Sustainable Utilization of By-Product of Eri Silkworm

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Abstract- *Recognizing the possibility of utilizing by-products of silk cocoons by applying appropriate methods is the immediate crave to optimize returns. Ericulture, a subsidiary occupation of rural hilly tribal population and the waste by-products of the culture is of enormous potential in generating the sources of human food, chocolates, animal food, fertilizers, medicines, cosmetics etc. The prospect of utility of eri pupae as an alluring dish in addition to its use in chocolate industry, animal feed, fertilizer, medicinal and cosmetic industries, Chitin as pharmaceutical and biomedical uses, Pupal skin in cosmetic industries and waste cocoon as cocoon art like garlands, flower pots definitely encourages the producers of eri silk. This ensures additional income for the eri rearers and in the upliftment of the socio- economic condition of the poor tribal people.*

Keywords- Eri silkworm- by products- uses

I. INTRODUCTION

The commercially exploited eri silkworm *Samia ricini* (Donovan) is a polyphagous and multivoltine insect and 5-6 crops can be raised in a year based on availability of foliage of host plants and prevalence of suitable climatic condition. Ericulture has been traditionally practiced in north eastern states contributing more than 98% of the total eri raw silk produced in the country. In addition, by-products in the form of protein rich eri pupae, silkworm litters and excreta also form important economic components of the culture. The by-products presently felt as wastes, can put to better use in generating the value-based products and thereby catapult the industry to a more profitable and economically viable spot. The full utilization of silkworm cocoons as different marketable products and such an integrated operation can certainly make the Sericulture more practical. The cost of end product i.e. the silk can be proportionately brought down by the combination of regulating the processing methods and converting the wastes as useful by-products. The optimal by-product utility concept can be highly useful to sericulture industry, which can help in elevating the socio economic status of the rural poor rearers.

Production trend of Eri silk

During 2019-20, the total production of eri raw silk in the country was 7157 MT, out of which 7116.5 MT were produced by north eastern states, sharing 98.53% of the total eri raw silk produced in the country. Other major eri producing states included West Bengal (9 MT), Uttar Pradesh (8 MT), Andhra Pradesh (5 MT), Bihar (5 MT), Orissa (5 MT) and Madhya Pradesh (4.5 MT), while remaining quantity of 4 MT of raw silk were produced by other states viz., Tamilnadu, Punjab and Uttarakhand.

Prospects for sustainable utilization of Eri silkworm products and byproducts

The average cocoon weight, shell weight and shell ratio of eri cocoons ranged from 3.0-3.50g, 0.40-0.50g and 12.5-15.80 per cent respectively. Eri silk fibre with 2.0-2.5 denier, tenacity of 2.5- 3.5 g/denier, 83 per cent and 13.0 per cent fibroin and sericin content respectively, is finer than Muga and Tasar but coarser than Mulberry; and softest and warmest among all silks.

A. Potential for diversified products

Eri cocoons cannot be reeled but spun like cotton for production of fine, soft fabrics in the form of scarves, shawls, and garments. The silk can be blended with wool, other silks, cotton and synthetic fibres to produce wide ranges of attractive and irresistible apparels. Products such as furnishings, stoles, dyed fabrics, hand bags, caps, jackets, quilts and other diversified materials can also be obtained by virtue of its thermal property with vast marketing avenues at international level.

B. Utilization of post cocoon products

The eye catching art of cocoon craft is one of the very interesting utility of by-products which will give scope to develop human skills in addition to generate self-employment and revenue. The value addition in post cocoon sectors is estimated to generate income ranging from 10 to 25 per cent in total returns. Different articles like garlands, flower vase, wreath, pen stand, dolls, jewellery, wall hangings, wall plates, clocks, bouquets and greeting cards are being prepared using the waste silk cocoons.

In Japan some laboratories have produced silk paper in different colors for making craft articles like flowers and lamp stands. The silk leather, a paint containing silk powder is

used to decorate plastics, steel and fabrics. The hybrid silk, net raw silk, silk tow and silk wave were produced in Japan for making under garments, jackets, sweaters, carpets and furnishings (Singh *et al*., 2002).

C. Effective utilization of by-products

Eri silk worm pupae have high nutritional values with 53.3 per cent protein, 25.6 per cent fat, 4.4 per cent carbohydrates and vitamins on dry weight basis. Oil extracted from pupa has pharmaceutical and medicinal value while deoiled pupae are the valuable source of essential amino acids. The tribals of North – Eastern states consume pupae of eri silk worm as a delicacy. Eri pupae are consumed as food by tribals.

Pharmaceutical and Biomedical uses

Chitin, a component of pupal skin used in post operational treatments such as conchotomy, deviatomy, polypectomy because of its easy usability, less hemophase, greater pain relief and fastens healing of wounds. Chitin used as immuno-adjuvant (antiviral agent), bacteriostatic, fungistatic, anti-sordes agents in preventing carcinogenic bacteria from teeth and bio-compatible membrane to check bleeding in major surgeries. Silkworm proteins in the form of Serratio peptidase is used in pharmaceuticals for anti-inflammatory, anti-tumefacient action of acute sinusitis, tonsiloctomy, oral surgery, during filling, cleaning and taking out teeth.

The silk protein sericin used as anti-oxidative, bio-adhesive and also in wound healing treatments. The glucosamine extracted from silkworm pupae can be used for treating osteoarthritis. The pupae were used in medicinal wine since ancient days and for lowering fat, blood pressure and blood sugar levels. They also used for treating liver hepatitis, pancreatitis, leukocytopenia, neurological, ophthalmic, anti-bacterial, anti-histaminic, gastric ailments and in preparation of vitamins A, E and K (Velayudhan *et al*., 2008).

Cosmetic uses

Pupal skin protein derivative, chitin found used in cosmetic preparations and the absorbent/ resilient hybrid silk films used in wound healing and in de-scarring. The silk bio-polymer used in manufacturing contact lenses, tissue regeneration for treating burn victims and matrix of wound dressing. The silk fibroin peptides are used in cosmetics due to their glossy, flexible, elastic coating power, easy spreading and adhesion characters (Dandin and kumar, 2007). The silk protein, sericin due to its saturation, revitalization and UV rays absorption properties has got potential as skin moisturizer, anti-irritant, antiwrinkle and sun protector in addition to shaping the hair by making soft and flexible. The silk worm pupal oil is used in cosmetics like hair oil, face powder, creams and body deodorants.

Animal feed uses

The pupae and silk waste are being used as poultry or fish feed. The de-oiled pupae fed hens improved their egg laying capacity with impact on the color of the egg yolk and the fat free pupae used as feed of carps and fish for better yields. Silkworm pupae were used as food in piggery, poultry, pisciculture and as dog feed due to their richness in protein and fatty acids. The dried pupal feed has enhanced growth rate and egg quality in hens and improved survival rate, feed conversion rate and specific growth rate in fish. The deoiled feed of pupae made rabbits to gain better weight and growth of fur.

Chemical industry uses

The silk worm pupae oil has got wide uses in food processing industries. Pupal fat is good raw material in soap, glycerin, cosmetic industries and fertilizer can also be generated from the pupa and pupal excreta. The n-triacontanol, a plant growth promoter is found in good quantities and being extracted from silkworm. The pupal skin which is available abundantly in the reeling and grainage sectors as a waste can be utilized as commercial raw material for various industries (Han *et al*., 2002). The silk worm pupal fat and oil is useful in soap / cosmetology industries and found working in anti-aging, darkening gray hair and body weight reduction.

D. Prospects for diversified uses of eri food plants

Castor leaves are rich in protein (25%) and carbohydrates (50%). Dried/powdered leaves are useful in repelling aphids, mosquitoes and termites while fresh leaves reduce body pain. Castor stem pulp can be used as raw material for wrapping paper and straw boards while stalks are utilized in production of biogas, vermicompost and organic manure. Castor seeds contain 40-55 per cent oil, 20 per cent protein, 20 per cent carbohydrates, 5 per cent sugar and 2 per cent ash. The oil is extensively used as lubricants and has medicinal values. In addition, mixture of castor oil, liquid wax and mineral oil are largely used as lubricants in industries and machineries. Tapioca tubers are staple food in Kerala and North eastern states. The tuber contains 83 per cent carbohydrate, 1.5 per cent protein in dry state with 25 per cent starch; and used for production of starch and glucose.

II. CONCLUSION

By-product utilization hopefully should play a crucial role in the coming years to make the sericulture an economically viable proposition enabling it to withstand competition from other cash crops. The useful conversion of byproducts through indigenously available processing techniques brings additional income lead to socio economic up-liftment of rearers.

REFERENCES

[1] Dandin, S. B. and S. N. Kumar. 2007. Bio-medical uses of silk and its derivatives. *Indian Silk*. 45(9): 5-8.
[2] Han, S. M., Y. S. Suk, H. J. Baek, H. R. Park and M. S. Han. 2002. Effects of silkworm extract on streptozotocin – induced diabetic rats. *Int. J. Indust. Entomol*. **5**: 201-204.
[3] Singh, B.K., N. Tiken, P. K. Baruah, K. Dutta, S. N. Mishra J. C. Mahanta and P. Jayaprakash. 2015. Studies on rearing performance and economic traits of eri silkworm (*Samia ricini*) on castor and kesseru: prospects for sustainable utilization of by products. *Journal of Environment science*, **1**(4): 305-308
[4] Velayudhan, K., N. Balachandran, R. K. Sinha and C. K. Kamble. 2008. Utility of silkworm pupae: A new dimension as food and medicine. *Indian Silk*. **47**(1): 11-18.