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Rearing performance of c2 breed of eri silkworm, *Samia cynthia ricini*, (Family: Saturniidae, order: Lepidoptera) feeding with different castor genotypes

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Abstract
Eri silkworm (*Samia cynthia ricini)* is one of the most exploited, domesticated and commercialized non mulberry silkworms. Eri silk production and productivity depends highly on feeds consumed by eri silkworms. A study was undertaken to evaluate different castor genotypes for the rearing performance of C2 breed. Seeds of different castor genotypes *viz*., GCH 4, GCH 7, DCH 519, and TMV 5 along with local variety were obtained from Tapioca and Castor Research station, Yethapur, Salem. The treatments were laid out in a Completely Randomized Design (CRD) with three replications. The performance of eri silkworm *viz*., larval parameters, cocoon parameters and grainage parameters were studied by feeding them with the leaves of five castor genotypes separately in cellular rearing method. The genotypes showed significant differences among rearing and grainage parameters of C2 breed of eri silkworm. Among the five genotypes, GCH 4 and DCH 519 genotypes showed superior among all the other genotypes on rearing and grainage performance. This study reveals that of the five castors genotypes GCH 4 cultivation would be more beneficial to the castor farmer for ERI culture as it yields more after local castor variety.

Keywords: C2 breed, castor genotypes, rearing and grainage parameters

Introduction

India enjoys a unique distinction of being the only country in the world producing all the five varieties of natural silk, *viz*., Mulberry, Eri, Tasar, Oak tasar, and Muga. Among the commercially exploited silkworms, Eri silkworm, *Samia cynthia ricini*, is one of the most exploited, domesticated and commercialized non mulberry silkworms. It's a multivoltine and reported to feed on almost 29 host plant species and is amenable for indoor rearing [1, 2]. Reported the host plant preference of eri silkworm in the descending order of performance, *viz*., Castor, Tapioca, Papaya, Barkesseru and Gulancha.

Among the host plants of eri silkworm, Castor (*Ricinus communis*) is the primary and the most preferred host plants for eri silkworm followed by *Manihot utilissima, Heteropanas fragrance, Curica papaya, Evodia falxinifolia, Jatropha curcas* etc, are secondary and territory host plants [3]. Reported the superiority of castor among the different host plants.

R. communis is an important oil seed crop widely grown in rain fed conditions and its foliage used for rearing of eri silkworm [4]. It is reported that 25 to 30 per cent of castor leaves is utilized for eri rearing without affecting the seed production and plays supportive economy for the poor, dry land cultivators and afford gainful employment to the women [5]. Eri silkworm which feed on castor leaves gains major nutrients for growth, survival, production of silk cocoon and reproduction. Thus, production is basically based on nutritive value of castor leaves [6]. reported that castor was best compared to other host plants in terms of different growth parameters of silk worm, *viz*., larval weight, ERR, cocoon weight and shell weight [7]. has reported significant variation in performance of eri silkworm fed with different castor genotypes. Hence, it can be known that selection of castor genotypes is a key criteria for better growth and development of eri silkworm and cocoon productivity. Hence, different genotypes of castor were chosen as food crop in the present study.

Therefore, the present work was carried out to recognize the influence of castor genotypes on rearing performance of C2 breed of eri silkworm and to identify promising castor genotypes for better production of silk.

Materials and methods

The present investigation deals with studying the rearing performance of high yielding C2 breed of eri silkworm with different castor genotypes.

The experiment was conducted at the Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India during 2017- 18 under laboratory conditions with three brushing in Completely Randomized Design (CRD) with three replications. Different castor genotypes, *viz*., GCH 4, GCH 7, DCH 519 and TMV 5 along with local variety were selected for the studies which were procured from Tapioca and Castor Research station, Yethapur, Salem.

Rearing of C2 breed of eri silkworm

Disease free layings (Dfls) of high yielding C2 breed of eri silkworm were obtained from Central Sericulture Germplasm and Research Institute, Hosur and reared following the standard rearing method [8]. The silkworm rearing room and equipment were disinfected with 2% formalin solution. C2 breed was reared with different castor genotypes following cellular rearing method starting from brushing till cocoon spinning with three replications. In each replication 30 worms were used and allowed to complete the larval period on selected genotypes of castor. First instar larvae of eri silkworm were fed with tender castor leaves twice in a day, and then thrice a day upto second and third instar. Fourth and fifth instar larvae were fed with mature castor leaves four times a day.

The different rearing parameters recorded were Morphological characters, Larval parameters (Larval weight in grams, Larval duration in days), cocoon parameters (Single cocoon weight in grams, rate of pupation in %, Pupal weight in grams, Shell weight in grams, Shell ratio in % and Effective Rate of Rearing in ERR %), Fecundity (%) and Hatchability (%) were calculated. The formula for estimating the shell ratio, Effective rate of rearing, Fecundity and Hatchability is described here below

i. Shell Ratio (%)

The shell ratio indicates the quality of silk that can be spun from a lot of live cocoons.

$$\text{Shell ratio (\%)} = \frac{\text{Weight of cocoon shell without pupa}}{\text{Weight of cocoon with live pupa}} \text{ X } 100$$

ii. Effective Rate of Rearing (%)

$$\text{Effective Rate of Rearing (ERR \%)} = \frac{\text{Number of cocoons harvested}}{\text{Number of larvae brushed}} \text{ X } 100$$

iii. Fecundity (%)

Total numbers of eggs laid by a single female moth in three nights.

iv. Hatchability (%)

$$\text{Hatching (\%)} = \frac{\text{Number of eggs hatched}}{\text{Number of eggs kept for brushing}} \text{ X}100$$

Results and discussion

The results of experiments on the effect of feeding different castor genotypes on rearing performance are discussed in the light of earlier work and presented hereunder.

a) Morphological Characters

The morphological characteristics of C2 breed of eri silkworm were observed during the rearing period. Among the egg characters, the colour of egg shell was white with cream coloured yolk; the larval body colour varied from instar to instar such as yellow/ cream/bluish/green with weak and thorny skin. The cocoon colour was white with flossy enclosing oval shaped brown coloured pupa and chocolate brown coloured wings in the moth (Table 1). The present result is in line with [9] who reported that egg colour was white with a creamy coloured yolk in *S. ricini.*

Table 1: Qualitative characteristics of C2 breed of Eri silkworm, *Samia ricini*

Egg		Larva			Cocoon		Moth	Voltinism
Colour of egg shell	Colour of yolk	Body colour	Marking of skin	Nature of skin	Colour of the cocoon	Shape of the cocoon	Wing colour of the moth	
White	Cream	Yellow Cream Blue Greenish	Plain	Weak thorn	White	Flossy No peduncle	Greyish Chocolate brown	Multivoltinism

b) Larval Parameters

The data on larval parameters are presented in Table 2.

i) Larval duration

Significant variations are evident in respect of larval duration of each castor genotypes, five instars and total larval duration. The batch of worms nourished with leaves of GCH 4 (26.45 days) recorded least larval duration closely followed by DCH 519 (26.60 days). Longer duration (29.15, 28.00, 27.30 days) with TMV 5, GCH 7 castor genotypes and local castor variety respectively (Table 2). [10, 11] also observed variations in larval duration when the worms were nourished with leaves of various castor genotypes.

Table 2: Larval parameters of C2 breed of eri silkworm by feeding with five castor genotypes

Castor genotypes	Instar I (days)	Instar II (days)	Instar III (days)	Instar IV (days)	Instar V (days)	Total larval duration(days)	Larval weight (g)
GCH 4	3.40	4.75	4.80	5.60	7.90	26.45	9.20
GCH 7	4.00	4.90	5.25	5.75	8.10	28.00	8.35
TMV 5	4.35	4.90	2.90	5.80	8.20	29.15	8.29
DCH 519	3.50	4.85	4.70	5.70	7.85	26.60	9.18
Local Variety	3.60	4.80	4.85	5.85	8.00	27.30	8.56
SEd	-	-	-	-	-	-	0.051
CD (0.05%)	-	-	-	-	-	-	0.109

ii) Larval weight (g)

C2 breed of eri silkworm fed on leaves of castor genotypes exhibited marked difference in matured larval weight with a maximum of 9.20 and 9.18 g when fed with GCH 4 and DCH 519 genotypes. A lower weight of 8.29, 8.35 and 8.56 g were observed due to feeding by TMV 5, GCH 7 and local castor variety respectively. Studies of [11, 12] are in conformity with these observations. The variations noticed among the genotypes might be attributable to the fact that, these genotypes vary in the composition of foliar nutrients, which in turn contribute for differences in larval weight.

c) Cocoon parameters

The data on cocoon parameters such as cocoon weight, rate of pupation, pupal weight, shell weight and shell ratio are presented in Table 3.

i) Cocoon weight

Feeding of eri silkworm with different castor genotypes registered significant differences in respect of cocoon weight. Among the genotypes, significantly higher weight was recorded in the cocoons formed out of worms fed on GCH 4 (3.96 g), the next best was cocoons formed from the worms fed on DCH 519 (3.88 g) followed by local castor variety (3.62 g) and GCH 7 (3.59 g). The lowest cocoon weight was recorded on TMV 5 (3.20 g). The present study is in line with the findings of [13] who have reported that maximum cocoon weight of 4.12 g was obtained in C2 breed fed with castor genotypes. [14, 15] reported that nutritional value of the feed played a major role in larval and cocoon parameters.

ii) Rate of pupation

The present experiment inferred that feeding with different castor genotypes did not influence rate of pupation. Higher rate of pupation was noticed in GCH 4 (97%) treatment. The overall rate of pupation ranged between 92-94% in the remaining genotypes with marked differences.

iii) Pupal weight

The findings exhibited significant variations on the pupal weight of eri silkworm larvae with castor genotypes. Significantly higher weight was recorded in pupae formed from the worms fed on GCH 4 (3.37 g) and DCH 519 (3.33 g), in the second order were pupae formed by worms fed on local castor variety (3.11 g) and GCH 7 (3.10 g). The worms fed with TMV 5 showed a lower pupal weight of 2.77 g [16]. recorded a pupal weight of 3.53g in worms fed on rosy castor variety. The variations on the weight of pupae due to feeding of different castor genotypes might be a reflection on the nutritional status of the genotype.

iv) Shell weight

Shell weight registered by C2 breed of eri silkworm showed significant difference in respect of different castor genotypes. The cocoons spun by the worms fed on GCH-4 (0.59 g) and DCH 519 (0.55 g) recorded significantly superior shell weight. Shell weight was less in cocoons spun by worms fed on other genotypes. Similarly, [10] who recorded a shell weight of 0.50 g in the cocoons formed by the worms fed on DCH 519 castor genotype [5, 17] opined that the shell weight varied with the type of hosts provided at the larval stage.

v) Shell ratio

Castor genotypes had profound influence on the shell ratio produced by the eri silkworm. Higher shell ratio was recorded in GCH-4 (14.89%) and DCH 519 (14.17%) followed by local castor variety (14.08%) and lower in cocoons spun by worms fed on TMV 5 (13.43%). The shell ratio recorded in the present study is comparable with observation of [11] who recorded that the shell ratio of 15.0% fed with GCH 4 genotype.

Table 3: Effect of castor genotypes on cocoon parameters in C2 breed of eri silkworm

Genotypes	Cocoon weight (g)	Rate of Pupation (%)	Pupal weight (g)	Shell weight (g)	Shell ratio (%)
GCH 4	3.96	97.0	3.37	0.59	14.89
GCH 7	3.59	92.0	3.10	0.49	13.64
TMV 5	3.20	92.0	2.77	0.43	13.43
DCH 519	3.88	94.0	3.33	0.55	14.17
Local Variety	3.62	94.0	3.11	0.51	14.08
SEd	0.116	0.816	0.055	0.018	0.495
CD (0.05%)	0.247	1.740	0.118	0.038	1.056

vi) Effective rate of rearing (ERR)

Effective rate of rearing (ERR), which reveals significant difference when eri silkworm were fed on different castor genotypes. Highest ERR being recorded in GCH 4 (92.2%) followed by DCH 519 (91.02%) and were on par with each other. Lowest was in TMV 5 (77.62%) closely followed by GCH 7 (81.1%) and local castor variety (81.9%) and were significantly on par with one another (Fig.1). Similar observations were reported by [18].

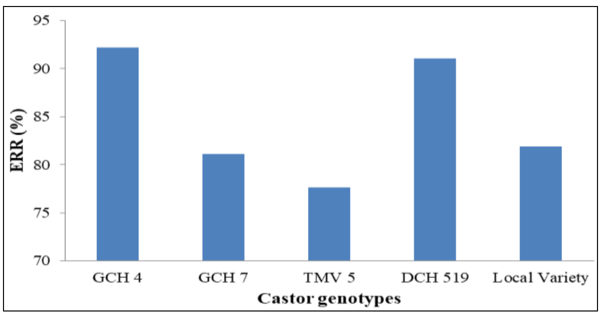

Fig 1: Effect of castor genotypes on Effective Rate of Rearing (ERR %) of C2 breed of eri silkworm

d) Grainage parameters

i) Fecundity

Genotypes did influence the fecundity, it was higher in moths emerged from pupae from worms fed with local castor variety (360) and DCH 519 (352) leaves. Fecundity was lower in moths emerged from cocoons formed by worms nourished with GCH-4 (345) and was on par with moths resulted from pupae formed by worms which received GCH 7 (348). [19] recorded the highest fecundity with DCS-85 (340 eggs) and it was least in GCH-4 (275). [20, 21] those who observed the same in their studies.

ii) Hatchability

Hatching percentage showed significant variation when larvae of eri silkworm were fed on different castor genotypes. Maximum hatchability was obtained when worms were fed on GCH 4 (99.12%) and local castor variety (98.55%) followed by TMV 5 (97.00%) and DCH 519 (96.23%) and lower in eggs laid by moths emerged from pupae of worms nourished with GCH 7 (95.21%). The present results corroborate with the observations of [22, 23] who found variations in grainage traits due to different castor genotypes when used for rearing eri silkworm.

Table 4: Fecundity (nos.) and Hatching (%) of C2 breed of eri silkworm fed with different castor genotypes

Castor genotypes	Fecundity (nos.)	Hatching (%)
GCH 4	345	99.12
GCH 7	348	95.21
TMV 5	329	97.00
DCH 519	352	96.23
Local Variety	360	98.55
SEd	7.386	3.142
CD (0.05%)	15.745	6.698

Conclusion

The present study reveals that of the five castor genotypes, GCH 4 and DCH 519 genotype were superior in all the rearing, cocoon and grainage parameters than the other genotypes except fecundity. So these genotypes could be used as food plants to eri silkworm to maximize cocoon yield and egg production. These castor genotypes can be grown for dual purpose which gives additional returns to eri culture for the resource poor farmers with less fertile lands under rain fed cropping situation. However, there is an enormous scope for ericulture in castor growing areas without hampering castor seed production and it also provides a supportive economy for the small and marginal farmers.

References

1. Singh BK, Das PK. Evaluation on the rearing and grainage performance of eri silkworm *Samia ricini* (Donovan) on Kesseru. In: National Workshop on Eri Food Plants, Guwahati and Oct.11-12. 2006, 122.
2. Neelu Nangia, Jagadish PS, Nageshchandra BK. Evaluation of the volumetric attributes of the eri silkworm reared on various host plants. International Journal of Wild Sikmoth & Silk. 2000; 5:36-38.
3. Devaiah MC, Rajashekhargouda R, Suhas Y, Govindan R. Growth and silk production in *Samia cynthia ricini* Boisdual as fed on four different host plants. Indian Journal of Sericulture. 1985; 24:33-35.
4. Chowdhury SN. Eri Silk Industry. Department of Sericulture and Weaving, Guwahati, Assam, 1982, 177.
5. Devaiah MC, Dayashankar KN. Effect of different host plants on the economic traits of eri silkworm, *Samia cynthia ricini* Biosduval (Lepidoptera: Saturnidae). Proc. Nation. Sem. Silk Res. Dev., Bangalore, 1982, 10-13.
6. Hazarika U, Barah A, Phukan JCD, Benchamin KV. Study on the effect of different food plants and seasons on the larval development and cocoon characters of silkworm *Samia cynthia ricini* Boisduval. Bulletin Indian Academic of Sericulture. 2003; 7(3):77-85.
7. Patil GM, Kulkarni KA, Patil RK, Badiger KS. Performance of eri silkworm, *Samia cynthia ricini* Boisd on different castor genotypes. In: Proceedings of the 3rd International conference on Wild Silkmoths, Bhubaneshwar, India, 1998, 193-195.
8. Dayashankar KN. Performance of eri silkworm, *Samia cynthia ricini* Boisduval on different host plants and economics of rearing on castor under Dharwad conditions. M.Sc. Thesis, University of Agricultural Sciences, Bangalore, 1982, 23-32.
9. Renuka G, Shamitha G. Studies on the economic traits of Eri silkworm, *Samia cynthia ricini*, in relation to seasonal variations, International Journal of Advanced Research. 2014; 2(2):315-322.
10. Prasanna D, Bhargavi G, Manjula. Evaluation of castor varieties based on the performance of eri silkworm, *Samia cynthia ricini*. International Journal of Biological and Pharmaceutical Research. 2013; 4(12):835-839.
11. Mandali R, Lakshmi Narayanamma V. Eri silk worm rearing on different castor genotypes and their economic analysis, An International Journal of Life Science. 2015; 10(2):567-571
12. Prasanna D, Bhargavi GY. Evaluation of different castor genotypes based on rearing performance of ERI silkworm, *Samia cynthia ricini* in Telangana State. International Journal of Entomology Research. 2017; 2(4):64-68.
13. Sarmah MC, Datta RN, Das PK, Benchamin KV. Evaluation of certain castor genotypes for improving ericulture. Indian Journal of Sericulture. 2002; 41:62-63.
14. Chaudhary SN. Effort of food plant species on rearing performance of Seri silkworm *Samia cynthia ricini*. Bulletin Indian Academic of Sericulture. 1979; 5(1):36-39.
15. Sarkar DC. Ericulture in India, Central Silk Board, Bang, 1988, 51.
16. Dookia BR. Varied silk ratio in cocoons of eri silkworm (*Philosamia ricini* Hutt) reared on different castor varieties in Rajasthan. Indian Journal of Sericulture. 1980; 19:10-15.
17. Sannappa B, Jayaramaiah M. Interaction of castor genotypes and breeds of eri silkworm in relation to cocoon and grainage parameters. Mysore Journal of Agricultural Sciences. 1999; 33:214-223.
18. Jayaramaiah M, Sannappa B. Influence of castor genotypes on rearing performance of different eri silkworm breeds. International Journal of Wild Sikmoth & Silk. 2000; 5:29-31.
19. Chandrashekhar S, Govindan R. Studies on the performance of castor genotypes on rearing cocoon of eri silkworm. International Journal of Plant Protection. 2010; 3:219-224.
20. Ramakrishna Naika, Sannappa B, Govindan R. Influence of castor varieties on rearing and grainage performance of different breeds of eri silkworm, *Samia cynthia ricini*.

Journal of Ecobiology. 2003; 15:279-285.

21. Chandrashekhar S, Sannappa B, Manjunath KG, Govindan R. Efficacy of castor genotypes on bio-assay, cocoon and grainage traits of the domesticated vanya silkworm *Samia cynthia ricini* Boisduval. Journal of Pharmacy Research. 2012. 5(3):1346-1349.
22. Govindan R, Sannappa B, Bharathi VP, Singh MP, Hegde DM. Influence of feeding leaves of some castor varieties on rearing performance of eri silkworm, *Samia cynthia ricini* Biosduval. Indian Journal of Environment and Ecoplanning. 2002; 6:485-488.
23. Govindan R, Sannappa B, Bharathi VP, Singh MP, Hegde DM. Evaluation of castor genotypes through bioassay of eri silkworm rearing for cocoon and grainage traits. Natl Sem. Sustainable Seric., 1-2 February, 2003 Society for Eco-Sustainable Development, Lucknow, 2003, 96.