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The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(11): 322-325

www.thepharmajournal.com
Received: 10-09-2021
Accepted: 30-10-2021

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Research impact on different host plants of Eri silkworm *Samia ricini* Donovan (Lepidoptera: Saturniidae)

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Abstract
The present study was conducted during 2020-21 at Forest College and Research Institute, Mettupalayam and Tapioca and Castor Research Station, Yethapur, Salem district to identify the most suitable host plants for Eri silkworm (*Samia ricini* Donovan) rearing which can lead to sustainable production of silk in relation to physiological and economic parameters. Majority, Castor YTP 1 variety had high level of moisture content, protein and total carbohydrate which attributed to the superior economic traits including cocoon yield and silk percentage. The economic parameters *viz.* Mature larval weight (g), Single cocoon weight (g), Shell weight (g), Shell ratio (%) and Effective Rate of Rearing (ERR %) was found to be highest in Castor YTP 1 variety (9.05g, 3.85g, 0.55g, 17.43% and 96%). This study reveals that Eri silkworm reared on the leaves of castor variety YTP 1 showed superiority for the commercial parameters and same can be exploited for maximization of Eri cocoon production.

Keywords: Castor, economic parameters, ERI silkworm, host plant and tapioca

Introduction
Eri silkworm (*Samia ricini* Donovan) is a non-mulberry domesticated silkworm belongs to the family Saturnidae order of Lepidoptera which majorly feeds on leaves of castor and tapioca [1, 2]. It is exclusive prerogative of North Eastern States of India and of late introduced to other parts of India [3]. Eri silkworm being hardy and tolerant to diseases, its productivity per acreage is higher compared to other silkworm. Beside the environmental factors, silkworm economic traits such as cocoon weight, shell weight and shell ratio greatly influence by supplied of quantity and quality of leaves. The amount of nutrients content in leaves may showed significant variation within the same species with different cultivars and this variation has been found to have a significant impact on silkworm growth and development, as well as cocoon production [4, 5]. Eri silkworm larva reared on castor leaves showed clear preference for host plants when offered with different alternate host plants [6]. The comparative studies of nutritional values between castor and tapioca in four different seasons reported that spring season recorded higher nutritional values and lower anti-nutrient content in castor compared to tapioca plants [7]. Therefore, the present work was carried out to evaluate the impact of different castor and tapioca cultivars on rearing performance of C2 breed of Eri silkworm and to identify suitable cultivars for better production of silk.

Materials and Methods
Rearing of S. ricini Donovan was conducted at Tapioca and Castor Research Station in Yethapur, Salem district, Tamil Nadu. The rearing room and equipment were cleaned and disinfected with a 5 percent bleaching solution at a rate of 800ml/10 m^2. Eri silkworm C2 breed was reared from brushing to cocoon spinning on the selected leaves of castor cultivars *viz.*, YTP 1, YRCH 1, YRCH 2 and Local variety with two tapioca cultivars *viz.*, YTP 1 and YTP 2. The treatments were arranged in a Completely Randomized Design with three replications. In each replication, 50 worms were employed and the larval phase was completed. First instar larvae of Eri silkworm were fed with tender leaves twice in a day, and then thrice a day up to second and third instar. Fourth and fifth instar larvae were fed with mature castor leaves four times a day [8].

Biochemical analysis

The moisture and crude protein content of the sample were assessed using the Association of Official Analytical Chemists' procedures [9]. Chlorophyll 'a', 'b', and total chlorophyll were calculated using established equations according to the approach of Arnon, [10]. The total carbohydrate content of the leaf was calculated using Anthrone method [11].

Results and Discussion

Proximate composition

The proximate composition of castor and tapioca cultivar leaves varied significantly ($p< 0.05$) as presented in Table 1. According to the present investigation, Castor YTP 1 variety had the highest moisture and protein content (70.38% and 24.92%, respectively), followed by Castor hybrid YRCH 2 (68.01% and 24.05%), while Tapioca YTP 2 had the lowest (61.27% and 17.88%). Castor YTP 1 had the highest total carbohydrate content (39.35%). Castor YRCH 1 has the highest total phenol concentration (19.34%), followed by Castor YRCH 2 (19.18%). Castor YTP 1 had the highest levels of chlorophyll 'a' (2.96 mg/g of leaf), chlorophyll 'b' (1.14 mg/g of leaf), and total chlorophyll (4.11 mg/g of leaf), followed by Castor YRCH 2 (2.89 mg/g, 0.87 mg/g, and 3.75 mg/g, respectively). These findings corroborate those of [12, 13], who found chlorophyll 'a', 'b', and total chlorophyll levels of 1.226, 1.353, and 2.579 mg/g with the Local castor genotype.

Table 1: Biochemical composition of different cultivars of tapioca and castor leaves

Host plant	Moisture Content (%)	Crude Protein (%)	Total Carbohydrate (%)	Total Phenol (%)	Chlorophyll (mg/g)		
					a	b	Total (mg/g)
Castor YTP 1	70.83^{a}	24.92^{a}	39.35^{a}	15.67^{c}	2.97^{a}	1.15^{a}	4.11^{a}
Castor YRCH 1	65.99^{c}	23.98^{b}	36.53^{b}	19.34^{a}	2.85^{c}	0.85^{c}	3.67^{c}
Castor YRCH 2	68.01^{b}	24.05^{b}	36.42^{b}	19.18^{b}	2.90^{b}	0.87^{b}	3.75^{b}
Tapioca YTP 1	63.79^{d}	17.24^{f}	33.28^{d}	10.23^{d}	2.43^{f}	0.69^{e}	3.11^{f}
Tapioca YTP 2	61.27^{e}	17.88^{e}	33.97^{c}	10.10^{e}	2.53^{e}	0.84^{c}	3.33^{e}
Castor local Variety	65.28^{c}	21.97^{d}	36.54^{ac}	18.56^{b}	2.75^{d}	0.80^{d}	3.54^{d}
Mean	65.78	21.67	36.02	15.51	2.74	0.87	3.59
SEd	1.30	0.77	1.28	0.60	0.09	0.03	0.16
CD(0.05)	2.83	1.69	2.80	1.31	0.21	0.08	0.36

Data collection

The different larval parameters: Larval weight (g), effective rate of rearing (%) and cocoon parameters; Single cocoon weight (g), Shell weight (g) and Shell ratio (%) were calculated.

Larval weight (g)

Ten mature larvae were randomly picked from each treatment and weighed treatment and replication wise and their average was calculated.

Single cocoon weight (g)

On the sixth days of spinning, ten cocoons were randomly harvested from each treatment and individual cocoon weight was weighted and their average was recorded.

Shell weight (g)

Ten cocoons were cut open, pupae and larval excuvium were removed and average shell weight was recorded separately.

Shell Ratio (%)

The shell ratio indicates the quality of silk that can be spun from a lot of live cocoons and calculated by the following formula:

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

Effective Rate of Rearing (ERR) (%)

It indicates the effectiveness of the experimental feeding provided to the larvae. ERR% is calculated by the following formula.

$$\text{ERR}(\%) = \frac{\text{Number of cocoon harvested}}{\text{Total Number of larva brushed}} \text{x}100$$

Larval parameters

Mature Larval Weight

When silkworms were fed different castor and tapioca cultivars, the weight of a single mature larvae exhibited statistically significant variation ($p< 0.05$) (Table 2). Castor YTP 1 and YRCH 2 fed mature larvae had substantially greater larval weights of 9.0 and 8.70g, respectively. The worms fed with Tapioca YTP 1 recorded lowest larval weight 7.75 g [14]. The present finding is in line with [15] who reported the larval weight with a maximum of 9.20 and 9.18 g when fed with castor GCH 4 and DCH 519 genotypes. The variation on mature larval weight due to feeding on different cultivars might be reflection on the nutritional status of the host plants.

Effective Rate of Rearing (ERR)

Feeding of Eri silkworm with different castor and tapioca registered significant difference ($P< 0.05$) with respect of effective rate of rearing. Among the cultivars, Castor YTP 1 variety had the highest effective rate of rearing (ERR) (96.00%), followed by Castor YRCH 2. (95.00%). and the lowest was observed in Tapioca YTP 1 (92.00%) (Table2). Studies of [16, 17] are in conformity with these observations.

Cocoon parameters

Cocoon weight

Cocoon indicates the yield attributes which is the end product of a crop in sericulture. Cocoon weight was significantly higher in Castor Variety YTP 1 (3.85 g), Castor YRCH 2 (3.633 g), and Tapioca YTP 1 (3.23 g) fed larva (Table 2). The present findings are comparable with [17] who opined that cocoon weight varied with the type of host plants provided at the larval stage and he obtained 3.38 g of single cocoon weight in castor accessions of Acc. 003. Similar findings were reported by [18-20] who observed the variations in cocoon weight when silkworms were fed with different genotypes.

Shell weight

Larva fed with Castor YTP 1 Variety had the maximum shell weight (0.55g) other than host plants, and Tapioca YTP 1 (0.44g) had the minimum shell weight (Table 2). Similarly, [21] who recorded a shell weight of 0.50 g in the cocoons formed by the worms fed on castor hybrid DCH 519 castor genotype and opined that the shell weight varied with the type of hosts provided at the larval stage. These results are in agreement with the findings of [22] who reported that the shell weight depends on the type of hosts provided for feeding the worms.

Shell ratio

Significant differences were observed in single Cocoon weight of those larvae which were fed with the leaves of different castor and tapioca cultivars. Maximum significantly higher was recorded in with those larvae which were fed with leaves of castor YTP 1 (17.43%) while minimum value was recorded with Tapioca variety YTP 1(13.15%) (Table.2). Studies with different host plant genotypes, [23] reported that shell ratio attained 18.44% when larvae fed with castor hybrid PCH 111. The presence of biochemical compositions like as moisture, protein, phenol, and other nutrients in the leaves might explain the differences in rearing performance and cocoon characteristics. These findings agree with those of [24-26] who found variations in larval and cocoon parameter when Eri silkworms were fed various host plants.

Table 2: Rearing performance and cocoon traits of Eri silkworm fed on different host plants

Host plant	Larval weight (g)	ERR (%)	Cocoon weight (g)	Shell weight (g)	Shell ratio (%)
Castor YTP 1	9.05^{a}	96^{a}	3.85^{a}	0.55^{a}	17.43^{a}
Castor YRCH 1	8.67^{c}	94^{ce}	3.55^{c}	0.51^{c}	16.64^{b}
Castor YRCH 2	8.70^{b}	95^{b}	3.63^{b}	0.52^{d}	16.57^{c}
Tapioca YTP 1	7.75^{f}	92^{d}	3.23^{f}	0.44^{e}	13.32^{f}
Tapioca YTP 2	7.90^{e}	94^{c}	3.32^{e}	0.49^{d}	14.19^{e}
Castor Local Variety	8.25^{d}	94^{cd}	3.52^{d}	0.50^{cd}	15.9^{d}
Mean	8.49	94.55	3.54	0.51	15.67
SEd	0.11	0.20	0.059	0.008	0.41
CD (0.05)	0.25	0.401	0.13	0.017	0.89

Conclusion

The data analysis revealed that Eri silkworms fed on the Castor YTP-1 cultivars were determined to be the superior in terms of larval and cocoon parameters on Eri silkworm rearing. Variance in biochemical contents of leaves might be one of the causes for variation in leaves preference and appropriateness as host plant for the Eri silkworm. Because of the high nutrient content, the new findings of this study suggest that castor YTP 1 variety might be employed as a nutritionally promising Eri silkworm host plant.

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