Proc. Indian natn. Sci. Acad. B48 No. 1 pp 55-58 (1982)

Nitrogen Balance of Eri Silk Worm (*Philosamia cynthia ricini* Boisduval) Reared on Tapioca (*Manihot utilissima* Pohl) Leaves

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(Received 13 August 1981; after revision 25 January 1982)

Nitrogen balance of eri silk worm (*Philosamia cynthia ricini* Boisduval) reared on tapioca leaves (*Manihot utilissima* Pohl) was worked out. For the formation of silk and other biochemical changes at pupal stage there is a reduction of 9677.5 g/ha of nitrogen from the final larval stage. From pupal to moth stage and from moth to egg laying stage the nitrogen sink is 5760.7 g/ha and 4479.1 g/ha respectively. The nitrogen trapped in stage 2 and metabolised at stage 4 are low comparatively.

Key Words: Eri silk worm, Nitrogen balance, Tapioca

Introduction

Castor leaves are the conventional feed for eri silk worm (*Philosamia cynthia ricini* Boisduval). They can also be reared on tapioca (*Manihot utilissima* Pohl) leaves. Cherian (1934) and Kapil (1967) have studied the growth of the eri silk worm larvae reared on tapioca leaves. Muthukrishnan et al. (1978) have worked out the life table of these worms reared on tapioca and castor leaves. A few tapioca varieties were studied for their comparative performance by Kaleemurrahman and Muthukrishnan (1980). Pant and Sharma (1968a, 1968b) have studied the changes of nitrogenous compounds during embryonic development of eri silk worm *Philosamia ricini*. However, understanding of the nutritional physiology of these worms is lacking. Eid et al. (1978) have reported that silk production could be affected by the amino acid balance. The present investigation deals with the nitrogen balance of eri silk worm feeding on tapioca leaf.

Materials and Methods

Two sets of feeding experiments, one with 50 larvae and the other with 1000 larvae were run parallelly under identical conditions. They were reared on tapioca leaves (Variety ME 116). The temperature and relative humidity of the rearing room ranged from 27 to 30°C and 80 to 82% RH respectively. The larvae were fed *ad libitum* at every 4 hours between 6 AM and 6 PM. The first stage larvae were fed with the second and third leaves from the top and the second, third and fourth stage larvae were fed with successive leaves below each and the final stage larvae were fed with rest of the matured leaves. The left-over leaves after feeding, and faecal matter were collected at 9 PM each day. The actual consumption and faecal output were calculated for the experimental set up containing 50 larvae. The faecal matter was dried at 98°C for 4 hr in hot air oven and subsequently preserved in a desiccator. The faecal matter collected daily was pooled stage wise, sampled and analysed for total nitrogen content. Sample of the leaves fed to different stage larvae were collected, dried in hot air oven at 98°C for 4 hr and analysed for their total nitrogen content.

From the second trial, comprising 1000 larvae, immediately after hatching 50 larvae were sampled and dried at 98°C for 4 hr and the total nitrogen was analysed. At the end of every stage 25 larvae were sampled for nitrogen analysis. Similarly pupae and moth were sampled and analysed for nitrogen. Nitrogen content of all samples were analysed by the microkjeldahl's method.

The experiments were repeated twice and the average nitrogen value was computed per hectare taking into account of the basic data as number of larvae per hectare, leaf availability per hectare etc. given by Central Muga and Eri Research Station (Anon 1978). The mortality during the experiment was deducted while computing the nitrogen budget.

Results and Discussion

The total nitrogen content of the eri silk worm during different stages are given in (table 1). It is observed that the reduction in nitrogen content between egg and brushing is obviously negligible (0.5 g/ha) and this is mostly due to the waste during the process of hatching. Subecquently, there is a progressive increase in the nitrogen content in all the stages up to stage five. However there is a sizeable (9677. 5 g/ha) reduction of nitrogen between stage five and pupal stage. Apparently this reduction is for the formation of silk and associated metabolic changes. Further, another drop of 5760.7 g/ha has been observed between pupal and moth stage which may be due to the enormous expenditure for emergence and also accountable on waste pupal shell. The difference in nitrogen content (4479.1 g/ha) in moth before and after egg laying is also conspicuous. In this context, the quantity of nitrogen in egg alone could not be accounted for this loss. Substracting the nitrogen in the egg (26.7) from 4494.1 we get 4467.4 g/ha. This massive loss is attributed to the expenditure for mating and laying processes.

The average nitrogen content of leaves and quantity consumed are given in table 2. There is a progressive reduction

Table 1 *Nitrogen content of the eri silk worm in various stages (expressed in g/ha)*

Egg	Brushing	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Pupae	Female moth before laying
26.7	26.2	136.5	198.0	1400.4	3831.8	26431.2	16753.7	10993.0

Table 2 *Nitrogen content (%) and quantity of leaves consumed by the larvae (Expressed in kg/ha)*

Stages	Tapioca leaves used from the top	% nitrogen (dry weight basis)	Quantity of leaves consumed (Dry weight kg/ha)
1	2nd and 3rd	5.3	24.3
2	4th and 5th	5.1	30.3
3	6th and 7th	4.8	65.2
4	7th and 8th	4.0	199.9
5	9th and below	3.9	1313.6

in the average nitrogen content of the leaves fed from first to fifth stage larvae (table 2) coñtrary to the observations of Hiratsuka (1917 and 1920) who observed a reverse pattern for mulberry leaf. A complete nitrogen balance of the larvae was worked out as perRoyan et al. (1977) and Samuel Paul Raj and Kutty (1981) (table 3). There is a steady increase in the quantity of nitrogen consumed from stage 1 to 5. Obviously as much as 77.6% of the whole nitrogen is consumed by the 5th stage larvae. In the 1st stage the percentage of nitrogen consumed over the total consumption is 1.9 and the faecal output is only 1.7 but in subsequent stages a reverse trend is observed up to stage 4. In stage 5 once again the percentage of faecal matter over the total of all the stages falls down disproportionately to the consumption compared to the previous three stages. This may be due to the maximum built up of nitrogen in the 5th stage as supported by the high assimilation efficiency (79.7%) and low faecal output (20.3%) in stage 5 when compared to other stages. There is a gradual reduction in assimilation efficiency between stage 1 and 4 the maximum at stage 1. El-Nakday et al. (1978) observed the digestion of amino acid was higher in the 1st four instars in eri silk worm, feeding on castor leaf. In the present case nitrogen built up is lowest (0.2%) in stage 2. This may be due to the highest metabolism with 67.1% efficiency in that stage, since the assimilation is satisfactory. High metabolism was observed in the first two stages, which is supported by Hiratsuka (1920) who has calculated coefficient of metabolizable energy and observed that the metabolism is maximum at the initial two stages compared to the metabolism and body nitrogen built up at the other stages. Here, the low body built up at

Table 3 *Nitrogen balance in eri silk worm fed with tapioca leaf*

	Stages				
	1	2	3	4	5
1. Consumption (C) g/ha	1366.9	1670.1	3558.4	9519.7	55714.5
2. Consumption of nitrogen over the total consumption of all the stages (%)	1.9	2.3	4.9	13.3	77.6
3. Faeces (F) g/ha	347.7	488.3	1158.2	7082.4	11308.5
4. Faecal output of nitrogen over the total output of all the stages (%)	1.7	2.4	5.7	34.7	55.5
5. Faecal output over the consumption (%)	25.4	29.2	32.5	74.4	20.3
6. Actual build up(B) g/ha	110.3	61.6	1202.4	2431.4	22599.4
7. Body nitrogen build up over the total of all the stages (%)	0.4	0.2	4.6	9.2	85.6
8. Body nitrogen build up over the consumption (%)	8.1	3.7	33.8	25.5	40.6
9. Assimilation ($A=C-F$) g/ha	1019.2	1181.8	2400.2	2437.3	44406.1
10. Assimilation Efficiency $\frac{C-F}{C}$ %	74.6	70.8	67.5	25.6	79.7
11. Metabolism ($A-B$) g/ha	909.0	1120.3	1197.8	5.9	21806.7
12. Metabolism Efficiency $\frac{(A-B)}{C}$ %	66.5	67.1	33.7	0.1	39.1

stage 2 is disproportionate. This has to be investigated further.

Though there is a steady increase in the body nitrogen built, a drop observed in stage 4 (25.5%), after stage 2. This depression can be attributed to the comparatively low assimilation (25.6%). Also the metabolism is found to be negligible at stage 4, which may be due to conservative adaptation in view of the low assimilation resulting in low body nitrogen built up.

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