

## PROSPECTS OF SERICULTURE BY-PRODUCTS FOR ENTREPRENEURSHIP DEVELOPMENT AMONG RURAL WOMEN IN ASSAM

*Rekhmoni Gogoi<sup>1</sup>, Sundar Barman<sup>2</sup>, Monimala Saikia<sup>3</sup>, A. Hazarika<sup>4</sup> & U. Hazarika<sup>5</sup>*

<sup>1</sup>Research Scholar, Department of Extension Education, Assam Agricultural University, Jorhat, India

<sup>2</sup>Assistant Professor, Department of Extension Education, Assam Agricultural University, Jorhat, India

<sup>3</sup>Assistant Professor, Department of Sericulture, Assam Agricultural University, Jorhat, India

<sup>4</sup>Research Scholar, Department of Extension Education, Assam Agricultural University, Jorhat, India

<sup>5</sup>Scientist, Central Silk Board, MSSO, Narayanpur, Lakhimpur, Assam, India

Received: 28 Apr 2020

Accepted: 04 May 2020

Published: 20 May 2020

### ABSTRACT

*Sericulture is an agro-based industry, which suits rural-based farmers, farm women, entrepreneurs, and artisans need less investment. India is the second largest producer of silk in the world, next to China. In reality, sericulture is an occupation for mostly small and marginal farmers as well as for women. Women constitute more than 60 per cent workforce in sericulture activity in Assam. The products of sericulture are cocoon, raw silk and ultimately the fabric. It involves lots of activities beginning with the cultivation of host plants to harvesting of leaves for feeding of silkworm and the rearing of silkworm from the egg to harvesting of cocoon and the reeling of cocoons to produce raw silk and processing it to produce the finished product. In each of the activities, a number of by-products, popularly called wastes are generated such as: unused leaves, dead, unhealthy & diseased larvae, larval litters & excreta, pupa, defective cocoon, silk waste and parts of host plants like mulberry fruits & stem, castor seed, tapioca tuber etc. Lots of value added products like spun silk, ghicha yarn, pupa, compost, craft items, medicines, cosmetics etc. can be prepared from these wastes. Effective utilization of these waste products make sericulture sector more attractive and remunerative as well as will help in doubling farmer's income. So, there is a large scope of development of entrepreneurship among rural women through utilization of sericulture by-products. The earlier concept of sericulture to produce only silk, now has changed into the functional sericulture of a new paradigm to relieve the patients as well as to increase the farmer's income dramatically.*

**KEYWORDS:** *Sericulture, By-Product, Waste, Entrepreneurship Development, Income*

### INTRODUCTION

Entrepreneurship is the process of innovation that reallocates resources, often creating new opportunities through unusual combination of resources and skills of risk taking and in the field of agriculture, it can generate wide range of economic benefits such as increased agricultural productivity, creation of new business ventures, new jobs, innovative products and services, development of rural areas and increased wealth. Agripreneur is a dynamic business manager who performs various agri-based activities using different resources viz, physical resources, financial resources, human resources and information, in order to accomplish a certain goal. For the development of any nation, the females play a significant role.

Since the dawn of civilization, men and women have equally contributed to the field of agriculture. According to the United Nations, India has 48.20 % female population of the total population and majority of Indian females are involved in agriculture and its allied sector (Anonymous, 2019 a). Rural poverty, unemployment and underemployment are some important issues of Indian economy that need to be addressed strategically. Agricultural development alone cannot provide suitable solution for alleviating these problems. Sericulture i.e. the production of silk worms is an agro-based industry, which suits rural-based farmers, entrepreneurs, and artisans, and has become a promising rural activity in India because of its minimum gestation period, minimal investment, maximum employment potential and quick turnover for investment (Kasi, E. 2009).

Women make considerable contribution in agricultural activities and silk production. Traditionally, the economy of India is largely dependent on the success of agriculture and its allied sector. In reality, Sericulture might be an occupation for women as women constitute more than 60 % of the work force in sericulture and it can generate employment up to 11 persons for every kg of raw silk produced, out of which more than 6 persons are women (Bukhari *et al.*, 2019). In Indian condition, women have been generally termed as home-makers. Women spend 16-18 hours per day working at indoor and outdoor, but still their contribution is often unrecognized, under counted and undervalued. In fact, women have to bear double burden in the development process as they play triple role i.e. production, reproduction and community roles. The continuous increase in prices of necessary commodities has also pushed women to income generating activities within or outside the household to maintain an economically sound family. Sericulture is one of the income generating activities of rural women specifically in some region, castes and tribes. At present, sericulture is practiced in more than 59, 528 villages in India and contributes around 5 % to our GDP. India is the second largest producer of silk, next to China. Total silk production during 2018-19 in India is 35,468 MT (Anonymous, 2019 b) and 5029 MT in Assam including Bodoland (Anonymous, 2019 c). The importance of silk in Indian economy is evident by the fact that 18 percent of the global raw silk is produced in India and out of that 65 % eri and 95 % muga silk is produced in Assam (Anonymous, 2019 d). The employment generation in the country is raised to 9.12 million persons in 2018–19 (Provisional) compared to 8.60 million persons in 2017-18, indicating a growth employment generation of 6 %. (Anonymous, 2019 e).

Sericulture involves lots of activities beginning with the cultivation of host plants for feeding of silkworm, the rearing of silkworm for harvesting of cocoon, the reeling of cocoons to produce raw silk and processing of raw silk to produce the finished product. In each of the activities, a number of by-products, popularly called wastes are generated. A by-product is something which is produced during the manufacture or processing of another product. Actually, in silk industry nothing goes as a waste. Waste can be minimized at every stage by producing some valuable products. Effective utilization of waste will help in making the sericulture industry more viable, stable, and economical and to create more employment opportunities.

This paper reviews the prospects of entrepreneurship development among rural women through sericulture by products in Assam. In order to review the prospects in Assam, the secondary information sources like published report of sericulture department and other research reports were reviewed meticulously.

## Entrepreneurial Prospects through by-Products Generation in Different Stages of Sericulture

### Stage 1: Host Plant Cultivation

Cultivation of host plant is the first step of rearing of silkworm. The primary uses of host plants are to feed to the silkworm. Except this, the host plants have lots of uses in commercial point of view which may be considered as by product of host plants.

#### Mulberry Tree

The different parts of mulberry plant have some other uses. In case of silkworm rearing, only the leaves are used. Unused leaves, mulberry fruit, bark etc., are considered as wastes. So, mulberry plant alone provides lots of entrepreneurial scope for women of Assam as it is available all over the Assam.

#### The By Products from Mulberry Tree are

##### Mulberry Leaf

The mulberry leaf can be used to prepare mulberry tea, which is known to improve the function of liver and kidney and sharpen the hearing and brighten the eyes. Mulberry leaves are also used for a forestation, decoration, and as animal feed. Mulberry leaves are rich in calcium, phosphorus, magnesium, vitamins like B, C and K. They also contain antioxidants and are good source of ascorbic acid. The medicinal properties of mulberry leaf are recognized for its diuretic, blood sugar and blood pressure reducing effects. It also has anticancer effect and weight loss property (Nazim *et al.*, 2017). So, leaves are used to prepare different types of medicines, herbal supplements etc.

##### Mulberry Fruits

They carry colorful berries. Due to their sweet flavor, impressive nutritional value, and various health benefits, mulberry fruits are gaining popularity worldwide. Mulberry fruits are rich in many vitamins and minerals, particularly vitamin C and iron. Besides, ice cream, pies, tarts, puddings etc., mulberry fruits are used to prepare jam, jelly, pickle, squash, juice, wine, vinegar etc. It is also used to make various cosmetic products. Table 1 shows the nutrients present in 100-gram of fresh mulberry fruits.

Mulberry fruit is also used in the food industry for natural coloring and its root bio mass is a valuable raw material for the pharmaceutical industry, due to its high flavones and phenol content.

Table 1 Shows Women of Assam can establish enterprise to produce mulberry tea, jam, pickle, squash, juice etc. They can also send different parts of mulberry tree to different food industries, cosmetic industries and medicine preparation industries to earn extra income. Another important scope of mulberry is to establish mulberry nursery. Women can prepare mulberry cuttings easily and can send it to various sericultural farms and farmers.

**Table 1: Nutrients Present in 100 Gram Fresh Mulberry Fruits**

Sl. No	Nutrients	Unit	Quantity
1	Calories	Grams	43
2	Water	Percentage	88
3	Protein	Grams	1.4
4	Carbs	Grams	9.8
5	Sugar	Grams	8.1
6	Fat	Grams	0.4
7	Fiber	Grams	1.7

Source: Adda Bjarnadottir, 2019

### Castor Plant

Castor is the primary food plant of eri silkworm. Castor is also very important as castor seed is the source of castor oil which has a wide variety of uses. Castor oil and its derivatives are used in the manufacturing of soaps, lubricants, hydraulic and brake fluids, paints, dyes, coatings, inks, cold resistant plastics, nylon, pharmaceuticals, perfumes, waxes and polishes. The table 2 shows the average composition of castor seed oil.

**Table 2: Different Acid Contents in Castor Seed**

Sl. No	Acid Name	Average Range (%)
1	Ricinoleic acid	85–95
2	Oleic acid	2–6
3	Linoleic acid	1–5
4	$\alpha$ -Linolenic acid	0.5–1
5	Stearic acid	0.5–1
6	Palmitic acid	0.5–1
7	Dihydroxystearic acid	0.3–0.5
8	Others	0.2–0.5

Source : (Mutlu and Meier, 2010)

### Jatropha Plant

Jatropha seed oil has similar oil content with castor seed oil. The seed contains 28-30% oil. It is easily soluble in alcohol. It is an excellent lubricant, a good wetting agent and a fairly good raw material to manufacture soap. This oil is also considered as good hair stimulant. Traditionally, this oil is used for lighting purposes in Assam and elsewhere. Its stem is used as tooth brush and leaves are used as green manure in tea garden.

### Tapioca Plant

In case of tapioca 10-12 tones of tuber can be obtained per hectare of tuber plant. Besides using it as a source of food, the tuber is used in manufacture of Sago, Starch, glucose and dextrine. The tuber contains 20 to 25% starch. Both Tamil Nadu and Kerala states are known for tapioca products. Sago is one of the important foods for nursing mothers as it increases breast milk and good for stomach ailments. Tapioca starch is well-accepted as sizing material for cotton, jute and paper industries. Starch is also used for fire crackers explosives, match-box manufacturing, dry cell etc. Of the total demand of starch in the country about one-fourth is met from tapioca.

An Eri silk development project was implemented in Assam which has been dedicated for sustainable livelihood for women of Bodoland Territorial Council through tapioca plantation in Kokrajhar. The objective of the project was to utilize tapioca plantation for dual purpose- i.e. the tuber for food and the leaves for eri silkworm to cover tribal families of below poverty line. It exhorted people to adopt and practice turning waste silk into new fabric and this helped farmers and farm women in realizing the idea of waste to wealth. Around 1400 farmers and farmwomen were benefited through this project.

Besides, in Assam women are involved in eri silkworm rearing specifically from ST, SC and OBC communities. By and large, these host plants are available in every household but they are not aware about the use of by-products of host plant.

Enterprise can be established by women to prepare lots of products like castor oil, jatropha oil, tubers, starch etc. They can also create enterprise to supply the castor seed, tapioca tuber, jatropha seed etc to different industries for production of valuable products.

### **Som and Sualo Plant**

Wood of som and sualo is very soft, lacks strength, but they can be used for manufacture of decorative items and as raw material for pulp and paper. Leaves are good for green manuring.

### **Stage 2: Rearing of Silkworm**

During the process of rearing lot of wastes like unfertilized eggs, excess of harvested leaves, larval litters and excreta, diseased, dead, unhealthy larvae, etc. are generated and these waste products can be used to produce different usable products.

#### **a. Unfertilized Silkworm Eggs**

All silkworm eggs are not fertile. Waste eggs can be used for various purposes as it contains albumin, fats, sugars, glycoproteins, B<sub>1</sub> and B<sub>2</sub> vitamins etc. and eggs are processed into proteic extract which in turn is used in the pharmaceutical industry for the preparation of medicines (Nazim *et al.*, 2017). The extract is also used as male sexual stimulator. In some countries like Bulgaria some people believe that If alcohol addicted people eat silkworm eggs, they will give up drinking completely because, they start feeling alcohol disgust. This fact is yet to be proved scientifically. But, silkworm eggs are commercially very important, so farmers can send the waste eggs to industries and it will provide extra income for them.

#### **Dead, Diseased, Unhealthy Silkworms, Excess of Harvested Leaves, Larval Litters and Excreta etc**

All larvae are not suitable for spinning of silk. Dead Larvae is used for feeding young animals, reptiles, as protein flour having the role of dietary supplement. It is also used in the pharmaceutical industry for the preparation of medicines having anti diabetic action or in the food industry as supplementary nutraceutical. So in many aspects, larvae also have huge entrepreneurship scope.

Another important scope of entrepreneurship for women sericulture farmer is preparation of compost and vermin compost. Sericulture farmers usually throw the dead, diseased, insect infested larvae. But, if they use it in making compost, then it will be beneficial for them. The left over mulberry leaves from rearing bed, field and other waste including silk worm litter are not properly utilized in preparing compost of high nutritive value. It was reported that nitrogen content in the compost prepared by silkworm rearing wastes is 1.68 % or similar to those obtained from the cow dung (Ichim *et al.*, 2008).

### **Stage 3: Reeling of Silkworm**

In case of reeling a cocoon, the whole cocoon is not suitable for reeling. Some wastes are produced even from good cocoons. These are deflossing waste, cooking waste; thread waste, plead layer or basin refuse, charkha waste, filature waste, re-reeling waste, throwster's waste etc. Again, all cocoons are also not suitable for commercial reeling. The unreelable cocoons which are produced due to various reasons like genetic defects, diseases, pest, improper mounting, early harvesting or improper transportation of cocoon etc are termed as defective cocoon. These are considered as waste as these cannot be reeled along with normal cocoons. These unreelable cocoons and silk wastes have lots of scope for entrepreneurship development.

**Spun Silk:** Spun silk is a form of cheaper silk thread of short lengths obtained from wastes and damaged cocoons or broken off during processing, twisted together to make yarn. Different types of yarn produced from wastes and defective cocoon are.

**Dupion Silk** - Dupion literally means double. Dupion silk is made from double cocoon.

**Noil Yarn** - Noil Yarn is short staple residue obtained during dressing operations in silk spinning from silk waste.

**Matka Yarn** -Matka Silk is a rough handloom hand spun yarn made from the pierced cocoon and cut cocoon. Matka yarn is good for making jacket, suit etc.

**Ghicha Yarn** - Ghicha is the silken yarn obtained from cocoon which does not get included in the routine process of reeling. This yarn is generally used as blend material with pure silk fabric or katia silk or pure cotton fabric.

**Balkal Yarn**-Balkal is a thick, coarse yarn made from tasar peduncle.

**Katia Yarn**-Katia yarn is made from tasar silk waste left after reeling including floss.

**Uses of Spun Silk Yarns**-The best grades of spun silk yarn are used as filling or weft in several varieties of silk fabrics, both plain and twill, and in pile goods such as velvets. Spun silk yarn of high grade is also used as warp in goods that have a cotton or wool filling. A considerable amount is used in the production of embroidery and knitting silks. Lower grades of spun silk yarns are used in making ribbons and silk cords, while the cheapest grades are used in making knit goods and the poorest and coarsest silk or silk-mixed fabrics. The poorest grades of spun silk, those which are carded only and not combed, are used as filling in cheaper grades of silk dress goods, in the silk upholstery fabrics in polishing cloths, and in coarse grades of knit goods.

### **Cocoons for Beauty Purpose**

Rubbing silkworm cocoons on face results in gentle and precise exfoliating, ultimately leading to healthier, softer skin. Silk cocoons contain natural proteins, amino acids and collagen which are excellent for anti-aging and keeping skin supple and nourished, removing blemishes and dead cells. Statistics show that UV damage and scarring have improved by 20% after using the silk cocoon for a month or so.

Lily silk beauty cocoon is a specialized silk store, has already sold beauty product with best quality and service. Lily silk beauty cocoon is first used by Chinese. Packaged in a beautiful yarn bag, the freshest Lilysilk mulberry silk cocoons bring a unique beauty experience. In Assam also, women can make a group and start such type of business. They can earn a huge profit by selling the cocoons for beauty purpose.

### **Craft Items from Cocoon**

Cocoon crafting is an art of designing of some handicraft products like flowers, bouquets, garlands, greeting cards and other artistically designed fancy items. Defective cocoons double cocoons, inside stained cocoons (dead cocoons), outside stained cocoons, montage pressed cocoons, deformed cocoons, thin end cocoon, pierced cocoon, multi-end cocoon, flimsy cocoon etc. can be used by women to produce attractive craft items which will minimize cocoon waste and help to earn extra income. The craft items like cocoon garland, Flower, bouquet, earrings, necklace, greetings card, Small gift / decoration items like colorful birds, images of deity Ganesha, miniature mulberry or other trees, historic monuments like Taj Mahal and mythological Snowman, or any other items of aesthetic value which will exhibit the creative skill of craftsmanship, can be easily prepared from waste cocoon with the help of easily available raw materials like color, paint brush, gum, threads, scissor, etc. After giving it a finishing artistic touch, fancy product thus prepared can be glass framed

and presented as gift or sold in the market, these items exhibit exquisite look and attract the attention of dignitaries and customers.

Shrimayum Gita Devi of Khurai Thongam Leikai is an innovative craftsperson in Manipur who successfully takes up the craft of making varied designs of lady ornaments like erring, necklace, rings etc from cocoon under the brand Leima Liklang Nayin. Initially, she started her business with mere investment of Rs. 3000 /- and at present her business volume has reached Rs.10 lakhs. And around 40 artisans are still working at her unit. And so far she has trained more than 80 trainees, especially womenfolks. The tribe considered the ornaments made out of cocoons a luxury they could afford. Based on the designs worn by the Manipuri women in early times, Gita attempted to experiment with Leimatil silk cocoon to make various ornaments. She learnt the craft of making silk cocoon based ornaments once she along with 20 sericulture workers from Manipur took part in a five days training programme at the Central Sericulture Research and Training Centre in Mysore in September 2007. The trainees were taught as to how to make cocoon based ornaments and garlands. After joining the training, she was highly motivated that she initiated her craft in making various ornaments out of cocoon.

### **Silk Powder**

Silk powder is also prepared from left over silk waste which is used in cosmetics and medicine for reducing cholesterol and blood pressure. The waste are also utilized by the rearer themselves to produce crude silk for household use.

### **Pupa**

Pupa is the main by product which is mostly available as a local food. In India, eri pupa is sold in several markets of north eastern states which are appreciated as a tasty food. Table 4 shows the amount of nutrients present in silkworm pupa. Beondegi is a Korean street food. It comprises steamed or boiled silkworm pupae, which are seasoned. In Assam, some people rear silkworm only to eat the pupa. It has a great market value in Assam. Price of pupa is 400–800 per kg based on locality. In villages eri rearers sell pupa at Rs. 2–4 / pupa. The use of diets containing 5 % to 8 % silkworm pupa can replace 50 % of fish meal and lower weight gain. Silkworm pupa has lots of entrepreneurship scope. Farmers can establish an enterprise on the basis of pupa to utilize its quality.

### **Different Usages of Silk Worm Pupae**

- Silk worm pupae is directly used as poultry feed, fish feed etc.
- Pupae oil is used in the pharmaceutical industry having anti- inflammatory and anti-tumefying like effects.
- It is also used for treating sinusitis, otitis, bronchitis, asthma, tuberculosis and urinary infection.
- The DHA found in silkworm pupae oil can be an effective supplement for human nutrition. Hence, the pupae oil can be used as a replacement for other edible oils and can be future food with healthy fats which can prevent the risk of many diseases.
- The silkworm pupae due to their high fat content are also used as chrysalis oil to obtain soaps, lotions and emulsions.
- In crop production, it can be used as an organic source. In animal production, de-oiled pupal powder can be directly used as a feed for fish, poultry bird, for mushroom cultivation and vermiculture.
- Pupal powder can be used for biscuit production.

- Pupal skin contains chitopoly associated with chitosan in polysonic fiber widely used as blend spun yarn mixed with cotton, polyester, nylon and rayon.
- Pupal oil can be utilized in major surgeries to check bleeding which acts as a bio-compatible membrane.

Source: Anonymous, 2018

### **Silkworm Moth**

The silkworm moth has number of following usages and thus opens up the scope for entrepreneurship development, specifically women.

- Male silkworm moth is used in the preparation of Wine.
- The liquid extract from the moth can be used to treat impotence, abnormal menstruation & menopausal symptoms.
- Silkworm moths are used to prepare pharmaceutical product for curing trauma and to strengthen the masculine function.
- Moths are used as compost material.
- Silkworm moth oil is used to obtain textile dyes & soaps.
- Moths are used as an animal feed.

Source: Singh and Jayasomu, 2002

### **CONCLUSIONS**

By applying some modern methods for processing the secondary and waste products from sericulture, additional incomes can be obtained that may even double or triple the farmers' incomes. Proper utilization of sericulture and silk waste adds a value of up to 40% to the silk industry (Singh and Jayasomu, 2002). In Assam, by-products like only pupa and spun silk are used. Women sericulture rearer still are unaware about the various utilization of the waste products. By providing training, they can be shown awareness about the different uses of by products through which they can empower themselves by creating enterprise of mulberry pickle, mulberry squash, jam, compost, vermicompost etc. very easily. Cocoon crafting can be taken as a commercial activity particularly by women folk which will attract attention of huge number of local masses and thereby they can boost up their revenue returns and value addition in sericulture through handicraft market. Therefore, the earlier concept of sericulture to produce only silk, now has changed into the functional sericulture of a new paradigm to relieve the patients as well as to increase the farmer's income dramatically. Those functional sericulture aspects are likely to be further developed and finally reborn into a real biotechnology-based sericulture in the future.

### **REFERENCES**

1. Adda Bjarnadottir (2019) *Mulberries 101: Nutrition Facts and Health Benefits*  
<https://www.healthline.com/nutrition/foods/mulberries>.
2. Anonymous (2018) <https://www.slideshare.net/chandiniamaan/nutrient-and-dietary-uses-of-silkworm-pupae>.
3. Anonymous, (2019a). <http://statisticstimes.com/demographics/sex-ratio-of-india.php>.retrieved on 16th May, 2019.

4. Anonymous, (2019b) [http://www.csb.gov.in/statistics/silk production-sericultural statistics in India-A glance](http://www.csb.gov.in/statistics/silk%20production-sericultural%20statistics%20in%20India-A%20glance).
5. Anonymous (2019c) [http://texmin.nic.in/sites/default/files/Note on Sericulture English.pdf](http://texmin.nic.in/sites/default/files/Note%20on%20Sericulture%20English.pdf) retrieved on April 2019.
6. Anonymous, (2019d) <https://sericulture.assam.gov.in/how-to/know-about-silk-and-its-production-in-assam>.retrived on 2019.
7. Anonymous (2019e) [http://texmin.nic.in/sites/default/files/Note on Sericulture English.pdf](http://texmin.nic.in/sites/default/files/Note%20on%20Sericulture%20English.pdf) retrieved on April 2019.
8. Bukhari, R. Kour, H. and Aziz, A. (2019) Women and the Indian Sericulture Industry *Int.J.Curr.Microbiol.App.Sci* 8(5): 857–871.
9. Ichim, M., Tanase, D., Tzenov, P., & Grekov, D. (2008, September). Global trends in mulberry and silkworm use for non–textile purposes <https://fddocuments.in/document/global-trends-in-mulberry-and-silkworm-use-sericulture-involves-a-large-scale.html> workshop—Possibilities for Using Silkworm and Mulberry for Non-Textile Purposes (pp. 23–26).
10. Kasi, Eswarappa (2009) ‘Socio-Cultural Dimensions of Sericulture: A Village Study from Andhra Pradesh’. In M. Moni and Suresh Misra (eds.), *Rural India: Achieving Millennium Development Goals and Grassroots Development* (pp. 298–313). New Delhi: Concept.
11. Mutlu, H.; Meier, MAR (2010) Castor oil as a renewable resource for the chemical industry. *European Journal of Lipid Science and Technology* 112 (1): 10–30.
12. Nazim, N., Buhroo, Z. I., Mushtaq, N., Javid, K., Rasool, S., & Mir, G. M. (2017). Medicinal values of products and by products of sericulture. *Journal of Pharmacognosy and Phytochemistry*, 6(5), 1388–1392.
13. Ganie, N. A., Kamili, A. S., Baqal, M. F., Sharma, R. K., Dar, K. A., & Khan, I. L. (2012). Indian Sericulture Industry with particular reference to Jammu and Kashmir. *International Journal of advanced biological research*, 2(2), 194–202.
14. Savthri, G., Sujathamma, P., & Kumari, N. V. (2009). Sericulture for Sustainable Rural Development–in Indian Percepective. *RURAL DEVELOPMENT* 2009, 141.
15. Singh, K.P. and Jayasomu, R.S. (2002) *Bombyx mori* – A Review of its Potential as a Medicinal Insect *Pharmaceutical Biology* 40 (1): 28–32.



