FOOD CONSUMPTION AND NUTRITIONAL INDICES OF OAK TASAR WORM *ANTHERAEA PROYLEI* (JOLLY) FED ON *QUERCUS GLAUCA*

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ABSTRACT: Studies were conducted under laboratory conditions to evaluate the food consumption and nutritional indices for the development of *Antheraea proylei* larvae fed on *Quercus glauca*. Larval duration was 5.4±0.489, 6.4±0.48, 7.2±0.4, 9.8±0.74 and 14.2±0.74 days in the 1st, 2nd, 3rd, 4th and 5th instars, respectively. Larvae consumed a total of 28.85 g insect^{-1} day^{-1}, egested 4.164 g insect^{-1} day^{-1} and assimilated 24.69 g insect^{-1} day^{-1} of food provided. 82.3% of tissue growth was observed in the 4th and 5th instar larvae. Approximate digestibility (AD) decreased from 91.94% in the first instar larva to 80.79% in the 5th instar larva. Efficiency of conversion of digested food (ECD) into body tissue and efficiency of conversion of ingested food into growth (ECI) increased from 1st instar larva to 5th instar larva. The result obtained in the present study indicate that *Q. glauca* could serve as an alternate host plant for rearing *A. proylei* in areas where the main host plant *Q. serrata* is not found.

KEYWORDS- *Antheraea proylei*, Consumption, Assimilation, Nutritional indices, *Quercus glauca*

INTRODUCTION

Non-mulberry sericulture is universally known as forest and wild sericulture. India is a home for wild sericigenous insects and is the centre of wild silk culture including Eri, Muga and Tasar in both tropical and temperate regions[12]. Nearly forty different species of wild silkmoths producing non-mulberry silk have been reported from India[1]. Of these, the most common Indian species reported in the sub Himalayan belt are *Antheraea proylei*, *A. roylei* and *A. pernyi*[5]. In India, *A. proylei* is bivoltine and most common silkmoth used in the production of tasar silk in many states viz. Uttarakhand, Manipur, Himanchal Pradesh, Meghalaya and Jammu and Kashmir.

The quality and quantity of host plants affect the life-history of lepidopteron larvae by affecting the survival rate of different stages, sex ratio and reproduction[4,13,15]. Energy flow studies through different larval stages of lepidopterans have been reported [6,8,1018,19,20,21].

Food consumption and nutritional indices through larval stages of *A. proylei* fed on *Quercus glauca* were investigated under laboratory conditions for the first time. The results of this study will provide useful information on production of cocoons by rearing *A. proylei* on *Q. glauca* as an alternative to the natural host plant *Q. serrata*.

MATERIALS AND METHOD

For rearing, the eggs of *A. proylei* were procured from Regional Sericultural Research Station (RSRS), Bhimtal and kept in petri-dishes for maintaining a stock culture in laboratory. Eggs were reared in a room temperature of 24-25°C and a relative humidity of 65-70%. After emerging out, the larvae are provided with the leaves of a host plant *i.e. Q. glauca.* The larvae because of their soft jaws were firstly fed on soft tendor leaves till its 3rd stage and later instars were fed on mature leaves.

The weight of each larvae was measured in a weighing machine before the start of experiment and then placed on a plant twig kept inside bottle of length 25 cm and 8 cm diameter. The larvae were allowed to feed for about 24 hrs. The unconsumed leaves and egesta were collected separately from each petridishes and weighed. The larvae were also weighed after feeding for 24 hrs.

The unconsumed leaves and egesta were then oven-dried at 65°C for 24 hrs and re-weighed till a constant weight was reached. The experiment was repeated for different instars of larvae, but not for the first instar because they are too small and could not be handled easily, and an average value was calculated for each replicate at different stages.

Food consumption was calculated as the difference between the initial weight of leaves provided and the weight of unconsumed leaves.

Assimilation was estimated by subtracting the weight of fecal matter from the weight of food consumed, while increase in body weight was taken as a measure of tissue growth.

Nutritional indices were calculated as follows:

Approximate digestibility (AD) -

$$\frac{\textit{Assimilation}}{\textit{Consumption}} \times 100$$

Tissue growth efficiency (ECD) -

$$\frac{\textit{True growth}}{\textit{Assimilation}} \times 100$$

Ecological growth efficiency (ECI) -

$$\frac{\textit{True growth}}{\textit{Consumption}} \times 100$$

RESULTS AND DISCUSSION

The data was recorded for duration of instars, consumption, egesta, assimilation and tissue growth. The data is given in Table 1.

Duration of instars:

Duration of larval stages was 5.4±0.489, 6.4±0.48, 7.2±0.4, 9.8±0.74 and 14.2±0.74 days for 1st, 2nd, 3rd, 4th and 5th stages, respectively. Total larval duration was 43.0 days.

Consumption:

The percentage requirements of food for the consecutive stages calculated from total consumption for the whole developmental period were: 3.4, 6.8, 14.2, 22.1 and 53.5%. Total consumption was 28.85 g insect^{-1} day^{-1}. A significant correlation was observed between initial

Table-1. Duration, initial biomass, consumption, egesta, assimilation and tissue growth in *Antheraea proylei* fed on *Quercus glauca*

Stage (Days)	**Duration** (g insect^{-1} day^{-1})	**Initial Biomass** (g insect^{-1}day^{-1})	**Consumption** (g insect^{-1} day^{-1})	**Egesta** (g insect^{-1} day^{-1})	**Assimilation** (g insect^{-1} day^{-1})	**Tissue Growth** (g insect^{-1} day^{-1})
I instar	5.4±0.489	0.015±0.003	0.98±0.02	0.07±0.00003	0.90±0.03	0.0058±0.001
II instar	6.4±0.48	0.218±0.004	1.97 ± 0.095	0.25 ± 0.021	1.711 ± 0.071	0.077 ± 0.004
III instar	7.2±0.4	0.92 ± 0.033	4.10 ± 0.07	0.701 ± 0.04	3.40 ± 0.12	0.19 ± 0.01
IV instar	9.8 ± 0.74	2.006±0.013	6.38 ± 0.28	1.12 ± 0.014	5.25 ± 0.29	0.39 ± 0.02
V instar	14.2 ± 0.74	5.70 ± 0.36	15.42 ± 2.01	2.023 ± 0.16	13.4 ± 2.21	0.88 ± 0.50

biomass and food consumption (Fig. 1).

The steep increase in the amount of food consumed during third, fourth and fifth instars were due to the change in the way the larvae feed and the duration of these instars. The larvae of the first and second instars feed on the bottom of the leaves, eating chiefly the soft palisade tissue and epidermis. In the later instars, the larvae feed upon small veins containing more cellulose, which is a factor deciding the amount of plant mass consumed. The nutritional requirements of insects are associated with biomass and duration of immature stages and has been also reported by Schroeder[17] and Vats and Kaushal[22]. More than 75% of the total food was consumed by the last two larval instars because of their higher weight. Similar studies have been reported for other lepidopteran larvae also[2,3,11,20]. Bailey and Singh[2] reported more than 80% of the total ingestion in the sixth instar larva of *Mamestra configurata***.**

Egesta:

Higher consumption in the fourth and fifth instar resulted in higher production of egesta by the larvae. These two instars accounted for 75.5% of the total ingestion. A positive correlation was observed for the food consumed and egestion (Fig. 2).

The quantity of egesta produced by *A. proylei* in the present study is comparable to Waldbaur's[23] observation on *Protoparce sexta* and Namin *et al.*[8] on *Heliothis armigera.*

Assimilation:

A total of 24.661 g insect{ ^{1} day{ ^{1} consumed food was assimilated by all the larval instars. The last two assimilated by all the larval instars. The last two instars assimilated 75.7% of the food consumed. Assimilation increased from 1st instar to the 5th instar larva (Fig. 3). Kaushal and Vats[7], Namin *et al.*[8], Nath *et al.*[10] also reported an increase in amount of food assimilated with increased food consumption.

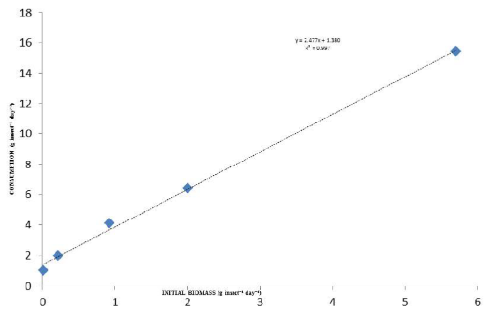

Fig. 1

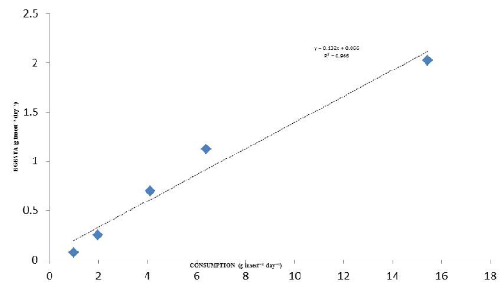

Fig. 2

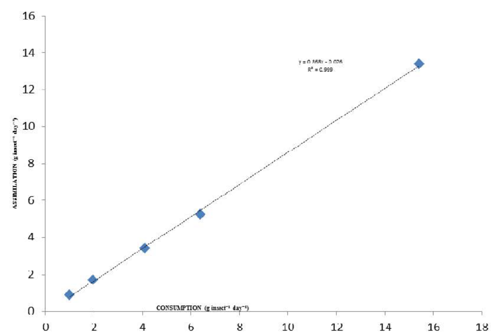

Fig. 3

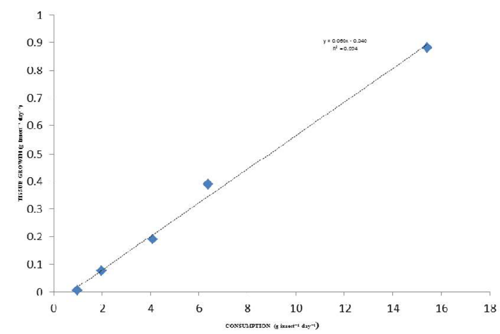

Fig. 4

Fig. 1-4. Nutritional indices of *Antheraea proylei* fed on *Quercus glauca* showing relation between:
1. Initial biomass and food consumption
2. Food consumed and egesta
3. Consumption and assimilation
4. Consumption and tissue growth

Tissue growth:

The distribution of tissue growth was 0.37, 5.00, 12.3, 25.3 and 57.0% in the 1st, 2nd, 3rd, 4th and 5th instars, respectively. Fig. 4 represents the relationship between consumption and tissue growth. 90% to 95% of the total tissue occurred in the last two instars of *Platysomia cercopia*[16], *Mamestra configurata*[2] and *Helicoverpa armigera*[8] similarly, 4th and 5th instars larvae accounted for 82.7% of the total tissue growth in the present study also. Quality and digestibility of food has been reported to be responsible for the better growth and larval development[8,11,14].

Nutritional Indices:

Percent values of approximate digestibility (AD), efficiency of conversion of ingested food into tissue growth (ECI) and the efficiency of conversion of digested food into tissue growth (ECD) are presented in Table 2.

Approximate digestibility (AD) was

maximum in the 1st instar larva (91.94±0.56%) and minimum in the 5th instar larva (80.79±11.61%) in the present study. Waldbaur[23], Sangha[14] and Nath *et al.*[10] have also reported maximum values of approximate digestibility declined gradually in successive in lepidopteran larvae similar results have also been recorded in the present study.

Table-2. Nutritional indices in *Antheraea proylei* fed on *Quercus glauca* (Mean±SE)

Stage	Approximate Digestibility (AD) (%)	Tissue Growth Efficiency (ECD) (%)	Ecological Growth Efficiency (ECI) (%)
I instar	91.94 ±0.56	0.64 ± 0.169	0.58 ± 0.151
II instar	86.89± 0.53	4.55 ± 0.23	3.95 ± 0.22
III instar	82.98 ±0.65	5.61 ± 0.27	4.65 ± 0.24
IV instar	82.10 ±0.93	7.43 ± 0.38	5.98 ± 0.28
V instar	80.79 ±11.61	8.80 ± 1.92	7.63 ± 1.76

Efficiency of conversion of ingested food (ECI) is a measure of insects ability to incorporate ingested food into tissue growth, and efficiency of conversion of digested food (ECD) as a parallel parameter, indicates the proportion of digested food converted into net insect biomass (Nathan *et al.*, 2005).

Minimum value of ECI was obtained in the 1st instar larvae (0.58±0.15%) and maximum in the 5th instar larva (7.63±1.76%) in the present study. Similar results have been reported by Nath and Joshi[9] and Nath *et al.*[10] for *A. proylei* fed on *Q. leucotrichophora,* respectively.

Similarly ECD values also showed an increase from 0.64±0.17% in first instar larva to 8.80±1.92% in the 5th instar larvae in the present study. These values of ECD are similar to those reported for *A. proylei* fed on *Q. leucotrichophora*[10].

The results obtained in the present study indicate that *Q. glauca* could serve as an alternative host plant for rearing of *A. proylei* for production of cocoons in areas where *Q. serrata* trees are not found.

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