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INFLUENCE OF AMPICILLIN SUPPLEMENTATION ON FOOD UTILISATION AND ECONOMIC CHARACTERS OF COCOON OF MULBERRY SILKWORM *BOMBYX MORI* L.

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Investigation was carried out to improve some important economic characters of *Bombyx mori* L. through usage of antibiotic ampicillin in the diet. Concentration of ampicillin at 0.03% brought about significant changes which have potential economic value. This marked improvement was interpreted through food utilisation parameters.

INTRODUCTION

Fortification (increasing the nutritive value of food) of mulberry leaves with antibiotics has been reported to influence favourably the growth of animals in general (Heilman, 1953) and particularly the productivity in silkworm (Radha *et al.*, 1980). Murthy & Sreenivasaya (1953) reported an increase in body weight of silkworm with penicillin, streptomycin, aureomycin and terramycin when each of these antibiotics was supplemented individually with the diet. Similarly, chloromycetin enchanced the growth and fecundity of silkworm (Sharada & Bhat, 1956), food utilisation and silk production (Shyamala *et al.*, 1956) and cocoon characteristics (Sharada *et al.*, 1956; Krishnaswami *et al.*, 1980; Radha *et al.*, 1980; Tayade *et al.*, 1988.) Eventhough the literature survey reveals that there is sufficient work on enhancing cocoon characters of silkworm using antibiotics, no attempt has so far been made to relate its efficacy through food utilisation parameters. The present study is thus directed to investigate the effect of ampicillin on food utilisation and further to relate the values obtained to the economic characters of the silkworm.

MATERIALS AND METHODS

The disease free egg layings (dfls) of *B. mori* hybrid L x NB_4D_2 (Local multivoltine X Nandhini bivoltine) were collected from Silkworm Rearing Centre, Injar, Sivakasi (Tamil Nadu). The eggs were then incubated and allowed to hatch under room temperature varying between 26°C and 28°C. The freshly hatched larvae were introduced into a rearing chamber which was disinfected with 2% formalin solution two days prior to the begining of rearing. The larvae were fed five times a day at 06.00, 10.00, 14.00, 18.00 and 22.00 hours. The larvae were allowed to grow till the completion of fourth instar, after which they were separated into three experimental sets (treatments), each containing 45 larvae (three replicates of 15 larvae each). To each of the three treatments, mulberry leaves coated with 0.01, 0.02 and 0.03% concentration of ampicillin (in distilled water) were provided separately. The treated leaves were shade dried before feeding. Care was taken to provide equal quantities of leaves at each time to all the sets. The control larvae were fed with the untreated mulberry leaves sprayed with distilled water.

The food utilisation parmeters were estimated following standard gravimetric method of Waldbauer (1968). Larvae were regularly monitored for their weight gain and amount of food consumed in the control as well as experimental sets. During spinning stage, the larvae were transferred to "*chandraki*" to spin cocoons. The cocoons were harvested on the fifth day after initiation of spinning. Each cocoon was then weighed with and without the pupa. The shell ratio was calculated by dividing the shell weight by the single cocoon weight with pupa. The results obtained were further analysed using Student's t - test.

RESULTS AND DISCUSSION

Table I summarizes the data obtained for production, approximate digestibility (AD), efficiency of conversion of ingested (ECI) and of digested food (ECD) of silkworm *B. mori* reared on mulberry leaves supplemented with different concentrations of ampicillin (0.01, 0.02 and 0.03%). The test

larvae showed an increase in production by 4, 5, and 16% at 0.01, 0.02 and 0.03% concentrations of ampicillin respectively, over control. The observation indicates an overall benefical effect of ampicillin on production, which increases with increasing dosage. However, the value for 0.03% concentration alone is statistically significant with control. This is in conformity with earlier reports of Murthy & Sreenivasaya (1953); Sharada & Bhat (1956); Shyamala *et al.* (1956); Verma & Kushwaha (1970); Rhada *et al.* (1980) and Tayade *et al.* (1988) who reported an increase in larval weight of silkworm due to antibiotic supplementation. This increased production may be due to an overall beneficial effect of antibiotics, possibly through increasing the turning over of the feed into body weight (Goldberg, 1959; Walton, 1977).

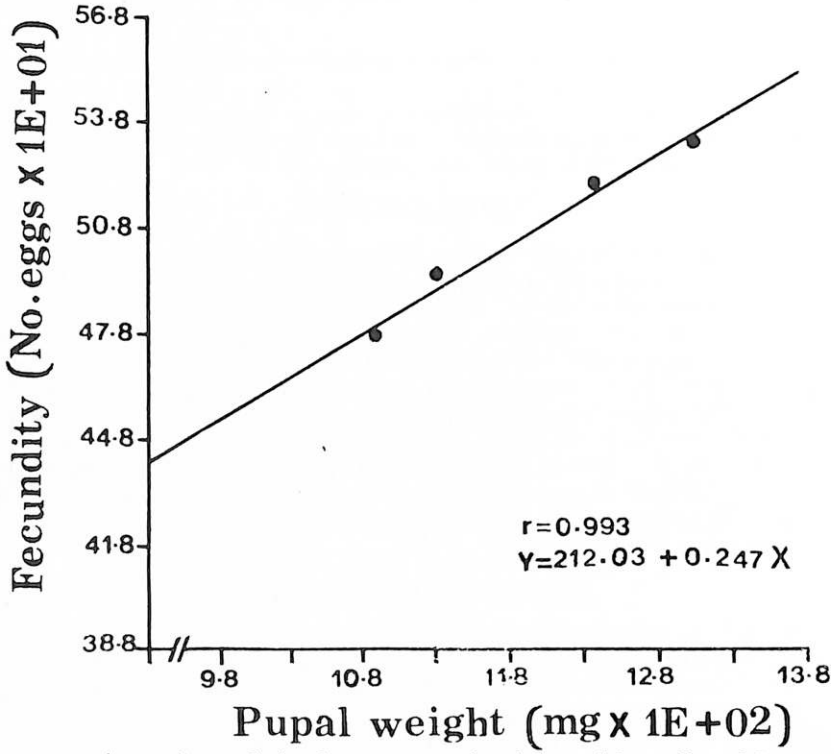

Fig. 1. Linear regression and correlation between pupal weight and fecundity of *B. mori*.

Table I : Influence of ampicillin on the production and food utilisation of silkworm, *B. mori* L.

Parameters	Control	Ampicillin supplementation		
		0.01%	0.02%	0.03%
Production (mg dry wt/larva)	679.9 ± 35.0a	708.7 ± 25.1a	715.9 ± 20.8a	785.2 ± 1.1b
AD (%)	41.4 ± 1.3a	44.1 ± 1.3b	47.9 ± 2.1c	52.8 ±1.0d
ECI (%)	13.1 ± 0.8a	13.9 ± 0.6a	14.8 ± 0.8a	16.9 ± 0.3b
ECD (%)	31.7 ± 0.4a	32.5 ± 0.9a	32.0 ± 0.8a	32.6 ± 0.5a

Values followed by similar superscripts "across a row" are not statistically different at $P < 0.05$.

Irrespective of the concentrations, the approximate digestibility (AD) increased significantly with the application of ampicillin (Table I). Shyamala *et al.* (1956) who registered an increase in AD on supplementation of chloromycetin suggested that the increase may probably be due to the ability of the antibiotic to rearrange and condition the intestinal flora of the silkworm larvae which is nutritionally beneficial. At 0.03% concentration only, 4% increase in gross conversion efficiency (ECI) was found to be statistically significant. The increase in ECI values in other concentrations was found to be statistically insignificant. Shyamala & Bhat (1959) suggested that an increase in ECI as

a result of feeding on antibiotic supplemented diet may be associated with an increase in the activity of gut proteinases as well as an increased availability of vitamins in the larval tissues. However, the net conversion efficiency (ECD) values of larvae exposed to ampicillin remained statistically insignificant in all the three tested concentrations.

Table II presents the daily increment of larval weight during experimental period. It shows a firm indication on the overall stimulatory effects of antibiotic treatment on larval performance, which visibly increased with increasing dosage. However, the difference between 0.01 and 0.02% concentrations was not significantly different.

Table II : The daily increment in the weight of final instar larvae of silkworm, *B. mori*.

Day	Control	Ampicillin supplementation		
		0.01%	0.02%	0.03%
1st	826.4 ± 29.4a	961.3 ± 69.9b (16.3)	995.5 ± 88.0b (20.5)	1016.9 ± 46.8b (23.1)
2nd	1196.5 ± 58.5a	1409.4 ± 48.9b (17.8)	1452.7 ± 24.8b (21.4)	1716.0 ± 77.3c (43.4)
3rd	1656.0 ± 46.7a	1918.2 ±52.2b (15.8)	1986.7 ± 65.0b (20.0)	2193.3 ± 62.9c (32.4)
4th	2097.6 ± 26.0a	2460.0 ± 13.7b (17.3)	2481.8 ± 13.9b (18.3)	2809.8 ± 46.2c (34.0)
5th	2630.2 ± 59.0a	3043.8 ± 45.6b (15.7)	3147.3 ± 121.7bc (19.7)	3170.5 ± 24.2c (20.5)
6th	2908.9 ± 34.1a	3301.3 ± 79.7b (13.5)	3439.1 ± 27.9c (18.2)	3529.8 ± 70.6c (21.3)
7th	3422.9 ± 34.1a	3529.8 ± 70.6a (3.1)	3562.2 ± 73.5b (4.1)	3805.8 ± 16.9b (11.2)

Values followed by similar superscripts across a row are not statistically different at $P < 0.05$.
Values within the parentheses indicate the percentage of increase over control.

Table III enumerates the effects of dietary supplementation with three different concentrations of ampicillin on the economic characters of silkworm, *B. mori*. Each character has applied relevance with potential of drawing commercial attention. The cocoon weight was found to be statistically higher due to ampicillin supplementation and it significantly increased with increasing concentration of ampicillin (Table III).

Table III : Influence of ampicillin supplementation on economic characters of silkworm, *B. mori*.

Parameters	Control	Ampicillin supplementation		
		0.01%	0.02%	0.03%
Cocoon weight (mg/cocoon)	1565.0 ± 66.8a	1650.9 ± 43.6b (5)	1751.7 ± 88.6c (12)	1803.3 ± 9.2c (15)
Pupal weight (mg/pupa)	1088.3 ± 46.0a	1133.0 ± 81.9b (4)	1238.3 ± 85.9c (14)	1306.7 ± 57.6c (20)
Shell weight (mg/shell)	252.5 ± 14.1a	269.2 ± 25.9b (7)	289.1 ± 20.1bc (15)	310.3 ± 29.4c (23)
Shell ratio (percentage)	16.2 ± 1.3a	16.3 ± 1.5b	16.6 ± 1.4bc	17.9 ± 0.9c
Silk filament length (m/cocoon)	710.0 ± 8.2a	820.0 ± 24.5b (16)	866.7 ± 41.1c (22)	890.0 ± 16.3c (25)
Fecundity (no. of eggs/moth)	478.0 ± 4.1a	495.0 ± 6.7b (4)	520.0 ± 12.3c (7)	533.0 ± 12.8d (9)

Values followed by similar superscripts across a row are not statistically different at $P < 0.05$;
Values within the parentheses indicate the percentage of increase over control.

The result are in agreement with the earlier reports of Verma & Kushwaha (1970); Radha *et al.* (1980); Tayade *et al.* (1988) and Seenivasagan *et al.* (1993). In this study, a 14 - 20% increase in pupal weight was also observed in the treatment sets over control. The shell weight was found to be significantly higher in the treated sets than the control. In addition, an increase in the silk filament length ranging from 16 to 25% was recorded from cocoons obtained from the larvae reared on ampicillin fortified leaves. Earlier works with supplementation of tetracyclines (aureomycin, subamycin and ledermycin), reveal an increase in silk filament length (Verma & Kushwaha (1970). Similar observation was also made by Tayade *et al.* (1988) on supplementation with abrimox, cloxacillin, hostacycline and ledermycin.

Ampicillin also showed pronounced influence on the adult fecundity (number of eggs/moth). An increase of 4.7 and 9% in 0.01, 0.02 and 0.03% concentrations of antibiotic treatment respectively, was recorded over the control. These results are in agreement with earlier work of Tayade *et al.* (1988). The fecundity was found to be positive and highly correlated to the female pupal weight ($r = 0.993$) as shown in Fig. 1. Similar observation was made by Watanabe (1961), Shamachary & Krishnaswami, (1980), Shaheen *et al*, (1992) in silkworm larvae.

In the present study, the possible role of the antibiotic ampicillin in enhancing the growth of *B. mori* larvae might be due to an overall inhibition of gut microorganisms which directly compete with the host for nutrients. There is also the possibility of antibiotic mediated increase in gut enzyme activity which indirectly favours growth through better utilisation of the diet as well as an increase in production and larval weight. This is evident from the enhancement of individual economic characters, such as reeled silk filament length and cocoon weight. Such traits are well desired by Sericultural industry and it is recommended that rearing silkworm on a diet supplemented with 0.03% ampicillin would result in better and increased production of silk.

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