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**RESEARCH ARTICLE**

# Studies on the economic traits of Eri silkworm, *Samia cynthia ricini*, in relation to seasonal variations

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## *Abstract*

The Eri silkworm, *Samia cynthia ricini* is a non-mulberry, domesticated, multivoltine insect, producing spun silk. It is mostly found in Assam and Meghalaya, spreading to non-traditional states like Bihar, West-Bengal, Orissa, Tamil-Nadu, Kerala, Karnataka and Andhra Pradesh. The present studies has been done by tray rearing method, spreading castor leaves over the worms in wooden trays. Of late, Ericulture is spreading to non-traditional states, owing to the availability and suitability of high yielding castor varieties. The present study is focused on economically important cocoon and post cocoon characteristics of eri silkworms reared in different seasons. The studies revealed that post cocoon parameters were highest during winter with occasional variations providing an insight into the physiological strategy of survival adopted by this silkworm species during winter (18 °– 28°C). 

## Introduction

The genus *Samia* contains 19 species from tropical and temperate eastern Asia (Naumann and Peigler, 2001; Peigler and Naumann, 2003), while Arora and Gupta (1979) reported *S. cynthia* with several sub species from India including *ricini.* The eri silkworm *Samia ricini* (Donovan) is a polyphagous and multivoltine insect and 5-6 crops can be raised in a year (Choudhury, 1982). The larvae feed on various host plants of which castor (*Ricinus communis* L.,) and kesseru (Heteropanax fragrans Seem.) are the primary food plants and the other important host plants include Payam (*Evodia flaxinifolia Hook*.), Tapioca (*Manihot utilissima Phol*.) and Barpat (*Ailanthus grandis Roxb*).

The Eri silkworm, *Samia cynthia ricini* is a multi-voltine, domestic moth, reared completely in an indoor environment, and it is a non-mulberry worm, producing spun silk mostly found in North-east especially Assam and Meghalaya. The primary host plants are Castor (*Ricinus communis*) and Papaya (*Carico papaya*) Jatropa and Tapioca being the secondary host plants. Ericulture has a great potential to grow into a big industry if meticulous planning and strategies are adopted. The present study, undertaken in order to exploit the growing awareness and demand for Eri silk, is based on evaluating the metabolic activity of eri silkworm during different seasons.

The Eri silkworm undergoes complete metamorphosis like other Lepidopterans and has four stages egg, larva, pupa and adult. It completes 5-6 life cycles in a year. The environmental factors play a major role in Eri silk production. Since eri worms are quite delicate and sensitive to environmental conditions the prospect of obtaining silk production depends more on the food or host plant nutrition. In silkworms, the protein synthetic activity of the body wall and the midgut decreased when the larvae began to moult and increased again from the midstage to moulting period (Nagota, 1976). Like all other animals, growth and development in insects is associated with protein metabolism (Man Singh and Baquaya, 1971).

Most of the literature available on Eri silkworm, *Samia cynthia ricini* is based on the comparative studies on the effect of castor food plants on the rearing performance, biochemical analysis and seasonal variations. A study on the worms fed with castor leaves were found to possess predominantly higher content of the metabolites followed

by jatropa and papaya (Vittal Rao, 2004). In the present study, the cocoon characteristics like Cocoon weight, Pupal weight, Shell weight and Shell ratio.

## Material and methods:

The rearing of Eri silkworm in a convenient, equipped rearing room with adequate ventilation, on freshly collected castor leaves from plantation raised (*Ricinus communis)* during the summer (Feb-March), rainy (July-Aug) and winter (Nov –Dec) seasons at Kakatiya University, Warangal, under normal temperature and humidity, by recording climatological influences on the life span of eri silkworm during 2009-2011. Castor, a crop of the tropics, is one of the major oil seed crops of India are generally grown on sandy or clayey red loams and also good light alluvial loams. The castor crop can withstand drought heavy rains and floods and also slightly acidic soil conditions but not alkaline and water logged soils. The agricultural operations like weeding, irrigation, cultivation have been done from time to time. The rearing site was also cleared off weeds to avoid pests.

The rearing was done by tray rearing method in which the eri silkworms were reared in wooden trays. A paraffin paper of tray size was used to cover over the beds in the early stages. During the first three instars, care was taken to feed the worms with tender leaves, while late instar worms were fed with mature leaves (top most leaves of stem). The optimum temperature and relative humidity under which Eri silkworm thrive the best are 25° - 28 °C and 80 – 90 % respectively and were maintained in the laboratory (Fig 1).

**Shell Ratio (%):**

The shell ratio is calculated by the following formula

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

**EFFECTIVE RATE OF REARING**::

$$\text{ERR by Number} = \frac{\text{Total number of cocoons produced}}{\text{Total number of larvae brushed}} \times 100$$

## Results

The morphological characteristics of the eri silkworm *Samia cynthia ricini* were observed during the rearing period: the color of the egg shell was white with a cream colored yolk; body colour varied from yellow/cream/blue/green with weak and thorny skin; white flossy cocoons without peduncle, enclosing a brown coloured pupa and chocolate colored wings in the moth (Fig 2 and Table 1).

The seasonal and instar wise total average larval length and its standard deviation of Eri silkworm, *Samia cynthia ricini*, in winter, rainy and summer seasons of 2009 were1.12 ± 0.25(S. D), 1.9 ± 0.25(S. D), 3.4 ± 0.35(S. D), 4.84 ± 0.53(S. D) and 7.34 ± 0.24(S. D); 1.04 ± 0.25(S. D), 1.44 ± 0.05(S. D), 2.42 ± 0.45(S. D), 4.2 ± 0.5(S. D) and 7.08 ± 0.27(S. D); 0.76 ± 0.11(S. D), 1.62 ± 0.28(S. D), 2.6 ± 0.29(S. D), 4.32 ± 0.19(S. D) and 6.62 ± 0.72(S. D) of I, II, III, IV and V instar respectively .

The seasonal and instar wise total average larval length and its standard deviation of Eri silkworm, *Samia cynthia ricini*, in winter, rainy and summer seasons of 2010 were 1.3 ± 0.1(S. D), 2.5 ± 0.41(S. D), 4.84 ± 0.58(S. D), 6.02 ± 0.277 (S. D) and 7.62 ± 0.39(S. D) ; 1.2 ± 0.18(S. D), 1.43 ± 0.07(S. D), 2.42 ± 0.39(S. D), 4.26 ± 0.29(S. D) and 7.18 ± 0.28(S. D); 0.92 ± 0.19(S. D), 1.9 ± 0.22(S. D), 3.02 ± 0.30(S. D), 4.5 ± 0.38(S. D) and 6.54 ± 0.62(S. D) of I, II, III, IV and V instar respectively .

The seasonal and instar wise total average larval length and its standard deviation of Eri silkworm, *Samia cynthia ricini*, in winter, rainy and summer seasons of 2011 were1.02 ± 0.311(S. D), 2.02 ± 0.25(S. D), 3.2 ± 0.33(S. D), 4.92 ± 0.35(S. D) and 7.8 ± 0.33(S. D); 1.24 ± 0.20(S. D), 1.38 ± 0.03(S. D), 2.3 ± 0.25(S. D), 4.1 ±

0.44(S. D) and 7.2 ± 0.25(S. D); 1.66 ± 0.75(S. D), 2.06 ± 0.56(S. D), 3.74 ± 0.24(S. D), 5.08 ± 0.53(S. D) and 6.88 ± 0.13(S. D) of I, II, III, IV and V instar respectively ( Table 2).

The seasonal and instar wise total average larval weight and its standard deviation of Eri silkworm, *Samia cynthia ricini*, in winter, rainy and summer seasons of 2009 were 0.0062 ±0.006(S. D), 0.070 ± 0.010(S. D), 1.24 ± 0.14(S. D), 4.84 ± 0.76(S. D) and 7.74 ± 1.64(S. D); 0.0057 ±0.0008(S. D), 0.047 ±0.002(S. D), 0.069 ± 0.002(S. D), 1.09 ± 0.14(S. D) and 4.84 ± 0.73(S. D); 0.0054 ± 0.0031(S. D), 0.039 ± 0.010(S. D), 0.061 ± 0.003(S. D), 0.92 ± 0.233(S. D) and 3.43 ± 0.95(S. D) of I, II, III, IV and V instar respectively .

The seasonal and instar wise total average larval weight and its standard deviation of Eri silkworm, *Samia cynthia ricini*, in winter, rainy and summer seasons of 2010 were 0.0059 ± 0.006(S. D), 0.065 ± 0.011(S. D), 0.098 ±0.0007(S. D), 1.19 ± 0.04(S. D), 5.53 ± 0.22(S. D); 0.0051 ± 0.0005(S. D), 0.045 ± 0.002(S. D), 0.060 ± 0.003(S. D), 0.97 ± 0.14(S. D), 4.60 ± 0.72(S. D); 0.0045 ± 0.0034(S. D), 0.043 ± 0.010(S. D), 0.050 ± 0.003(S. D), 0.96 ± 0.06(S. D) and 3.67 ± 0.25(S. D) of I, II, III, IV and V instar .

The seasonal and instar wise total average larval weight and its standard deviation of Eri silkworm, *Samia cynthia ricini*, in winter, rainy and summer seasons of 2011 were 0.0064 ± 0.0065(S. D), 0.063 ± 0.008(S. D), 0.096 ± 0.003(S. D), 2.57 ± 0.79(S. D) and 5.64 ± 0.36(S. D); 0.0052 ± 0.0005(S. D), 0.049 ± 0.002(S. D), 0.064 ± 0.004(S. D), 1.12 ± 0.07(S. D) and 4.74 ± 0.85(S. D); 0.0045 ± 0.003(S. D), 0.043 ± 0.014(S. D), 0.054 ± 0.004(S. D), 0.99 ± 0.049(S. D) and 3.69 ± 0.26(S. D) of I, II, III, IV and V instar respectively ( Table 3).

The season – wise post-cocoon characters of Eri silkworm, *Samia cynthia ricini* during the winter, rainy and summer seasons of 2009 includes cocoon weight(gr), Pupal weight(gr), shell weight(gr) and shell ratio(%) were 3.98 ± 0.008(S. D.), 3.40 ± 0.004(S. D.), 0.58 ± 0.007(S. D.), 14.56 %; 3.57 ± 0.04(S. D.), 3.08 ± 0.04(S. D.), 0.49 ± 0.01(S. D.), 13.75 %, 3.37 ± 0.03(S. D.), 2.93 ± 0.04(S. D.), 0.43 ±0.02(S. D.), 12.86 % of cocoon weight(gr), Pupal weight(gr), shell weight(gr) and shell ratio(%) respectively .

The season – wise post-cocoon characters of Eri silkworm, *Samia cynthia ricini* during the winter, rainy and summer seasons of 2010 includes cocoon weight(gr), Pupal weight(gr), shell weight(gr) and shell ratio(%) were3.93 ± 0.01(S. D.), 3.36 ± 0.008(S. D.), 0.56 ± 0.02(S. D.), 14.34 %; 3.55 ± 0.05(S. D.), 3.04 ± 0.04(S. D.), 0.49 ± 0.01(S. D.), 14.01 %; 3.31 ± 0.02(S. D.), 2.83 ± 0.01(S. D.), 0.45 ± 0.01(S. D.), 13.89 % of cocoon weight(gr), Pupal weight(gr), shell weight(gr) and shell ratio(%) respectively.

The season – wise post-cocoon characters of Eri silkworm, *Samia cynthia ricini* during the winter, rainy and summer seasons of 2011 includes cocoon weight(gr), Pupal weight(gr), shell weight(gr) and shell ratio(%) were 3.92 ± 0.052(S. D.), 3.36 ± 0.04(S. D.), 0.53 ± 0.004(S. D.), 13.57 %; 3.61 ± 0.05(S. D.), 3.10 ± 0.03(S. D.), 0.48 ± 0.01(S. D.), 13.44 %; 3.27 ± 0.08(S. D.), 2.07 ± 0.25(S. D.), 0.43 ± 0.01(S. D.), 13.25 % of cocoon weight(gr), Pupal weight(gr), shell weight(gr) and shell ratio(%) respectively (Table 4).

**(Table 1) Qualitative Characteristics of Eri silkworm, *Samia Cynthia ricini***

| Egg | | Larva | | | Cocoon | | Moth | Voltinism |
|---|---|---|---|---|---|---|---|---|
| **Colour of egg shell** | **Colour of yolk** | **Body colour** | **Marking of skin** | **Nature of skin** | **Colour of Cocoon** | **Shape of Cocoon** | **Wing Colour of moth** | **Multivoltine** |
| White | Cream | Yellow, Cream, Blue, Green. | Single spot, double spot, Semi Zebra. | Weak thorn | White | Flossy, no peduncle. | Chocolate, greenish. | |

The values are expressed in terms of Standard Error of the Mean.

**(Table 2) Average larval length, of in Eri silkworm, *Samia cynthia ricini* in various seasons in 2009 to 2011.**

| Year | Season | Instar | | | | |
|---|---|---|---|---|---|---|
| | | **I** | **II** | **III** | **IV** | **V** |
| 2009 | Winter | 1.12 ± 0.25 | 1.9 ± 0.25 | 3.4 ± 0.35 | 4.84 ± 0.53 | 7.34 ± 0.24 |
| | Rainy | 1.04 ± 0.25 | 1.44 ± 0.05 | 2.42 ± 0.45 | 4.2 ± 0.5 | 7.08 ± 0.27 |
| | Summer | 0.76 ± 0.11 | 1.62 ± 0.28 | 2.6 ± 0.29 | 4.32 ± 0.19 | 6.62 ± 0.72 |
| 2010 | Winter | 1.3 ± 0.1 | 2.5 ± 0.41 | 4.84 ± 0.58 | 6.02 ± 0.277 | 7.62 ± 0.39 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Rainy | 1.2 ± 0.18 | 1.43 ± 0.07 | 2.42 ± 0.39 | 4.26 ± 0.29 | 7.18 ± 0.28 |
| | Summer | 0.92 ± 0.19 | 1.9 ± 0.22 | 3.02 ± 0.30 | 4.5 ± 0.38 | 6.54 ± 0.62 |
| 2011 | Winter | 1.02 ± 0.311 | 2.02 ± 0.25 | 3.2 ± 0.33 | 4.92 ± 0.35 | 7.8 ± 0.33 |
| | Rainy | 1.24 ± 0.20 | 1.38 ± 0.03 | 2.3 ± 0.25 | 4.1 ± 0.44 | 7.2 ± 0.25 |
| | Summer | 1.66 ± 0.75 | 2.06 ± 0.56 | 3.74 ± 0.24 | 5.08 ± 0.53 | 6.88 ± 0.13 |

The values are expressed in terms of Standard Error of the Mean.

**(Table 3) Average larval weights in grams, of Eri silkworm, *Samia cynthia ricini* in various seasons in 2009 to 2011.**

| Year | Season | Instar | | | | |
|---|---|---|---|---|---|---|
| | | I | II | III | IV | V |
| **2009** | **Winter** | 0.0062 ±0.006 | 0.070 ± 0.010* | 1.24 ± 0.14 | 4.84 ± 0.76* | 7.74 ± 1.64 |
| | **Rainy** | 0.0057 ±0.0008 | 0.047 ±0.002 | 0.069 ± 0.002 | 1.09 ± 0.14 | 4.84 ± 0.73 |
| | **Summer** | 0.0054 ± 0.0031 | 0.039 ± 0.010 | 0.061 ± 0.003 | 0.92 ± 0.233 | 3.43 ± 0.95 |
| **2010** | **Winter** | 0.0059 ± 0.006 | 0.065 ± 0.011 | 0.098 ±0.0007 | 1.19 ± 0.04 | 5.53 ± 0.22 |
| | **Rainy** | 0.0051 ± 0.0005 | 0.045 ± 0.002 | 0.060 ± 0.003 | 0.97 ± 0.14 | 4.60 ± 0.72 |
| | **Summer** | 0.0045 ± 0.0034 | 0.043 ± 0.010 | 0.050 ± 0.003 | 0.96 ± 0.06 | 3.67 ± 0.25 |
| **2011** | **Winter** | 0.0064 ± 0.0065 | 0.063 ± 0.008 | 0.096 ± 0.003* | 2.57 ± 0.79 | 5.64 ± 0.36 |
| | **Rainy** | 0.0052 ± 0.0005 | 0.049 ± 0.002 | 0.064 ± 0.004 | 1.12 ± 0.07 | 4.74 ± 0.85 |
| | **Summer** | 0.0045 ± 0.003 | 0.043 ± 0.014 | 0.054 ± 0.004 | 0.99 ± 0.049 | 3.69 ± 0.26 |

The values are expressed in terms of Standard Error of the Mean.

**(Table 4) Post cocoon parameters in Eri silkworm, *Samia cynthia ricini* in various seasons in 2009 to 2011.**

| Year | Seasons | Post cocoon parameters of Eri silkworm, *Samia cynthia ricini* in various seasons in 2009 to 2011 | | | |
|---|---|---|---|---|---|
| | | **Cocoon weight** | **Pupal weight** | **Shell weight** | **Shell ratio** |
| 2009 | Winter | 3.98 ± 0.008 | 3.40 ± 0.004 | 0.58 ± 0.007 | 14.56 % |
| | Rainy | 3.57 ± 0.04 | 3.08 ± 0.04 | 0.49 ± 0.01 | 13.75 % |
| | Summer | 3.37 ± 0.03 | 2.93 ± 0.04 | 0.43 ±0.02 | 12.86 % |
| 2010 | Winter | 3.93 ± 0.01 | 3.36 ± 0.008 | 0.56 ± 0.02 | 14.34 % |
| | Rainy | 3.55 ± 0.05 | 3.04 ± 0.04 | 0.49 ± 0.01 | 14.01 % |
| | Summer | 3.31 ± 0.02 | 2.83 ± 0.01 | 0.45 ± 0.01 | 13.89 % |
| 2011 | Winter | 3.92 ± 0.052 | 3.36 ± 0.04 | 0.53 ± 0.004 | 13.57 % |
| | Rainy | 3.61 ± 0.05 | 3.10 ± 0.03 | 0.48 ± 0.01 | 13.44 % |
| | Summer | 3.27 ± 0.08 | 2.07 ± 0.25 | 0.43 ± 0.01 | 13.25 % |

The values are expressed in terms of Standard Error of the Mean.

**(Table 5) The instar –wise temperature during various seasons from 2009-2011, recorded during rearing of Eri silkworm, *Samia cynthia ricini.***

| Year | Season | Instar – Temperature ($^0$C) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | | II | | III | | IV | | V | |
| | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 2009 | Winter | **29.25±2.21** | **18.75±0.95** | **30.33±2.08** | **19.66±1.52** | **28.5±0.57** | **24±0.81** | **30.4±1.51** | **24.2±1.30** | **28±0.81** | **19.28±1.97** |
| | Rainy | **29.25±0.5** | **25.75±1.70** | **31.66±1.52** | **26±1** | **31±2.64** | **27±1** | **32.1±1.47** | **26.5±1** | **34.14±1.21** | **26.14±0.37** |
| | Summer | **35.37±0.75** | **23.25±0.5** | **36.66±0.57** | **23.66±0.57** | **36.5±0.70** | **20.5±0.70** | **37±1** | **21±1** | **36±0.81** | **21.42±1.81** |
| 2010 | Winter | **28.6±1.67** | **23.8±1.30** | **29±1.73** | **23.33±0.57** | **30.33±0.57** | **23.66±0.57** | **29.75±0.86** | **23.75±1.70** | **28.75±1.28** | **20.62±1.30** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rainy | 27.7±2.24 | 26±0.81 | 27.73±0.83 | 25±1 | 28.6±1.70 | 25.3±1.12 | 29.44±1.87 | 26.04±1.77 | 30.35±1.22 | 25.12±1.15 |
| | Summer | 32±1 | 22.33±0.57 | 32.5±0.70 | 24.5±0.70 | 33.5±0.70 | 25±1.41 | 31.5±2.12 | 22.5±0.70 | 33.82±1.09 | 24.2±1.77 |
| 2011 | Winter | 27.66±0.57 | 22±2 | 28.66±1.15 | 20.33±0.57 | 28.5±0.70 | 19.5±0.70 | 28.33±1.52 | 28.33±1.52 | 28.75±1.16 | 18.37±1.99 |
| | Rainy | 33.75±2.62 | 22.5±2.51 | 33.33±1.15 | 23.66±2.08 | 32.33±2.08 | 24.66±1.152 | 27.33±2.30 | 27.33±2.30 | 30.2±1.93 | 24±1.63 |
| | Summer | 30.33±0.57 | 19.66±0.57 | 30.5±0.70 | 19.5±0.70 | 33±1.41 | 23.5±0.70 | 32.66±1.15 | 32.66±1.15 | 31.66±1.93 | 22.88±1.76 |

The values are expressed in terms of Standard Error of the Mean.

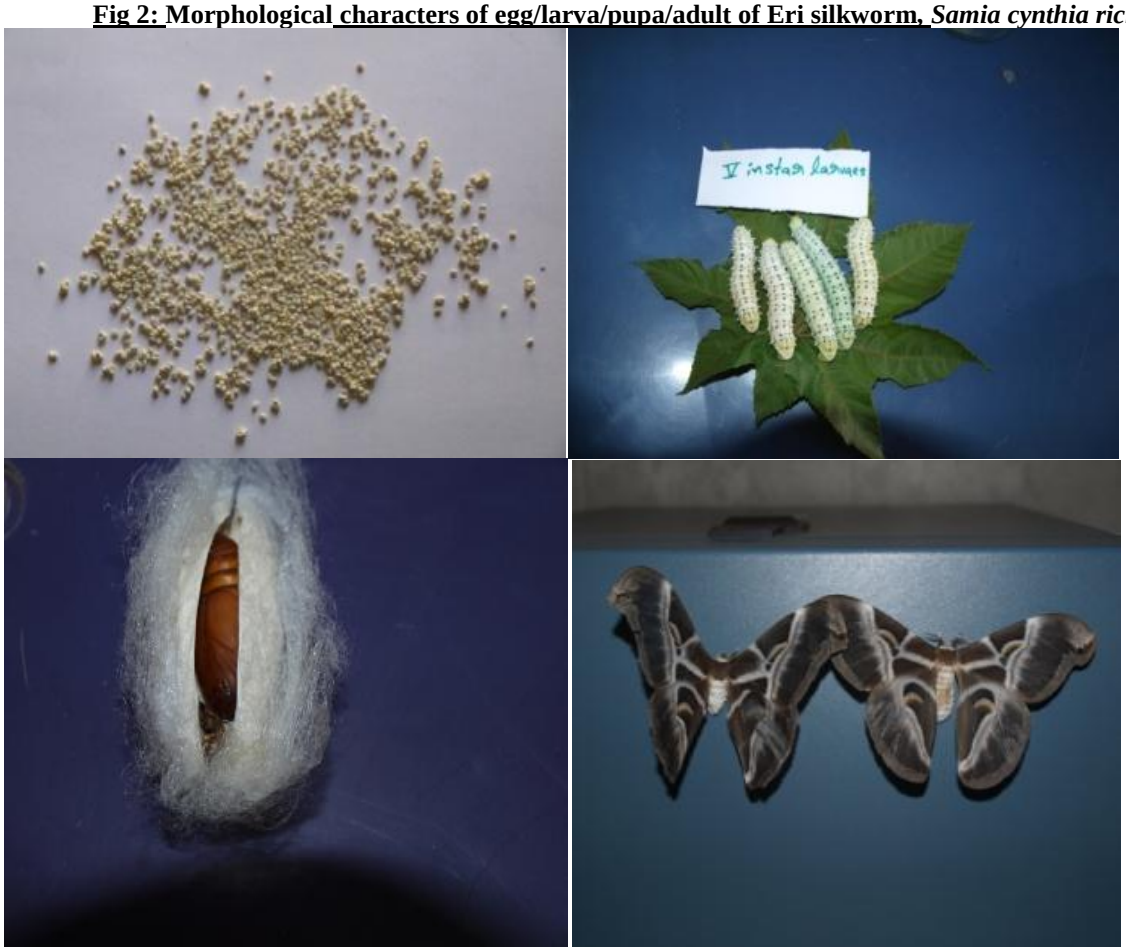
**(Table 6) The instar –wise Relative humidity during various seasons from 2009-2011, recorded during rearing of Eri silkworm, *Samia cynthia ricini.***

| year | Season | Instar - Relative Humidity ( RH ) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | | II | | III | | IV | | V | |
| | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 2009 | Winter | 80±12.46 | 51.25±8.61 | 81.4 ± 5.72 | 59.2±10.35 | 84±9.45 | 57.25±12.47 | 86.75±5.05 | 67.25±4.57 | 86.85±6.22 | 58.85±11.86 |
| | Rainy | 85.25±3.86 | 60.25±2.21 | 69.66±6.50 | 55.33±4.50 | 79±4.35 | 59.66±1.15 | 74.2±6.26 | 60.4±7.40 | 81.2±8.89 | 55.4±3.40 |
| | Summer | 77.66±4.61 | 34±5.29 | 75±0 | 24.25±2.06 | 72.66±11.37 | 29.33±2.081 | 74.33±1.15 | 74.33±1.15 | 72.14±9.13 | 28.28±2.49 |
| 2010 | Winter | 87.2±7.15 | 71.4±7.82 | 84±0 | 71.33±6.02 | 83.5±1 | 64.5±5.74 | 79.87±6.91 | 64.5±5.74 | 79.87±6.91 | 55.5±10.07 |
| | Rainy | 88 ±4.61 | 56.5±10.63 | 85.66±9.23 | 56 ± 5.56 | 86.33±4.93 | 63.4±15.63 | 84.63±7.06 | 63.4±15.63 | 84.63±7.06 | 63.45±9.57 |
| | Summer | 81.66±11.37 | 66 ± 5.56 | 82.5±10.66 | 73.5±10.75 | 74 ± 2.64 | 64.33±5.68 | 72.75±7.36 | 64.33±5.68 | 72.75±7.36 | 57.37±10.75 |
| 2011 | Winter | 82.66±1.52 | 61.33±7.50 | 84.66±4.61 | 65.66±7.76 | 77 ± 4.69 | 60 ± 3.46 | 83.5±8.38 | 61.25±4.03 | 81.87±7.86 | 81.87±7.86 |
| | Rainy | 79.5 ± 5.92 | 79.5 ± 5.92 | 84.66±4.61 | 62.33±15.30 | 88±4.35 | 54.33±10.78 | 85.4±3.78 | 69 ± 5 | 84.3 ± 7.08 | 65.4 ± 4.55 |
| | Summer | 80.25±13.22 | 60.75±7.41 | 80 ± 6.92 | 60.66±10.01 | 71.66±6.65 | 64.33 ± 8.14 | 83.33±0.57 | 73.68±2.30 | 85 ± 6.12 | 68.44±13.22 |

The values are expressed in terms of Standard Error of the Mean.

**Fig:1. The fifth instar larvae, cocoons and moths in Tray rearing method of Eri silkworm *Samia cynthia ricini,* fed on Castor (*Ricinus communis)***

**Fig 2: Morphological characters of egg/larva/pupa/adult of Eri silkworm, *Samia cynthia ricini***



## Discussion

The present study emphasizes on the parameters of growth, comparative rearing performance and cocoon characters of eri silkworm, *Samia cynthia ricini*, based on seasonal variations. A similar work on the comparative rearing performance of eri silkworm eco-races/strains and efficacy of rearing on various host plants has been reported identifying their utilization and strategies for conservation of bioresources as they are the sources of livelihood for several communities of the north east India (Singh *et al.,* 2012) which revealed castor as the best food plant when compared to other host plants in all the seasons while the overall performance on castor showed higher during . Similar findings were also reported by Thangavelu and Phukan (1983); Pathak (1988); Devaiah and Dayashankar (1982) and Kumar *et al.,* (1993).

From the present studies it is seen that the cocoon weight, pupal weight, shell weight and shell ratio were highest in the winter followed by rainy and lowest in the summer season. This pattern was observed in all the three years of study.

The study by Rajesh *et al* .,(2010) on the increase of larval weight, cocoon and pupal weight and SR% exhibited by eri silkworm fed on castor leaf was explained due to the higher rate of food ingestion, food assimilation and respiratory activity. The involvement of these factors in increasing the larval body substance has been reported by Hiratsuka (1920) in *Bombyx mori,* later by Stockner (1971) in *Philosamia ricini* Hutt.

As cited in literature, India stands second in the world with respect to eri silk production next only to China; northeastern region being the major contributing region in our country. Recently, ericulture is being introduced in Madhya Pradesh, Delhi, Punjab, Karnataka and Maharashtra (Kshama Giridhar *et al.,* 2007) and also introduced in Southern states on castor and tapioca plants, but owing to several constraints in their cultivation, as the crop has to be sown every year, castor leaf is not available throughout especially during summer. The cultivation practices also depend on rainfall resulting in uncertainty in raising the castor crop and ultimately ericulture. Further, several pests and diseases affect the castor crop and needs large quantity of chemicals for their management. The chemical

sprayed leaves are harmful to eri silkworm (Manjunatha *et al.,* 2010). This may be attributed to significant decrease in economic traits in rainy and summer seasons.

In the present investigation, the larval length was greater in winter in all the instars in two years of study, while it was more in summer in third year in all instars except the fifth instar, where it reached maximum in winter. In contrast to cocoon parameters, which was lowest in summer, the larval length was much less during rainy season in most of the instars in the three years of study. However, it is interesting to note that, though length varied in I,II,II and IV instars, there was no notable difference observed when the larvae reached fifth instar in all the seasons studied, which explains that larval length during four instars does not play significant role, and that during fifth instar larvae grow to a maximum length.

Though there are several reports revealed that castor (*Ricinus communis*) is the best suitable host plant for the commercial rearing of eri silkworm *Philosamia ricini* Donovan (Rajesh *et al.*,2010), a systematic study on the effect of seasonal variations has to be envisaged as in the present study, performed at the temperature/ relative humidity were ranging from 18.75 – 30.33°C/ 55.50-87.2% during winter, 24 – 34.14°C /54.3-88% during rainy and 20.50-36.66°C / 24-83% during summer seasons respectively. From the tables 5 and 6, it can be deciphered that low temperature and high humidity was seen in winter in contrast to high range of temperature and low RH in summer, while rainy season has shown high temperature as well as high relative humidity. From the studies, it is clear that the larval weights were found to be highest in winter in all the instars, followed by rainy and lowest in summer seasons. In some instances a notable increase was also seen in winter, which clearly indicate the association of larval weight to RH and temperature. Larval weights also include the water content in the body of the silkworm, which is high due to more RH and low temperature during winter. These values are in conformation with the cocoon weight, pupal weight, shell weight and shell ratio which were highest in the winter followed by rainy and lowest in the summer season. Thus it can be concluded that the optimum temperature and RH as seen during winter are most suitable for producing good quality eri cocoons, which are economically important.

Though the results of the present study indicate that castor is the best suited host plant for Eri silkworm and show better adaptability during winter season for commercial purposes, it opens an avenue for further studies based on quality and consumption of leaves in various seasons, thereby helping the rural populace in the utilization of castor plantation and help in their economy.

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