

# Life Cycle of *Philosamia ricini*

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# INTRODUCTION

- Eri silkworm, *Philosamia ricini* is **multivolitine** and their **cocoons are open mouthed**.
- The Eri silkworm *Philosamia ricini*, is also known as **Endi** or **Errandi** and it belonging to family saturniidae.
- It is one of the **commercially exploited silkworm species** and can be **reared indoors throughout the year** to produce silk.
- The silk produced by *Philosamia ricini* is called **Eri silk**.

# INTRODUCTION

- The production of Eri silk is traditional in north-eastern states of India and particularly carried by the tribal people of **Assam, Bihar, Orissa, U.P., West Bengal** and some other states of India where ericulture is practised on commercial basis.
- The systematic position of Eri moth is:
  - Phylum-Arthropoda
  - Class-Insecta
  - Order-Lepidoptera
  - Genus-*Phylosamia*
  - Species-*ricini*

# INTRODUCTION

- The Ricini moth has a **brown wing colour in different shades of brown** and has a beautiful **black stripe along the wings**.
- They also have **yellow spot** and **lines** on the wings. At the tip of the wings is a **small eye spot meant to distract predators**.
- The body of the moth is **white with brown stripes**.
- The **male moth smaller than the female moth** and bear **bushy antennae** and **smaller abdomen**.
- The moths are **nocturnal** in habit.



***Philosamia ricini*  
male (bottom)  
and female (top).**

# INTRODUCTION

- This is **multivoltine**.
- **Six broods** can be reared in a year with adequate supply of food.
- Though ricini species are mostly cultured, there are about 16 other varieties of eri silkworm.
- One of the other important eri species is *Philosamia cynthia* which are mostly found in wild form. They may be uni, bi or trivoltine.

# INTRODUCTION

- Eri silkworm is a **polyphagus** insect and feeds on the leaves of several food plant viz,
  - **Castor** (*Ricinus communis* L),
  - **Tapioca** (*Manihot esculenta*, Crantz.),
  - **Wild castor** (*Jatropha curcas* L.),
  - **Papaya** (*Carica papaya* L.),
  - **Barkesseru** (*Ailanthus exceisa* Roxb.),
  - **Kesseru** (*Heteropanan fragrans* Seem.), etc.
- Although, Eri silkworm is known to feed on the leaves of more than **30 host plant species** but among them **Castor** is considered as the **principal host plant**.

Castor plants are of two varieties; the green leaved [Fig. 3.25(i)] and violet leaved [Fig. 3.25(ii)]. Both are equally suitable for feeding the eri silkworm.



(i) Green castor plant



(ii) Violet castor plant

**Fig. 3.25.** Host plants of eri-worms : (i) Green castor; (ii) Violet castor



# Life cycle

- The life cycle of *Philosamia ricini*, is completed through
  - (a) eggs
  - (b) larva
  - (c) pupa in cocoon
  - (d) adult moth
- In summer ,the life cycle is completed in **44-48 days** and in winter it takes about **85-87 days**.

**Lifecycle:** The life cycle of *Philosamia ricini*, Hutt. Is completed through (a) eggs, (b) larva ,(c) pupa in cocoon and (d) adult moth.

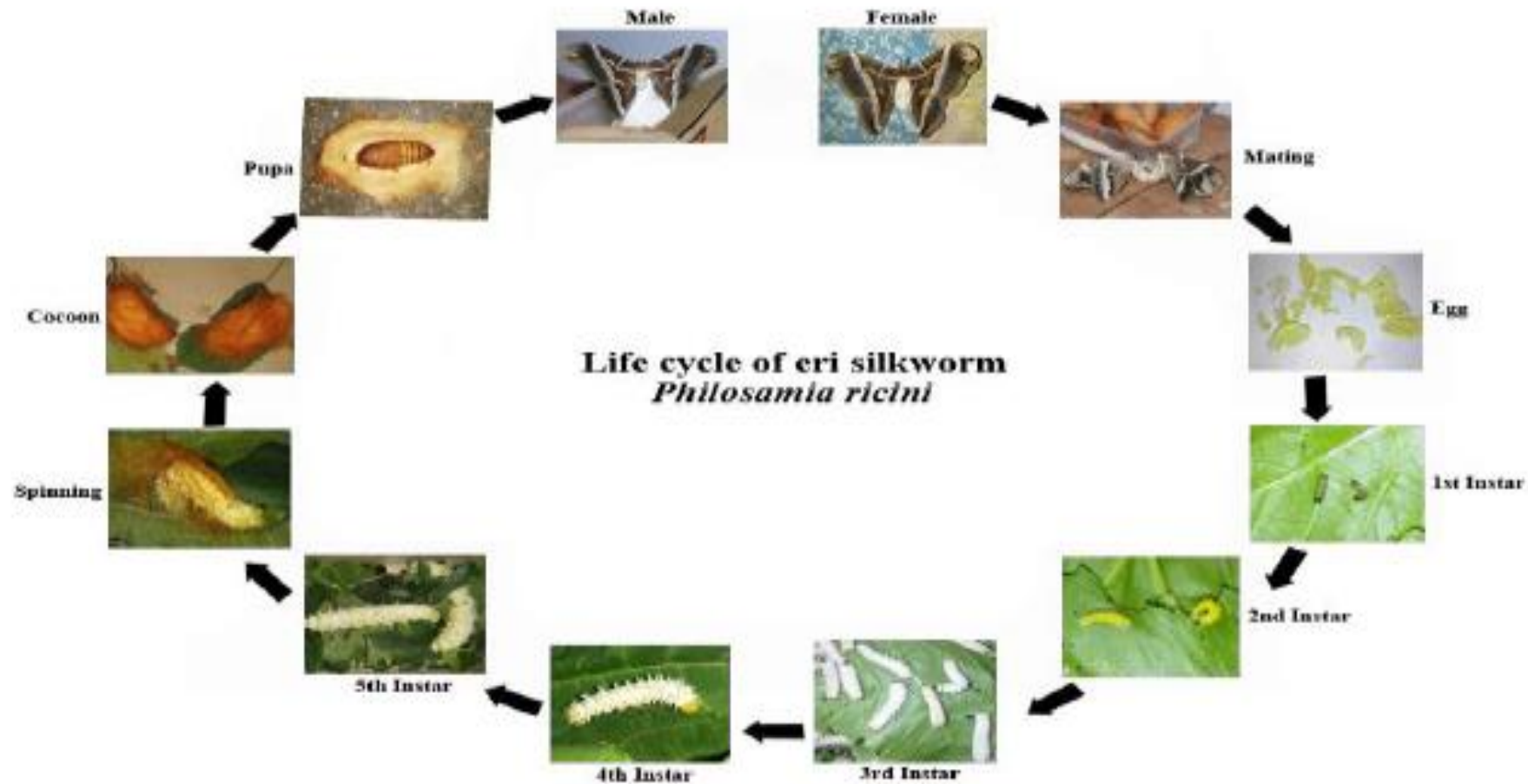




Fig. 3.26 (a). Adult moth



Fig. 3.26 (b). Egg

Fig. 3.26. Life cycle of eri moth

Fig. 3.26 (c).  
1st instar

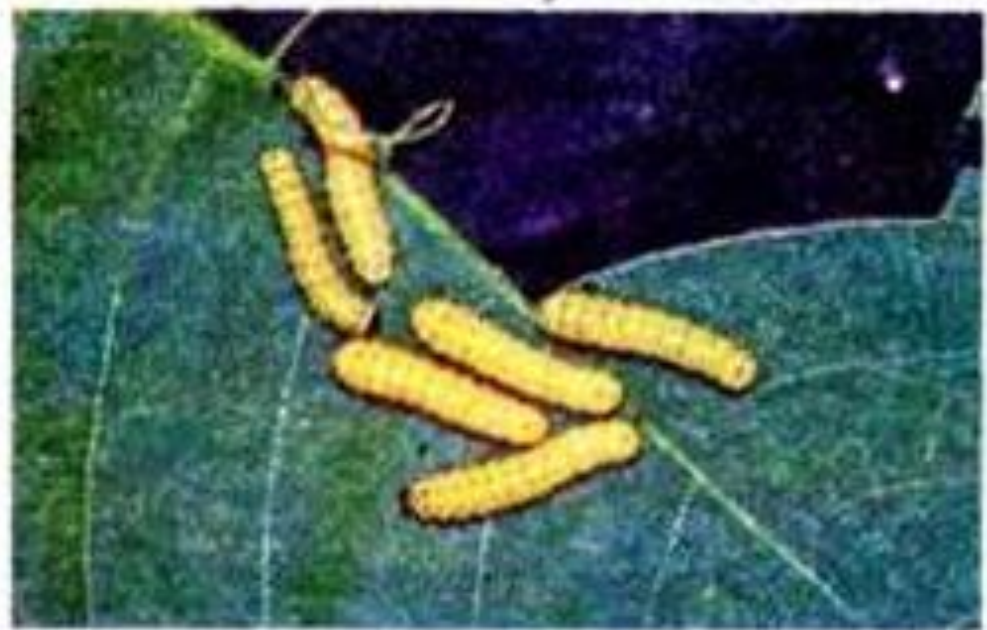


Fig. 3.26 (d). 2nd instar



Fig. 3.26 (e). 3rd instar



Fig. 3.26 (f). 4th instar



Fig. 3.26 (g). 5th instar



Fig. 3.26 (h).  
Cocoon

Fig. 3.26. 1. life cycle of eri moth

# Life cycle- Eggs

- The eggs are **oval shaped** with medium size. It is covered by a hard chitinous white coloured shell. The **shell colour may be creamy** as in wild forms.
- The eggs are attached to the surface with one another by **colourless glue**.
- A female moth after copulation lays about **300-500 eggs** in cluster. The laying may continue for **3 to 4 days** but the eggs of first two days are only kept for rearing.
- The hatching of eggs takes place after about **10 days** but it depends on the **temperature of the environment**. The hatching may be delayed upto **14-15 days** in winter.
- **Temperature and humidity** play important role in hatching of the eggs.

## Egg laying:

May-12,2017,after separation within 24 hrs the females start laying eggs which are green white in colour but later it becomes white in colour. The average no. of eggs laid by females within 2-3 days is 270.



fig.1 egg



fig.2 immature 1<sup>st</sup> instar



fig.3 mature 1<sup>st</sup> instar

# Life cycle- Larva

- After hatching, the larvae tend to remain together. It is about **one centimeter** in length.
- It grows to a size of **8 centimeters, when mature.**
- The newly hatched larvae possesses a **black coloured head** and the body becomes yellow in colour but gradually changed to green yellow.
- The male and female larvae can be distinguished in later stage by the genetical markings.
- The first moult occurs after three days.



fig.4 newly hatched 2<sup>nd</sup> instar



fig.5 mature 2<sup>nd</sup> instar



fig.6 3<sup>rd</sup> instar



# Life cycle- Larva

- The **larva matures in 17 to 45 days** depends on the environmental temperature and humidity. During this period ,the larva moults four times.
- During the onset of moulting ,the **larva becomes motionless** and it does not feed.
- On moulting ,the integument of the head breaks on the sides and the larva comes out with a new integument.
- The larva possesses a **long tubular silk glands**. This gland is responsible for production of silk.
- The silk gland secretes the silky substance to form the cocoon. In the cocoon , the larva transform into a chrysalid.



fig.7 4<sup>th</sup> instar



fig.8 immature 5<sup>th</sup> instar



fig.9 mature 5<sup>th</sup> instar



fig.10 before spinning



fig.11 during spinning



fig.12 cocoon

# Life cycle- Pupa

- The larva of last instar before moulting ceases feeding and transform into a chrysalid.
- The larva excretes **silk substance after settling in a crevice and spin the cocoon.**
- In 3-4 days, the cocoon formation is completed. Inside the cocoon the larva transforms itself into a **brown coloured chrysalid.**
- It is an **intermediate form in between the larva and the moth.**
- The **essential organs** of the moth are formed. The body is covered by **hard integument.** It can survive for long time inside the cocoon.
- The **colour of the chrysalid turns black** before the emergence of the moth.



fig.13 immature pupa



fig.14 mature pupa



fig.15 pupa turns to black

# Life cycle- Moth

- The moth emerges from the chrysalid forms after about **2 weeks**.
- The moth comes out through the **open end of the cocoon**.
- It emerges normally in **morning hours**.
- As soon as the moth emerges, they secrete some brown liquid which is known as **meconium**.
- The newly hatched male and female moth abdomen has almost **same size and their wings remain very soft** but after sometime the male abdomen gradually become smaller and they fully stretch their wings which becomes harder.
- The colour of the wing varies from **green to orange brown** and the wing expanse varying from 10 cm to 15 cm.

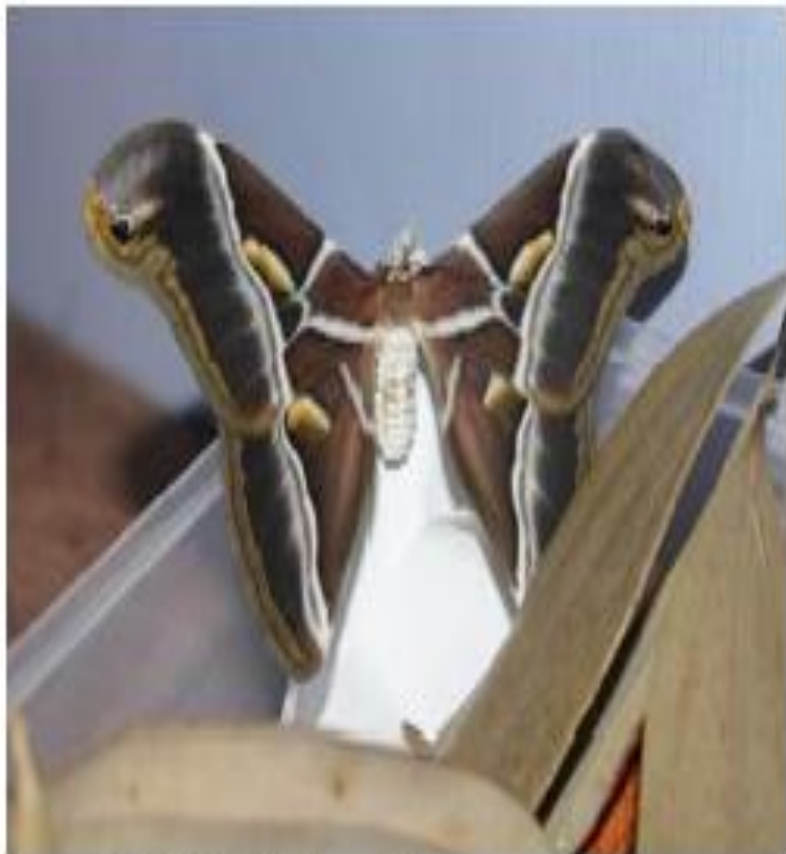


fig.16 adult male



fig.17 male reproductive structure



fig. 18 adult female

# Life cycle- Moth

- **After stretching the wings, the male finds out the female for mating which lasts about 24 hours.**
- **During mating the moths remain motionless.**
- **The male unpairs in next evening.**
- **After unpairing, the female lays the eggs normally during the night.**
- **A female moth lays about 300-500 eggs in cluster in 3-4 days.**



# Life cycle

- Body is divided into **head, thorax and abdomen**.
- Whole body is covered with **fine scale**.
- They are  **$3.11 \pm 0.07$  cm long and  $0.63 \pm 0.02$  cm width** in case of **male** and  **$4.14 \pm 0.09$  long and  $1.08 \pm 0.08$  cm width** in case of **female**.
- Head bears **paired compound eyes, antennae and reduced mouth parts which lack proboscis**.
- The antennae is about  **$1.29 \pm 0.02$  cm long and  $0.41 \pm 0.01$  broad** in case of **male** whereas  **$1.21 \pm 0.01$  cm long and  $0.32 \pm 0.01$  broad** in case of **female**.
- Thorax shows **pro,meso and meta-thorax**. Each segment bears **paired legs**.



fig.19 female reproductive structure



fig.19 mating



fig.20 egg laying by female

# Life cycle

- **Meso and meta-thorax bear paired wings** which is  $12.77 \pm 0.25$  cm long in case of male and  $12.9 \pm 0.16$  cm long in case of female.
- Dorsally abdomen shows **eight narrow segment in case of male and seven swollen segment in case of female** and ventrally abdomen shows 7 narrow segment in case of male and 6 in case of female.
- The last segment is modified to form **reproductive organ**.
- In case of **male** on each side of the penis there is a hook called **herpes** which is used for holding female during breeding.
- In case of **female** at the **ventral side on 6th segment** there is a **genetial aperture to which ovipositor** is attached.

### *Adult Male:*

Morphological parameters	Measurment in (cm)
Length of the body	3.11±0.07
Length of the Head	0.31±0.01
Length of the thorax	0.98±0.01
Length of the abdomen	1.85±0.06
Width of the body	0.63±0.02
Length of the antennae	1.29±0.02
Width of the antennae	0.41±0.01
Length of the wing	12.77±0.25
Length of the Leg	
1 <sup>st</sup> pair	1.45±0.20
2 <sup>nd</sup> pair	1.66±0.01
3 <sup>rd</sup> pair	1.59±0.20

### *Adult Female:*

Morphological parameters	Measurment in (cm)
Length of the body	4.14±0.09
Length of the Head	0.31±0.01
Length of the thorax	0.99±0.01
Length of the abdomen	2.85±0.09
Breadth of the body	1.08±0.02
Length of the antennae	1.21±0.01
Width of the antennae	0.32±0.01
Length of the wing	12.9±0.16
Length of the Leg	
1 <sup>st</sup> pair	1.40±0.01
2 <sup>nd</sup> pair	1.64±0.02
3 <sup>rd</sup> pair	1.59±0.02

## *Larva:*

1<sup>st</sup> instar:

Parameters	Measurement in cm
Length of the body	0.75±0.02
Breadth of the body	0.12±0.01

Colour of the body	Yellow
Colour of the head	Black
Colour of the hair	Black

3<sup>rd</sup> instar

Parameters	Measurement in cm
Length of the body	2.36±0.09
Breadth of the body	0.55±0.02

Colour of the body	White
Colour of the head	Black

2<sup>nd</sup> instar:

parameters	Measurement in cm
Length of the body	1.55±0.05
Breadth of the body	0.39±0.01

Colour of the body	yellow
Colour of the head	black
Colour of the hair	whitish

4<sup>th</sup> instar

parameters	Measurement in cm
Length of the body	3.83±0.07
Breadth of the body	0.78±0.03

Colour of the body	White
Colour of the head	Yellow

5<sup>th</sup> instar:

Parameters	Measurement in cm
Length of the body	6.8±0.21
Breadth of the body	1.53±0.02

Colour of the body	White
Colour of the head	Yellow

*Male Pupa:*

parameters	Measurement in cm
Length of the pupa	3.07±0.07
Breadth of the pupa	1.28±0.03
Colour of the pupa	Copper brown

- All the parameters are average of 10 individual.
- ± = Standard error of mean

*Female pupa:*

parameters	Measurement in cm
Length of the pupa	3.11±0.05
Breadth of the pupa	1.29±0.02
Colour of the pupa	Copper brown

# Rearing of eri silkworm

- Disease-free seed cocoons are obtained from grainages or agencies and reared fully indoors. Healthy cocoons are spread on bamboo trays in cool dark room. On hatching, active males are separated from passive females and are then allowed to mate in quiet dark room.
- Fertilised females are then tied to 'kharikas' by passing a thread around the thoracic joint of the right wings. Kharikas are then suspended from a string. Eggs are laid within 25 hours on Kharika and are normally selected for rearing. The eggs are white, oval and covered with a gummy substance, which makes them adhere to one another.



**The adult moth emerging from  
the cocoon**



**The female moth laying the eggs and tied  
to the kharikas**



# Rearing of eri silkworm

- The eggs are disinfected with 2% formalin solution and then washed thoroughly with water. Eggs are incubated at 26°C, the colour changes to blue on the day prior to hatching. Hatching takes place in the morning after ten days of incubation. The newly hatched larvae are yellow with black segments.
- These larvae are brushed to rearing trays over which few tender food leaves are spread, and crowding is avoided. As the worms advance in age, older leaves can be given as food at 2-hour interval for four to five times.



# Rearing of eri silkworm

- Bed cleaning is carried out at regular interval in the same way as for the mulberry silkworm. The growing worms undergo four moults and have five instar stages. Total larval period lasts for 30-35 days. The 5th instar, mature larvae stop feeding and start searching for a proper place to spin the cocoon.
- At this stage, the mature worms are picked up and transferred to mountages (Chandri-kas). In wild, cocoons are spun between folds of leaves.



**Rearing of Eri silk worm**

# Post cocoon processing

- Stifling is done by spreading and exposing the cocoons to the sun for 1 -2 days. For degumming, cocoons are tied in a cloth sac and dipped in boiling soda solution. After sufficient boiling, the cocoons are taken out washed with water several times to remove soda, squeezed to remove water and then spread on mats to dry.
- Being open mouthed, the thread of the cocoons is discontinuous. So, the thread can only be spun and not reeled. Traditionally, spinning is done in wet condition on takli and in semidried condition on a charkha. Improved spinning machines like N.R. Das type charkha and Chaudhury type charkha are also available for spinning of silk from eri cocoons.



**Eri cocoons, as seen in 7Weaves,  
Assam**



**Eri fiber, as seen in 7Weaves, Assam**

# Eri Silk

- The silk produced by eri moths is referred to as eri and endi or errandi silk by local people. This silk is collected from pierced cocoons, so it is spun silk. The fibres in the cocoon are like a tiny bale of cotton, all wound together and tangled. So when eri silk is spun, it forms a lower grade of silk of unusual quality.
- Depending on how it is spun and woven it can give a very woolly result and as with poorly made wools, eri can feel like cheap acrylic. But it can also give a tight, strong fibre-like linen. This is what makes eri textiles amazing — they can have the drape and weight of linen but are warm and insulating like cotton or wool. Eri silk is less glossy and wrinkleless.

# Uses of Eri silk fabric

- [Eri silk fabric](#) is a boon for those who practice absolute [non-violence](#), not using any product obtained by killing any animal.
- It is widely used by everyone in the regions in which it is produced. It is becoming popular the world over. Buddhist monks in India, Bhutan, Nepal, China, and Japan prefer this silk, due to its non-violent origins.
- In India, eri was mostly used for the preparation of winter shawls for men and women. The thermal properties of eri silk makes it a suitable fabric for shawls, jackets, blankets, and bed spreads. Dress materials and baby dresses are also made from eri silk fabric because of its soft texture and moisture absorbent quality.
- Nowadays very fine (up to 210 Nm eri spun yarns are available, which enables weavers to weave very fine clothing, including traditional sari dress materials.







**Eri silk clothes, as seen in 7Weaves, Assam**

# Uses of Eri silk fabric

- Eri silk is durable and strong and has a typical texture; hence, it is widely used in home [furnishing](#) like curtains, bed covers, cushion covers, wall hangings, quilts, etc. Its woolly feel adds to the comfort.
- Two eri spun-silk mills have been established in Hindupur in Andhra Pradesh and Kokrajhar in Assam while another is at Chaygaon, near Guwahati, Assam, which is spinning the finest Eri spun-silk yarn with various blends with bamboo, muga silk, and cotton.
- Eri silk products are promoted as eco-friendly and natural, and provide jobs and money for the tribal peoples who practice eri culture.
- Eri silk production in India during 2007–2008 was 1,530 tons. This made up 73 percent of the total wild silk production of 2,075 tons.
- Vegan designer [Lucy Tammam](#) uses eri silk in her couture evening and bridal wear collections.

