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Evaluation of host plants' nutrition on life cycle, economic traits and nutrition value of eri silkworm (*Samia ricini* Donovan)

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Abstract The eri silkworm is important in the textile industry. The pupae, a byproduct of silk yarn production, are highly nutritious. Eri silkworms can be reared on various host plants, each affecting their production and nutritional value differently. Eri silkworms fed on castor leaves resulted to high in crude protein (26.04%dm) which showed shorter larval and pupal development times (18.70 and 21.70 days, respectively), and higher values for mature larval weight (6.18 g), cocoon weight (2.60 g), pupa weight (2.28 g), and fresh cocoon weight per 10,000 larvae (26.00 kg), all of which were statistically significant ($p \leq 0.05$) compared to those fed on cassava leaves. Additionally, these silkworms showed the highest contents of crude protein (69.64%dm), crude fat (9.42%dm), crude fiber (5.97%dm), and ash (4.41% dm), which were significantly different ($p \leq 0.05$) from those reared-on cassava leaves. The pupae reared on castor leaves had high crude protein content (70.66%dm), similar to KU50 (70.81%dm) and HuayBong 60 (69.59%dm). The pupae reared on Rayong72, KU50, Rayong 11, and Huay Bong 60 had the highest levels of crude fat, crude fiber, carbohydrate, and ash, respectively. Castor leaves are optimal for rearing eri silkworms to increase productivity and enhance their nutritional value for use as food for humans and animals.

Keywords: Cassava, Castor, Eri silkworm, Nutrition, Proximate

Introduction

Currently, consuming insects as food is highly popular both domestically and internationally. Insects are considered superfoods because of their rich nutritional value. The eri silkworm (*Samia ricini* Donovan), besides its importance in the textile industry, also provides larvae (ripe worm), prepupae and pupae with high nutritional value, containing crude protein content ranging from 55-60%, total lipids at 26%, free amino acids at 5-8%, as well as vitamins

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E (36.88–39.08 mg/100 g), B2 (3.55–3.84 mg/100 g), B1 (1.32–1.47 mg/100 g), and A (0.58–0.67 mg/100 g), and minerals (calcium, iron, phosphorus, sodium, potassium) (Umer *et al*., 2017; Mazumdar, 2019; Choudhury *et al*., 2020; Gangopadhyay *et al.*, 2022). Additionally, prepupae and pupae also have a high content of ω-3 PUFA (Polyunsaturated Fatty Acids) together with a low dietary ω-6/ω-3 ratio. The fatty acid composition ranges from 28.73 to 30.29% for saturates, 11.68–12.53% for monounsaturates, and 54.07–56.83% for polyunsaturates (Ray and Gangopadhyay, 2023). The protein, fat, vitamins, minerals, and energy obtained from eri silkworms are comparable to those from meat and fish (Sirimungkararat *et al*., 2010).

Consumption of eri silkworms as food has been widely accepted both in Thailand and other countries, including China, Japan, Nagaland, Northeastern India, and Korea (Longvah *et al*., 2011b; Imtinaro *et al*., 2012; Thangjam *et al*., 2020; Sharma *et al*., 2022). Particularly in India, eri silkworms have been consumed for a long time. Not only are the larvae and pupae popular for consumption, but also the adult forms. They are commonly consumed raw, dried, boiled, and fried (Kim *et al*., 2019; Akhtar, 2020). In Nagaland, they are typically fried before consumption (Mozhui *et al*., 2020). In Thailand, they are often boiled, grilled, fried or roasted before consumption. Additionally, they are processed into various dishes such as chili paste (jaew), crispy fried larvae and pupae (in flavors like tom yum, herbal, larb, and basil), and crispy rice snacks with larvae as an ingredient (Sirimungkararat *et al*., 2010).

Eri silkworms are known for their robustness, ease of cultivation, and cost-effectiveness, which eliminates the need for chemical agents like formalin powder, a known carcinogen. This assurance of safety extends to silkworm rearers, consumers, and the environment (Sirimungkararat *et al*., 2009). Another notable aspect of eri silkworms is their polyphagous nature, allowing them to feed on a diverse range of plants. Reports indicate that eri silkworms can consume up to 30 different plant species (Arora and Gupta, 1979; Reddy *et al*., 2002; Das *et al*., 2020).

Castor leaves are commonly used as the primary host plant for eri silkworms. However, castor is an annual crop that can only be harvested for feeding eri silkworms for a period of 6 months. Therefore, studies have explored alternative food sources, such as Tapioca/Cassava (*Manihot utilisima*), Jatropha (*Jatropha curcas*), and Papaya (*Carica papaya*), which can be used as supplementary feed. However, these alternatives have been found to yield lower silk gland and cocoon shell production compared to feeding with castor leaves (Kumar and Elongovan, 2010). Similarly, Sarmah *et al*. (2015) reported that while castor leaves are the best food source for eri silkworms, other plants like Kesseru, Borpat (*Ailanthus grandis* Prain), and Borkesseru (*Ailanthus excelsa*

Roxb) can be used to feed eri silkworms during periods of scarcity of castor leaves. One such alternative source is cassava, a tuber crop known for its tolerance to unfavorable climatic conditions. These plants are abundant in all the states of northeastern Thailand. The nutritional composition of cassava leaves includes 24-30% carbohydrates, 17.85% crude fiber, 16.7-39.9% total protein, and 9-14% minerals like nitrogen, phosphorus, and potassium. Additionally, they maintain low levels of anti-nutrient components such as tannins (2.80 - 4.23%) and HCN (310 - 402 mg/kg) (Harishkumar and Thirupathaiah, 2023). Ravinder *et al.* (2016) reported that silkworm oil from tapioca-fed silkworms exhibited higher free fatty acid (FFA) content compared to castor-fed silkworm oil, ranging from 0.11 to 0.17%. Additionally, it had a phosphorus content of 0 ppm and a peroxide value of 2.5. In addition, Chutia *et al.* (2014) reported that cocoons from cassava-fed silkworms were white, followed by those from castor and Kesseru. Additionally, cocoons from cassava-fed silkworms were firm, compact, and slightly elastic, and they produced more moderate-quality cocoons compared to those fed with castor. It can be observed that different food sources have different effects on the growth and production of eri silkworms. Furthermore, even different genotypes/varieties/strains of the same type of host plant can have varying effects on the growth of eri silkworms (Patil *et al.*, 2009; Narayanamma *et al.*, 2014; Chhatria *et al.*, 2017; Kumara, 2023).

The majority of studies have primarily focused on the growth, yield, and quality of silk cocoons. However, feeding eri silkworms with different nutritionally rich host plants can significantly impact both the yield and nutritional value of the silkworms. The research finding aimed to investigate how different nutritionally rich host plants which can enhance both the yield and nutritional value of eri silkworms, providing guidance in selecting food plants to improve both yield and nutritional value of eri silkworms in the future.

Materials and methods

Host plant cultivation

Castor and cassava leaves (Rayong 11, Rayong 72, Huay Bong 60, Kasetsart 50 (KU50), and CMR43-08-89), commonly cultivated in Nakhon Ratchasima province, were employed. Castor seeds and cassava stem cuttings were planted in the experimental agricultural plot at the Nong Rawiang Educational Center, Rajamangala University of Technology Isan, Nakhon Ratchasima. The experiments were conducted between December 2020 and February 2021. After germination, a NPK fertilizer with a 16-16-16 formula was applied, following the guidelines of the Jutangka (2008). Once they reached six months of age, they were utilized for the experiment.

Eri silkworm

Eri silkworm eggs of the Kamphaeng Saen variety were provided by the Center of Excellence for Sericulture, Faculty of Agriculture, Kasetsart University, Kamphaeng Saen Campus. The eggs were incubated for hatching in the Plant Science Laboratory at Rajamangala University of Technology Isan, Nakhon Ratchasima Campus, at a room temperature of 23-28°C and 65-75% relative humidity.

Eri silkworms at the first instar, hatched simultaneously within a 3–5-hour period, were separated and placed in insect rearing boxes measuring 6.3 x 9.6 x 3.5 inches. They were then provided with different host plants (castor leaves and cassava leaves from Rayong 11, Rayong 72, Huay Bong 60, Kasetsart 50, and CMR43-08-89 varieties). The experimental design followed a Completely Randomized Design (CRD) with three replicates for each type of host plant. In each replicate, 150 larvae were used. They were fed twice a day and provided ad libitum with equal quality host plants across all treatments. Plant leaves were weighed before each feeding. The eri silkworm rearing process was modified from the method described by Sirimungkararat *et al.* (2002).

The parameters observed during this research included the development time of each stage (eggs, larvae, pupae, and adults), which was meticulously calculated and recorded. Adult development time was monitored and recorded daily until the end of the adults' lifespan. Furthermore, the weight of mature larvae, cocoon, pupa, and shell were measured. Additionally, data on shell ratio, total cocoon shell weight, and cocoon yield by weight (in kilograms) for 10,000 larvae were also recorded.

Mature larvae weight (g): The average weight in grams of mature larvae (5 days of 5th instar) was measured for 15 male and 15 female larvae, which were randomly selected and individually weighed before being averaged.

Cocoon weight (g): The average single cocoon weight in grams was measured for 15 male and 15 female cocoons chosen randomly on 7^{th} day of spinning.

Pupal weight (g): The average single pupa weight in grams was measured for 15 male and 15 female pupae chosen randomly on 7^{th} day of spinning. The pupae used were the same cocoons used for the cocoon weight determination.

Shell weight (g): The average single shell weight in grams was measured for 15 male and 15 female pupae chosen randomly on 7^{th} day of spinning. The shell used were the same cocoons used for the cocoon weight determination.

Shell ratio (%): The amount of silk present in a cocoon shell was expressed in percentage. This is the weight of cocoon shell out of weight of the cocoon with pupa.

Total cocoon shell weight (g): Total cocoon x Cocoon shell weight

Cocoon yield by weight (kg) for 10,000 larvae: The mean weight of the cocoons harvested in kilogram (kg) for every 10,000 larvae by weight.

The data were subjected to analysis of variance (ANOVA) using SAS program. Significance differences between treatment means were delineated by Duncan's New Multiple Rang Test (DMRT) test at 5% level of significance.

Proximate analysis

The method for chemical composition analysis was performed according to the standard methods of AOAC (2005).

Moisture content (%): After drying the host plants (castor and cassava leaves) samples in hot air oven for 4 h at 105ºC, the samples were cooled in desiccators and then weighed. The moisture content was obtained from the difference between wet weight and dry weight.

Ash content (%): After moisture content analysis, the samples were placed on porcelain dishes and then placed in furnace at 550ºC for 4 h.

Crude fiber content (%): The dried samples were digested with 1.25% sulphuric acid, filtered and washed and then digested with 1.25% sodium hydroxide, filtered, washed and dried. This dried sample was then ignited.

Fat content (%): The samples were kept in diethyl ether for 2 h at 90 ºC. After extraction, the samples were then kept at 70ºC in an incubator for 30 min, cooled in desiccators and weighed.

Protein content (%): The nitrogen content was evaluated using the Kjeldahl method. The crude protein content was determined by multiplying the crude nitrogen content by a factor of 6.25.

Total carbohydrate (%): Calculated as 100 minus the sum of moisture, crude protein (%), crude fat (%), crude fiber (%) and ash (%)

Results

Nutrient composition of host plant

Castor leaves exhibited the highest moisture content, crude protein, and ash, at 70.07%, 26.04%dm, and 9.81%dm, respectively. There were statistically significant differences ($p \leq 0.05$) compared to cassava leaves. In contrast, Rayong 72 showed the lowest crude protein (17.53%dm), while the CMR43-08-89 variety had the highest crude fat and crude fiber (11.68%dm and 10.65%dm, respectively), with statistical differences ($p \leq 0.05$) compared to other host plants. Rayong 11 had the highest carbohydrate content (59.24%dm), with statistical differences compared to other host plants ($p \leq 0.05$) (Table 1).

Table 1. Proximate composition of host plant for eri silkworm rearing

Host Plant	Moisture (%±sd)	Proximate Composition (%dm±sd)				
		Crude Protein	Crude Fat	Crude Fiber	Carbohydrate	Ash
Castor	**70.07±1.66^{A}**	**26.04±0.27^{A}**	8.50±0.07^{C}	9.13±0.43^{B}	39.71±0.23^{E}	**9.81±0.04^{A}**
Rayong 11	66.88±0.67^{B}	17.85±0.19^{D}	6.82±0.14^{F}	5.17±0.16^{C}	**59.24±0.46^{A}**	5.67±0.90^{E}
Rayong 72	66.88±0.67^{B}	17.53±0.58^{D}	11.14±0.15^{B}	9.93±0.18^{AB}	48.22±0.72^{C}	7.91±0.10^{B}
Huay Bong 60	66.27±0.25^{B}	19.31±0.44^{C}	8.10±0.07^{D}	5.59±0.22^{C}	55.00±0.23^{B}	6.43±0.04^{D}
Kasetsart 50	69.37±1.75^{A}	21.60±0.29^{B}	7.68±0.05^{E}	10.52±1.38^{A}	49.65±1.88^{C}	5.61±0.02^{E}
CMR43-08-89	67.56±1.12^{B}	21.06±0.25^{B}	**11.68±0.14^{A}**	**10.65±0.70^{A}**	44.20±1.11^{D}	7.31±0.09^{C}
P- value	**< 0.0005**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**

Means±sd followed by the same letter within a column are not significantly different (DMRT, $p > 0.05$), sd. = Standard deviation

Life cycle of eri silkworm

The life cycle of eri silkworms reared on both castor and cassava leaves at a room temperature of 26.42ºC (ranging from 19.3 to 36.0ºC) and 49.42% relative humidity (ranging from 33% to 66% R.H.) was similar, encompassing the stages from egg, larva, pupa, to adult. Growth and development occurred from the egg stage to adult within 50-72 days. However, the larvae developed more quickly when fed on castor leaves compared to cassava leaves. Similarly, the pupa development time of castor-fed silkworms was shorter than that of cassava-fed eri silkworms, with a statistically significant difference ($p \leq 0.05$). In contrast, the development times of eggs and adult stages were similar (Table 2).

Economic traits of eri silkworm

Eri silkworms reared on castor leaves exhibited the highest weight for mature larvae (5 days of the 5th instar), yet did not show statistically significant differences ($p > 0.05$) compared to those reared with KU50, at 6.18 g and 5.71 g, respectively. Similarly, rearing on castor leaves also led to the highest values for cocoon weight, pupa weight, and fresh cocoon per 10,000 larvae, with statistical differences ($p \leq 0.05$) compared to rearing on cassava leaves. However, there were no statistically significant differences ($p > 0.05$) in terms of shell weight and shell ratio (Table 3).

Table 2. The life cycle of eri silkworms reared on different host plants

Development Stage	Host plants/Development time (Days)						p-value
	Castor	Rayong 11	Rayong 72	HuayBong60	KU 50	CMR43-08-89	
Egg stage	**7-10 (8.30)**	**8-10 (8.90)**	**7-10 (8.90)**	**8-10 (9.10)**	**7-9 (8.50)**	**8-11 (9.30)**	**0.2382**
Larval stage	**18-19 (18.70^C)**	**18-22 (20.20^B)**	**18-22 (20.10^B)**	**18-24 (21.10^A)**	**19-21 (20.50^{AB})**	**18-22 (20.70^{AB})**	**<0.0001**
1st instar	4 (3.9)	4 (4.0)	4 (4.0)	4-5 (4.4)	4 (4.0)	4 (4.0)	-
2nd instar	3 (3.0)	3 (3.0)	3-4 (3.5)	3-4 (3.4)	4 (4.0)	3 (3.1)	-
3rd instar	3 (3.1)	3-4 (3.5)	3 (3.0)	3-4 (3.5)	3 (3.0)	3-4 (3.3)	-
4th instar	4 (4.0)	3-4 (3.8)	3-4 (3.8)	4-5 (4.4)	4 (4.0)	3-4 (3.6)	-
5th instar	4-5 (4.7)	5-6 (5.7)	5-7 (5.8)	4-6 (5.4)	4-6 (5.4)	5-7 (6.3)	-
Pupal stage	**19-26 (21.70^C)**	**20-28(24.50^{AB})**	**20-28 (25.10^{AB})**	**19-26 (24.30^{AB})**	**19-26 (23.10^{BC})**	**19-29 (25.80^A)**	**0.0093**
Adult stage	**6-10 (8.05)**	**6-11 (8.60)**	**6-11 (8.30)**	**6-10 (8.05)**	**6-12 (8.95)**	**6-11 (9.15)**	**0.0682**
Female moth	6-10 (8.60)	6-11 (9.10)	6-11 (9.10)	6-9 (8.30)	6-12 (10.00)	6-11 (9.50)	-
Male moth	6-10 (7.20)	7-11 (8.10)	6-9 (7.50)	6-10 (7.80)	6-9 (7.90)	7-10 (8.80)	-
Egg-Adult stage	**50-65 (56.60^B)**	**52-71 (61.50^A)**	**51-71 (62.40^A)**	**51-70 (62.55^A)**	**51-68 (61.05^A)**	**51-72 (64.94^A)**	**0.0004**

numbers in parentheses are the mean values.
Means followed by the same letter within a low are not significantly different (DMRT, p >0.05),

Table 3. The mature larvae weight and economic traits of eri silkworms reared on different host plants

Host Plants	Mature larvae weight (g±sd /larva)	Economic traits					
		Cocoon Weight (g±sd)	Pupa Weight (g±sd)	Shell Weight (g±sd)	Shell Ratio (%±sd)	Total Cocoon Shell Weight (g±sd)	Fresh Cocoon/ 10,000 Larvae (Kg±sd)
Castor	6.18±0.55^A	2.60±0.13^A	2.28±0.10^A	0.31±0.03	11.65±0.15	13.00±0.87	26.00±1.31^A
Rayong 11	5.08±0.13^B	2.06±0.08^{BC}	1.83±0.07^{BC}	0.23±0.02	11.16±0.52	10.83±1.02	20.63±0.81^{BC}
Rayong 72	4.42±0.26^C	1.90±0.02^D	1.66±0.02^D	0.23±0.01	11.82±0.37	10.77±0.40	18.98±0.21^D
HuayBong 60	5.04±0.22^B	1.98±0.06^{CD}	1.72±0.05^{CD}	0.24±0.01	12.08±0.38	11.72±0.50	19.74±0.58^{CD}
Kasetsart 50	5.71±0.16^A	2.15±0.04^B	1.88±0.03^B	0.31±0.08	14.45±3.45	14.62±4.15	21.47±0.36^B
CMR43-08-89	4.85±0.14^{BC}	2.06±0.12^{BC}	1.80±0.11^{BC}	0.25±0.01	12.20±0.56	11.38±1.57	20.62±1.23^{BC}
P- value	**<0.0001**	**<0.0001**	**<0.0001**	**0.0545**	**0.2188**	**0.1784**	**<0.0001**

Means±sd followed by the same letter within a column are not significantly different (DMRT, p >0.05), sd. = Standard deviation

Nutrition value of eri silkworm

Eri silkworm larvae raised on castor leaves had the highest levels of crude protein, crude fat, crude fiber, and ash (69.64%dm, 9.42%dm, 5.97%dm, and 4.41%dm, respectively), which were statistically significantly different ($p \leq 0.05$) from those raised on cassava leaves (Table 4).

Table 4. Proximate composition of eri silkworm larvae (ripe worms) reared with different host plants

Host Plants	**Proximate Composition (%dm±sd)**				
	Crude Protein	Crude Fat	Crude Fiber	Carbohydrate	Ash
Castor	**69.64±0.45**^{A}	**9.42±0.29**^{A}	**5.97±0.18**^{A}	**10.56**±0.14^{E}	**4.41±0.05**^{A}
Rayong 11	54.47±0.33^{E}	7.53±0.22^{B}	5.17±0.16^{C}	29.40±0.68^{A}	3.43±0.01^{F}
Rayong 72	60.85±0.56^{C}	7.98±0.16^{B}	5.59±0.22^{B}	21.90±0.47^{C}	3.68±0.04^{E}
Huay Bong 60	59.01±0.36^{D}	8.81±0.30^{A}	4.59±0.17^{D}	23.74±0.51^{B}	3.85±0.04^{D}
Kasetsart 50	66.28±1.27^{B}	8.82±0.16^{A}	5.33±0.09^{BC}	15.24±1.10^{D}	4.33±0.03^{B}
CMR43-08-89	60.65±0.19^{C}	7.64±0.38^{B}	4.74±0.17^{D}	22.85±0.40^{BC}	4.12±0.05^{C}
P- value	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**

Means±sd followed by the same letter within a column are not significantly different (DMRT, $p > 0.05$), sd. = *S*tandard deviation

The pupae raised on KU50 leaves had the highest crude protein (70.81%dm), but did not statistically differ ($p > 0.05$) from castor leaves (70.66%dm) and Huay Bong 60 (69.59%dm). Meanwhile, pupae raised on Rayong 11 had the lowest crude protein (54.32%dm). The highest crude fat was observed in the pupae raised on Rayong 72 (16.01%dm), while KU50 had the highest crude fiber content at 5.07%dm. Rayong 11 had the highest carbohydrate content (18.04%dm), and the larvae raised on the Huay Bong 60 cassava variety had the highest ash content (6.12%dm) (Table 5).

Table 5. Proximate composition of eri silkworm pupae reared with different host plants

Host Plants	**Proximate Composition (%dm±sd)**				
	Crude Protein	Crude Fat	Crude Fiber	Carbohydrate	Ash
Castor	70.66±0.75^{A}	13.88±0.02^{B}	4.65±0.06^{B}	1.73±0.60^{C}	5.82 ± 0.02^{BC}
Rayong 11	54.32±0.63^{C}	10.90±0.51^{D}	3.40±0.30^{D}	**18.04±0.48**^{A}	4.38 ± 0.06^{E}
Rayong 72	66.17±0.08^{B}	**16.01±0.07**^{A}	4.82±0.05^{AB}	2.60±0.37^{B}	5.75 ± 0.06^{CD}
Huay Bong 60	69.59±0.44^{A}	12.75±0.43^{C}	4.52±0.24^{BC}	2.84±0.49^{B}	**6.12 ± 0.06**^{A}
Kasetsart 50	**70.81±1.13**^{A}	15.96±0.55^{A}	**5.07±0.23**^{A}	0.67±0.29^{D}	5.85 ± 0.07^{B}
CMR43-08-89	66.34±0.51^{B}	12.66±0.38^{C}	4.29±0.17^{C}	2.37±0.44^{BC}	5.71 ± 0.07^{D}
P- value	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**

Means±sd followed by the same letter within a column are not significantly different (DMRT, $p > 0.05$), sd. = *S*tandard deviation

Discussion

The research finding illustrated that rearing eri silkworms on host plants with different nutritional values, especially crude protein, affected the production of eri silkworms differently. Host plants with higher crude protein content resulted in shorter development time and higher growth and production of eri silkworms. Rearing on castor leaves resulted in eri silkworms with higher mature larval weight, cocoon weight, pupal weight, and fresh cocoon/10,000 larvae compared to rearing on cassava leaves. This is consistent with Kumar and Elongovan (2010) who reported that castor leaves are the best host plants for rearing eri silkworms. Additionally, rearing eri silkworms on castor leaves also affects the nutritional values and growth parameters, such as effective rate of rearing (ERR), larval weight, cocoon weight, shell weight, pupal weight, egg number, egg hatching, and shorter larval duration compared to rearing with other types of host plants (Hajarika *et al*., 2003). In addition, Vasanth *et al*. (2023) reported that Eri silkworms fed with castor leaves exhibited better growth performance compared to those fed with cassava, showing improvements in larval duration, larval weight, cocoon weight, pupal weight, shell ratio, and ERR. Nurkomar *et al*. (2022a) found that eri silkworm larvae exhibited faster development when consuming castor leaves as opposed to cassava leaves. Additionally, the total development period was shorter when the larvae were fed castor leaves. Furthermore, adult female eri silkworms fed with castor leaves showed higher pupal weight and fecundity compared to those fed with cassava leaves. Generally, castor leaves tend to have higher level of crude protein, lipid, crude fiber, carbohydrate, and sugar, but lower levels of hydrogen cyanide (HCN) compared to cassava leaves (Deuri *et al*., 2017). Specifically, nutrients such as crude protein, crude fat, carbohydrate, phosphorus, and moisture content in food plant leaves directly affect the growth and production of eri silkworms (Umer *et al*., 2017; Derara *et al*., 2020).

It was observed that different varieties of cassava had varying effects on the production of eri silkworms. In this study, the KU50 variety ranked second in terms of yielding improved fresh cocoon weight, larval weight, shell weight, and fresh cocoon/10,000 larvae, following castor leaves. However, KU50 had a higher percentage of shell weight compared to other varieties of host plants. even though cassava leaves are of the same type, different varieties can impact the production of eri silkworms. This depends on the nutrient content in the leaves, consistent with Nurkomar *et al.* (2022b) who found that variations in the development duration of eri silkworms could be attributed to the inherent qualities of cassava leaves. Moreover, the performance of eri silkworm larvae could be affected by the nutritional composition of cassava leaves, which varies among varieties. Sakthivel (2016) reported that different varieties of cassava leaves have varying nutritional content, including minerals and other components such as tannin and HCN, which affect the production of eri silkworms. Varieties with higher levels of protein, total carbohydrate, nitrogen, phosphorus, potassium, and total minerals result in higher eri silkworm production. In this study, the KU50 variety of cassava leaves had higher crude protein content compared to the other varieties, leading to higher production. Nutrients in the leaves of host plant play a crucial role, with carbohydrates being the main energy source. Carbohydrates can convert into lipids and contribute to amino acids. Proteins and amino acids are vital for the growth of silkworm larvae, with female moths requiring protein for cell development and egg production (Borah and Boro, 2020).

Eri silkworms reared with castor leaves, which have a higher crude protein content compared to other host plants, not only affected cocoon production but also influenced the nutritional value of the larvae and pupae. This is consistent with Deori *et al.* (2016), who reported that eri silkworm larvae reared on castor leaves had significantly higher levels of crude protein and crude fat compared to those reared on Barpat (*Ailanthus grandis*) and Barkesseru (*A. excelsa*). However, moisture content, crude fiber, total minerals, and total carbohydrates did not show significant differences. Conversely, Longvah *et al.* (2011a) reported that prepupa and pupa of eri silkworms reared on castor leaves and cassava leaves had similar levels of crude protein, crude fat, and minerals.

Additionally, proteins play a crucial role in the growth, production, and quality of eri silkworm cocoons. The quantities of amino acids, carbohydrates (sugar), lipids, fiber, minerals (potassium, magnesium, and calcium), and vitamins (Vitamin B complex, Ascorbic acid, Choline, Inositol) also play significant roles (Mane *et al.*, 1998; Khedr *et al.*, 2013). In addition to the nutritional value of host plant leaves, the characteristics of the host plants also affect the functioning of the amylase enzyme released by silkworms to digest the leaves. Some types of food plants can be broken down more effectively by silkworms using amylase and proteolytic enzymes (proteases), allowing the silkworms to absorb nutrients for growth more efficiently. Conversely, certain types of host plants are less easily broken down by silkworms, resulting in lower absorption of nutrients for growth (Ruth *et al*., 2019).

Furthermore, even though they may be the same type of host plant, variations in environmental conditions or plant age can result in differences in nutritional value. For instance, castor leaves accumulate crude protein in June, whereas cassava leaves have higher protein levels in January. Additionally, the nutritional content of host plant leaves, such as mineral and carbohydrate content, decreases as the leaves mature. Conversely, the total nitrogen, crude protein, crude fiber, and crude fat content increase from tender leaves grow into mature leaves during the spring season. During the autumn season, the leaves have higher levels of crude fat and total carbohydrate content (Baruah, 2013). This study utilized food plants grown in the same area, under the same environmental conditions, fertilizer application, and pest management methods. Moreover, the age of the food plants used for rearing eri silkworms was consistent. Therefore, it was possible to compare the growth of eri silkworms.

It is concluded that the nutrients in the host plant leaves used to rear eri silkworms affect the production and nutritional value of the silkworms. Castor leaves showed the highest crude protein content, resulting in higher mature larval weight, cocoon weight, pupal weight and fresh cocoon/10,000 laevae, as well as higher levels of crude protein in both the larvae and pupae of eri silkworms. Therefore, castor leaves are suitable as a food source for rearing eri silkworms in order to increase cocoon production and protein content in the silkworms for the textile industry and future alternative food sources.

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