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RELATIONSHIP OF PROTEIN AND CARBOHYDRATE CONSTITUENTS OF *QUERCUS SERRATA* LEAVES WITH THE LARVAL WEIGHT OF OAK TASAR SILKWORM *ANTHERAEA PROYLEI* J.

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The multiple correlation and Beta coefficient of fifth instar larval dry weight of *Antheraea proylei* J. with total sugar and crude protein constituents of *Quercus serrata* foliage was studied. Positive and significant impact of total sugar and protein existed on larval weight.

INTRODUCTION

The quantity and quality of food plant consumed by an insect larva has great bearing on its survival, growth rate, developmental duration and final body weight (Remadevi *et al.*, 1993). The oak tasar silkworm *Antheraea proylei* J. has been exploited by man as it produces silk. Much emphasis is being laid presently on the feeding of nutritious leaves to get higher body weight of larva which in turn will produce quality cocoon (Shamachary & Krishnaswami, 1980). From the sericultural view point nutritious leaves mean leaves with higher level of soluble carbohydrates, proteins, minerals etc. and low level of crude fibre (Anonymous, 1975).

In the present investigation it has been attempted to predict the effect of two variables, *viz.* total sugar and crude protein constituents of *Quercus serrata* leaves on a dependent variable. *i.e.* larval body weight by using multiple regression and Beta coefficient.

MATERIAL AND METHODS

Five year old *Quercus serrata* plants with 120 cm x 120 cm spacings were selected for this study. A total of 36 plants in a plot were selected for rearing of silkworm (*Antheraea proylei* J.) as well as for estimations of total sugar and crude protein. The experiments were carried out with 18 replications and two plants were considered as a replicate. In each plant 25 nos. first staged worms were mounted to rear them up to final stage for measuring dry weight of larva at fifth stage. After utilisation of one plant the worms were transferred to the next plant for each replicate and the rearing was carried out under *in situ* condition during spring season.

Leaf samples from each replicate were collected randomly when the larva entered in the final stage (20 days after mounting of first staged larva), oven dried at 60°C for 24 h, then powdered and used for analysis.

The biochemical analysis included Plumer method (1982) for total sugar and AOAC (1984) method for crude protein. All the analysis for each replicate were conducted in triplicate. Multiple regression and β coefficient (Snedecor, 1967) were carried out to predict the impact of total sugar and crude protein on larval weight.

RESULTS AND DISCUSSION

Table I summerizes the observed (mean) values of each replicate for total sugar, crude protein and larval dry weight and also the predicted larval dry weights. A multiple regression equation was fitted for predicting the contribution of total sugar and crude protein on fifth instar larval dry weight.

The fitted line is as follows :

$$y = -13.64 + 23.45\,x_2 + 13.68\,x_3$$

where, y = larval dry weight for prediction; x_2= total sugar and x_3 = crude protein.

The coefficient of determination (R^2) was calculated as given below :

$$R_{1.23} = \sqrt{\frac{r_{12}^2 + r_{13}^2 - 2\,r_{12}\,r_{13}\,r_{23}}{1 - r_{23}^2}}$$

$$= \sqrt{\frac{0.42 + 0.31 - 2 \times 0.65 \times 0.56 \times 0.48}{1 - 0.23}}$$

$$= 0.70$$

Therefore, $R_{1.23}^2 = 0.49$

The coefficient of determination (R^2) was calculated to be 0.49 in the fifth stage, indicating the predictability of body weight of larva with reference to the impact of leaf constituents through total sugar and protein.

In order to test the significance of the observed multiple correlation coefficient, the following statistics has been calculated.

$$F = \frac{R^2}{1 - R^2} \times \frac{(N - P - 1)}{2}$$

where, N = Total no. of observations; P = No. of independent variables.

The F test shows that the observed value of R^2 is significant at 1% probability level.

The regression coefficient of the multiple correlation equation indicates the change in the value of the dependent variable (larval weight) for a unit change in the value of independent variables (such as total sugar and crude protein). These regression coefficients of multiple regression equation are not comparable because independent variables involved in the multiple regression equation are expressed in different units. They also differ in variability. So to overcome this anomaly β coefficients were also calculated as follows:

$\beta_{12.3} = b_{12.3}$ where, $\delta_1 = 55.85$

$= 0.37$ $\delta_2 = 0.87$

$\delta_3 = 1.426$

and

$\beta_{13.2} = b_{13.2}$ $b_{12.3} = 23.45$

$= 0.34$ $b_{13.2} = 13.68$

The β coefficients indicate the effect of independent variables, such as total sugar (x_2) and crude protein (x_3) on larval weight (x_1). It is evident from the calculation shown above that both x_2 (total sugar) and x_3 (crude protein) affect positively on x_1 (larval weight). Moreover, the magnitude or the degree of impact of x_2 on x_1 is more than that of x_3 on x_1. In other way we can say that the contribution of total sugar on larval weight is 37% whereas the contribution of protein on larval weight is 34%.

This investigation is supported by the observation of Anonymous (1975) who found that total sugar is an important component for the healthy growth of silkworm. It has also been found that accumulation of protein in larvae depends largely on the concentration of carbohydrate in the leaves (Sastri, 1962). Moreover, the average digestibility of soluble carbohydrates has been found to be 95% (Horie *et al.*, 1985) which is very high as compared to the digestibility of protein which is only 60 - 67% (Horie *et al.*, 1978). Role of nitrogen in the development of insect and host-plant relationship has been emphasized by McNeill & Southwood (1978) whereas Slansky & Feeny (1977), Mattson

(1980) and Lawson *et al.* (1984) indicated that leaf protein is the major determinant of nutrient quality for many lepidopteran larvae.

Therefore, the increase in soluble carbohydrate and protein content of *Quercus serrata* would led to a beneficial effect on the growth of silkworm.

Table I. Comparison of the expected 5th instar larval dry weight with observed larval dry weight of *Antheraea proylei* in relation to the impact of total sugar and crude protein estimated from the foliage of *Quercus serrata* plants.

No. of observ.	Percentage Dry Weight		Larval Body Weight (mg)	
	Total Sugar	Crude protein	Observed	Expected
1.	9.79	21.15	469.17	505.26
2.	10.72	24.82	598.20	577.24
3.	10.21	24.43	508.27	559.98
4.	10.58	22.03	579.14	535.83
5.	10.38	22.72	582.11	540.71
6.	12.72	22.63	562.15	591.87
7.	9.78	22.82	546.21	527.87
8.	9.82	25.76	553.17	569.03
9.	11.76	24.75	531.32	600.71
10.	10.88	22.18	525.03	544.91
11.	9.91	21.63	492.13	514.64
12.	11.31	23.75	520.11	576.47
13.	10.35	21.42	516.40	522.09
14.	9.80	21.30	498.71	507.55
15.	11.73	24.21	640.19	592.62
16.	11.38	23.27	602.23	571.55
17.	11.82	24.92	671.32	604.44
18.	11.52	24.03	632.12	585.23

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