from 1.75 to 2.39 (cg/day) for control and 0.3 mg/ml concentration of antibiotic, respectively. Absolute silk yield ranged between 13.01 and 19.63g for control and 0.3 mg/ml concentration of antibiotic, respectively.

INTRODUCTION

Silkworm, *Bombyx mori* L commonly known as the domestic silk moth, is a moth species belonging to the family Bombycidae. Order Lepidoptera. Life of many people in Asia depended on rearing of silkworm. Consequently, supplementation of mulberry leaves with some compounds aim to increase the production of cocoon. According to Philips *et al*. (2004), using antibiotics in silkworm rearing is allowed for 4 reasons. The first: treating the diseased larvae with antibiotics stops the heavy loss through the bacterial diseases in silkworms. The second: antibiotic treatment prevents the larvae from diseases. The third: antibiotic treatment control diseases in silkworms. The fourth: antibiotic treatment help for health maintenance and promotion of growth of silkworms. Fortification of mulberry leaves with complementary compounds was found to increase the larval growth and post cocoon characteristics (Lalita *et al.,* 1992, Muniandy *et al.,* 1995, Sarker *et al.,* 1995, Nirwani & Kaliwal, 1998 and Etebari & Fazilati, 2003). Synthetic antibiotics are widely used in sericulture units for disease control. Administration of antibiotic was reported to have detrimental effect on intestinal micro flora of silkworms. Chloromycetin

administration cause general reduction in gut bacterial population of silkworms. It was observed that population of endogenous gut bacteria *viz., Micrococci, Streptococci* and *Flavobacteria* were reduced in number with concomitant increases in the number of coliforms (Shyamala *et al.,* 1960). Probiotics formulations are commercially used for human (Brigidi *et al.,* 2001), for aquaculture (Douillet & Langton, 1994). Using ampicillin on *Bombyx mori* decreased infection of flacherie and increased the productivity (Sridar *et al.*, 2000). Meeramaideen *et al.* (2017) found improving in cocoon characters of silkworm, *Bombyx mori* when using antibiotics as food supplement. Khyade (2020), observed good effect to garamycin antibiotic on productivity of *Bombyx mori*. According to the previous data, the present study aimed to provide information on the delzosin antibiotic on production of silkworm, *Bombyx mori* L**.**

MATERIALS AND METHODS

Bombyx mori (Chinese hybrid -9f7x) feed on mulberry leaves during all instars. Tablets of delzosin antibiotic contain 600mg azithromycin. Manufactured by El Delta for Pharmaceutical industries. Egypt. Larvae were reared on mulberry leaves (*Morus alba* var. *indicia*), leaves have been washed before tests by normal water. Three concentrations (0.1, 0.2, and 0.3 mg/ml of distilled water) of antibiotic were prepared. Leaves were soaked in each of the prepared concentrations for 20 minute and left to dry under laboratory conditions. From the beginning of the first larval stage, the larvae were divided into three groups and one control. In control mulberry leaves were soaked in distilled water only. Each group was divided into three replicates. 100 larvae were used for each replicate. Larvae fed on treated leaves day after day during first, second and third instar, in addition to control fed on untreated leaves under laboratory conditions (27±2ºC, 75% ±5RH) during spring season of 2022. The larval mortality, larval duration and cocooning were recorded. Cocoon indices were determined, effective rate of rearing, silk productivity and absolute silk yield were calculated according to some equations as follows:

Cocooning percentage was calculated according to Goudar and Kaliwal (2000).

$$Cocooning\ percentage = \frac{Number\ of\ cocoon\ formed}{Total\ number\ of\ larvea\ kept} x100$$

Silk productivity was calculated according to Chattopadhyay *et al*. (1995).

$$Silk\ productivity\ per\ day\ (cg/d) = \frac{Cocoon\ shell\ weight}{Fifth\ instar\ duration(d)} x100$$

Where cg: centigram, d: day

Absolute silk yield was calculated according to Debaraj *et al*., (2011).

Absolute silk yield (g) = single cocoon shell weight (g) × effective rate of rearing.

One way analysis of variance (ANOVA) was used to statically analyze the data through SPSS 16.0 (Berkowitz & Allaway, 1998) to find out the variance between experimental groups and control**.** Means were separated by (L.S.D at 0.05%).

RESULTS AND DISCUSSION

Mortality Percentage:

In Table (1) & Figure 1, showed that, mean of larval mortality were 34.6, 30.0, 26.6 and 35.0 % for 0.1, 0.2, 0.3 mg/ml and control respectively. The data obtained from the current study were found to be consistent with many others references, for ex., Drusano *et al.*(1986), who found that ciprofloxacin was effeminacy against both gram positive and negative bacteria of silkworm larvae, also Subramanian *et al.*(2009), tested the impact of

Chloromycetin on gut bacterial population of *Bombyx mori* larvae. Hou *et al*. (2010), mentioned that, the larval body of *Bombyx mori* get triggered reaction for infection, Aarati *et al*. (2019), stated that, larvae of silkworm can be infected with many of pathogens. Although Rafiq *et al.* (2020) fed the larvae of *bombyx mori* till third moult on mulberry leaves without any treatment and then on leaves treated with ceftiofur sodium concentrate 0.15%. He found that an antibiotic, ceftiofur sodium (0.15%) showed significantly improved results in economic parameters like cocoon characters, cocoon yield, average filament length, raw silk percentage and filament denier. So, our present investigation compatible and reflected that antibiotics have the potential to be used for enhancing the cocoon and raw silk production.

Larval Duration:

According to data in Table (1) & Figure 2, mean of larval duration were 37.4 d for 0.1 mg/ml, 35.5 d for 0.2 mg/ml, 34.4 d for 0.3 mg/ml and 37.5 d for control. According to Analysis there were significant change between treated and control. Radha *et al.* (1981), observed improving in rearing and larval duration when using antibiotics administration on *Bombyx mori*. Khyade (2020), showed that, durations of *Bombyx mori* larvae were decreased when treated with Garamycin antibiotic.

Cocooning Percentage:

Mean of cocooning percentage in the present study were 93.0%, 93.8%, 95.0% and 91.9 % for 0.1 mg/ml, 0.2 mg/ml, 0.3 mg/ml and control respectively (Table 1 & Figure 3). Analysis statistical showed significant change between treated and control. The present data take the same line with Shyamala *et al*. (1956) and Radha *et al.* (1981), when reported that, absence of gut pathogens improved consumption of food conversion of energy and production of silk when using chloramphenicol on silkworm. The characters of cocoon improved when larvae feed on leaves of mulberry supplemented with some antibiotics (Venkatesh & Srivastava, 2010). Meeramaideen *et al.* (2017), found increasing in larval growth and economic characters of silkworm, *Bombyx mori* when using antibiotics as food supplement.

Table 1: Mean of larval mortality, larval duration and cocooning percentage of *Bombyx mori* L treated with delzosin antibiotic ± standard error.

Concentrations (mg/ml.)	Larval mortality (%)	Larval duration (d)	Cocooning percentage (%)
0.1	34.6±0.1111	37.4±0.1211	93.0±1.422
0.2	30.0±0.1101	35.5±0.1121	93.8±1.000
0.3	26.6±0.2100	34.4±0.1009	95.0±1.110
control	35.0±0.1100	37.5±0.1311	91.9±1.121
Significance	**	*	*
LSD at 0.05%	2.034	1.325	2.489

**: Significant at 0.01%,*: Significant at 0.05%.

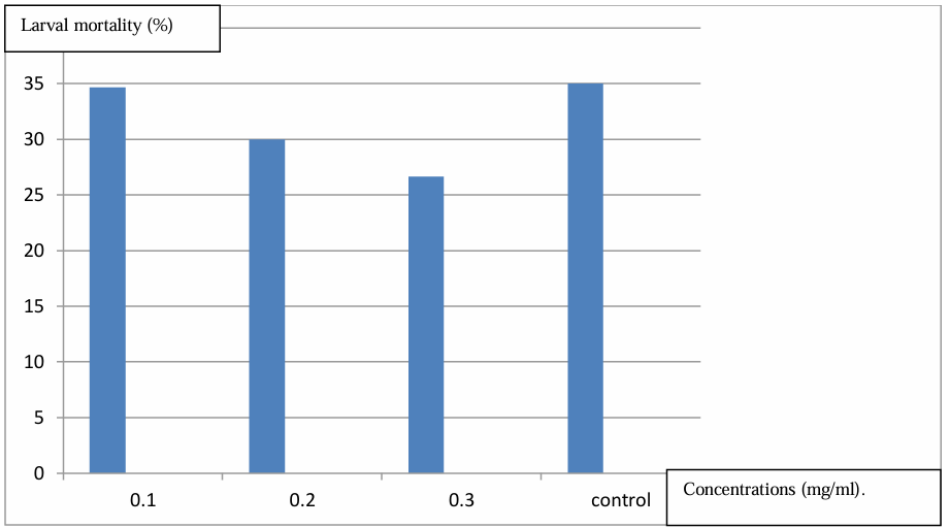

Fig. 1. Means of Larval mortality (%).

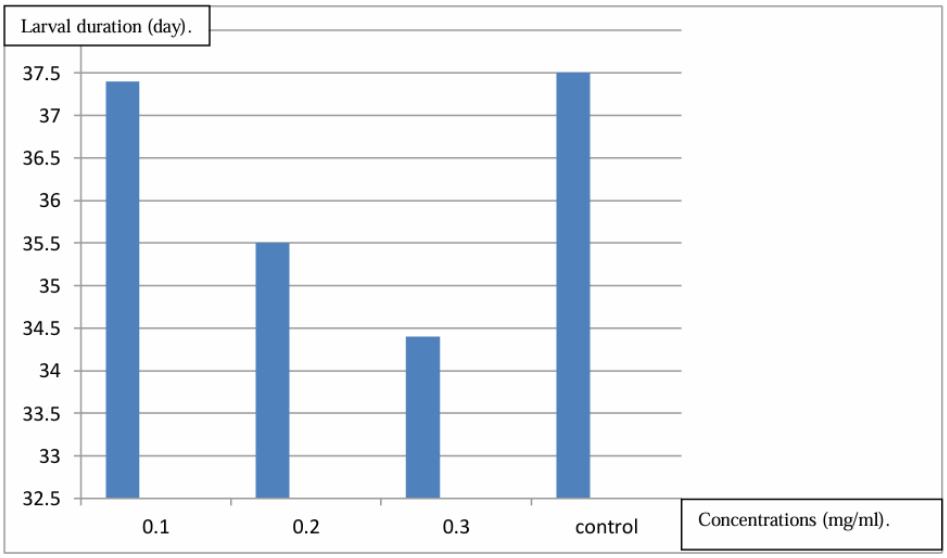

Fig. 2. Means of Larval duration (day).

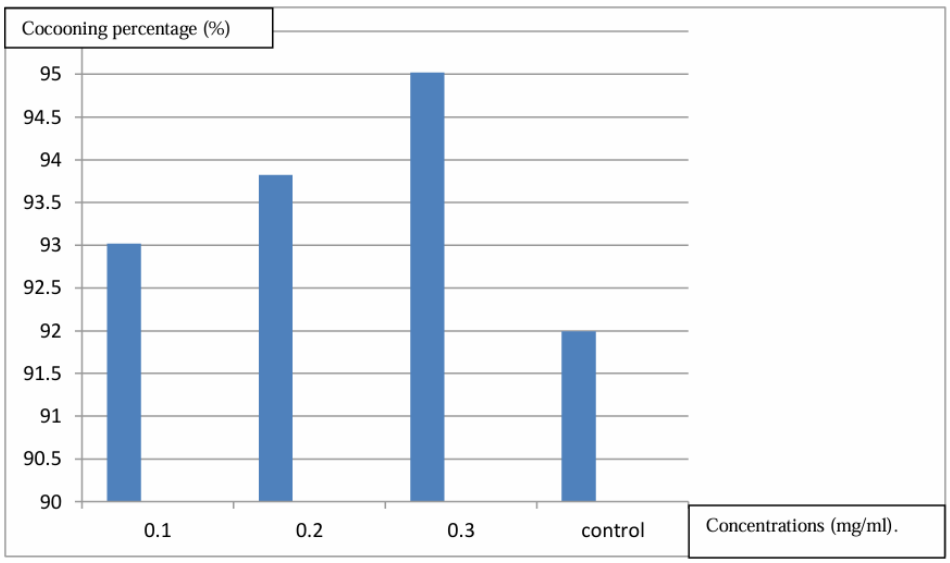

Fig. 3. Means of cocooning (%)

Weights of Cocoon:

In Table 2 & Figure 4, the means of weights of cocoon were 1.024, 1.090, 1.165 and 1.000g for 0.1, 0.2, 0.3% and control respectively. Radha *et al.* (1981), observed that significantly improve in economic parameters like duration, cocoon parameters when using chloramphenicol on silkworm. The cocoon indices were good when the larvae feed on leaves enriched with different antibiotics (Venkatesh & Srivastava, 2010).

Weighs of Cocoon Shell:

The cocoon' shell weights varied, as indicated by the data in Table 2& Figure 5, where ranged between 0.169g for control and 0.231g for 0.3 mg/ml concentration of antibiotic. Savithri *et al.* (1999), found positive response for antibiotics on cocoon shell. The cocoon production also improved when worms feed on leaves of mulberry supplemented with different antibiotics (Venkatesh & Srivastava, 2010). Feeding silkworm larvae of antibiotics increased production of cocoon according to Meeramaideen *et al.* (2017).

Cocoon Shell Ratio:

Means of cocoon shell ratio ranged from 16.90 to 19.82 % for control and 0.3 mg/ml concentration of antibiotic, respectively (Table 2 & Fig. 6). Singh *et al.* (2005) observed improving in larval growth, production of cocoon & weight of shell when larvae fed on *Lactobacillus plantarum* formulation. Khyade (2020), reported good effect to antibiotics, doxycycline hydrogen chloride, lincomycin, streptomycin sulphate (standard), erythromycin (standard) alone and in combinations with *B. thuringiensis*. *Streptomyces* on silkworm *Bombyx mori* economic characters.

Table 2: Mean of cocoon parameters (cocoon weight, cocoon shell weight and cocoon shell ratio) of *Bombyx mori* L treated with delzosin antibiotic ± standard error.

Concentrations (mg/ml.)	Cocoon weight (g)	Cocoon shell weigh (g)	Cocoon shell ratio (%)
0.1	1.024±0.0233	0.182±0.0043	17.7±0.2111
0.2	1.090±0.0511	0.197±0.0021	18.0±0.3011
0.3	1.165±0.0510	0.231±0.0030	19.8±0.3320
control	1.000±0.0500	0.169±0.0036	16.9±0.3300
Significance	**	**	*
LSD at 0.05%	0.064	0.009	0.366

**: Significant at 0.01%,*: Significant at 0.05%.

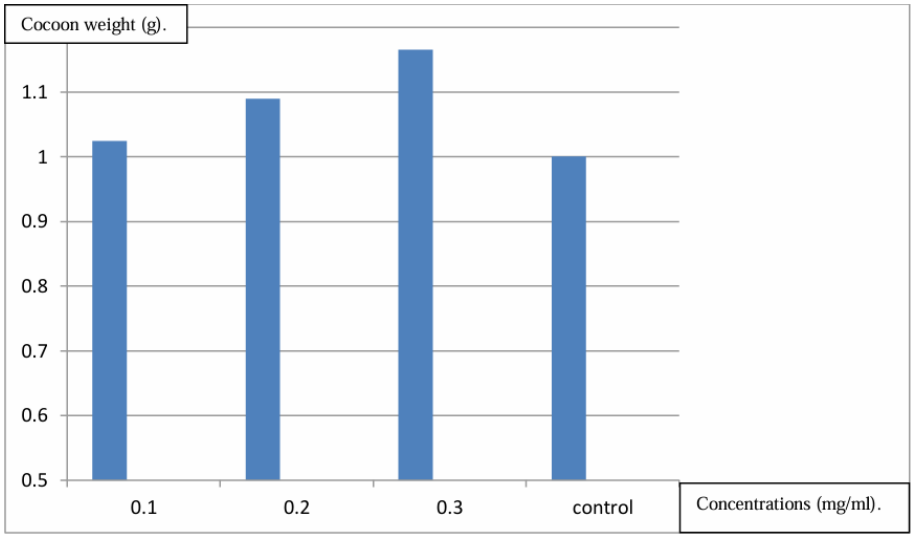

Fig. 4. Means of cocoon weight (g).

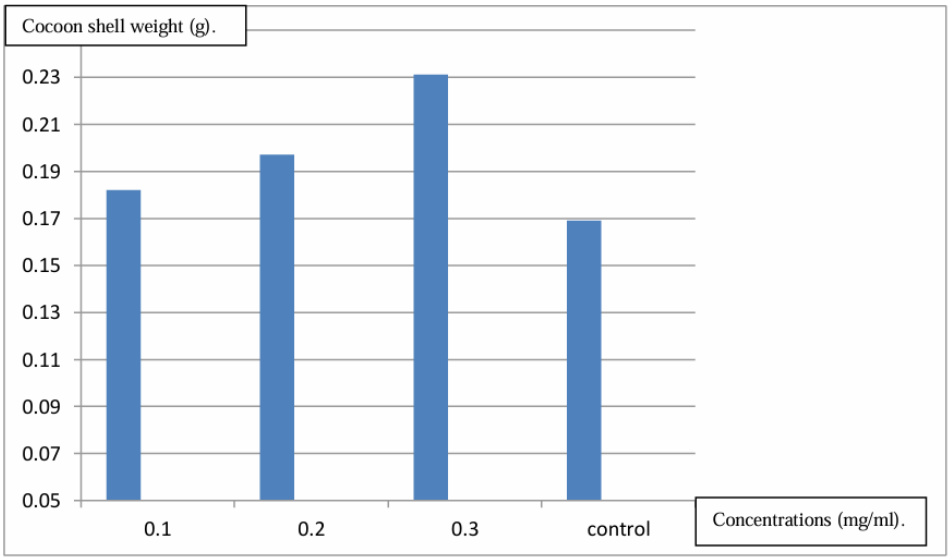

Fig. 5. Means of cocoon shell weight (g).

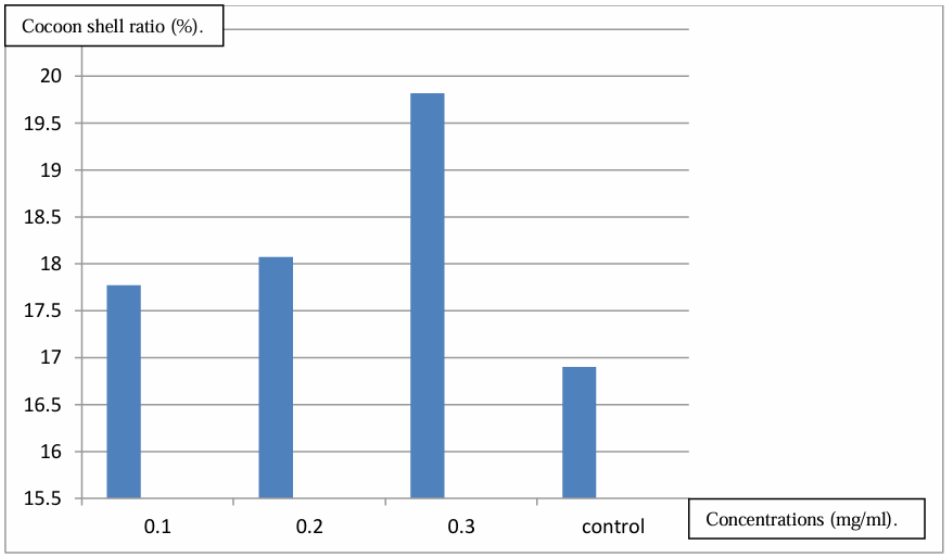

Fig. 6. Means of cocoon shell ratio (%).

Effective Rate of Rearing:

Data in the present study were 80.00, 82.00, 85.00, 77.00%for for 0.1, 0.2, 0.3% and control respectively according to data in Table 3& Figure 7. Data in present study take the line with several authors (Sahin & Ugur, 2003, Pandey *et al.,* 2004 and Cecilia *et al.,* 2004). Effective rate of rearing (ERR) was increased when larvae of *bombyx mori* treated with antibiotics, doxycycline hydrogen chloride, lincomycin, streptomycin sulphate (standard), erythromycin (standard) alone and in combinations with *B. thuringiensis. Streptomyces* (Khyade, 2020).

Silk Productivity:

As shown in Table 3 & Figure 8, means of silk productivity ranged from 1.75 to2.39 (cg/day) for control and 0.3 mg/ml concentration of antibiotic, respectively. Earlier studies also indicated the positive impact of antibiotics on growth, cocoon characters and silk filament length (Savithri *et al.,* 1999). Khyade (2020) reported increasing in productivity of silkworm *Bombyx mori* when treated with antibiotics, doxycycline hydrogen chloride, lincomycin, streptomycin sulphate (standard), erythromycin (standard) alone and in combinations with *B. thuringiensis. Streptomyces*.

Absolute Silk Yield:

According to Table 3 & Figure 9, data ranged between 13.01 and 19.63g for control and 0.3 mg/ml concentration of antibiotic, respectively. In the present study data similar to Baig *et al.* (1990), when treated larvae of *Bombyx mori* with antibiotics *viz*., streptomycin sulphate, gentamycin, cloxocillin and kanamycin and found improving in silk production. Oral administration of amoxycillin, ampicillin, cloxacillin, cephalexin, chloramphenicol and tetracycline to *Bombyx mori* showed positive effect on cocoon parameters and length of silk filament (Savithri *et al.,* 1999). Sridar *et al.* (2000), reported that, administration of ampicillin reduced the incidence of flacherie and increase the cocoon indices.

Table 3: Mean of effective rate of rearing, silk productivity and absolute silk yield of *Bombyx mori* L treated with delzosin antibiotic ± standard error.

Concentrations (mg/ml.)	Effective rate of rearing (%)	Silk productivity (cg/d).	Absolute silk yield (g).
0.1	80±1.650	1.88±0.189	14.5±0.322
0.2	82±1.533	2.04±0.123	16.1±0.333
0.3	85±1.008	2.39±0.136	19.6±0.213
control	77±1.677	1.75±0.122	13.0±0.421
Significance	**	*	**
LSD at 0.05%	4.032	0.190	1.389

**: Significant at 0.01%,*: Significant at 0.05%. Cg/d: centigram per day.

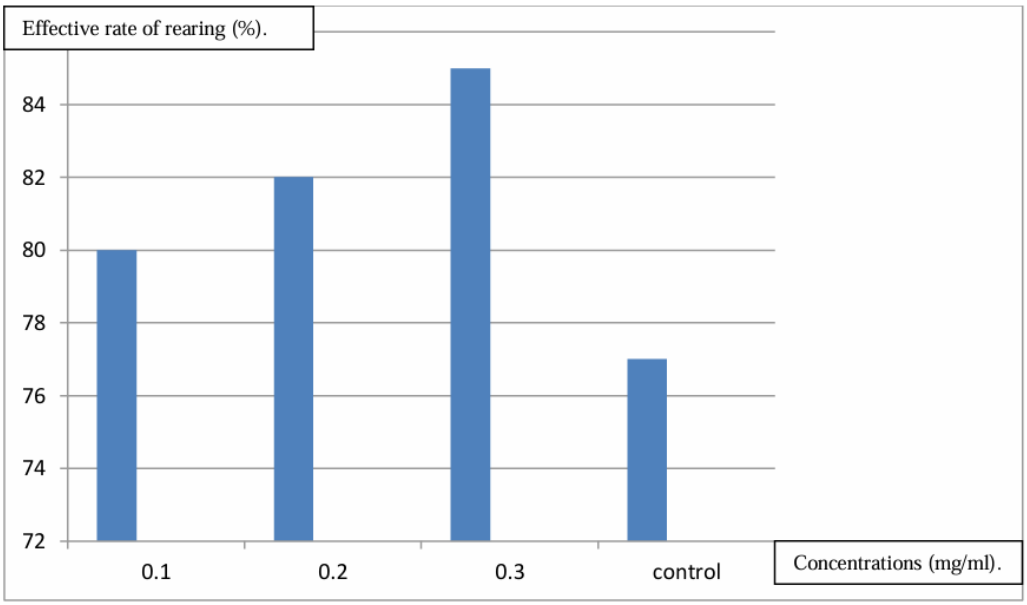

Fig. 7. Means of effective rate of rearing (%).

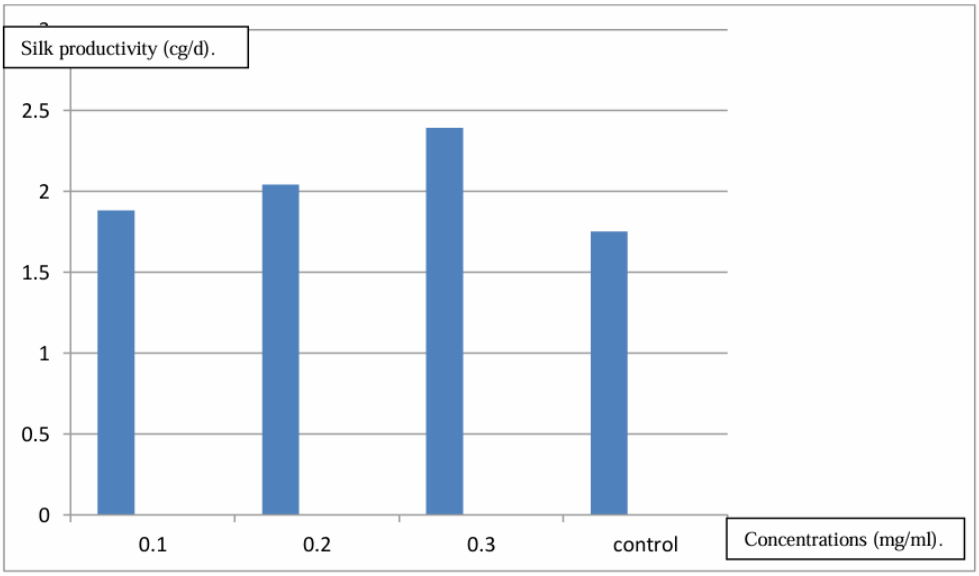

Fig. 8. Means of silk productivity (cg/d).

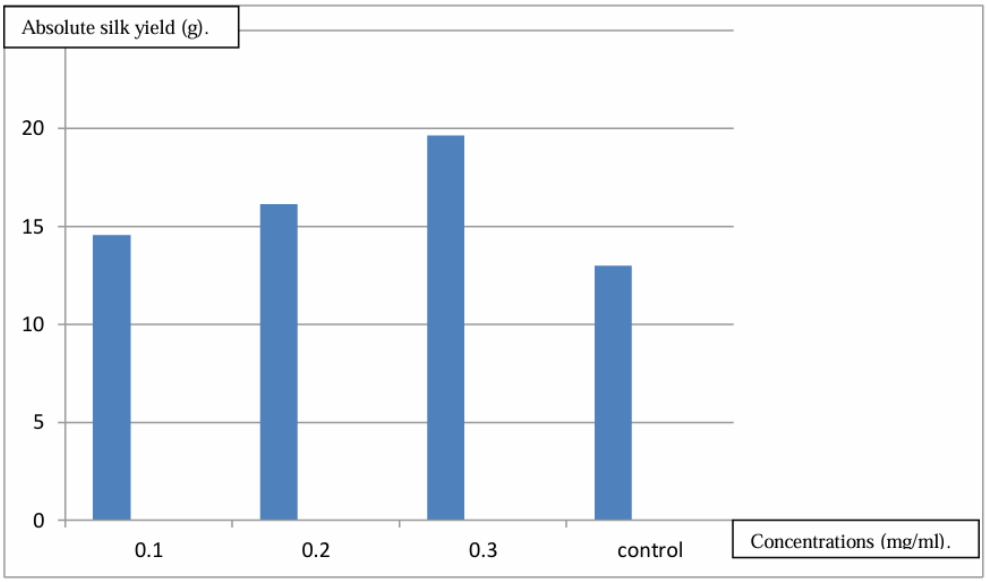

Fig. 9. Means of absolute silk yield (g).

Conclusion

In the present study, delzosin antibiotic improved studied parameters such as larval mortality, duration of larva, cocooning percentage, cocoon weight, cocoon shell weight, cocoon shell ratio, effective rate of rearing**,** silk productivity, absolute silk yield. Therefore, delzosin antibiotic has good effect on productivity of *Bombyx mori* because it reduces the number of pathogens that attack the larvae. The best concentration was 0.3 % while results were 26.6%, 34.4d and 95% for larval mortality, duration of larva, cocooning percentage respectively. Cocoon parameters were 1.165g, 0.231g and 19.6% for cocoon weight, cocoon shell weight and cocoon shell ratio respectively.Effective rate of rearing was 85%. Silk productivity was 2.39 cg/d. Absolute silk yield was19.6g.

Declarations

Ethics Approval and Consent to Participate: Since the experimental effort was limited to invertebrate pest species (*Bombyx mori*), ethics committee approval was not necessary for this study. The authors have all confirmed that this work is unique and hasn't been published anywhere else.

Availability of Data and Materials: The data supporting the study are included in the manuscript.

Source of Funding: There is no funding source for this study.

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