

STUDY ON HEALTH ISSUES FACED BY WORKERS OF SERICULTURE INDUSTRY & SAFETY MEASURES AT WORK PLACE

S. V. Ghonmode

S.S.E.S.Amt's Science College, Congress Nagar, Nagpur University, Nagpur-440012 (M.S.)
sharyu.ghonmode@gmail.com

ABSTRACT

In India, sericulture is well-established agro-cottage industry. Sericulture in India provides employment to poor, rural and tribal people. India generates nearly 25,000 crores of which Rs. 2500 crores are generated by foreign exchange by employing 5 lakh rearers and rest of them are reelers, twisters, weavers, printers etc. Sericulture involves hatching of eggs up to reeling. Silk has got tremendous importance in our country which is used during wedding functions and festival seasons. Although life cycle of silkworm is eco-friendly but there are several health hazards in which the workers are exposed to various health problems due to lack of education, poor nutrition, and unawareness about the hazards of their occupation. Silk manufacturing involves cultivation of mulberry and non-mulberry food plants, rearing of silkworms, grainages, reeling of filaments, twisting, weaving, printing and dyeing. It has been observed that women are more prone to the health hazards as compared to men. Further the farmers both men and women are prone to deadly health hazards like neurophysiological disorders, behavioral changes, headache, nausea, vomiting, skin and eye related problems, respiratory diseases like asthma, chronic bronchitis, diminished lung functioning, blister formations on hand, dermatitis, reproductive related problems, back pain, joint pain, stress etc. It is therefore very important to check the health, safety, welfare and protection of the workers to reduce the illness and problems.

Key words: Silk industry, health problems, safety measures

Introduction

Sericulture or silk farming is an agro based cottage industry where it involves cultivation of silkworm to produce silk. Several species of silkworm like *Bombyx mori*, *Antheraea mylitta* are used to produce silk like mulberry and tassar. Women and men both get the employment in this sector. Sericulture involves cultivation of mulberry, tasar plants, rearing of silkworm, reeling and other post- cocoon activities such as twisting, dyeing, weaving, printing and finishing (Fig. 1 to 8). Among the three natural fibers i.e, silk, wool and cotton, silk is considered as the “Queen of Textiles”. India produces all four different types of silk varieties. Following processes are involved beginning from cultivation of food plants upto printing and dyeing.

1. Mulberry and non-mulberry food plant cultivation,
2. Silkworm rearing,
3. Production of egg in grainages,
4. Silk filament reeling,
5. Twisting,
6. Weaving,
7. Printing,
8. Dyeing.



Fig.1 Tassar plant cultivation[1]
(Source:MulberryCultivation and Silkworm Rearing – A Full Guide,JagdishReddy,2015)



Fig.2 Silkworm rearing[2](Source:https://www.123rf.com/photo_36576050_silkworm-rearing-farm-fed-mulberry-leaves-and-have-a-lot-in-life-history-.html)



Fig.3 Egg production in grainages [3] (Krushidhan Biotech, Kolhapur, Maharashtra, India, Silkworm Seeds)



Fig.6 Weaving [6](Source: [https://handwovenmagazine.com/weaving-silk-ultimate /](https://handwovenmagazine.com/weaving-silk-ultimate/))



Fig.4 Silk filament reeling [4] (Source:<http://www.wormspit.com/2004/12/06/silk-reeling/>)



Fig.7 Printing [7](Source: <https://www.clothroads.com/come-behind-scenes-naturally-dyeing-printing-silk-fabric/>)



Fig.5 Twisting [5](Source:<https://www.exportersindia.com/a-r-silk-twisting/twisted-mulberry-silk-yarn-4065095.htm>)



Fig.8 Dyeing [8] (Source: <http://www.wormspit.com/dyeing.htm>)

The larvae hatch from the eggs and feeds on the food plants. They undergo various developmental stages from Ist Instar larvae to Vth Instar larvae. After this the Vth instar larvae starts oozing out a secretion from the mouth of the silkworm called as spinneret. After coming in contact with surrounding environment the

oozed out secretion solidifies and forms a soft covering called as cocoon. This cocoon protects the silkworm pupae from adverse conditions of climate. The next process is reeling where the cocoons are boiled in hot water so that the silk thread wrapped around the cocoon gets loosened and the thread comes

out of cocoon. This thread is reeled. After reeling the thread is weaved. After this the silk thread is dyed or printed accordingly. Various other processes are done like the smoothening, polishing, lustering and removing wrinkles from the thread which requires human resource.

Sericulture farming is an eco and environmental friendly process. Still the workers have to face lot of health hazards which may be life threatening. Textile industries in abroad have reported respiratory problems but there is less study on the respiratory problem in India [9-11]. Women are more prone to such diseases [12]. The industry has been handling with chemicals which may be fatal to the workers and farmers life. Thousand of sericulture workers and the risk associated with this industry are very high due to lack of education, not aware about the health hazards associated with their occupation, backwardness in their daily hygiene, poor sanitation, and poor nutrition [13].

2. Material and Methods

Area of study

This study was carried out in the village Dawadipar. Dawadipar is a small village located in Mohadi Taluka of Bhandara district, Maharashtra. It is situated 8km away from Bhandara. The tasar silkworm, *Antheraea mylitta* (D) "Dabha Race" is regularly cropped since last 40 years at the Central Tasar Research and Training Institute (CTRTI) and Basic Seed Multiplication and Training Centre (BSMTC) Dawadipar, Bhandara (Maharashtra State), India. In India, the species *A. mylitta* (D) occurs in 25 ecotypes or races [14].

Total population of Dawadipar is 1,530. Male Population is 794 & female Population is 736. 110 were engaged in work activities. 89.09 % of workers describe their work as Main Work (minimum half yearly income) while 10.91 % were involved in Marginal activity providing livelihood for less than half yearly income. Of 110 workers engaged in Main Work, 17 were cultivators (owner or co-owner) while 59 were Agricultural labourers. Out of 110 workers 64 are male and 46 are female workers. Data was collected by visiting

houses of every worker and asking the questions based on the questionnaire prepared.

Result and Discussion

Health risk factors in various processes during sericulture farming (Table-1)

Mulberry cultivation

Food plants include plantation of Mulberry, Ajan and Arjun. Weeds are most important enemies that may hamper the growth of sericulture food plants. Monocot and dicot weeds are the main mulberry weeds which hamper the development of the mulberry food plants. Some of the mulberry pests have been identified during the cultivation of food plants. This pest can also diminish the growth and development of mulberry food plants.

Disinfectants and pesticide used during mulberry cultivation and its effect on health

The dicot and monocot weeds are controlled by the chemicals namely 2, 4, D amine and glyphosphate respectively. These chemicals have carcinogenic potential and causes cancer [15]. Most of the mulberry pests like Dichlorvos (DDVP) and Bavistin causes neurophysiological and behavioural changes in human beings. DDVP reacts with acetyl cholinesterase and stops the brain function [16]. Chronic and long term exposure to toxic pesticides results in skin, eyes, nervous, reproductive, blood liver, kidney GIT related problems [17].

Silkworm rearing

Temperature of the silkworm rearing house often fluctuates with changing season like winter and summer. This fluctuating temperature like extreme hot and cold conditions can cause the silkworm mortality. To raise the temperature during winter the silkworm rearers use the charcoal stoves.

Disinfectants used during silkworm rearing and its effect on health

To maintain the temperature during winter the silkworm rearers use the charcoal stoves. Use of charcoal stoves in ill ventilated rooms release toxic gases such as carbon di oxide and carbon monoxide and also cause suffocation. Death of rearers occurs due to elevation of

carbon mono oxide beyond the tolerance level i.e., 100ppm and also causes cherry red lividity in human body [18, 19]. Long term inhalation of such gases cause nausea, headache and vomiting. Silkworm litters and the leftover leaves in the rearing house cause silkworm death and also affect the rearers health. Formalin is used as disinfectant whose prolonged use can cause eye, nose and skin irritation. The effectiveness increases with its concentration i.e., 0.1ppm levels. Bleaching powder (5%) is used as a disinfectant and release of nascent oxygen and chlorine from bleaching powder can cause skin and eye problems. Diseased, dead caterpillars should be picked and immersed into bleaching powder or formalin solution. If left untreated or during the unhygienic conditions silkworm decay causes health problems. Bed disinfectants like Resheem Keet Oushadh (R.K.O.), Sanjeevini, Suraksha contains benzoic acid, paraformaldehyde and slaked lime which may hurt eyes resulting in itching and watering of eyes. Formalin used may cause peeling of skin, burning of eyes [20].

Production of egg or grainages and its effect on health

Grainages are the centers where disease free laying of eggs known as industrial seeds is produced. In grainages different processes are carried out like-cocoon preservation, emergence of moth, coupling and decoupling and oviposition. Lot of workers supplies this seeds to various government and private rearing centres. Workers are in constant touch with the adult moth the wings of which triggers asthma and many more respiratory diseases along with diminished lung function and chest tightness. Male silkworm caterpillars release wing and body scales as they flutter during copulation causes allergy[21].

Silk filament reeling

Unwinding of the weaved thread from the cocoon is called as reeling. Prior to reeling there are various process like cooking, boiling, deflossing and riddling. Prior to reeling, stifling is done where the pupa is suffocated and killed without causing damage to silk quality. After sorting and riddling the cocoons are cooked. During reeling the cocoons are

impressed in hot water having 45 to 65⁰C so that the silk fiber gets loosened.

Process of reeling and its effect on health

Process of reeling involves boiling of cocoons in hot water at the temperature ranging between 45 to 65⁰C so that the silk fiber gets loosened. This process involves picking the silk threads with ungloved hands from the boiling water which results in the formation of blisters in hands causing dermatitis. This skin lesions on forearm, wrists and fingers cause erythema and hyperemia which causes increased blood flow. The reeling industry is highly exposed to dust and if inhaled for longer time cause lung infections, chronic bronchitis, cough and asthma [22]. Asthma has also been observed children working in silk industry [23]. It also leads to swelling of face, skin allergies and inflammation of eyes. These diseases are commonly found in reeling industry or during the spooling of the silk thread, as the silk allergens are continuously exposed and released in the air [24]. High temperatures during boiling of cocoons cause skin rashes dizziness, dehydration, heat stroke etc. continuous strained positions of hands and hips causes musculoskeletal problems.

Process of weaving and its effect on health

Fabric is produced by weaving technique where two separate yarns or threads are intertwined at right angles to form a fabric or cloth. The longitudinal threads are known as warp and lateral thread are known as weft. Once the shuttle is passed, the suspended lay of a loom is pulled to form the weave. The women are sitting in a squatting position continuously causing joint pain, back ache, stress and strain. They are also suffering from eye sight problem. Some type of special solutions, which contains dyes and chemicals are used for dyeing. Some metal complex dyes are used as fasteners. Heavy metals damages vital organs and physical and mental conditions of the worker. Lead acetate is used for dyeing and lead nitrate is used as mordent and oxidizer. These chemical affects the reproductive system, nervous system. These chemicals particularly azo and chromium dyes also causes river pollution as the waste is allowed to flow in the water bodies. Weaving

process also causes noise pollution causing damage to ear [25].

Process of printing and its effect on health

Printing of fabric includes various highly toxic chemicals like dyes, bleaching agents, salts acid and alkali. Various printing inks, thinners are used, xylene, toluene, and methyl ethyl ketones (permitted <1.0="" b="" ppm="">) are also used which cause skin and eye irritation, dizziness, headache, fatigue, reproductive problems like miscarriages and neurophysiological problems [26,27]. As the duration of exposure is larger, the workers are highly exposed to serious health hazards.

Process of dyeing and its effect on health

Dyeing is the process where the silk fabric is coloured with various chemicals like trivalent chromium which undergoes oxidation forming hexavalent chromium are used. These chemicals affects the skin, causes ulcers, sensitization and dermatitis. The tracing chemicals release strong smells which affects the eyes, throat and nose. They also burn hands and stain fingers and nails. They never use hand gloves as the gloves melt in zinc oxide. Lead acetate used as a dyeing agent is highly neurotoxic which affects brain and reproductive system [28]. Apart from this the dye factories dump millions of tons of effluent in rivers causing heavy water pollution and damage the water fauna and flora [29] which when used for agricultural purpose may damage the crops.

Safety measures at work place

Safety of the worker is the priority of the employer. His prime and most important duty is to take care of his workers health, welfare and protection as the health, safety are directly associated with the output or profit of the employer. Thus following safety measures are to be taken in the sericulture industry:

- 1) Rearing house should be well ventilated,
- 2) Regular health check-up camps should be organised,
- 3) Glasses, gloves and masks should be provided as an when required during the process,

4) All the accessories used should be clean and hygienic condition should be maintained for disease free environment.

5) Ventilation should be provided in grainage and dyeing chambers for the removal of toxic fumes,

6) Antifungal ointments should be applied on hand and exposed body part for prevention against any fungal infections,

7) Lab coats, masks and full hand and foot gloves should be used to avoid the moth scales allergens in grainages.

8) Exhaust fans should be provided in each and every rearing, reeling, weaving, dyeing, printing rooms.

9) Emergency eye washing fountains and shower facility should be provided so that the worker can use the facility as an when required to maintain the personal hygiene and to remove any of the chemical to which the body has come in contact.

10) Health education and medical supervision is essential for the workers,

11) To reduce the noise coming from reeling machineries regular oiling or lubrication should be done. More over ear muffs can be used to reduce the noise.

Conclusions

Silk is considered as the most elegant textile in the world with natural soft lusture, and inherent affinity for dyes, light weight and its high durability. It provides employment opportunities for millions. Lot of farmers get employment based on both farm and non form related opportunities. Large number of employment refers to large number of occupational hazards. The workers are more prone to disorders associated with silk industry. This includes eye related disorders, respiratory, nerve, reproductive disorders, skin injuries, cancer, joint pain etc. these disorders can be prevented by taking proper precautions and necessary facilities to be provided by the employer. It is therefore very important to organize awareness camps among the sericulture farmers, health check-up camps, personal hygiene awareness and cleanliness of

the instruments to be used so that the risk of suffering from these diseases are minimized.

Table-1.Data taken from 110 workers working in the silk industry of Dawadipar village (males =64 and Females=46)

S.No.	Ailment	Males(%)	Females(%)	Children(%)	Total (%)
1	Headache	15(23.4%)	16(34.78%)	-	28.18%
2	Skin related problems	10(15.6%)	12(26.08%)	-	20%
3	Eye related problems	06(9.3%)	07(15.21%)	-	11.81%
4	Lower back and joint pain	30(46.8%)	21(45.6%)	-	46.36%
5	Reproductive ailment	-	15(32.6%)	-	13.63%

References

- Jagdish Reddy. 2015 Source: Mulberry Cultivation and Silkworm Rearing – A Full Guide.
- Source:https://www.123rf.com/photo_36576050_silkworm-rearing-farm-fed-mulberry-leaves-and-have-a-lot-in-life-history-.html
- (Krushidhan Biotech, Kolhapur, Maharashtra, India, Silkworm Seeds)
- (Source:<http://www.wormspit.com/2004/12/06/silk-reeling/>)
- (Source:<https://www.exportersindia.com/a-r-silk-twisting/twisted-mulberry-silk-yarn-4065095.htm>)
- (Source: <https://handwovenmagazine.com/weaving-silk-ultimate-free-guide-weave-silk/>)
- (Source: <https://www.clothroads.com/come-behind-scenes-naturally-dyeing-printing-silk-fabric/>)
- (Source: <http://www.wormspit.com/dyeing.htm>)
- Murlidhar V, Murlidhar VJ, Kanhere V., 1995. Byssinosis in a Bombay textile mill. *Nat. Med J India*; 8:204–207.
- Mathur N, Gupta B.N., Rastogi S.K., 1993. The multivariate analysis of byssinosis risk assessment. *Indian J Chest Dis Allied Sci*: 35;185-190.
- Jaiswal A., 2004. Respiratory Efficiency as affected by exposure to textile dust-health status evaluation of textile workers of district Varanasi, Utter Pradesh. *Gene, Environment and Health, Delhi*, 135-162.
- Nilvarangkul K, Wongprom J, Tumngong C., 2006. Strengthening the self-care of women in informal sector: Local fabric weaving in KhonKaen, (Phase I), *Industrial Health*; 44: 101-107.
- Wang, X. R., Eisen, E.A., Zhang, H. X., Sun, B. X., Dai, H.L., Pan, L.D., Wegman, D.H., Olenchock, S.A., Christiani, D.C., 2003. Respiratory symptoms and cotton dust exposure; Results of 15 year follow up observation; *occupational and Environmental Medicine*, 60, pp. 935 – 941.
- Jolly, M.S., Sen, S.K., Sonwalkar, T.N. and Prasad, G.K. (1979). Non-mulberry silks.FAO.Agric.Servic.Bull.29:1-178.
- Von Stackelberg K., 2013. A Systematic Review of Carcinogenic Outcomes and Potential Mechanisms from Exposure to 2, 4-D and MCPA in the Environment *J Toxicol*. 2013;371610.
- Colborn T., 2006. A case for revisiting the safety of pesticides: a closer look at neurodevelopment. *Environ. Health Perspective* 114(1):10-17.
- IPCS., 2010. INCHEM: Chemical safety information from intergovernmental organizations. Geneva, World Health Organization, International Programme on Chemical Safety.
- Wani, K. A. and Y. K. Jaiswal., 2011a. Health hazards of rearing silkworms and environmental impact assessment of rearing households of Kashmir, India. *Nature Environment and Pollution Technology*, 10, (1), 85-90.
- Wani, K. A. and Y. K. Jaiswal 2011b, Occupational health risk factors in

- carpet industry:A review. *Asian J.Exp.Biol.Sci.*2 (1), 135-138.
20. Pandey, Rajesh, Kanhere and Vijay., 1993. Activists“ Handbook of Occupational Health and Safety”, PRIA, New Delhi.
 21. Venkatappa. B., A. N. Chandrakala., P. Anuradha and P. Chatrappa., 2005.Evaluation of silk moth (Bombyxmori) allergens in sericulture grainage industries as major pollutants.Journal of Scientific and Industrial Research.Vol. 64. pp. 287-292.
 22. Beckett WS. Occupational respiratory disease.The New EnglandJournal of Medicine. 2000; 342(6):406-413.
 23. Wen, CM, Ye, ST, Zhou, LK and Yu, Y., 1999. Silk – induced asthma in children. A report of 64 cases, Ann. Allergy, 65, pp. 375-378.
 24. Harindranath N, Prakash O, Subba Rao PV. Prevalence of occupational asthma in silk filatures. Ann Allergy 1985;55:511-5
 25. Subramani. T., S. K. Somasundaram., 2015. A Case Study of Occupational Hazards in Silk Industry International Journal of Application or Innovation in Engineering & Management.Volume 4 (5).
 26. Rakesh. K. Pandey., 2014. Occupational health problems in silk production: A review. Regional Sericultural Research Station, Miransahib, Jammu, India.
 27. Kuntamalla Sujatha, Janga Sathish, 2017. A study on health problems faced by workers in silk industry * International Journal of Entomology Research ISSN: 2455-4758; Volume 2; Issue 1; January 2017; Page No. 76-78
 28. Bangladesh Centre for Advanced Studies (BCAS). 1997. Study on Textile Dyeing and Printing Industries in Bangladesh. Technical & Socio-Economic Survey and Case Studies.BCAS, Dhaka, Bangladesh.
 29. Berube, J., 1996. Environmental Assessment for BRAC Rural Development Programme Phase IV: The Use of Chemicals in Sericulture and Aquaculture Activities. AGA Khan Foundation, Canada.