Beneficial Effect of Cyanobacteria \textit{Anabaena variabilis} on Quantitative Traits of Eri Silkworm \textit{Samia cynthia ricini}, Boisduval

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Abstract: The study is to investigate the impact of fortifying Anabaena, a cyanobacteria, on castor leaves for nutritional studies. Anabaena is found in water and soil, having a potential to produce an elaborate array of secondary metabolites which shows metabolic effect on worms besides having antibiotic effect. In the present study, Anabaena at various aqueous concentrations was fortified and orally administrated to Samiacynthia, B. The results indicate that Eri silkworms fed with \textit{Anabaena variabilis} at 500 ppm concentration showed improved larval weight (59.95%), pupation rate (31.83%), cocoon yield (146.88%), ERR (80.87%) and reduced larval mortality (75.60%) while other quantitative parameters were significantly high at 500 and 300 ppm concentrations when compared to control Data is collected and subjected to statistical analysis. It is evident that \textit{Anabaena variabilis} is very efficient feed supplement in increasing the productive traits besides reducing the larval mortality in the Eri silkworm.

Keywords: \textit{Anabaena variabilis}, Eri silkworm, quantitative parameters

INTRODUCTION

Nutrition is an incremental factor which individually augments insect growth and development; subsequently cocoon production (Laskar and Datta, 2000). The physiological potential of an insect is influenced by its food intake, growth regulators and various biotic factors (Slansky and Scriber, 1985; Rath, 2005).

The specific doses of dietary supplements in nutrition viz. proteins, carbohydrates, amino acids and vitamins etc., evinced their effect on various metabolic activities of silkworm (House, 1966; Horie, 1980). Mulberry leaves supplemented with proteins, amino acids, vitamins and antibiotics have improved larval growth, fecundity and silk content in silkworm. Soyabean and Spirulina, blue green algae, containing anarray of bioactive phytochemicals were studied on worms (Subburathinam et al., 1990; Devi et al., 1981; Murugappa, 1997). Oral administration of foliage of mulberry and eri silkworm supplemented with cyanobacteria enhanced larval and shell weight besides reduction of larval mortality (Jayaprakash et al., 2005; Venkataramana et al., 2003; Kumar et al., 2009; Masthan et al., 2011). Babu et al. (2005) reported that antiviral protein of \textit{Spirulina platensis} showed 90% resistance to BmNPV of \textit{Bombyx mori}.L.

\textit{Anabaena sps} blue green algae are found in fresh marine water and also in soil profile. They are first photosynthetic organisms filamentous, N2 fixing, morphologically diverse genus of cyanobacteria having 40 common species including \textit{A. wisconsinense} and \textit{A. flosaquae}. As they store reserve food materials, they can be used as sources of proteins, lipids, vitamins and certain secondary metabolites thus can be consumed as food due to their high protein and fibre content (Devi et al., 1981; Anupama, 2000; Tan, 2007; Cardozo et al., 2007). In addition to these, exudates have also shown to have antibiotic effects (Starr et al., 1962; Welch, 1962; Flint and Moreland, 1946).

A broad spectrum antimicrobial antibiotic produced by \textit{Nostoc muscorum} inhibits the growth of bacteria notably multiple resistant \textit{Staphylococcus aureus} and yeasts \textit{Candida albicans} and \textit{C. pseudotrapicales} (Bloor and England, 1989). Therefore, the current investigation highlights the effect of different aqueous concentrations of \textit{Anabaena variabilis} on the quantitative parameter of Eri silkworm \textit{Samia cynthia ricini}, Boisduval.

MATERIALS AND METHODS

Organisms and growth condition: Algal strains selected for the studies belong to cyanobacteria growing in cultures of rice field of Telangana region (A.P) were collected and cultured in BC 11 media with or without nitrogen source at a temperature of 25±1°C under continuous illumination (3000 lux) for 12 days. Therefore, collected (after 12 days) washed with distilled water and the pellets obtained were dried at room temperature.
Rearing: Mass culture of 25 Eri silkworm disease free layings (dfls) was maintained at rearing house of Sericulture Department, Kakatiya University, Warangal, (A.P.) under controlled (temperature 25-26°C and RH 85%) condition. Eridfls were incubated and black boxed properly for synchronization of hatching at rearing house during summer season of 2012-13. Six thousand (6000) first instar larvae of Eri silkworm were grouped into six treatments including control treatment. Each treatment was replicated four times to have 250 worms/repetition to observe the effect of Anabaena variabilis extracts an economic trait. Aqueous (distilled water) solution of Anabaena variabilis 100 ppm (T1), 200 ppm (T2), 300 ppm (T3), 400 ppm (T4), 500 ppm (T5) and control (T6) were prepared daily for soaking of castor leaves for 10 min in each treatment. Soaked leaves were shade dried and fed five times (0.6 AM, 02 PM, 06 PM and 10 PM) a day under room conditions to the worms. The control batches of worms were fed with castor leaves soaked in distilled water.

Larval count was done daily in each treatment of four replications for computing the larval mortality. Twenty five mature larval (Vth instar) weight was recorded.

There after the matured larvae were mounted on bamboo (Chandrikas) mountages for spinning of cocoons. The experiments on the effect of Anabaena variabilis were conducted based on the methodology of Venkataramana et al. (2003) and Jayaprakash et al. (2005). Data on larval weight (g), larval mortality (%), single cocoon weight, single shell weight, single pupal weight and silk ratio (%) were recorded. Recorded data was statistically analyzed for variance among the treatments.

RESULTS

The observations recorded on the effect of feeding different concentration of Anabaena variabilis on the productive and cocoon traits Eri silkworm Samia cynthia ricini Boisdvul were statistically analyzed and presented in Table 1 and 2. Mean larval weight (g), pupation rate (%), cocoon yield (kg/100 dfl) and ERR (%) were found the highest under concentrations 500 ppm (T5) followed by 400 ppm (T4) and 300 ppm (T3) concentrations (Table 1). Castor leaves foliated with 500 ppm (T5) concentrations of Anabaena variabilis significantly increased the larval weight, pupation rate, cocoon yield and ERR by 59.95, 31.83, 146.88 and 80.87%, respectively over control lots (Table 1). It is observed that the larval mortality was significantly reduced by 75.60% in 500 ppm (T5) treated eriworms followed by 71.76% (400 ppm) and 66.35% (300 ppm) over the distilled water treated (control) lots.

However, Anabaena variabilis treatments had no significant effect on larval duration throughout the life span; the larval duration is reduced from 18 days 50 min. in the control lot to 16 days 50 min in 500 ppm (T5) and 200 ppm (T2).

The analysis of variance has indicated high significant differences (at 1 and 5% level) between treatment values in respect of single cocoon weight, single shell weight and silk ratio are shown in Table 2. The treatments with 500 ppm (T5) and 300 ppm (T3) have very significantly (1% level) increased the single cocoon weight, shell weight and silk ratio when compared with control. The effect of the said concentrations Anabaena variabilis was consistent

### Table 1: Effect of Anabaena variabilis on productive parameters of eri silkworm, Samia cynthia ricini, boisduval

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Larval weight (g)</th>
<th>Larval mortality (%)</th>
<th>Larval period (days)</th>
<th>Pupation rate (%)</th>
<th>Cocoon yield (kg) 100 DFL</th>
<th>ERR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>5.46 (20.80)</td>
<td>37.50 (-11.45)</td>
<td>17.00 (-8.11)</td>
<td>61.50 (6.68)</td>
<td>22.52 (32.46)</td>
<td>42.47 (6.76)</td>
</tr>
<tr>
<td>T2</td>
<td>6.25 (38.27)</td>
<td>30.28 (-28.50)</td>
<td>16.50 (-10.81)</td>
<td>70.00 (21.42)</td>
<td>28.90 (71.51)</td>
<td>62.90 (58.12)</td>
</tr>
<tr>
<td>T3</td>
<td>6.46 (42.92)</td>
<td>33.65 (-20.54)</td>
<td>17.00 (-8.11)</td>
<td>67.50 (17.08)</td>
<td>37.36 (121.100)</td>
<td>64.52 (62.19)</td>
</tr>
<tr>
<td>T4</td>
<td>6.95** (53.76)</td>
<td>28.24** (-33.20)</td>
<td>17.00 (-8.11)</td>
<td>71.75** (24.45)</td>
<td>37.80** (124.33)</td>
<td>67.74** (70.28)</td>
</tr>
<tr>
<td>T5</td>
<td>7.23** (29.95)</td>
<td>24.41** (-42.36)</td>
<td>16.50 (-10.81)</td>
<td>76.00** (31.83)</td>
<td>41.60** (146.88)</td>
<td>71.95** (80.87)</td>
</tr>
<tr>
<td>T6 (cont)</td>
<td>4.52</td>
<td>42.35</td>
<td>18.50</td>
<td>57.65</td>
<td>16.85</td>
<td>39.78</td>
</tr>
<tr>
<td>F-value</td>
<td>12.57</td>
<td>281.80</td>
<td>3.38 (NS)</td>
<td>28.99</td>
<td>70.41</td>
<td>720.78</td>
</tr>
<tr>
<td>C. D at 5%</td>
<td>6.47</td>
<td>4.88</td>
<td>5.67</td>
<td>8.65</td>
<td>-4.75</td>
<td>-4.34</td>
</tr>
<tr>
<td>C. D at 1%</td>
<td>7.52</td>
<td>5.67</td>
<td>6.25</td>
<td>9.05</td>
<td>-5.10</td>
<td>-5.70</td>
</tr>
</tbody>
</table>

*: Significant at 5%; **: Significant at 1%; Values in parenthesis are percent increase (+) /decrease (-) over control

### Table 2: Effect of Anabaena variabilis on cocoon character of eri silkworm

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Cocoon weight (g)</th>
<th>Pupal weight (g)</th>
<th>Shell weight (g)</th>
<th>Silk ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>2.826 (23.41)</td>
<td>2.373 (19.25)</td>
<td>0.457 (51.82)</td>
<td>16.16 (22.89)</td>
</tr>
<tr>
<td>T2</td>
<td>2.721 (18.82)</td>
<td>2.304 (15.77)</td>
<td>0.417 (38.53)</td>
<td>15.33 (16.58)</td>
</tr>
<tr>
<td>T3</td>
<td>3.140** (37.37)</td>
<td>2.629 (32.11)</td>
<td>0.511** (69.77)</td>
<td>16.28** (23.80)</td>
</tr>
<tr>
<td>T4</td>
<td>3.024* (32.05)</td>
<td>2.571 (29.19)</td>
<td>0.453* (50.49)</td>
<td>14.97* (13.84)</td>
</tr>
<tr>
<td>T5</td>
<td>3.156* (37.82)</td>
<td>2.720 (36.68)</td>
<td>0.436* (44.85)</td>
<td>13.82* (5.09)</td>
</tr>
<tr>
<td>T6 (cont)</td>
<td>2.290</td>
<td>1.990</td>
<td>0.301</td>
<td>13.15</td>
</tr>
<tr>
<td>F-value</td>
<td>36.110</td>
<td>141.000 (NS)</td>
<td>10.00</td>
<td>35.51</td>
</tr>
<tr>
<td>C. D at 5%</td>
<td>7.550</td>
<td>3.820</td>
<td>0.340</td>
<td>-2.15</td>
</tr>
<tr>
<td>C. D at 1%</td>
<td>8.650</td>
<td>4.410</td>
<td>0.422</td>
<td>-3.00</td>
</tr>
</tbody>
</table>

*: Significant at 5%; **: Significant at 1%; Values in parenthesis are percent increase (+)/decrease (-) over control
overall cocoon characters except pupil weights and further as the pupil weight did not evoce significant differences. The maximum improvement in shell weight (69.77%), silk ratio, (23.80%) and cocoon weight (37.37%) was recorded significantly (1% level) with 300 ppm (T4) (Table 2).

Analysis of overall results indicated that 500 ppm (T5) concentration treatment is found to be significant in increasing the productivity traits of eri silkworm, S.c. ricini, boisd.

**DISCUSSION**

The parameters viz. larval weight, pupation rate, cocoon yield, ERR, single cocoon weight, single shell weight and silk ratio analyzed in the present investigations clearly indicated the impact of Anabaena variabilis on the economic traits of S.c. ricini boisd. Castor leaves supplemented with aqueous solution of Anabaena variabilis at 500 ppm (T5) concentration significantly (1%) increased the larval weight, pupation rate and cocoon yield, ERR and reduced the larval mortality considerably when compared to control lots. The reduction in larval mortality might also be due to antibiotic activities of cyanobacterium that is evinced antibacterial, antiviral and antifungal effect on test insect (Bloor and England, 1989). The present findings on the effects of Anabaena variabilis on physiology of Eri silkworms are in close conformity with those results observed in Bombyxmori L., by Venkataramana et al. (2003). Further, Jayaprakash et al. (2005) reported that castor leaves feed supplemented with 300-400 ppm concentration of Spirulina aqueous extract to S.c. ricini Boisd found to be effective in reducing larval mortality and increasing the larval weight, pupation rate, pupal weight and silk ratio. Narayanaswamy and Ananthanarayana (2006) inferred the role of nutritional principles in castor crop. Supplementation of castor leaves with Anabaena extracts is the way for economic utilization of leaves that leads to maximize the eri cocoon and castor bean production.

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**REFERENCES**


