



# COLLECTION AND STORING OF COCOONS IN SERICULTURE

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## ABSTRACT

Livelihood generation is one of the major potentials of sericulture and silk industry. Sericulture has emerged as the most important cash crop with minimum investment, low gestation period, high employment potential and highly remunerative return. It is suitable for Tribal. Sericulture has provided downstream employment and income generation in rural and semi-urban areas, high participation for low-income and socially under privileged groups. 'This study investigate that how sericulture fulfill the opportunities of livelihood for tribal of Sundargarh district . The study finds that sericulture is the activity of low investment and high output. The study concludes with some suggestion to improve the long term feasibility of sericulture.

**KEYWORDS-** collection of cocoons, storing of coccons, silkworms, sericulture ,silk moth

## INTRODUCTION:

One agro-based industry is sericulture. It includes the scientific management of the production of eggs, silkworms, feeding plants, and silk technology. A variety of silkworm species, including the mulberry, bombymori, Tajar, Muga, and Eri varieties, produce the natural fiber known as silk from their silk glands. Although natural silk is less common than man-made silk, the latter is becoming more and more in demand. A commercial textile derived from animals, silk is a gift from nature to humans that differs from wool. Silk has taken on particular significance in the modern era due to its eco-friendliness, biodegradability, and self-sufficiency. India is the fifth-largest silk producer in the world and practices sericulture. In Odisha, three types of silkworms, such as Mulberry, Tasar, and Eri, are cultivated. Odisha occupies the 2<sup>nd</sup> position in the production of Tasar silk. Tasar is very old and traditional and is mostly cultivated in the natural forest by the people in a traditional manner. In Odisha, sericulture is known for its exquisite silk and Tasar fabrics. It is

also a major source of livelihood for the rural poor, mostly in the tribal-dominated districts of Ryagada, Keonjhar, Mayurbhanj, Sundargarh, Kalahandi, Koraput, Gajapati, Kandhamal, Jajpur, Deogarh, and Dhenkanal, Nawarangapur. The state is traditionally a 'Tasar' belt. Sericulture had been introduced in the early part of 1978. Tasar culture in Odisha was first organized by the princely state of Mayurbhanj under the royal patronage of the Bhanja Dynasty in 1952. Odisha is presently 2<sup>nd</sup> in Tasar cocoon production in India. 12,000 families are actively engaged in Tasar culture. There are more than 46,828 SC/ST families enrolled as members of primaries in Tasar culture in these 14 hilly districts.

## REVIEW OF RELATED WORK-

Silkworms are known to benefit nutritionally from mulberry leaves cultivated under suggested fertilization (Narayanan et al., 1960 and Sidhu et al., 1969). According to Krishnaswami et al. (1970), in order to preserve the nutritional value and freshness of the leaves, tender and solvent leaves should be harvested in cool water. According to Jolly et al. (1976), a variety of environmental conditions, including temperature, humidity, sunshine, and rainfall, have an impact on the growth of mulberries and the quality of their leaves. Narasimhan (1978) states that for irrigated mulberry plants, a base dose of organic manure, such as compost or animal manure, should be applied at a rate of 20 tons per hectare 1520 days before planting. Narayan et al. 1967 and Krishnaswami et al. 1970 reported that feeding silkworms with the top tender leaves of mulberry was found nutritionally richer to the worms and mature leaves to the late age worms was most important from the view point of good health and vigour of the leaves and reeling quality of the cocoons. According to Kovalev (1970), a temperature of 25-26 degree centigrade was to be maintained during the incubation and till hatching of eggs. Krishnaswami et al. (1973) observed considerable extent of leaf moisture to be lost during storage of mulberry leaves consequently making the mulberry leaves less acceptable to the silkworm. Krishnaswami et al. (1973) and Ullal and Narasinhanna (1978) concluded that the optimum temperature for rearing silkworm of different instars. In 1957, there were four eri rearer co-operative societies in Cuttack district VIZ. Sidhal, Dampara, Bhandal and Indupur. In Cuttack district VIZ, there were four eri rearer co-operative societies in 1957: Sidhal, Dampara, Bhadra, and Indupur. Carotenoids, or beta-carotene and xanthophylls, are the dyes found in yellow and pink cocoons, which are made from mulberry leaves. Flavonoids give green color; white is typically thought to be normal. Shape, size, and structure are physical traits that are regulated by the spinning behavior of the larvae; yet, it is highly challenging to link these traits to a small number of genes (Tazima, 1978). Yonemura and Ram Rao (1952) as well as Ullal and Narasinhanna (1978) reported that cleaning with husk and net is paired with spacing. The worms are removed from the old bed as a whole and equally spread across a newly constructed bed that has the necessary area.

## RATIONAL OF THE STUDY-

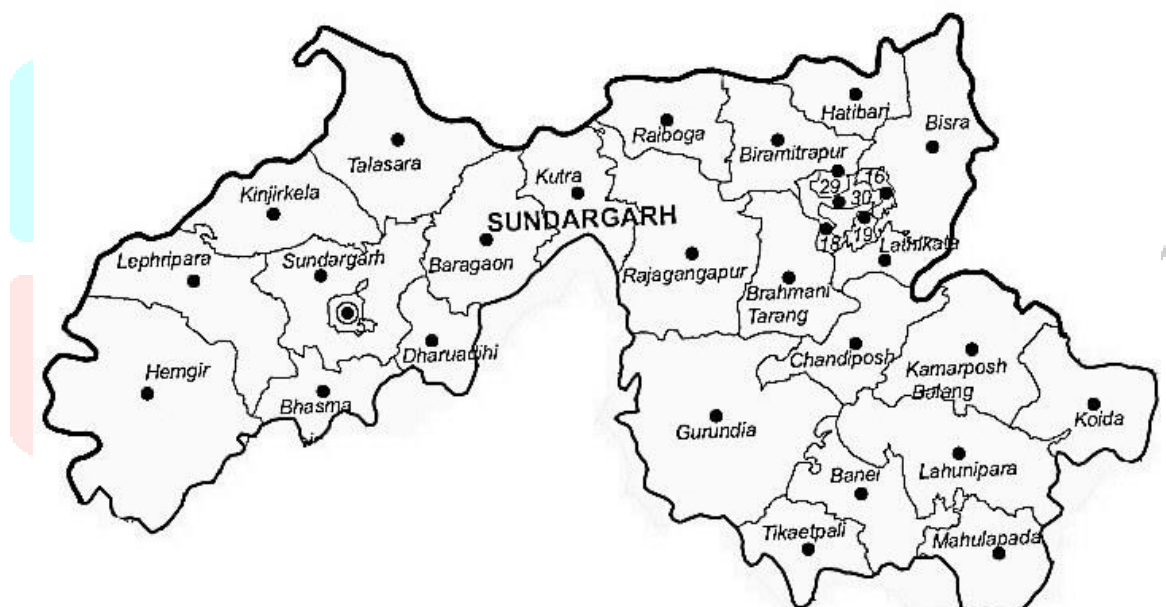
No study has been undertaken on the collection and storing of cocoons in sericulture of Sundargarh. It led the researcher to undertake this study.

**OBJECTIVES-**

1. To study the harvesting and storage of cocoons.

**DELIMITATION OF STUDY**

1. The study is confined to Sundargarh , Kirei.
2. The study is confined to only collection of cocoons.
3. The study is restricted to storing of cocoons only.
4. The study is confined to Sundargarh Sadar Block only.

**MATERIAL AND METHODS****STUDY AREA SITE:**

Sundargarh is a district in Odisha .Kirei is a village in Sundargarh Tensile .From Sundargarh town 2Km from National Highway towards left side BASIC SEED MULTIPLICATION AND TRAINING CENTRE, BASIC TASAR SILKWORM SEED ORGANISATION CENTRAL SILK BOARD ,MINISTRY OF TEXTILES,GOVT,OF INDIA. is present. It Is certified TASAR SEED CENTRE in ANISO 9001:2008.

This area mainly consist of 100 hectares, out of which 25hectores used in economic uses and others 75 hectores is forest. Here yearly 4Lkh cocoons produced for marketing. More than 3500 labourer present for this culture. Most of such people engaged in tasar culture come under BPL group. More than 12000 families are actively engaged in tasar culture.In a year 1DFL gives 1.5lakh eggs .In forest mainly Terminalea arjuna, Terminalea tomentos are used for host plant of tasar.In forest very long trees are present in more numbers as compare to small.Here 50feet x20 feet x10 feet size on an elevated and shady place to

accommodate 200-250dfis is present. So here 10 houses present for this. Then more than 10 store house present for storing cocoons. 5 dark room present for the incubation of eggs. 1 office room is present for officers. Well established rooms and roads are constructed for easy and quick travel.

## DATA COLLECTION:

In Sundargarh, the cocoon collection mainly happens during December to February. Cocoon harvested from trees only in winter season. At Sunargarh there is 75 hector forest where cocoon found. So it takes more time to collect. Basically collection of cocoons start from November last and researcher joined with them because of my project for better knowledge. There is huge forest so it required more no of laborers. Collection mainly started from 8.a.m to 11.a.m and at evening 4.p.m to 6p.m. It required more than 3000 workers. They are divided in to many groups, each groups having more than 10 peoples. They covers different parts of forest for easy collection. Researcher went to forest first time with them is 5<sup>th</sup> December 2018. At first Researcher introduce her self with them. I talk with them in their local language that is SUNDARGARHI, because most of them are uneducated and belongs to rural village. At 8a.m they are reached their destination. Some of them are climbing the trees. A rope, helmet, harness can be used to ensure the safety of the climber. Other equipment can also be used depending on the experience and skill of the tree climber. They are villager so most often they climbed the tree without any protection very easily because they are experienced. One man climbing and collect the cocoons from different branched carefully without damaged to cocoons. 2-4 man standing in trees in a cascade manner though which the harvested cocoons are passes from one person to another in a manner. 2-4 man and women are standing below the trees and collect the cocoons from them and collect in huge plastic bags. Some cocoons are found in bunched in a branches so it is difficult to separate in tree crown so climber cut that branches and throw it to ground where another member catch them from damaging. After collection of all matured cocoons they come to ground from tree and help others in collection of cocoons in bags. Bunches cocoons are separated from branches and fill in bags. After that they take some rest, drink water and move to another tree. Researcher also help them in collection of cocoons from small height tree and also help in collect in bags. In the same way they collect cocoons from another tree. After collecting 2 trees a big bags of cocoons we got. Then they we returned to home. After that at 4.15p.m all reached to same region where they stopped. Then again collection of cocoons started and collected in bags. In a whole day more than 4-5 bags were collected in a groups. So there are more than 90-100 groups in collection department. In average there are 50-60bags of cocoons are collected. In next day we go to forest with more numbers. A tractors also was there for transport the cocoons bags to storage area or office campus. In forest there is no good roads for tractors so tractor stand in main road. Man carried that bags on their back, group members help them for transport the bags to tractors. Some other members appoint their for transport only. It was also done very carefully without hurt himself and to cocoons. Bags were heavy, so it was also taking time. One day gone only in transporting. In this way collection and transporting occurs alternately for 1 month. I was going regularly in a week. They continuing their work in same way. Some day bags number increases due to increases cocoons or may be quick works. But some day decreases due to

less quantity of cocoons or uncover the target. Their target is mainly 50-60 bags. In this way they cover different area of forest and collect matured cocoons. Many people appoint for separating and cleaning of cocoons. After cocoons transporting from forest, cocoons are released from bags to separate damaged and unuseful cocoons. Cocoon are placed in sunlight for few days. Selection of good cocoons by externally. Then they are tested. Removal of odd shaped and defective cocoons from lots is called sorting of cocoons. Defective cocoons affect the reeling performance and quality of silk. Therefore, unsuitable cocoons are to be sorted out from the good cocoons to get optimum result during reeling. After all this good tassar were stored in stored room. The cocoons dried to the optimum level may be conditioned for a minimum period of 7-10 days before taking up for reeling in order to achieve better reeling performance. The cocoons should be stored in an appropriate storage room for long duration storage. The cocoons storage should have 20 degree C and below temperature in the center of the room and the air inside the room should have 55% and below relative humidity so that fungus will not attack the cocoons. Storage of cocoons for long period becomes necessary when availability of cocoons is not continuous. Storage of cocoons may also be warranted when reeling units make opportunity purchases in bulk quantity. Besides, storage of dried cocoons for a minimum period prior to reeling, so as to condition the dried cocoons is necessary for quality raw silk reeling. For long period of storage, cocoons need to be hot air dried to the optimum level in order to remove the water content from pupa. The cocoon storage room shall be double walled of brick construction. Thermocol shall be filled in between the two walls and the walls shall be plastered with cement. This is to provide maximum insulation. The inside wall shall be covered with wire mesh. Double doors shall be provided at the entrance, so that leakage of outside air in to the storage room is prevented. The room shall be disinfected using chloropicrin to prevent beetle attacks. The building shall provided with slanting wall at plinth level projecting outside the building so that rats do not enter the storage room. The cocoons storage room shall be maintained a temperature and relative humidity not exceeding 25 degree C and 55% respectively so that fungus attack on the cocoons is prevented. In a storage room if the temperature is above 25 degree C, then both at the bottom and top of the room moisture will condense in to droplets affecting cocoons quality. At the same time if the relative humidity of the air inside the cocoon goes beyond 60% then there will be difference in moisture level in pupae and cocoon shell leading to fungus attack. After this, cocoons were stored for 2-3 months in rooms. Then moths releases from pupae and stored them future use. Again there moths gave eggs and again these cycle repeated. Mainly cocoons stored from February to May. In some middle of January again collection occurs where the rested matured cocoons are collected and again cleaning and storing processing continuing. After all the cocoons are collected and storage they are ready for marketing. Cocoons produced are to be marketed.

## ANALYSIS OF DATA-

### ASSESSMENT OF COCOONS FOR DEFECTIVE COCOONS PERCENTAGE-

#### 1.COCOON WEIGHT-

Cocoons are being sold on weight basis. Sort out defective cocoons like double, flimsy ,melted, pierced etc. Count and weight good and defective cocoons separately. Assess defective cocoon percentage by following formula

-Defective cocoon(%)=weight .of defective in one kg/Wt. of cocoon taken(kg) X 100

#### 3.RENDITA-

It represents the quantity of green cocoons required to produce 1kg.of raw silk. If 10kg.of green cocoons of a lot is required to produce 1kg raw silk, then Rendita of that lot is 10.It is an indicator of price fixation of the cocoon when purchased for reeling.

#### 4.SHELL RATIO%-

It indicates the quantity of silk shell in terms of cocoon weight and expressed in percentage. This value gives a clear indication of quantity of raw silk that can be reeled from a lot of fresh cocoons. Calculate shell ratio % by using the formula.

Shell ratio(%)=shell weight/cocoon weight X 100

Transportation is a very important factor because often it affects the quality of cocoons. Pack the cocoons loosely, preferably in bamboo baskets or plastic crates or plastics nets. Transport the cocoon during the early cool hours as live pupa inside may die and melt leads to staining of cocoons. This will lower the quality of cocoons and get low price.

## RESULT DISCUSSION-

### SOIL-

This area mainly includes sandy and loamy soils. It also contain red soil.

### CLIMATE CONDITIONS-

It mainly required 25-30 degree C temperature for suitable growth of plant growth.

75-80% humidity required for growth of cocoons.

### RAINFALL-

Optimum rainfall required is 1000-1500mm.

## PLANTING TECHNIQUES-

Provides 20cm spacing between rows and 8cm between cuttings .Make a hole with a stock in the soil to insert cuttings. Irrigate the nursery once in a week during dry period.

## FERTILIZER APPLICATION TO NURSERY-

After 55-60 days of growth ,apply 500g urea dissolved in the irrigation water for each bed.

## TRANSPLANTING-

After 3-4months ,saplings become ready for transplanting Uproot the saplings with a spade or pick axe.

## PLANTATION IN THE MAIN FIELD-

SEASON-June-September

## LAND PREPARATION-

Prepare the land by ploughing and cross ploughing with power tiller or tractor during pre monsoon showers to a depth of 30cm.

## NUMBER OF LEAVES-

Observation on number of leaves was recorded at 5 days interval.

## NUMBER OF BRANCHES-

Observation on number of branches per plant was recorded at five days interval after 90<sup>th</sup> day of planting till 180 days.

## EGG PRODUCTION-

The eggs were produced from first week to last week of October. The number of seed cocoons were selected from the healthy batches.

## ECLOSION AND SEX SEPARATION-

Sex separation was done based on external morphology andbehaviour.Male more active and smaller in size with narrow abdomen.Female moths were relatively big in size with bulky abdomen.

## COPULATION-

Females and males moths were allowed for copulation in rectangular irons trays to produce pure races and hybrids , they are pairing for three hours.

## DEPAIRING-

After 3hr of copulation male and female moth are separated by hand twisted on either side.

## EGG PRODUCTION-

The fertilized female moth were allowed for oviposition on the egg card. Each females moth in a black plastic cellule for providing semi-dark condition. The egg card were collected next day.

## LOOSE EGGS PREPRATION-

Egg sheets are soaked in water for 30 mins and brushed gently to loosen the eggs. Thus loose eggs are collected. Egg sheets are dipped in 2%formalin for 10-15min.This helps in removal of pathogens adhering to the egg shell and further prevent secondary contamination.

## HOT HYDROCHLORIC ACID TREATMENT-

Eggs were treated with hot hydrochloric acid having a specific gravity 1.064 at a temperature of 46.1 degree C for 5minutes.

## EGG WASHING-

After formalin and hot hydrochloric acid treated with eggs were washed with slow running cold water to remove traces of formalin and hydrochloric acid for about 5minutes.Then the eggs were hung in grain age and loose eggs in muslin cloth bags were also hang and then spread on a sheet of paper in shad for drying. The loose eggs were collected in a cotton bag.

## SILKWORM REARING-

Rearing room was maintained to provide proper environmental condition to get good quality and yield of cocoons.

## DIS-INFECTION OF REARING ROOM AND EQUIPMENTS-

2% Of formalin used for dis-infection of rearing room. After spraying the formalin doors and windows were closed and made air-tight to achieve proper disinfection.

## INCUBATION OF EGGS-

Eggs are incubated in rearing box in the paraffin paper at the bottom .Awet foam rubber strip was kept around the egg cards. Another paraffin paper was used to keep the egg cards covered to prevents strong light .During incubation 9<sup>th</sup> day of incubation at blue stage. Maintain the temperature of 25+ 1 degree C ,relative humidity of 75+5%,16 hours of light and 8 hrs. darkness.

## BRUSHING THE NEWLY HATCHED WORMS-

Transfer the newly hatched worms carefully with a soft brush or feather to a paraffin coated paper kept ion a rearing tray. Feed the worms with tender leaves chopped in to 0.5-1cm size.



## CHEWKI REARING-

Distributes the worms uniformly in the trays. Feed the silkworms with nutritious and succulent leaf.

In first stage ,provide 3-4 times feeding with tender leaves of 0.5-1cm cut pieces.

Provide leaves 5Kg/100dfls for 2<sup>nd</sup> instar worms.

During 2<sup>nd</sup> stage ,cut the leaf in to 2-4sq.cm and feed 3-4 times.

Maintain temperature at 27-28degreeC and relative humidity at 80-90%.

Everyday before 2<sup>nd</sup> feeding ,spread the bed to facilitate drying of leaf applied in the previous feeding.Ensure bed cleaning once during 1<sup>st</sup> and 2<sup>nd</sup> moult and daily during 3<sup>rd</sup> stage with cotton cleaning net of 0.5sq.cm mesh size.

Reduce bed thickness prior to moulting.When 97% worms settle for moulting,stop feeding and apply slaked lime on the body of the worms.

## LATE AGE REARING-

Silkworms after second moult are shifted to shoot racks. Shoot rearing racks are made of iron, wood or bamboo. Shoot for feed the larvae should be 50-60days old.2/3 feedings day is recommended. Bed cleaning is done only once on 4<sup>th</sup> day of 5<sup>th</sup> instars.

## CARE DURING MOULTING-

Stop feeding when 90% worms enter in to moult.Spread the bed for proper drying and aeration.

## MOUNTING AND HARVESTING-

Pick fully ripened worms for mounting. Mount 40-45 worms per sq.ft.area.Remove diseased and dead worms. Maintain temperature of 27-28degreC and RH of 60-70%.Harvest the cocoons on 5<sup>th</sup> day of moulting.

## DISEASE AND PESTS-

The silkworm were infected by grasserie and flacherie disease. Based on pathogenic symptoms all the diseased worm were kept in a batch containing 2%formalin solution and buried.The worm were treated with a mixture of 96 parts of lime+1 part of Benzo10+1 part of paraformaldehyde against grasserie diseases.

## SORTING OF COCOON-

All the defective cocoons such as double, relted, stained, and abnormal sized cocoons of KIREI ,SUNDARGARH were sorted and made a record of physical characteristics of cocoon such as colour and shape.

**VOLUME OF THE COCOONS-**

The volume of the cocoons was measured as number of cocoons per litre.

**WEIGHT OF THE COCOON-**

The number of the cocoons per kg of green cocoon was counted and recorded.

**FLOSS CONTENT OF COCOON-**

The outer most entangled larger of the cocoons is expressed in percentage.

**PRESERVATION AND PROCTION OF SEED COCOONS-**

After the receipt of seed cocoons,spread them on trays in a single layer to facilitate good aeration.

Reject the seed cocoons which are unused.

Preserve only the healthy seed cocoon for further future use.

Maintain temperature at 25-30 degree and humidity 75-80%,and placed in dark room .

**EARLY ECLOSION-**

This helps in determining the disease freeness of a batch and helps in minimizing the loss to grain age.

For early emergence of moth ,50-60 seed cocoons are taken from individual lots and placed in to artificial eclosion box.

Maintain the temperature at 32-33 degree C with the help of thermostat.

**Table1. Data on quantitative characters of cocoons.**

Replication	Weight of the single cocoon(g)	Weight of the pupa(g)	Weight of the shell(g)	Shell percentage
1	1.535	1.340	0.265	17.26
2	1.435	1.295	0.258	18.03
3	1.389	1.322	0.268	19.29
4	1.542	1.342	0.270	17.51
5	1.401	1.340	0.249	17.77
Mean	1.460	1.327	0.262	17.972

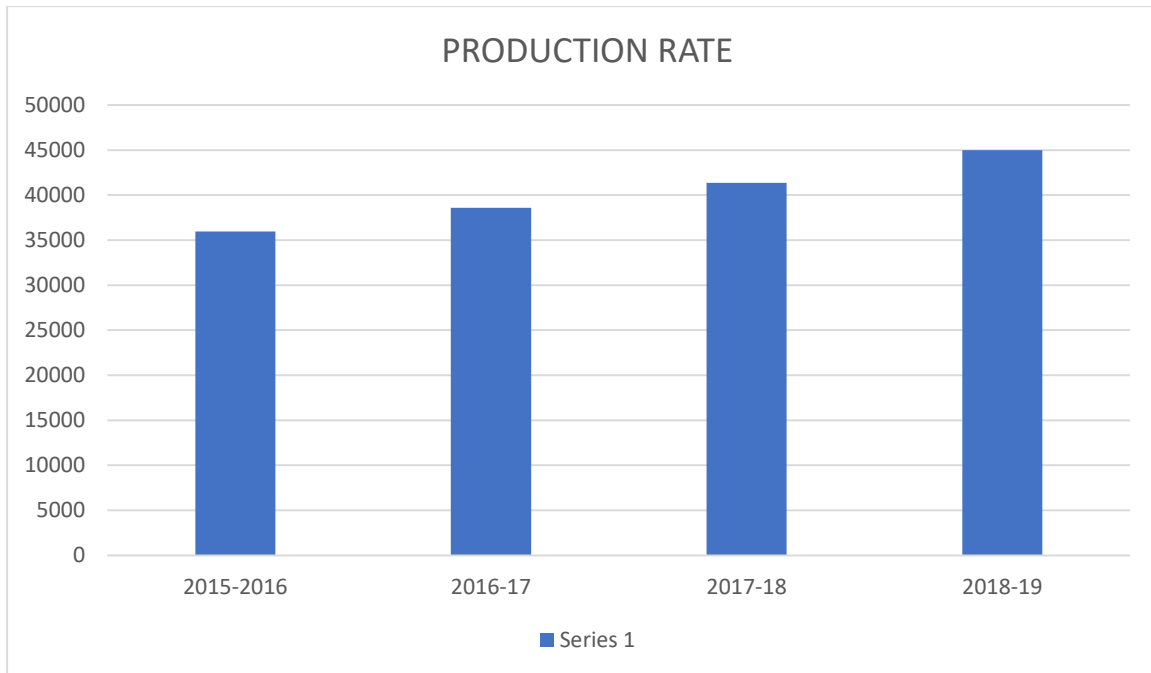
**Table2 .Number of good and defective cocoons from one kilogram of pure cocoons produced from Govt.Cocoon market,Sundargarh.**

Sl.No	Particulars	No. of defective cocoons	Percent
1.	Total number of healthy cocoons	850	91.10
2.	Stained cocoons	15	1.50
3.	Melted cocoons	17	1.72
4.	Double cocoons	22	2.25
5.	Flimsy cocoons	10	1.18
6.	Abnormal sized cocoons	08	0.96
7.	Uji pierced cocoons	15	1.29
	Total	937	100.00

Weight of the single cocoon was 1.535g. The total number of cocoons per kg was 930.430,107 lakh cocoons per yearly produced. So, average 600000 tone cocoons are transported to market for marketing.

The weight of the floss of pure cocoon is 10g. The deflossed bivoltine cocoon was supplied for reeling. The cocoon shell weighed 0.26g in pure cocoons.

Graph: Production rate of cocoons in Sundargarh in previous five years



(Figure1-Tasar seed centre, Kirei, Sundargarh, (Odisha)



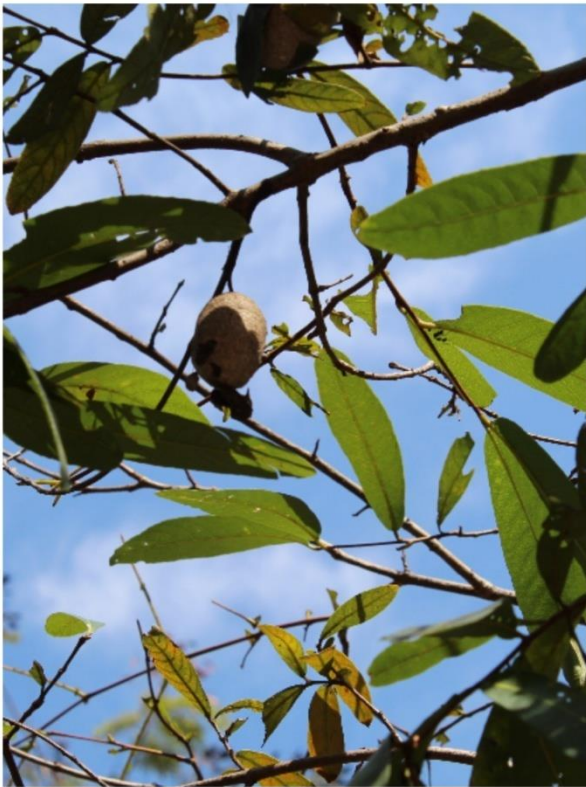
( Figure-2 Different rooms for storing, hatching of moth)



(Figure3-After feeding instars are transferred to forest by workers)



(Figure4-cocoons are hanging on the trees)



(Figure5-cocoons stored in store rooms.)



## RESULT DISCUSSION-

Tumul Singh's findings highlight the detailed process of cocoon formation in *Antherraea*, noting the larvae's intense leaf consumption and the subsequent stages leading to cocoon construction. The involvement of ecdysone in gut purging and the role of silk protein sericin in stiffening the cocoon are particularly intriguing. Furthermore, the comparison between natural forest collection and systematic rearing methods underscores the diversity of approaches in silk production. Ghanshyam Champia of Khosapura village and Roria Murmu of Rasul village serve as examples of sericulture in Kendujhar district. They acquire 400g of disease-free laying (DFLs) from the Tasar Rearers Cooperative Society (TRCS) in Tengriapal and rear them to produce 3 kahan of seed cocoons (1 kahan = 1,600). This yields 3.6kg of commercial DFLs, with Ghanshyam selling 2.6kg and rearing 1kg to generate 14.5 kahan in the initial crop. The Deputy Director of Sericulture, Zilla Panchayath, Chikkaballapur, supported by 5 Assistant Directors, oversees sericulture operations. 3354 reeler families are engaged, utilizing 13354.53 hectares for sericulture across 1131 villages, benefiting 15570 families, including 1159 SC, 1276 ST, and 219 minority families. The drop in overall production in Kendujhar district may be attributed to variations in weather conditions. Western Odisha experiences distinct weather patterns compared to the eastern region, with higher humidity levels near the sea. This humidity, typically ranging from 70-75%, is essential for successful silk culture, making it a significant factor in sericulture. Variances in weather conditions lead to disparities in production rates across different areas.

## EDUCATIONAL IMPLICATION-

In Sundargarh district, located in the Indian state of Odisha, the educational implications of collecting and storing cocoons can be significant due to the region's rich biodiversity and cultural context. Here are some specific educational implications:

Sundargarh district is known for its diverse flora and fauna. Collecting and studying cocoons can serve as a hands-on way for students to learn about the local insect diversity, life cycles, and ecological roles within the ecosystem. Understanding the significance of cocoons in the ecosystem can promote ecological awareness among students. Learning about cocoons can provide insights into traditional practices, such as silk production, and foster appreciation for the cultural significance of insects in local folklore and rituals. Engaging in cocoon collection and studying can instill a sense of environmental stewardship and conservation ethics among students. Overall, integrating cocoon collection and storage into educational activities in Sundargarh district can enhance students' understanding of biodiversity, ecology, agriculture, cultural heritage, and conservation, while also promoting experiential learning and community engagement.

## CONCLUSION-

The summary of tasar production, collection, and cocoon storage is as follows: The annual net cocoon production totals 400,000 (4 lakh) units. Each cocoon weighs approximately 1.535 grams, with 930 cocoons per kilogram. The total silk length amounts to 594.24 meters. Approximately 600,000 tonnes of cocoons are transported for marketing purposes.

Sericulture proves to be a highly lucrative venture, yielding substantial profits with minimal losses. Its success largely hinges on weather conditions, particularly temperature and humidity, which are crucial factors. Proper nurturing and a significant workforce are essential for its cultivation, given its seasonal nature. With advancing technology and improved facilities, the production of cocoons has witnessed a steady increase each year in Sundargarh.

## REFERENCES:

- Anonymous,(1972) Agriculture Technique Manual-1,Hand Book of silkworm Rearing.  
*Fuji Publication co.ltd.,Japan,p.319.*
- Jolly, M.S.(1982),Economics of Sericulture under irrigated conditions. Central Silk Board, *Central Sericulture Research and Training Institute*, Mysore Sericulture Project No.2.
- Kar, N.B(2015)Unpublished Teaching Material, *CSR and TI ,Berhanpore, India.*
- Kasisviswanathan, K., Krishnaswami , S. And Venkataramu, C.V. (1973),Effects of storage on the moisture content of mulberry leaves. *Indian J. Serio.*
- Kovaiev,P.A(1970),Organization And Technology of production of eggs for commercial rearing, in Silkworm breeding stocks. *Central silk board, Bombay p.107.*



NARAYANAN.et.al (1967), Preliminary observation on the effect of feeding leaves of varying maturity on the larval development and cocoon character of Bombyx mori L. *Indian J. Serio.*

Rangaswami (1976), Manual on Sericulture Vol-1 Mulberry cultivation, *F.A.O.Agricultural Services Bulletin 15/1 Rome P.150.*

Sidhu, N.S (1969), Effect of feeding leaves grown under N,P and K fertilization on the larval development and cocoon character of Tasar. *International journal.*

Tatzmia, Y.(1978). The silkworm – An Important Labrotary tool. *Kodasha Ltd. Tokyo,Japan,p.307.*

Yonemuram, M. and Ramaraon. ( 1925 ), A Hand book of Sericulture, .Rearing of Silkworm.Central Sericulture and office of the Superintendent of Sericulture , pp .19-100.

