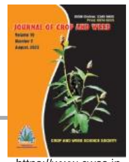
Journal of Crop and Weed, 19(2): 113-119 (2023)
ISSN- O : 2349 9400 ; P : 0974 6315



https://www.cwss.in
www.cropandweed.com

Studies on impact of different castor varieties and hybrid on growth and economic parameters of eri silkworm *Samia cynthia ricini*

***D. ELUMALAI, [1]INDIRA KUMAR K. AND [2]P. MOHAN RAJ**

Department of Agricultural Entomology, Adhiyamaan College of Agriculture and Research, Athimugam- 635 105, Krishnagiri District, Tamil Nadu, India, [1]P4 Unit, Muga Eri silkworm Seed Organization, Central Silk Board, Tura, Meghalaya, [2]Department of Sericulture, Forest College and Research Institute, Mettupalayam

Received : 16.04.2023 ; Revised : 05.06.2023 ; Accepted : 15.06.2023

DOI : https://doi.org/10.22271/09746315.2023.v19.i2.1711

ABSTRACT

The study was conducted at Adhiyamaan College of Agriculture and Research, Athimugam, Krishnagiri District, Tamil Nadu to understand the effect of some castor cultivars on eri silkworm's growth and other economic parameters. The Eri silkworm were reared in indoor condition on different Varieties/Hybrids of castor viz., YRCH 1, YRCH 2, GAUCH Red, GAUCH Black, YTP 1 and Local variety. Shortest life cycle was observed in Eri Silkworms fed with GAUCH Red (45.89 days) and followed by GAUCH Black (46.03 days). The highest Cocoon weight (3.10g / cocoon), pupal weight (2.68g /pupa) were recorded GAUCH Red and GAUCH Black and also shell ratio (14.08%) was contained highest in batches of silkworm fed by genotype of YTP 1. Apart from that, fecundity (349.33 no./ moth) and hatchability (94.55%) was highest in GAUCH Black. Rate of pupation and Effective Rate Rearing (ERR) were not influenced by the castor genotypes. Therefore, it can be concluded that GAUCH Red and GAUCH Black were superior which are highly suitable for Eri culture followed by YRCH 1 and YRCH 2 which are moderately suitable for rearing.

***Keyword*:** Castor, eri silkworm, economic parameter, varieties/ hybrid

Sericulture industry has been providing sustainable income for different strata of people in the rural society including the landless. Sericulture has a strong traditional and culture bound domestic market of silk in India. Mulberry silk is produced in traditional states viz. Karnataka, Tamil Nadu, Andhra Pradesh, West Bengal and Jammu Kashmir, while the non-mulberry silks are produced in states like Orissa, Jharkhand, Chhattisgarh and north-eastern regions. India holds the monopoly on producing the Muga silk (Phukon, 1983; Bhattacharya *et al*., 2006). The mulberry silkworm (*Bombyx mori* L.) is very delicate, highly sensitive to environmental fluctuations and unable to survive extreme natural fluctuation in temperature and humidity. Many mulberry growers are leaving the mulberry sericulture industries due to infection of milky diseases on silkworm larvae which wiped the entire batches. So, as an alternative to eri silkworm rearing is being practiced in Northern parts of India. Further, the industry has the advantage of rich natural resources such as food plants (Sarmah *et al.,* 2015) and tribal man power. It is domesticated and multivoltine orientated (Chakravorthy and Neog, 2006; Singh and Das, 2006) eri silkworm can be reared on throughout the year about 5 to 6 times and reared in indoor conditions (Joshi, 1992). Eri silkworm larva feed only the castor leaves. Unlike Mulberry silkworm, Eri silkworm is highly resistant to high temperature and humidity and moreover, it is resistant to pest and diseases. The eri silk cloth is having more demand in many temples as it involves no killing of insects. The eri pupae are contains 55-60 per cent protein; 25-30 percent of lipids is more nutritional and in great demand as food in tribal concentrated areas (Singh *et al.,* 2017). Hence, better growth of Eri silkworm larvae, pupae, silk and getting significant quality of eri cocoons determining on superior quality of castor leaves is vital role. Therefore, this study carried out to screening and identifying suitable castor genotype for production of silk.

MATERIALS AND METHODS

The present study on growth and economic parameters of *Samia cynthia ricini* for enhancement of eri silk production was carried out under the laboratory condition during 2021-22 at Entomology laboratory, Adhiyamaan College of Agriculture and Research, Athimugam. The suitable castor seeds of YTP1, YRCH1, YRCH2, GAUCHI Red, GAUCHI Black and

**Email: elu8032@gmail.com*

How to cite : Elumalai, D., Indra kumar, K. and Mohan Raj, P. 2023. Studies on impact of different castor varieties and hybrid on growth and economic parameters of eri silkworm, *Samia cynthia ricini*. *J. Crop and Weed,* 19(2): 113-119.

a Local variety were procured from Tapioca and Castor Research Station, Salem and P2 Eri silkworm Seed Production Centre, Central Silk Board, Hosur, Krishnagiri District, Tamil Nadu. Castor varieties were grown at ACAR farm and intercultural operation such as weeding, irrigation, fertilizer application and others were done as per recommendation. The pebrine disease free laying of eri silkworm egg was brought from P2 Eri silkworm seed production centre, CSRGC, Central Silk Board, Hosur, Krishnagiri District, Tamil Nadu. The silkworm rearing room was well disinfected and cleaned thoroughly with two per cent formalin and Bleaching powder. The eri silkworm commercial race can produce on white cocoon was used for the study. Tray method was followed for eri silkworm rearing. After two hours of hatching, the larvae were provide with soft and tender leaves of castor genotype under each tender leaves of castor genotype under each replication separate and transfer to the silkworm rearing trays. Evaluations were started from first instar larvae to the end of larval period. Soft leaves were fed to two times at day until third instar and semi tender and mature leaves were fed to three times for silkworm at the fourth and fifth instar stages. Eri silkworms rearing were conduct on YTP1, YRCH1, YRCH2, Gauchi (Red & Black) and Local variety. Eri larvae were fed two times during first instar. Three time during second and third instar. Four time during fourth and fifth instar. Bed disinfects namely Vijetha powder and Ankush was used to prevent various diseases of eri silkworm larvae. The present study host plants are feed to silkworm larvae to evaluate the economic parameters of ericulture. The statistical tools used for AGRES software to evaluate on the present study.

RESULTS AND DISCUSSION

The result was revealed that, current study endeavor on the growth and parameters of eri silkworm and its host exploitation for enhanced silk production. The final result is presented here under.

Evaluation of castor genotype

Eri silkworm larval duration

The eri silkworm was reared in indoor condition. The result showed that there is significant difference to the larvae duration and short duration on leaves of different castor varieties/hybrids (Fig.1). Short duration was reported in GAUCH Red, GAUCH Black (3.03 & 3.04 days) for first instar. Second instar larval duration was reported in GAUCH Red, GAUCH Black (3.04 & 3.03 days). Third, fourth and fifth instar larval duration were reported to be shorter in GAUCH Red, GAUCH Black and followed by YRCH1, YRCH2. GAUCH Red, GAUCH Black, YRCH1 and YRCH2 are better for rearing eri silkworm due to the nutritional content. For the study results are check with that of Sachan and Bajpai (1973). Above results are check with that of Sachan and Bajpai (1973) and Basaiah (1988). Even so Jayaramaiah and Sannappa *et al.* (2007) Jayaramaiah and Sannappa (2002a) and Sannappa *et al.* (2007) recored difference in the larval duration when eri silkworm were fed with leaves of various castor cultivars. Narayanamma *et al.* (2013) reported duration of 19.6, 20.0, 22.2, 22.3 and 22.6 days on GCH-4, Kuran, Haritha, Kranthi and control respectively. The current study very near in line with the report of Rajesh Kumar and Gangavar (2010), which observed minimum eri silkworm larval duration on castor (20 days), subsequently Cassava (21.12 days), barera (22 days) and papaya (24 days).

Impact of castor genotypes on different stages of eri silkworm larvae

The result revealed that, there is no significant different in egg period of eri silkworm for the castor genotypes. Duration period of eri egg, larval, pupal and adult is lowest recorded in the GAUCH Red, GAUCH Black and followed by YRCH1 and YRCH2. Result showed that, the total life cycle period *Samia cynthia ricini* on diverse genotype of castor from 45.89 to 54.27 days. Short life cycle period exhibited genotype of GAUCH Red, GAUCH Black followed by YRCH1 and YRCH2. Highest life cycle period expressed genotype of YRCH1 and YRCH2. The current experiments on par with studies of Manjunath Naik *et al*. (2010), who reported minimum total life cycle of 47.67 days on castor could on par with carrot (48.96 days) subsequently by fountain tree (53.05 days), banyan tree (54.25 days) and Indian almond (54.50 days) Thangavelu and Barah (1985) reported that the eri silkworm is influenced by the seasons and further recorded the duration of 45.00 days during summer and 50.00 days during winter. But eri silkworm completed life cycle in different host pants fed on castor, tapioca, red plumeria and excels in 46.49, 63.15, 61.73 and 72.06 days respectively (Reddy *et al.*, 1989). The variation in the total duration might be due to agro-climatic conditions, quantity and quality of different host plant leaves provided to eri silkworm larva for rearing (Fig. 2).

Larval weight (g)

Eri larvae fed on leaves of castor genotypes showed that significance variation in 10 day and mature larval weight (before spinning) where maximum mature larval weight was recorded in GAUCH red (10.20g) followed by YRCH-1(9.94 g), YRCH-2 (9.90g) and GAUCH black (9.89 g). Other genotypes were exhibited on mature larval weight ranged from 8.52 (YTP-1) to 8.20 g (Local variety) (Fig. 4.3). Narayanamma *et al.* (2013), who recorded mature larval weights of 4.69g, 4.48g 4.49

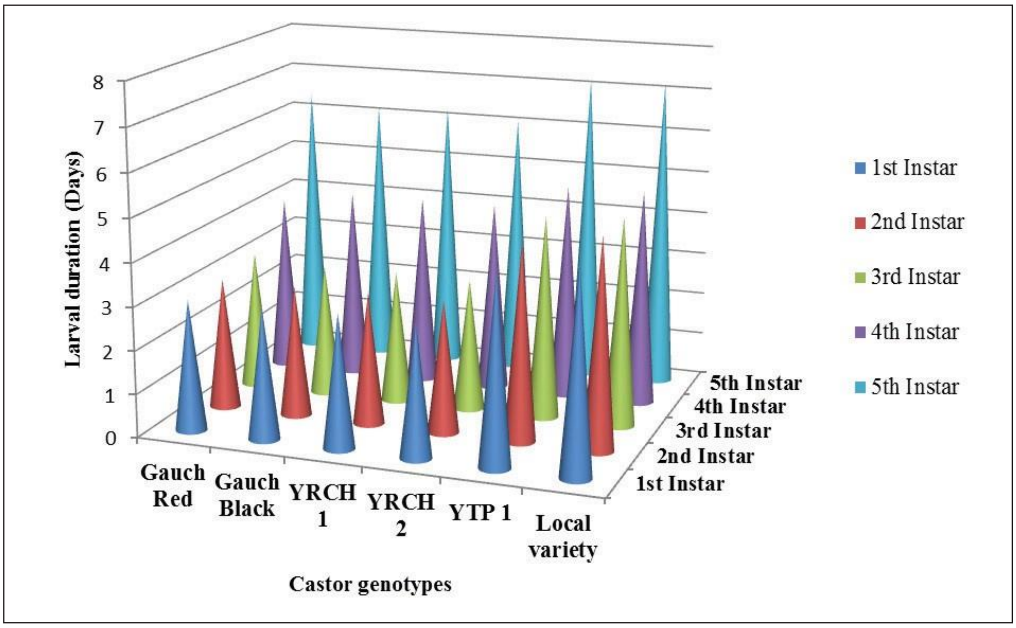


Fig. 1: Impact of castor genotypes on instar wise duration of eri silkworm larvae

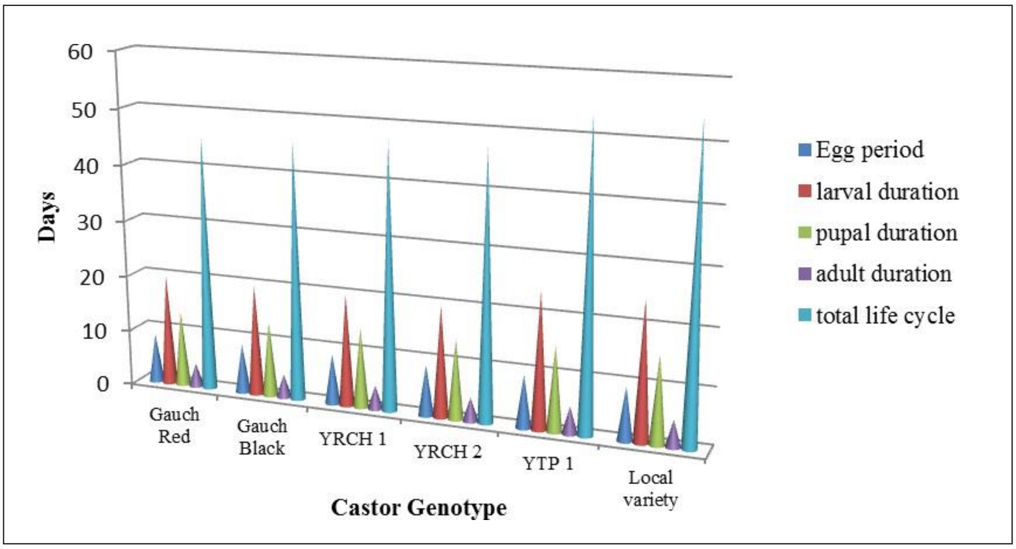


Fig. 2: Impact of castor genotypes on different sages of eri silkworm

g 4.25g larva on PCH-111, Haritha, GCH-4 and Kranthi respectively. Similar observations were made by Sachan and Bajpai (1973), Dookta (1980), Sarmah *et al*. (2002) and Ramakrishna Naika *et al.* (2003) who observed difference in the larval weight when eri larvae were fed with leaves of different castor cultivars. The variation noticed in the larval weight of eri silkworms reared on different cultivars of castor might be attributed to the composition of foliar nutrients of the cultivars.

Cocoon weight (g)

Cocoon weight was superior recorded by the castor genotype by the castor genotypes where maximum eri cocoon weight of 3.10 g cocoon was noticed in GAUCH Red followed by GAUCH Black (3.05 g), YRCH 2 (2.95 g cocoon) and YRCH 1 (2.90 g cocoon). Other castor genotypes recorded least cocoon weight in YTP 1 and Local variety.

Present results can be compared with Swathiga *et al* (2019) who recorded maximum cocoon weight of 3.44

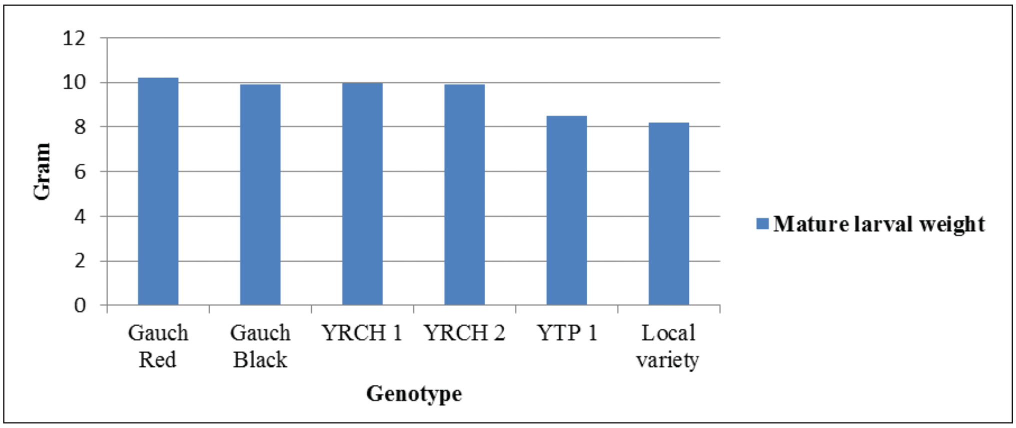


Fig. 3: Impact of castor genotypes on different stages of eri silkworm

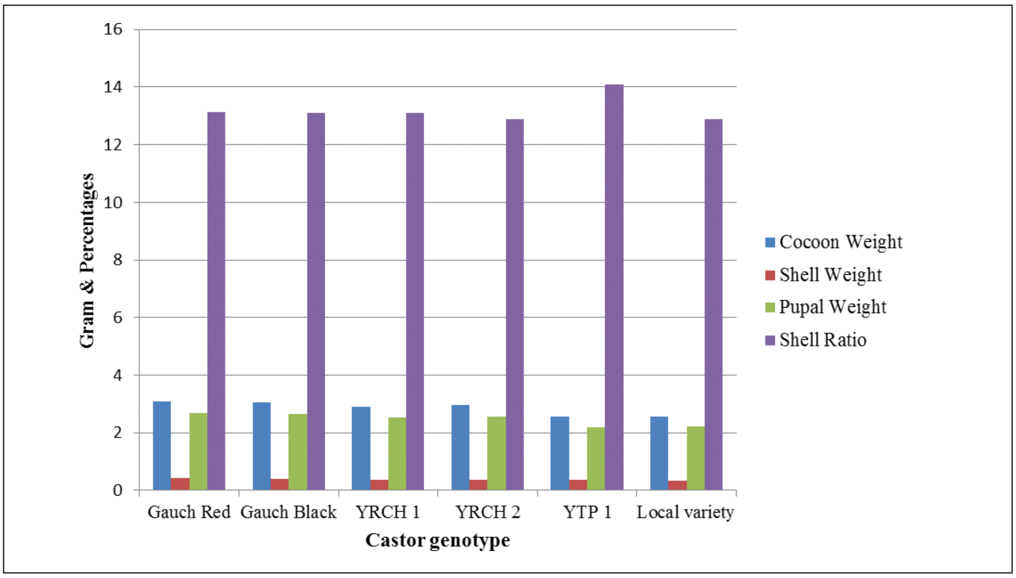


Fig. 4: Impact of feeding castor genotypes on cocoon parameters of eri silkworm

g, 3.21 3.14 g on GCH-4, TMV 5 and GCH-7 respectively. Similarly Devaiah and Dayashankar (1982) recorded maximum cocoon weight of 2.42 g on castor. However, Patil (2004) reported lowest cocoon weight on local castor (1.98 g) compared to highest (2.36 g) on champaca. The difference might be due to the impact of nutrient as correlated by the castor genotypes (Fig. 4).

Shell weight (g)

Significant differences were evidently to the shell weight among the castor genotypes, where highest reported in GAUCH Red genotype (0.42 g shell) followed by GAUCH Black (0.40 g). The substitute genotypes were YRCH 1 (0.38 g shell) and YRCH 2 (0.38g shell), were similar with each other and minimum shell weight was recorded in YTP1(0.36 g/shell) and Local variety (0.33 g/shell) (Fig. 4). Similar results were reported by Swathiga *et al*. (2019) with shell weight of 0.36 g and 0:34 g on GCH7 and TMVS castor genotypes. Sannappa and Jayaramaiah (1999) pointed that the shell weight differed with the type of host plants provided at the larval stage where shell weight of 0.37 g and 0.21 g was recorded in cocoons formed by the worms fed on castor and red plumeria, respectively. The experiments showed that, comparable with the report of Reddy *et al.* (1989) who recorded the maximum shell weight of 0.38g of castor followed by 0.33 g on Tapioca, 0.32 g on Excelsa and 0.26 g of red plumeria leaves. Kumar *et al.* (1993) reported the maximum single weight of 0.52 g on castor and 0.45 g of kesseru (Fig. 4).

Table 1: Impact of feeding castor genotypes on different stages of eri silkworm

S No	Treatments	Pupation rates (%)	Effective rate of rearing (%)	Fecundity (No.)	Sex ratio	Hatchability (%)
1	GAUCH Red	92.72	90.00	345.20	1.1	94.02
2	GAUCH Black	88.88	90.00	349.33	1:2	94.55
3	YRCH 1	87.03	88.33	337.79	1.1	91.98
4	YRCH 2	86.73	86.66	335.43	1.1	91.64
5	YTP 1	83.33	88.33	322.34	1.1	92.85
6	Local variety	85.18	85.00	314.66	1.1	92.35
	Agress	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**
	CD at 0.05%	**0.1416**	**2.1790**	**0.0305**		**0.0297**
	SD	**0.0650**	**1.0001**	**0.0140**		**0.0136**

Pupal weight (g)

Castor genotypes fed to the worms showed considerable influence on the pupal weight and significantly highest pupal weight was obtained when larvae were fed with Gauch Red (2.68 g), followed by Gauch Black (2.65 g). In the second time was pupae formed when the worms fed on YRCH 2 (2.57) followed by YRCH 1 (2.52 g) The worms fed on Local variety and YTP 1 recorded pupae with light weight of 2.23g and 2.20 g respectively (Fig 4.). Present study results are compatible with the earlier report of Devaiah and Dhayashankar (1982) who suggested that the pupal weight based on the type of hosts provided for the worms where highest single pupal weight of 2.153 g was recorded on castor and lowest on red pumeris (1.403 g).

Shell ratio (%)

Castor genotypes showed exhibited variation in respect of shell ratio where highest shell ratio was recorded on YTP 1 (14.08 %). Other castor genotypes recorded shell ratio of 13.12% on Gauch Red , 13.11 % on Gauch Black, followed by 12.89 % on Local variety, However, minimum shell ratio of 13.10% per cent recorded on YRCH 1 followed by YRCH 2 with 12.88 % (Fig 4). Similarly, Govindhan *et al.* (2002) and Narayananým *et al.* (2013) recorded maximum shell ratio of 12.66% on castor and 13.1. 12.7 and 11.8 % on Haritha, Kranthi and Kiran respectively Similar results are also reported by Manjunathnaik *et al* (2010), who obtained the highest shell ratio on castor (12.75%) followed by fountain tree (12.64%), banyan tree (11.97%). (Fig 4.).

Rate of Pupation (%)

No significant variation was recorded between the castor genotypes with respect to rate of pupation. However, rate of pupation ranged between 83 to 92 per cent (Table 4.5). Similarly Narayanamma *et al.* (2013) recorded rate of pupation 95 to 98 per cent rate of pupation Haritha, Kranthi, PCH-222, Kiran, GCH-4 and PCH-111 (Table 1).

Fecundity

Fecundity of the moths emerged from worms fed on various castor genotypes showed significant variation. Highest number of eggs 349.33 were laid by the female fed on GAUCH Red followed by GAUCH Red (345.2), YRCH 1 (337.79), YRCH 2 (335.43). However it was lowest in the moth emerged from cocoons fromed by worms fed with YTP 1 (322.34) and Local variety (314.36) (Table 1).

Present study findings are compared with the observations of Narayanamma *et al.* (2013) who reported fecundity on Kiran (303.9), PCH-111 (3128), PCH-222 (263.3), GCH-4 (2521) genotypes. Daya shankar (1982) and Rao (1986) also recorded the fecundity of 319.2 and 340.1 eggs on castor. Similar studies made by Manjunath naik *et al*. (2010), reported the highest fecundity of 339.50 eggs on castor followed by fountain tree (329.5), banyan tree (307.5) Indian almond (291.0) and carrot (272.50) are also comparable to the results obtained. According to Chandra shekhar and Govindan (2010) recorded highest fecundity with DCS-85 (340 eggs) and least with GCK-4 (275) (Table 1).

Hatchability (%)

Significance variation were showed that with regard to the hatchability of eri eggs which was high in eggs when worms were fed on Gauch Black (94.55%), which was followed by GAUCH Red (94.02%), YTP 1 (92.85 %) and Local variety (92.35 %). The worms fed on YRCH 1 and YRCH 2 recorded hatchability of 91.98 and 91.64 per cent respectively (Table 1.). Similar results were observed by Devaiah *et al.* (1978) who reveled that, hatching percentage up to 97.00 per cent under the climatic condition. Ravishankar *et al* (2000) reported 98.40 percent during September –October.

Ramakrishna naika *et al.* (2003) reported highest eri egg hatching per centage on breeds that were crossed with local white plain (99.31 and same as reported on local x white semi-zebra breed (99.31). parallel results were reported by Manjunathnaik *et al.* (2010) who noticed maximum hatchability of 95.18 and 96.75 per cent on castor. The variation in the hatchability which might be due to varying in the environmental condition at the various regions and quality of host leaves fed to the larvae (Table 1).

CONCLUSION

It is concluded that, the study among the several genotype of castor GAUCH Red and GAUCH Black are most suited for rearing of silkworm followed by YRACH 1 and YRCH2. These varieties better performance with respect to growth and economic parameters *viz.*, cocoon weight, shell weight, shell ratio and others. Hence, eri silkworm is highly suitable for marginal and small land holders.

ACKNOWLEDGEMENT

Grateful to the Division of Plant Protection, Adhiyamaan College of Agriculture and Research, Athimugam, Krishnagiri District, Tamil Nadu for the providing mandatory facilities and support for completing the research work.

REFERENCES

Basaiah, J. M. M. 1988. Consumption and utilization of castor and tapioca by the eri silkworm, M.Sc (Seri.) thesis, UAS, Bangalor.119.

Bhattacharya, A., Bindroo, B.B and Chakravorty, R. 2006. Additional use of food plants of eri silkworm leeds paper and Abstract of National Workshop on eri food plants. Held at Guwahati, 11th - 12th October.

Chandrashekhar, S. and Govindan, R. 2010. Studies on the performance of castor genotype on rearing cocoon of eri silkworm. *Int. J. Plant Prot.*, **3**(2): 219-224.

Dayashankar, K.N.1982. Performance of eri silkworm on different host plant and economics of rearing on castor under Dharwad conditions. M.Sc (Agri.) Thesis, UAS, Dharwad.

Devaiah, M. C., Rajashekar, Gouda, R., Yelshetty, S. and Govindan, R. 1985. "Growth and Silk Production in *Samiya cynthia ricini* Boisduval (Lepidoptera: Saturniidae) Fed on Four Different Host Plants". *Indian J. Sericulture.,* **24**: 33-35.

Devaiah, M.C and Dayashankar, K.N. 1982. Effect of different host plants on the economic traits of eri silkworm, *Samia cynthia ricini* Boisduval (Lepidoptera: Saturniidae), National seminar silk research development, CSB, March 10-13, Bangalore Abst. 152.

Devaiah, M.C., Govindhan, R. and Rangaswamy, H.R. 1978. Performance of Eri silkworm, Philosamia ricini on castor leaves under Karnataka condition. All India Symposium. Sericulture Science, Banglore.pp:48.

Dookia, B. R. 1980. "Varied Silk Ratio in Cocoons of Eri Silkworm (*Philosamia ricini* Hutt.) Reared on Different Castor Varieties in Rajasthan". *Indian J. Sericulture.,* **19**: 3840.

Govindhan, R., Sannappa, B., Bharathi, V.P., Singh, M.P. and Hegde, D.M. 2002. Influence of feeding leaves of some castor varieties on rearing performance of eri silkworm, *Samia cynthia ricini*. *Indian J. Environ. Ecoplan*, **6**: 485-488.

Jayaramiah, M. and Sannappa, B. 2000. Influence of castor genotype on rearing performance of different eri silkworm breeds. *Int. J. Wild Silk moth & Silk*, **5**: 29-31.

Kumar, R., Gargi, Prasad, D. N. and Saha, L .M. 1993. "A Note on Secondary Food Plants of Eri Silkworm**",** *Indian Silk,* Vol. 31, No. 9,8 pp. 20-21.

Manjunatha, Naik,C., Patil, G.M., Murthy, C., Awaknavar, J, S., Shenkharappa and Alagundagi, S, C. 2010. Development and Economic cocoon parameters of eri silkworm *Samia cynthia ricini* as influenced by new hosts. *Karnataka J. Agric. Sci.,* **23**(5): 716-721.

Naik, C. M., Patil, G. M., Murthy, C., Awaknavar, J. S., Shekharappa and Alagundagi, S. C. 2010. Development and economic cocoon parameters of eri silkworm *Samia ricini* Boisduval (Lepidoptera: Saturniidae) as influenced by new hosts. *Karnataka J. Agric. Sci.*, **23**(5): 716-721.

Narayanamma, V. L., Reddy, K,D. and Reddy, A. V. 2013. Castor genotype on rearing and cocoon parameters of eri silkworm, *Samia cynthia ricini*.

Patil, G. M. 2004. New tree hosts of eri silkworm *Samia cynthia ricini*, CSRTI, Mysore- Golden Jubilees conference, p. 159.

Phukon, J.C.D. 1983. Food preference of eri silkworm *Philosamia ricini* (Lepidoptera: Saturniidae) *Entomon.* **8**: 311-316.

Ramakrishna Naika, Sannappa, B., Govindan, R. 2003. Influence of castor varieties on rearing and grainage performance of different breeds of eri silkworm, *Samia cynthia ricini* (Lepidoptera: Saturnidae), *J. Ecol*.**15** (4): 279-285.

Ravisahankar, H.M., Reddy, D.N.R., Reddy, R.N. and Baruah, A.M. 2000. Evaluation of different methods of application of castor leaves to eri silkworm in relation to cocoon and egg production. *Int. J. Wild Silk moth,* **5**: 118-121.

Reddy, D. N. R., Kotikal, Y. K. and Vijayendra, M. 1989. "Development and Silk Yield of Eri Silkworm, *Samia cynthia ricini* (Lepidoptera: Saturnidae) as Influenced by the Food Plants", *Mysore J. Agric. Sci.,* **23**:506-508.

Sachan, J. N. and Bajpai, S. P. 1973a. "Response of Castor (*Ricinus communis* L.) Varieties on Growth and Silk Production of Eri Silkworm *Philosamia ricini* Hutt. (Lepidoptera: Saturniidae)", *Annual Arid Zone,* Vol. 11, pp. 112-115.

Sachan, J. N. and Bajpai, S. P. 1973a. "Response of Castor (*Ricinus communis* L.) Varieties on Growth and Silk Production of Eri Silkworm *Philosamia ricini* Hutt. (Lepidoptera: Saturniidae)", *Ann. Arid Zone,* **11**:112-115.

Sannappa, B. and Jayaramaiah, M.1999. Interaction of castor genotype and breeds of eri silkworm in relation to cocoon and grainage parameters. *Mysore J. Agric. Sci.,* **3**: 157-161.

Sannappa, B. 2007. Evaluation of castor genotypes for ericulture, M.Sc (Seri.) Thesis, UAS, Bangalore. 167.

Sarmah, M.C., Datta, R.N., Das, P.K and Benchamin, K.V. 2002. Evaluation of castor genotype for improving ericulture. *Indian J. Sericulture,* **41**: 62-63.

Sarmah, M.C., Sarkar, B. N., Ahmed, S. A. and Giridhar, K. 2015. Performance of C2 breeds of eri silkworm, *Samia ricini* (Donovan) in different food plants. *Entomol. Appl. Sci. Lett.,* **2**(1): 47-49.

Singh, B., Kumar, R., Ahmed, S. and Pathania, P. 2017. Diversity and their clarification on species of genus Samia (Lepidoptera: Saturniidae) in India and their prospects for utilization. *J. Insect Sci.,* **30** (1): 43.52.

Thangavelu, K. and Barah, A. 1985. Ericulture In: Lecture on Sericulture. Suramya Publishers, Bangalore. 135-137.