I.J.S.N., VOL. 1(2), 2010: 156-160 ISSN 2229 – 6441

INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

ASSESSMENT OF THE VOLUMETRIC ATTRIBUTES OF ERI SILKWORM (*PHILOSAMIA RICINI*) REARED ON DIFFERENT HOST PLANTS

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ABSTRACT
The eri silkworms (*Philosamia ricini* DONOVAN) were reared on different food plants viz. Castor (*Ricinus communis*), Tapioca (*Manihot utilisima*), Jatropha (*Jatropha curcas*) and Papaya *(Carica papaya*). The study was conducted on the fifth instar (ripe silkworm) of the eri silkworm. The larval and silk gland volumes were assessed and silk gland ratio was calculated in comparison with cocoon characters. Maximum silk yield was observed when larvae were fed on castor leaf and highest shell weight of 0.53 gm was observed. It was also observed that ratio of silk gland volumes was directly proportional to the rate of increase in the larval body volume.

KEY WORDS: Eri silkworm, food plants, volumetric attributes.

INTRODUCTION

Eri silkworms are multivoltine, polyphagous and feed on a wide range of host plants. The important host plants include Castor (*Ricinus communis*), Kesseru (*Heteropanax fragrans* Seem.), Tapioca (*Manihot esculenta*), Papaya (*Carica papaya*), Jatropha (*Jatropha curcas*), Barpat (*Ailanthus grandis*) and Payam (*Evodia fraxinifolia*) (Singh and Das 2006; Chakravorty and Neog 2006; Bhattacharya *et al.* 2006; Das *et al.* 2006; Chowdhary 2006; Bindroo *et al.* 2007). The growth, development and economic characters of silkworms are influenced to a great extent by a variety of food plants and nutritive contents of foliage (Singh and Das 2006). Silk is produced in over 30 countries of the World of which 14 are situated in the Asian region (Jaiswal, *et al.* 2008). The production of silk in India during 2006-07 was recorded to the tune of 18475 MT, out of which the mulberry silk production was 16525 MT, while Tasar, Eri and Muga produced 35 MT, 1485 MT and 115 MT silks, respectively (Srinivas *et al.* 2008). About 11.65 lakh hectares of eri food plants are available in India, which cater the rearing of about 25 crore dfls and produce 25,000 MT of eri silk (Somaprakash *et al.* 2008). India is the largest producer of eri silk in the World as 96% of eri silk produced in India. In the present scenario, sericulture an agro based labour intensive and environment friendly cottage industry involving maximum number of family members can become best effective tool. The host plants of eri silkworm are being found in entire Uttar Pradesh for extraction of castor oil and medicinal value (Jaiswal *et al*. 2006). However, recently introduced ericulture has shown a ray of hopes for under privileged in the state in addition of mulberry and tasar culture. In Uttar Pradesh a non-traditional sericulture state, ericulture has gained importance as alternate cash crop. The challenge before ericulture is to increase productivity of eri silk and simultaneously reducing its production cost (Bajpai *et al.* 2006). The host plants have profound effect on survival, rate of food intake, digestion and assimilation which directly influence the growth and development of silkworms. The amount and quality of food intake of larvae influence different parameters like growth rate, larval duration, survival rate and reproductive potential (Das and Das, 2003). Raychaudhury (1974) stated that the quality of leaf influence the growth and development of silkworm and overall silk production. The larval growth rate and rearing performance of eri silkworms have been studied extensively by Rajesh Kumar (2010), however there is a lacuna on effect of different host plants on larval growth and related volume of silk glands. Therefore, the current study was carried out to evaluate the effect of different host plants on larval volume and volume of silk glands.

MATERIALS & METHODS

The experiment was carried out at Department of Applied Animal Sciences, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh. Eggs of eri silkworm were procured from Central Silk Board and reared on different food plants, such as Castor (*Ricinus communis*), Tapioca (*Manihot utilisima*), Papaya (*Carica papaya*) and Jatropha (*Jatropha curcas*). The experiments were conducted on two seasons, viz. autumn and spring. The standard rearing methods were adopted as recommended by Sarkar (1988). Rearing was carried out by offering individual host plants with three replications, each consists 100 larvae. The volumes of larvae and silk glands were measured using a measuring cylinder. Each 10 fifth instar larvae which fed on different food plants were randomly picked and their body volume and volume of their silk glands were measured. The silk gland ratio (V/V) was calculated by dividing the silk gland volume by larval volume and the product was multiplied with 100. The duration between hatching and cocooning was considered as larval duration (h). The cocoon weight and shell weight were measured using an electronic balance at 0.1 g precision.

The cocoon characters namely Effective rearing ratio (%), pupation rate and shell ratio (%) were calculated by the following formulae:

$$\text{Shell ratio (\%)} = \frac{\text{Shell weight}}{\text{Cocoon weight}} \times 100$$

$$\text{Pupation rate (\%)} = \frac{\text{Number of larvae pupated}}{\text{Number of larvae mounts for spinning}} \times 100$$

$$\text{Effective rate of rearing (\%)} = \frac{\text{Number of cocoons harvested}}{\text{Number of worms brushed}} \times 100$$

RESULTS AND DISCUSSION

The temperature and relative humidity were ranged from 20.00 °C to 26.00°C and 69.00 % to 88.00 %, respectively during autumn rearing season. The temperature was slightly fluctuated due to infrequent rain and thus the relative humidity also fluctuated during autumn season. The temperature and relative humidity during spring rearing ranged from 23.00 °C to 28.00 °C and 65.00 % to 82.00 %, respectively (Table 1).

The results presented in Table 2 and 3 show significant differences in the volume of larvae and silk glands of eri silkworm which were grown on different host plants.

The castor food plant showed a maximum larval volume (7.94 ml) compared to tapioca (7.53 ml), papaya (6.60 ml) and jatropha (6.20 ml) food plants Fig.1. The volume of larva which fed on different food plants differed significantly ($F_{3,\ 11}$ =22.00, P < 0.001). In accordance to the larval volume, the volume of silk gland of castor fed larvae was higher (1.89 ml) compared to larvae which fed on tapioca (1.62 ml), papaya (1.49 ml) and Jatropha (1.20 ml) food plants. The volume of silk glands of different food plants fed larvae differed significantly ($F_{3,\ 11}$ =17.74, P < 0.001) Fig.1. Similar to the larval volume and silk gland volume, a maximum silk gland ratio percentage was recorded in castor fed larvae (23.80 %) followed by papaya (22.57 %), tapioca (21.51 %) and jatropha (19.51 %) fed larvae Fig.2. The silk gland ratio percentage of different food plants differed significantly ($F_{3,\ 11}$ = 162.75, P < 0.001).

The larval duration of castor leaves fed larvae was shortest (19.25 d) compared to larvae fed with the leaves of tapioca (20.50 d), papaya (22.00 d) and jatropha (22.00 d) food plants. The larval duration of eri silkworm fed with different food plants differed significantly ($F_{3,\ 11}$ = 26.07, P < 0.001) Fig.3. The castor fed matured larvae showed maximum larval weight (7.38 g) compared to tapioca (6.45 g), jatropha (5.85 g) and papaya (5.55 g) food plants Fig.6. The weight of larvae fed on different food plants differed significantly ($F_{3,\ 11}$ = 34.34, P < 0.001). Similarly, castor fed larvae yielded highest single cocoon weight (3.59 g) than larvae which fed on tapioca (3.20 g), jatropha (2.70 g) and papaya (2.65 g) food plants. The single cocoon weight of different food plants differed significantly ($F_{3,\ 11}$ = 33.56, P < 0.001) Fig.6. In addition, the castor fed larvae yielded highest shell weight (0.53 g) than other larvae which fed on tapioca (0.45 g), jatropha (0.37 g) and papaya (0.32 g) food plants, however, the shell weight did not differ statistically ($F_{3,\ 11}$ = 5.08, P > 0.05) Fig 6. The highest shell ratio percentage (14.74) Fig.5, effective rate of rearing (91.05 %) Fig. 4 and pupation rate (87.15%) Fig. 4 were also observed on larvae which fed on castor leaves. The shell ratio of different food plants fed larvae showed significant difference ($F_{3,\ 11}$ = 235.09, P < 0.001), while the effective rate of rearing ($F_{3,\ 11}$ = 2.39, P > 0.05) and pupation rate ($F_{3,\ 11}$ = 2.56, P > 0.05) did not differ statistically Fig.4.

The silk gland volume registered similar trend as larval volume of eri silkworm. The castor leaves fed larvae showed highest larval volume, silk gland volume and silk gland ratio. Our finding is similar with the observations of Nangia *et al.* (1998), Devaiah *et al*. (1985), Dayashankar (1982). Chowdhary (2006) reported that the castor fed larvae yielded highest larval weight, ERR, silk content percentage, than tapioca. Biswas *et al*. (2001) stated that the food plant influenced the larval growth, larval duration, cocoon weight, pupal weight, shell weight, SR %, ERR % and fecundity, when larvae were fed with *Ricinus communis* and larval duration was shorter. Chakravorty and Neog (2006) reported suitability of different eri food plants viz. castor, kesseru, tapioca and payam and appraised the suitability of castor in terms of fecundity, larval weight, cocoon weight and shell weight. Hazarika *et al.* (2003) studies that castor (*Ricinus communis*) was found best in terms of different parameters viz, nutritive value of larva, larval weight, ERR, cocoon weight, shell weight, pupal weight, fecundity, hatching percentage and larval duration was found shorter on castor fed leaves. The results of the current study reveals that castor (*Ricinus communis*) is the best suitable host plant for the commercial rearing of eri silkworm (*Philosamia ricini* Donovan).

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Table 1. Temperature and relative humidity during Autumn and Spring rearing seasons.

Month/Season	Temperature (ºC)		Humidity (%)		Rainy Days
	Maximum	Minimum	Maximum	Minimum	
Autumn season (September 2007 to October2007)	26.00	20.00	88.00	69.00	1 Day
Spring season (February 2008 to March2008)	28.00	23.00	88.00	65.00	Nil

Table 2. Volumetric attributes of eri silkworm (*Philosamia ricini* DONOVAN).

Host Plant	Larval volume (ml) Mean ± S.D.	Silk gland volume (ml) Mean ± S.D.	Silk gland ratio (%) Mean ± S.D.
Castor (*Ricinus communis*)	7.94 ± 0.163	1.89 ± 0.115	23.80 ± 0.216
Tapioca (*Manihot utilisima)*	7.53 ± 0.469	1.62 ± 0.098	21.51 ± 0.229
Papaya (*Carica papaya)*	6.60 ± 0.248	1.49 ± 0.088	22.57 ± 0.295
Jatropha *(Jatropha curcas)*	6.20 ± 0.211	1.20 ± 0.157	19.51 ± 0.238
F value	22.00**	17.74**	162.75**
P value	0.001	0.001	1.65

P < 0.001 Significant**

P > 0.05 Non significant

Table 3. Effect of different food plants on rearing parameters of eri silkworm (*Philosamia ricini* DONOVAN).

Parameters	Castor Mean ± S.D.	Tapioca Mean ± S.D.	Papaya Mean ± S.D.	Jatropha Mean ± S.D.	F value	P value
Larval duration (d)	19.25 ± 0.25	20.50 ± 0.5	22.00 ± 0.5	22.00 ± 0.5	26.07**	0.00
Larval weight (g)	7.38 ± 0.140	6.45 ± 0.216	6.18 ± 0.356	5.55 ± 0.098	34.34**	6.44
Cocoon weight (g)	3.59 ± 0.091	3.20 ± 0.141	2.65 ± 0.135	2.70 ± 0.156	33.56**	7.01
Shell weight (g)	0.53 ± 0.095	0.45 ± 0.078	0.28 ± 0.075	0.37 ± 0.07	5.08*	0.02
Shell ratio (%)	14.74 ± 0.125	14.05 ± 0.137	12.10 ± 0.151	13.65 ± 0.079	235.09**	3.88
ERR (%)	91.05 ± 0.229	88.00 ± 5.291	85.60 ± 0.539	86.50 ± 0.514	2.39*	0.14
Pupation rate (%)	87.00 ± 0.217	83.25 ± 0.298	82.00 ± 3.00	84.00 ± 3.464	2.56*	0.12

P < 0.001 Significant**

P > 0.05 Non significant*

Fig.1 Volumetric attributes of eri silkworm on different food plants.

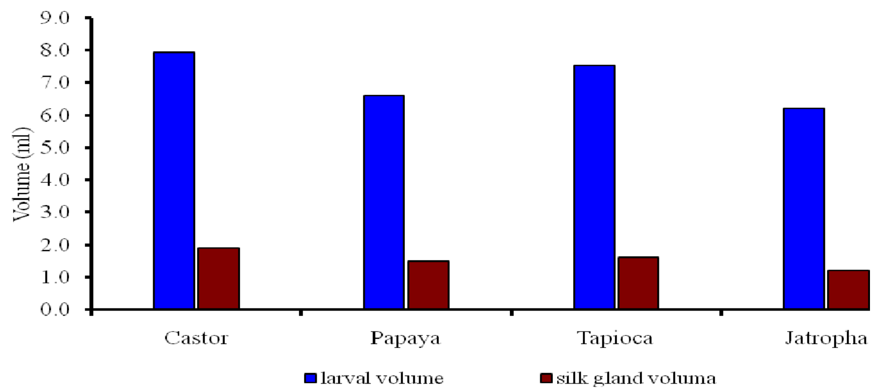

Fig.2 Silk gland ratio of eri silkworm on different food plants

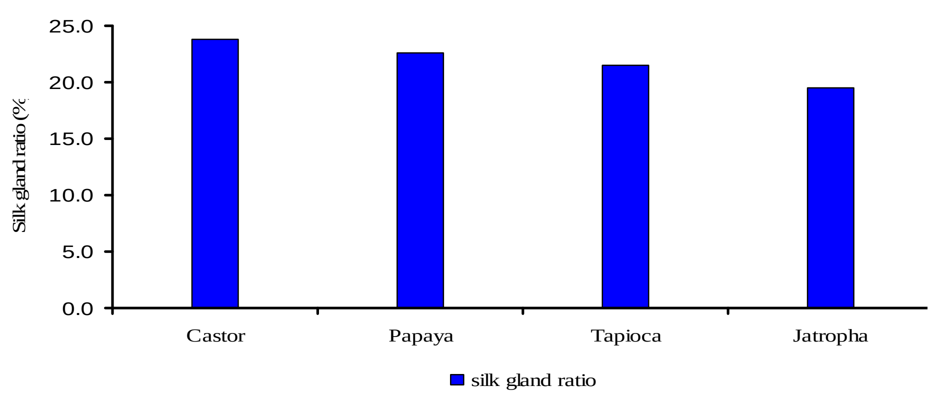

Fig.3 Larval duration of eri silkworm on different food plant

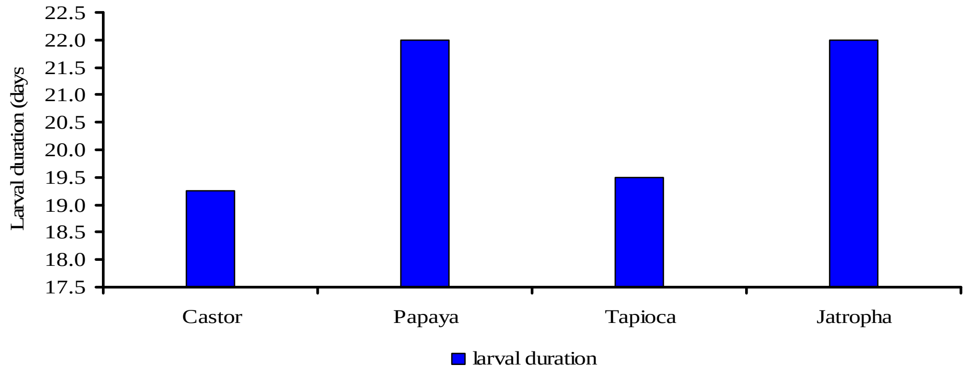

Fig.4 Effective rate of rearing and pupation rate of eri silkworm on different food plants.

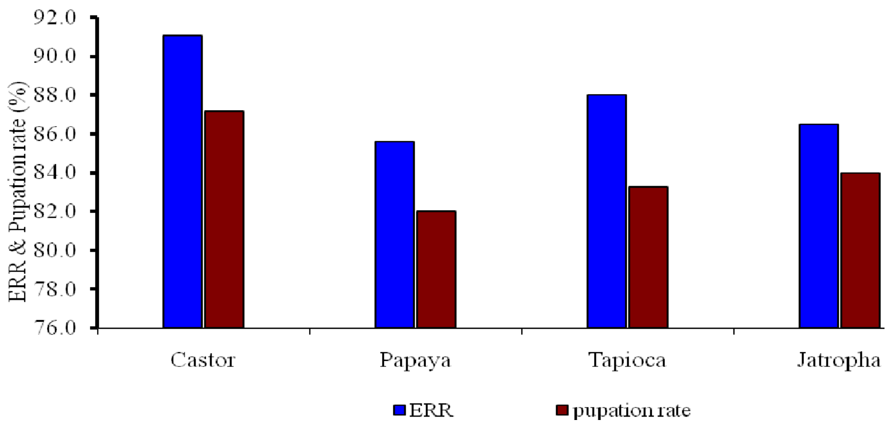

Fig.5 Shell ratio of eri silkworm on different food plants

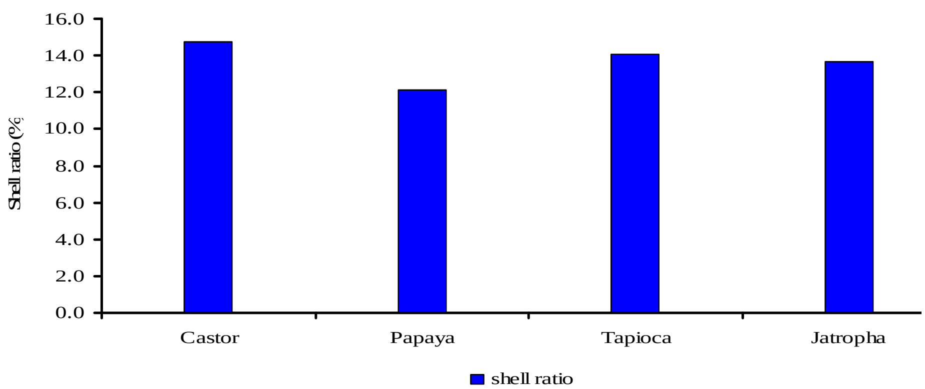

Fig.6 Larval weight, cocoon weight and shell weight of eri silkworm on different food plants.