

STUDIES ON THE CONSUMPTION, DIGESTION AND
UTILISATION OF FOOD PLANTS BY THE LARVAE OF
EUPROCTIS FRATERNA M. (LYMANTRIDAE: LEPIDOPTERA)

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There exists a dearth of knowledge on the digestibility and conversion of food by polyphagous leaf-eating insect pests even though some work has already been done in India on related aspects with silkworm *Bombyx mori* (Sharada and Bhat, 1957., Shyamala *et al.*, 1956 and 1960). Adaptive nutritional differences must be sought on a quantitative level for a meaningful study of insect nutrition. The present studies were hence undertaken to calculate the consumption, digestion and utilisation indices of the larva of a polyphagous insect, *Euproctis fraterna* M.

Materials and Methods

Fourth and fifth instar caterpillars of *E. fraterna* were used. They were reared under laboratory conditions. Castor, pomegranate, cow pea and rose were the food plants studied. The food consumed, excreta produced and the weight gained by caterpillars over the entire fourth and fifth instars were determined on a dry weight basis as described by Waldbauer (1964).

The fresh weight of caterpillars was determined at the beginning of each experiment. The initial dry weight was estimated by using the mean percentage of dry matter of an aliquot of similar larvae killed by freezing and dried at 80°C to a constant weight. The final dry weight of the caterpillars was determined similarly after the experiment. The mean weight of the insects was calculated by summing up the initial and final weights determined every day and dividing by the number of weighings. The estimation of total nitrogen in the leaves, caterpillars and faecal pellets was done by the micro-Kjeldahl method.

Results and Discussion

A summary of consumption indices (C. I.) is presented in Table 1. The fresh weight C. I. (calculated from fresh weight of food and insect) which is a measure of the behavioural response of the insect towards the food, ranged from 1.09 with pomegranate to 1.28 with cow pea, the difference being not significant.

The dry weight - fresh weight C. I. was calculated from the dry weight of the food and the fresh weight of the insect. This index is of nutritional significance since it measures the rate at which nutrients enter the digestive system. These values in the present case were low (0.29) for castor and cow pea but very high (0.49-0.50) for rose and pomegranate.

Table 1
Consumption indices of larvae of *E. fraterna* fed on different food plants

Food plant	% dry matter of leaves	Fresh wt. food and fresh wt. larva	Dry wt. food and fresh wt. larva	Dry wt. food and dry wt. larva
Castor	25.0	1.18	0.29	1.63
Pomegranate	48.6	1.09	0.50	3.11
Cow pea	22.5	1.28	0.29	2.23
Rose	40.8	1.21	0.49	3.28

The dry weight C. I.'s (calculated from dry weight of food and insect) were always higher than the corresponding fresh weight C. I.'s because the caterpillars contained a lower percentage of dry matter than their food. The rank order of C. I.'s with different food plants among the three groups of indices as evident from the table, was not the same and this could be attributed to the differences in the per cent dry matter of various food plants.

The data on the growth and the efficiency of conversion of ingested and digested food materials are presented in Table 2. Growth rate (G. R.) of caterpillars varied from 0.038 of cow pea to 0.273 of castor. Rose and pomegranate were medium food plants for *E. fraterna* with respect to its larval growth. Greater variation was discernible among the approximate digestibility (A.D.) values. Digestibility was at its maximum with cow pea and the least with rose. The differences in the A. D.'s may be ascribed to variations in the rate of food passage, digestive efficiency and or small individual differences in leaf constituents such as crude fibre, water content and nutritive substances.

E. C. I- is an overall measure of an insect's ability to utilize for growth the food which it ingests. There was marked variation among the E. C. I values in the present studies; they ranged from 1.42, (apparently the lowest E. C. I. so far recorded) with cow pea to 16.71 with castor. A perusal of literature shows that E. C. I. values vary both with the digestibility of a food and the proportional amounts of the digestible portion of that food which are converted to body substances and which are metabolized for energy.

Table 2

Growth rate and utilisation of dry matter by caterpillars of *£. fraterna*

Food plant	G. R.	A. D.	E. C. I.	E. C. D.
Caster	0.273	46.76	16.71	35.75
Pomegranats	0.156	53.90	5.01	9.30
Cow pea	0.038	78.50	1.42	1.81
Rose	0.190	35.22	5.79	16.50

G. R.= Growth rate. A. D.= Approximate digestibility E. C. I.= The efficiency of conversion of ingested food to body substances E. C. D. = The efficiency with which digested food is converted to body substances (proposed by Waldbauer, 1964)

Our data showed a negative correlation (correlation coefficient, $r = -0.805$) between the dry weight C. I's and the E. C. I. values as in the case of *Prodenia eridania* observed by Soo Hoo and Fraenkel (1966).

E. C. D. is a measure of the efficiency with which digested food is converted to body substance. The ranking of E. G. D. values paralleled with that of E. G. I's which clearly shows that the nutritional value of the food plant is positively correlated to the E. G. D. value.

Table 3 is a summary of results on the utilisation of total N by the larvae of *E. fraterna*. Coefficient of apparent digestibility (C. A. D.) for total N of the food plants is expressed as percentage and these values are equal (65%) with pomegranate and rose. The next in rank was with castor followed by that with cow pea.

Table 3

Utilisation of total N. by caterpillars of *£. fraterna*.

Food plant	C. A. D.	(E. C. I. (N))	E. C. D. (N)
Castor	56.0	33.3	60.0
Pomegranate	65.0	71.0	109.3
Cow pea	46.0	35.7	100.0
Rose	65.0	55.2	84.0

C. A. D. = Coefficient of apparent digestibility

E. C. I. (N) = The efficiency of Conversion of ingested nitrogen to body substance

E. C. D. (N) = The efficiency with which the digestible portion of nitrogen is converted to body substance.

The descending order of E. C. I's (N) with different food plants was pomegranate > rose > cow pea > castor. The last column of Table 3 shows that most of the E G. D's (N) actually deviate considerably from the expected 100%. It can be reasonably assumed that these deviations may be due to the rejection of exuviae for nitrogen estimation. Balogh and Gere (1953) ascribed an apparent surplus in N retention to the fixation of atmospheric nitrogen.

Summary

Indices of consumption, growth, digestibility and efficiency of conversion of ingested and digested food materials of fourth and fifth instar caterpillars of *Euproctis fraterna* with four food plants were ascertained. Reasons for the disparity observed among the values were discussed. Utilisation of total nitrogen from the food plants by the caterpillars was also determined

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