ISSN: 2454-9940

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

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www.ijasem.org

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN2454-9940www.ijsem.org

Vol 6, Issuse.4 Dec 2018

Rearing of Eri Silkworm (*Samia cynthia ricini* Boisd.) and Status of Rural Women in Agriculture

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ABSTRACT

Eri silkworm, *Samia cynthia ricini* Boisd. (Lepidoptera: Saturniidae) is reared in different parts of the globe for its silk fibre, food and biomaterials. In India, eri silkworms are reared in mostly in northeast region. In Tamil Nadu ericulture is practiced with limited success in the districts of Salem, Dharmapuri, Namakkal and Cuddalore districts where the people wear the eri silk clothes during religious community festivals and ritual events with traditional fervour. However, proper documentation on rearing practice of eri silkworm followed in Cuddalore region is found to be missing. Therefore, realizing the importance of eri silk in the region, a questionnaire based and self monitored survey was conducted in Cuddalore district, Tamil Nadu to understand the rearing technique, innovations and beliefs associated with eri silkworm in the region. Indigenous rearing technique was mostly found to be similar with that of Assam in certain aspects like selection of food plants, larvae rearing and spinning technique. Most of the farmers were found to lack the scientific knowledge regarding diseases and pests attacking the eri silkworm and modern eri spinning techniques. In addition to these, most of the farmers were ignorant of government of schemes provided to support the farmers. This indicates the need of training regarding the effective rearing technique and silkworm diseases.

Key words: *Samia cynthia ricini*, Ericulture, Tamil Nadu, rearing techniques

INTRODUCTION

Among the commercially exploited non-mulberry silkworms, the eri silkworm, *Samia cynthia ricini* (Lepidoptera: Saturniidae) is the only domesticated silkworm adopted for indoor rearing round the year (Debaraj *et al.*, 2002). Different larval colour morphs of *S. c. ricini* are known and are reared in many parts of the world expecting to produce silk for making up cloths and medically important biomaterials (Kim *et al.*, 2012).

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Ericulture, the rearing of eri silkworm is also one of such socio-culturally valued practices. In Tamil Nadu and Assam, India, the eri silk has its utility especially in making traditional winter cloth and fashionable modern dresses such as 'Chaddar' and 'Shawl'. Apart from silk production, eri caterpillar and pupa are used as delicious food item in Tribal parts of Tamil Nadu and Arunachal Pradesh like many other parts of the world. Thus, the eri silkworm rearing is a means of employment and income source for a wider section of rural population in ericulture concentrated regions as it provides engagement through food and eri silk production and weaving activities. Therefore, realizing the importance of eri silk in the region, present investigation was conducted to highlight the rearing technique, innovations and beliefs linked with the rearing of eri silkworms and to identify the problems and prospects of eri silkworm rearing in the region so that it can help in uplifting the eri culture practice.

MATERIALS & METHODS

Ericulture practice

Information relating to the ericulture practice in Tamil Nadu were collected through survey in five ericulture concentrated villages (locally known as 'Graamam') namely Sivapuri, Parangipettai. C. Mutlur, Vallampadugai and Keerapalayam in Cuddalore district. A questionnaire was prepared and self observation of rearing was done during the year 2017 to collect data on the current system and status of ericulture from 50 rearers.

Pathogens of the eri silkworm diseases

The diseased larvae were collected and the hemolymph smears were spread on clean dry glass slides. The smears were later air dried and then fixed using heat staining. The heat fixed slides were stained with safranin and cotton blue stain separately to detect the presence of bacteria and fungus respectively (Chelsters - Crusius *et al*., 2006; Vasic and Dubak, 2012) and photographed using Leica DM 5000B microscope.

RESULTS

Food plants

Castor (*Ricinus communis* Linn.) and Tapioca (*Manihot esculentus*) were found to be used by the farmers as food plant for raising eri silkworm. However, farmers preferred *R. communis* over *Manihot esculentus* as it was believed that feeding on castor yields large sized larvae and cocoons. Instead, the food plants grown in the wild were collected using specially constructed bamboo basket to feed the silk worms.

Rearing house

Seventy percent of the farmers used their residential hut for rearing the eri silkworm. However, other 30% farmers constructed farm house outside the residential house. Some of the rearing houses were of open type, structured without any wall while others were usually constructed with bamboo wall. The general layout of the farm houses included open areas and rearing beds. Open areas were designed for working area and storage area. Storage area were used for keeping leaves and rearing materials such as bamboo tray, bamboo mountage etc. Rearing beds were made of bamboo poles, bamboo railings and bamboo mats.

Seed cocoon

In the present study, three different coloured cocoons were found to be used by the farmers. Five percent farmers used both orange coloured cocoon breeds and white cocoon breeds, ninety percent farmers used white cocoon breeds and rest of five percent of the farmers randomly selected cocoon breeds as seed irrespective of colour. About 20-30 cocoons were kept hanging using a thread or rope in the rearing room until emergence of the moths. Moths were then freely allowed to mate. The female moths oviposited on the wall of the rearing house or on a white cloth kept as background against a wall of the rearing house. The eggs laid were collected and wrapped in a paper till the emergence of larvae. For rearing of larvae, farmers used two techniques.

Larvae rearing technique

Farmers used two techniques for larval rearing - (a) bunch hanging technique (b) tray (surface) rearing technique. The 1st, 2nd and 3rd instars were reared using surface rearing technique. The 4th and 5th instars were mostly reared using bunch hanging method in which bunches of the host plant leaves were hanged pointing downward on a bamboo pole hanged parallel to ground surface using rope fixed to the roof of the rearing house.

Mountage

Three types of mountages were used by the farmers. One type is made up of semi dried of banana leaves, second type is made up of dried banana and jackfruit leaves with twig kept in a jute or plastic sack ("Saakku") and the third type called 'chandrike' is made up of bamboo. Ripened larvae were picked up and transferred to mountages. The bamboo 'chandrike' ensures uniform distribution of larvae which reduced the chances of forming double cocoons. Five percent farmers constructed the mountages outside the rearing house believing that outdoor temperature is more suitable for silk production.

Spunning

Pre-pupa, the 5th instar larvae, before being metamorphosed into pupa were taken out from the cocoon through opening the loose end of the cocoon manually. The pupa free cocoons were then degummed in boiling water without adding soda or other surfactant or using traditional degumming ingredients prepared from ash of banana leaves, ash of husk etc. The degummed cocoons were then washed in normal water and dried in sunshine. Dried empty cocoons were used for manufacturing silk yarns using, a traditional device used by the farmers. (Taba Meth and Hiren Gogoi, 2016)

Diseases

As reported by the farmers, they did not observe any severe disease in eri silkworm which caused economic loss. However, negligible number of larval death was found to appear due to irregular cleaning and feeding indicating the occurrence of Flacherie disease. No disinfectants were found to be used by the farmers to control the larval death. Microscopic observation of the hemolymph of diseased larvae was found to be reason for infection.

Social taboos and beliefs

Some social taboos were practiced by the farmers during eri silkworm rearing. During menstruation period, women did not enter into the rearing room as it was believed that it causes death of eriworms. Some farmers also believed that minor

earthquake also causes the severe death of larvae.

DISCUSSION

During the present investigation, only *R. communis* and *Manihot esculentus* were found to be used by the farmers as food plants for eri silkworms. *R. communis* is an ideal candidate for bio-fuel production with environment friendly bio products (cake, seed coats and biomass) and unique fatty acid constituents. *R. communis* bean oil contains low concentration of cadmium, lead, zinc, nickel, manganese and is copper free. Cake and seed coats can be useful for soil fertilization applications since the metal concentrations are below safety regulations. The biomass carbon was around 43%, which suggests its potentiality to be used for bio gas production (González Chávez *et al.*, 2014). Thus, the cultivation of *R. communis* for dual purposes viz. for ericulture and castor oil production will deliver economic benefit to the eri farmers of Tamil Nadu. Moreover, the caterpillars and pupa can be used as feed ingredients in fishery, poultry and piggery sectors which has proven to be more beneficial and cost effective (Ijaiya and Eko, 2009).The silkworm's cocoon is composed of two kinds of silk proteins, the silk Sericin, which makes up the membrane and the silk fibroin, which makes up the inner portion. Sericin is a glue-like mixture of glycol proteins with varying molecular mass. The latter is removed by the process of degumming and rinsing steps. The aesthetic and physical properties such as dull appearance, surface sterilization and strength loss are known to be dependent on the process of degumming. Biodegradable natural surfactants can reduce damage to silk fabric, besides being cheap, abundant, eco friendly and economical (Sarmah *et al.*, 2012). The eri rearers in Cuddalore district degummed the silk cocoon by extracting sericin in boiling water without adding soda or other surfactant or using traditional degumming ingredients. However, these methods need standardization for gaining better quality silk. The eri silk in cocoons are discontinuous and hence cannot be reeled, but be spun. Spinning of eri silk filament to make silk yarn is time consuming.

Though, little improvement was done in the technology through motorized-cum-pedal operated ring as well as flyer spinning machine, amber charka and mill spinning, these were not found to be used by the farmers.

The farmers were not aware about the different diseases of the silkworms. Instead, they believe in some social taboos and superstitions. During the present study, diseased larvae of *S. c. ricini* showed the presence of *Bacillus* and *Coccus* bacteria in infected larvae indicating the occurrence of Flacherie disease. The farmers did not discriminate between the larval colour morphs while selecting their seed cocoons. C2 breed of eri silkworm developed by the central Muga and Eri Research Training Institute, Lahdoigarh, Jorhat, Assam is recommended by the sericulture department, Govt. of Tamil Nadu for its high productivity with higher shell weight and fecundity but it was not found to be reared by the local eri farmers. Rearing of *S. c. ricini* was mostly done by the local farmers during May to September. Farmers preferred these rearing months due to availability of food plants and shorter life cycle of *S. c. ricini*. Singh *et al*. (2006) observed maximum cocoon weight, shell weight, shell ratio and hatching percentage during September-October rearing season. Virk *et al*. (2009) found larval duration to be shorter during July-August (Monsoon) rearing compared to winter season. Hata *et al.*

(2005) and Mahobia *et al*. (2005) recorded highest hatching percentage, larval weight, cocoon weight, shell weight, silk ratio and minimum larval period during August-September. Thus, from the present study it can be stated that though the ericulture practice followed by the farmers of Tamil Nadu is a traditionally established; indoor rearing method of eri silkworm through time tested techniques, farmers need awareness on the scientific knowledge on rearing technique, silkworm disease and the use of disinfectants to prevent the occurrence of diseases.

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