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A Review on Silkworm (*Bombyx mori* Linn.) An Economic Important Insect

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ABSTRACT: India has to compete in the international market successfully and it is necessary to improve the quality of the silk yarn produced by improving the technology of the silk reeling and processing. But, production of raw silk of international grade is possible only through introduction of newer bivoltine silkworm strains especially double cross hybrids. India has strong sericulture base with enormous potential for boosting silk production. In India's context, stability of double cross hybrid with higher survival is more relevant than higher productivity under prevailing situation. Silkworm is a kind of night butterflies. Butterflies are light cream colour have chubby bodies and have soft feathers. Wingspan is about 4-5 cm. Butterfly have lost flying ability because of domestication also have 2 or 3 days life and at that period doesn't feed and doesn't fly. The stability of bivoltine crop was not achieved mainly due to climate, rearing and socio-economic conditions.

Major constants for silk production is high cost of the equipment and rearing room, lack of manpower, the difficulty in controlling silkworm diseases, the lack of knowledge regarding the physical conditions in the rearing room and grading of cocoons, the distance between cocoon trading units, and the unfavorable rates for cocoons during silkworm rearing are some of the constraints on silk production.

The purpose of the study was to helps for rearing, control disease and insect pest, processing & selling of cocoon and helps doubling farmer's income.

Keywords: Silkworm, *Bombyx mori*, Mulberry, Mulberry, Tasar, Oak, Eri, Muga and Disesas.

INTRODUCTION

The silkworm, *Bombyx mori* L. is one of the important productive insects cultured beneath the shade and exploited for silk of commerce. India is the second largest producer of silk in the world with an annual silk production of 23,855 MT in 2012-13 of which, mulberry raw silk output aggregated to 19,735 MT (79.06%) and bivoltine contributes to 1775 MT (Anon., 2016). Insects are a large, unexplored and unexploited source of potentially useful compounds for modern medicine Robert (1999). Approximately 80% of animal species on earth are insects, 99% are invertebrates. We share a large proportion of our genetic material with all life on earth down to the simplest worms Robert (1997). Silkworm (*Bombyx mori*) is one of the well-known beneficial lepidopteron insects for the production of sleek and sensuous silk fibre, often considered as "Queen of textiles".

The major silk producing traditional states are Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal and Jammu and Kashmir. Karnataka stands first by producing 8360 MT of the total silk production with 385.00 MT of bivoltine and 8025.00 MT of cross breed (Anon., 2016). Sericulture is the rearing of silkworms for the production of silk. Sericulture as a cottage industry has flourished in Brazil, China, France, India,

Italy, Japan, Korea, and Russia. China and India contribute more than 60% of world's annual production of silk. In India sericulture has made a good stride in the recent past, especially during eighties and nineties. The R&D (Research and Development) contributions of various institutions of Central Silk Board, Universities, and continuous efforts in transferring these R&D (Research and Development) achievements to the fields helped in spreading sericulture to varied agro climatic regions of the country.

In sericulture, it is established fact that several factors contribute in the growth and development of silkworm for the production of quality eggs. Quality silkworm seed refers to richness of layings, egg viability, hatching uniformity and more importantly good rearing performance of the progeny (Ullal and Narashimhanna 1981) and it depends on management practices *i.e.*, rearing temperature, humidity, nutrition, and genotype of the breed. The better rearing conditions, environment and nutrition during larval period may leads to higher fecundity by silkworm moths (Miller, 2005; Malik and Reddy 2007). At present sericulture farmers are reluctant to do sericulture even in various traditional districts of sericulture. It is also reported that some framers uproot their mulberry cultivation and switch over to other crops. This present study was conducted to know actual status of sericulture as compared to other crops in terms of income generation.

Sericulture all over the world is based on the production of only first-generation hybrids for the manifestation of heterosis. The heterosis effect is manifested mainly in the signs of two categories - viability and quantitative signs. High viability leads to increased resistance to diseases and extreme conditions, accelerated growth and development, fertility, as well as an increase in indicators of many quantitative signs, including those of economic importance Mirzakhodjaev *et al.* (2021); Larkina *et al.* (2020); Larkina *et al.* (2021).

Table 1: Scientific classification of the silkworm (Akbay 1981).

Phyluym	**Artropoda**
Class	Insecta/Hexapoda
Ordo	Lepidoptera
Subordo	Macro Lepidoptera-Heterocera
Super Family	Bomycoiden
Family	Bomycidae
Genus	*Bombyx*
Species	*B. mori*

Distribution. According to the recent statistics from Indian Government, India is the only country in the world that produces all the five kinds of silk namely Mulberry, Eri, Muga, Tropical Tasar and Temperate Tasar. India's total raw silk production recorded 28,523 metric tonnes in the fiscal year ending 2016. The top 10 largest silk producing states in India include: Karnataka, Andhra Pradesh, Assam, West Bengal, Jharkhand, Tamil Nadu, Meghalaya, Nagaland, Manipur and Maharashtra.

Silk was believed to have first been produced in China as early as the Neolithic period. Sericulture has become an important cottage industry in countries such as Brazil, China, France, India, Italy, Japan, Korea, and Russia. Today, China and India are the two main producers, with more than 60% of the world's annual production Duran *et al.* (2007).

Silk Worm – Types. There are five major types of silk of commercial importance, obtained from different species of silkworms which in turn feed on a number of food plants: Except mulberry, other varieties of silks are generally termed as non-mulberry silks. India has the unique distinction of producing all these commercial varieties of silk. These are classified as univoltine, bivoltine and multivoltine on the basis of number of generations per year.

Mulberry. The bulk of the commercial silk produced in the world comes from this variety and often silk generally refers to mulberry silk. It belongs to the family Bombycidae of insect order Lepidoptera. Assam and Bengal producing an inferior quality of silk. Mulberry silk comes from the silkworm, *Bombyx mori* L. which solely feeds on the leaves of mulberry plant. These silkworms are completely domesticated and reared indoors. In India, the major mulberry silk producing states are Karnataka, Andhra Pradesh, West Bengal, Tamil Nadu and Jammu & Kashmir which together accounts for 92 % of country's total mulberry raw silk production. Purification and structural analyses revealed that the predominant inhibitory factors in the crude extracts were allatotropin (AT) and GSRY amide after its C-terminal sequence. *In situ* hybridization revealed that AT and GSRY amide were expressed in enteroendocrine cells in the posterior and anterior midgut, respectively. Receptor screening using Ca^{2+}-imaging technique showed that the *B. mori* neuropeptide G protein-coupled receptor (BNGR)-A19 and -A22 acted as GSRY amide receptors and BNGR-A5 acted as an additional AT receptor (Sumihiro *et al.*, 2019).

Fig. 1. Cocoon of Mulberry Silkworm.

Fig. 2. Thread of Mulberry Silkworm.

Tasar. Tasar (Tussah) is copperish colour, coarse silk mainly used for furnishings and interiors. It also belongs to the family Saturniidae. It is usually found in forest areas feeding on *Dalbergia* sp., *Shorea* sp., *Terminalia sp.*, *Zizyphus* sp., *Ficus* sp. etc. but the more important hosts are *Shorea robusta* and *Zizyphus mauritiana*. It is less lustrous than mulberry silk, but has its own feel and appeal. Tasar silk is generated by the silkworm, *Antheraea mylitta* which mainly thrive on the food plants Asan and Arjun. The rearings are conducted in nature on the trees in the open. In India, tasar silk is mainly produced in the states of Jharkhand, Chattisgarh and Orissa, besides Maharashtra, West Bengal and Andhra Pradesh. Tasar culture is the main stay for many a tribal community in India. The feeding characteristics of this particular species provide an excellent model for studying the food selection of insect host plants. In recent years, there has been an increasing number of studies on the factors affecting the feeding of silkworms, especially with the development of molecular technology Wen-Ting *et al.* (2021).

Fig. 3. Cocoon of Tasar Silkworm.

Fig. 4. Thread of Tasar Silkworm.

Oak Tasar. It is a finer variety of tasar generated by the silkworm, *Antheraea proyeli* J. in India which feed on natural food plants of oak, found in abundance in the sub-Himalayan belt of India covering the states of Manipur, Himachal Pradesh, Uttar Pradesh, Assam, Meghalaya and Jammu & Kashmir. China is the major producer of oak tasar in the world and this comes from another silkworm which is known as *Antheraea pernyi*.

Eri. Also known as Endi or Errandi, Eri is a multivoltine silk spun from open-ended cocoons, unlike other varieties of silk. It belongs to the family Saturniidae. It is reared on castor leaves. As the silk thread is not continuous hence it is not reel able. These silk worms are commonly reared in Assam and West Bengal. Eri silk is the product of the domesticated silkworm, *Philosamiaricini* that feeds mainly on castor leaves. Ericulture is a household activity practiced mainly for protein rich pupae, a delicacy for the tribal. Resultantly, the eri cocoons are open-mouthed and are spun. The silk is used indigenously for preparation of *chaddars* (wraps) for own use by these tribals. In India, this culture is practiced mainly in the north-eastern states and Assam. It is also found in Bihar, West Bengal and Orissa.

Muga. This golden yellow colour silk is prerogative of India and the pride of Assam state. It resembles Tassar silk worm and is found in Assam. It is obtained from semi-domesticated multivoltine silkworm, *Antheraea assamensis*.

Fig. 5. Cocoon of Eri Silkworm.

Fig. 6. Thread of Eri Silkworm.

Fig. 7. Cocoon of Muga Silkworm.

Fig. 8. Thread of Muga Silkworm.

These silkworms feed on the aromatic leaves of Som and Soalu plants and are reared on trees similar to that of tasar. Muga culture is specific to the state of Assam and an integral part of the tradition and culture of that state. The muga silk, an high value product is used in products like sarees, mekhalas, chaddars, etc.

Anaphe silk. This silk of southern and central Africa is produced by silkworms of the genus *Anaphe: A.* moloneyi Druce, *A. panda* Boisduva, *A. reticulate* Walker, *A. ambrizia* Butler, *A. carteri* Walsingham, *A. venata* Butler and *A. infracta* Walsingham. They spin cocoons in communes, all enclosed by a thin layer of silk.

Fagara silk. Fagara silk is obtained from the giant silk moth *Attacus atlas* L. and a few other related species or races inhabiting the Indo-Australian bio-geographic region, China and Sudan. They spin light-brown cocoons nearly 6 cm long with peduncles of varying lengths (2-10 cm). The *A. atlas* is a multivoltine, it completes its life cycle from egg to adult within 62 days-100 days. The larvae is highly polyphagous and folivorous in nature. They feed on over 80 species of host plants, of which 6 species (*Mangifera indica, Swietenia macrophylla, Camellia sinensis, Terminalia catappa, Sapium insigne,* and *Psidium guajava*) can be considered as primary food plants based on their feeding preferences/rearing performance. Depending on the types of leaves the caterpillars consume, the yarns and fabrics can be golden brown or darker brown in color (Kumar and Kumar 2022).

Spider Silk. Like Mussel silk, you may be surprised to learn that spider silk has long been used by ancient cultures. But unlike other types of silk, this is the most difficult one to produce as spiders cannot just be bred like silkworms. Spiders cannot produce as much yarn as silkworms either But though the production of this type of silk may seem difficult, its output is certainly worth the effort. It is regarded as one of the most durable types of silk as it is now being utilised in the production of telescopes, bulletproof vests and wear-resistant clothing. In June 2012 the world's largest pieces of cloth made from spider silk went on public display for the first time. This included a brocaded shawl and a cape made from the silk of more than one million female golden orb-weaver spiders collected in the highlands of Madagascar.

Coan silk. The larvae of *Pachypasaotus* D., from the Mediterranean bio-geographic region (southern Italy, Greece, Romania, Turkey, etc.), feed primarily on trees such as pine, ash cypress, juniper and oak. They spin white cocoons measuring about 8.9 cm × 7.6 cm. In ancient times, this silk was used to make the crimson-dyed apparel worn by the dignitaries of Rome; however, commercial production came to an end long ago because of the limited output and the emergence of superior varieties of silk

BIOLOGY OF SILKWORM

The Silkworm, *Bombyx mori* produces the silk of commercial importance. It is the caterpillar of a moth

whose cocoon is used to make silk. This insect is also called the silkworm-moth and the mulberry silkworm. Male and female moths are flightless and lack functional mouth parts. The moths differ in morphological features. The female has a larger abdomen whereas the male has a much larger pair of antennae.

Egg. Egg is the first stage of a silkworm's life cycle. The female moth lays an egg about the size of an ink dot during summer or the early fall. The egg remains in dormant stage until spring arrives. The warmth of the spring stimulates the egg to hatch. The egg of *Bombyx mori* is a very small and hard structure; about the size of a pin head and resembling a poppy seed. The egg shell provides a protective covering for embryonic development. When first laid, an egg light yellow. A fertile ovum darkens to a blue-gray within a few days.

Larva. The larva is the vegetative stage where growth takes place. The larva of *Bombyx mori*, commonly called a silkworm, is host specific to mulberry. During growth, the larva molts 4 times. The period between successive molts is called an instar. The silk worm, upon hatching, is about 1/8th of an inch and extremely hairy. Young silkworms can only feed on tender mulberry leaves. However, during the growth phase they can eat tougher mulberry leaves as well. The larval stage lasts for about 27 days and the silkworm goes through five growth stages called instars, during this time. During the first molting, the silkworm sheds all its hair and gains a smooth skin.

Pupa. As the silkworm prepares to pupate, it spins a protective cocoon. About the size and color of a cotton ball, the cocoon is constructed from one continuous strand of silk, perhaps 1.5 km long (nearly a mile). The silk cocoon serves as protection for the pupa. Cocoons are shades of white, cream and yellow depending on silkworm genetics. After a final molt inside the cocoon, the larva develops into the brown, chitin covered structure called the pupa. Metamorphic changes of the pupa result in an emerging moth.

Cocoon. Cocoon is the stage in which the larva spins silk threads around it, to protect itself from its predators. The larva traps itself inside the cocoon in order to pupate. The color of the cocoon varies, depending upon what the silkworm eats. It can range from white to golden yellow. The second molting occurs inside the cocoon, when the larva turns into a brown pupa. It takes about 2-3 weeks for the pupa to metamorphose into an adult moth

Imago. The adult stage completes the life cycle of *Bombyx mori*. It is the reproductive stage where adults mate and females lay eggs. Moths are flightless and lack functional mouth parts, so are unable to consume the food/nutrition.

MORPHOLOGY

As like other Lepidoptera insect's silkworm has four various life cycles (Table 2). It has 2n=56 chromosomes. Polyvoltine breeds can give 300-400 eggs (Akbay 1981). Silkworm is a monofag creature (Akkaya, 2003) and it is only fed by eating mulberry leaves (Akbay 1981; Anon 2014a,b). Apoptosis is a programmed cell death and Lockshin proved in 1964 that silkworms have apoptosis in their metamorphosis process (Dogan *et al*., 2010). Pheromone is a secreted or excreted chemical factor that triggers a social response in members of the same species (Anon 2014c).

Fig. 9. Eggs of silkworm.

Fig. 10. Larva of silkworm**.**

Fig. 11. Puap of silkworm.

Fig. 12. Adult of silkworm.

Determined from the genetic material of the breeds of the world collection of silkworms of the SRIS, by the ranking method, the breeds labeled by sex at the stage of the silkworm egg with the best biological indicators: C-5 W2, C-10 W3, C-12 W2, C-13 W2, C-14 W3 for the creation of new high-heterosis hybrids.

Fig. 13. Cocoon Saleing Market at Ramanagrum in Karnataka.

Table 2: Life cysles of silkworm in polyvoltine breeds (Akbay 1981; Yasayanlar 2013).

Cycle	Duration	Mulberry leaves requirement (kg/per egg box)	Condition of heat and humidity
1st Age	3 days	1-2	27°C heat and 85% humidity
1st Sleep	20 hours		
2nd Age	2 days	5-6	
2nd Sleep	20 hours		
3rd Age	3 days	20-25	
3rd Sleep	1 day		
4th Age	5 days	80-90	22-24°C heat and 75% humidity
4th Sleep	1 day		
5th Age	9-10 days	450-475	20-23°C heat
Total	26-27 days		

Effect of Rearing Temperature and Humidity on Fecundity and Fertility of Silkworm. Temperature and humidity are key environmental factors that influence the physiology of insects. The range of adaptations to changing environments and maintenance of homeostasis is a complex and dynamic display of species inherent potential to keep internal changes within tolerable limits under wide fluctuations in their surroundings Kaya and Tutkun (2012). This has resulted in varied response to the environmental conditions (Temperature, humidity and photoperiod etc.) as compared to wild insect species. It means a significant interaction of environmental conditions and developmental stages governs the physiology of silkworm which affect the growth, development, productivity and quality of silk Kupeli and Karnak (2011).

The imposition of exposure to high temperature levels in 5th in star and the resultant low pupation rate could be attributed to the low feeding activity of the silkworm resulting in the physiological imbalance and poor health of the larvae and an increased number of nons pinning worms in the mountages. The work in (Ueda and Lizuka, 1962) demonstrated that silkworms are more sensitive to high temperature during 4th and 5th instars. The productive bivoltine breeds are reported to be susceptible to high temperature; the authors of Kato *et al.*, (1986), Suresh Kumar (2001) noticed higher survival in the hybrids than the pure races under high temperature conditions. Effect of high temperature and low humidity in terms of cocoon crop depends on several factors that operate within and outside the body of the silkworm. In the present study, it was observed that apart from the temperature, humidity also influences the productivity pattern in the silkworm and is in agreement with Krishnaswami, (1986); Sudhakar Rao; (2003). Mubashar *et al.* (2011**).** The best temperature and humidity for rearing silkworm lines for seed cocoon production (to obtain higher number of eggs per month with increased fertility) is 25±1°C with 75±5% RH. Pak-2, Pak-4, Pak-3 and PFI-I were the better lines which may be utilized in seed cocoon production and hybridization. Investigations elucidated that temperature and humidity variations during larval rearing resulted in low fecundity and high incidence of unfertilized eggs.

SUPPLEMENTARY FEED

The silkworm *Bombyx mori* is a typical monophagous insect and mulberry leaf is its sole food. The healthy growth of the silkworm and ultimately the economic traits are influenced largely by the nutritional status of the leaves fed to silkworms Krishnaswami *et al.* (1971); Kumar (1988). Kumar and Balasubramanian (2014). The silkworm larva were fed with different concentrations (1, 3 and 5%) of *spirulina*. The increased protein may be due to increased protein biosynthesis. The markedly elevated protein was indicating the building up of positive nitrogen balance that may be the characteristic feature of growth phase. *Spirulina* is a rich protein source as reported earlier Venkataramana *et al.* (2003). The highest ALKP activity in silk gland was reported by Eguchi *et al.* (1972); Essawy and Saad (2014). Larvae treated with potassium and sodium sulphate mixture presented the maximum increase of DHC and ADHC of plasmatocytes during the end of larval stage.

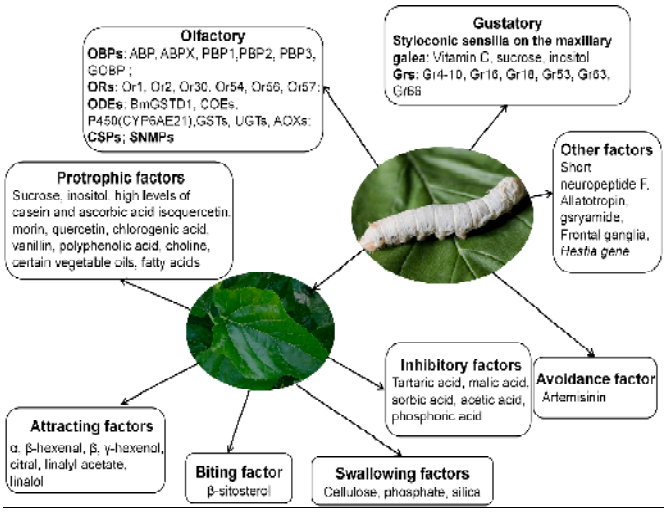

Fig. 14. Molecular factors affecting silkworm feeding (Wen-Ting *et al.*, 2021).

Minerals are major constituents of the silkworm's diets, playing a crucial role in osmotic pressure regulation of the intra and extracellular liquids and participating as co-factors in different enzyme systems. The production parameters of silkworms depend on the larval nutrition and health status. In order to improve these production parameters, both in quantity and quality, a large number of minerals have been used, many studies focusing on the effect of these minerals on silkworms Dasmahapatra *et al.* (1989); Quader *et al.* (1993); Sarker *et al.* (1995); Zaman *et al.* (1995); Nirwani and Kaliwal (1996); Hugar *et al.* (1996); Rajashekhargouda *et al.* (1998); Etebari *et al.* (2004); Bhattacharya and Kaliwal (2003); Islam *et al.* (2004); Khan *et al*. (2010); Saad *et al.* (2010).

SILKWORM DISEASES

Beauveria bassiana, a fungus, destroys the entire silkworm body. This fungus usually appears when silkworms are raised under cold conditions with high humidity. This disease is not passed on to the eggs from moths, as the infected silkworms cannot survive to the moth stage. This fungus can spread to other insects. The *A. atlas* cocoon extract has also been proven to protect Bt from UV damage Sukirno *et al*. (2022). Due to its sericin content, *A. atlas* extract is thus able to improve the pathogenicity of baculovirus (NPV) in controlling lepidopteron pests Widiawati *et al*. (2022).

Table 3: Some diseases of silkworm (Akbay 1981, Anon 2014b).

Protozoon	Bacterial	Virus	Fungal
1. Pebrine	1. Flacherie 2. Septisemi 3. Sotto 4. Court	1. Grasserie 2. Sytoplasma Plihedrozis 3. Spreadable Flacherie 4. Gattine	1. Muscardine (Calcino) 2. White Muscardine 3. Green Muscardine 4. Japanise Green Muscardine 5. Yellow Muscardine 6. Aspergillus 7. Nosemabombycis 8. *Botrytis bassiana*

Flacherie. The larvae become soft and flaccid The growth of infected larvae retarded, becomes inactive and vomit gut juice. The faeces become soft with high moisture content. Sometimes chain type excreta and rectal protrusion also observed. Larval head and thorax become translucent. When infected with Bacillus thuringiensis symptoms of toxicity such as paralysis and sudden death are observed. After death, larvae turn black in color and gives foul smell. Sometimes, the dead larvae turn red when infected.

Management. Disinfect the rearing house, its surroundings and equipments with recommended disinfectant mentioned above. Pick up diseased larvae and dispose them by burning. Provide good quality leaf grown under good Sunlight and recommended inputs. Do not provide over matured/over stored /dirty leaf to the silkworms Avoid starvation, overcrowding and accumulation of faeces in the rearing bed. Rear silkworms under optimum temperature and humidity. Avoid injury to the larvae. Apply recommended bed disinfectant as per schedule and quantity. Feed Amruth as per schedule to control flacherie disease

Grasserie, also known as nuclear polyhedrosis, milky disease, or hanging disease, is caused by infection with the *Bombyx mori* nuclear polyhedrosis virus. If grasserie is observed in the chawkie stage, then the chawkie larvae must have been infected while hatching or during chawkie rearing. Infected eggs can be disinfected by cleaning their surfaces prior to hatching. Infections can occur as a result of improper hygiene in the chawkie rearing house. This disease develops faster in early in star rearing.

Management. Practice thorough disinfection of rearing house, its surroundings and appliances with any recommended disinfectant. Conduct an optional disinfection with 0.3% slaked lime solution when high incidence of disease noticed in the previous crop. Practice personal and rearing hygiene. Collect the diseased larvae and ensure its proper disposal. Maintain optimum temperature and humidity in the rearing house. Feed quality mulberry leaf and avoid overcrowding. Apply recommended bed disinfectant as per schedule and quantity. Feed Amruth as per schedule to control grasserie disease.

Muscardine. The larvae loose appetite and become inactive. Presence of moist specks on the skin. The larva vomits and turns flaccid. After death, larva gradually becomes hard followed by mummification due to growth of aerial mycelia and conidia over the body and body turns chalky white.

Management. Disinfect the rearing house, its surroundings and equipments with recommended disinfectant as mentioned above. Control mulberry pests in the mulberry garden. Pick up diseased larvae before mummification and dispose them by burning Avoid Low temperature and high humidity in the rearing house. If required use heater/stove to raise the temperature. Regulate bed humidity during rainy season by dusting slaked lime powder during moult. Apply bed disinfectant, Vijetha and Vijetha supplement/Ankush/any recommended bed disinfectant as per schedule and quantity

Pebrine is a disease caused by a parasitic microsporidian, *Nosemabombycis* Nageli. Diseased larvae show slow growth, undersized, pale and flaccid bodies, and poor appetite. Tiny black spots appear on larval integument. Additionally, dead larvae remain rubbery and do not undergo putrefaction after death.

Management. Disinfect the rearing house, surroundings and with recommended disinfectant as mentioned above. Conduct strict mother moth examination and surface disinfection of silkworm eggs to produce and rear disease free layings. Follow strict hygiene maintenance during rearing. Control mulberry pests in and around the mulberry garden. Apply recommended bed disinfectant, Vijetha/Ankush as per schedule and quantity. Monitor seed crops constantly to eliminate the microspodian infection. 0.05% Asthra solution (Add 50g Asthra powder in 100 liters of water and stir thoroughly and keep for 2 hours for dissolution of the powder). 2.5 % Sanitech/Serichlor in 0.5% Slaked lime solution (To prepare 100 liters of solution, take 250g of activator in to a basin/bucket and add 2.5 liters of Sanitech/Serichlor solution. Keep it for 10 minutes. Add activated solution to the rest of water. To this solution, add 500 g slaked lime powder and mix thoroughly). 2% Bleaching powder in 0.3% slaked lime solution (To prepare 100 liters of solution, add little water to 2 kg bleaching powder and 300g slaked lime powder and make a paste. Add this paste to the rest of water and stir thoroughly. Keep for 10 minutes and use the supernatant). 0.3 % Slaked lime solution (optional disinfection if viral diseases noticed in previous crop – Add 300g of slaked lime to 100 liters of water and stir thoroughly. Keep for 10 minutes and use supernatant). The total requirement of disinfectant solution for disinfection is estimated based on the rearing house floor area (Length × Breadth of floor). The quantity of disinfectant solution required is 1.5 lt./sq. m or 140 ml/sq. ft. floor area of rearing house (height 3 m /10 ft.) + 10% of total quantity of disinfectant solution.

N. bombycis kills 100% of silkworms hatched from infected eggs. This disease can be carried over from worms to moths, then eggs and worms again. This microsporidium comes from the food the silkworms eat. If silkworms get this disease in their worm stage, no visible symptoms occur. However, mother moths pass the disease to the eggs, and 100% of worms hatching from the diseased eggs will die in their worm stage. To prevent this disease, it is extremely important to rule out all eggs from infected moths by checking the moth's body fluid under a microscope.

CONCLUSION

The success of sericulture industry depends upon several factors of which the impact of the environmental factors such as biotic and abiotic factors is of vital importance. Among the abiotic factors, temperature plays a major role on growth and productivity of silkworm, as it is a poikilothermic (cold blooded) insect Benchamin and Jolly (1986). It is also known that the late age silkworms prefer relatively lower temperature than young age and fluctuation of temperature during different stages of larval development was found to be more favourable for growth and development of larvae than constant temperature. There are ample literature stating that good quality cocoons are produced within a temperature range of 22–27◦C and above these levels makes the cocoon quality poorer Krishanaswami *et al.* (1973). However, polyvoltine races reared in tropical countries are known to tolerate slightly higher temperature Hsieh *et al.* (1995). Although there are silk fiber that obtained from undomesticated silkworm such as Tasar, Muga, Eri, Anaphe, today silk fiber that obtained from *Bombyx mori* is important for production and consumption worldwide (Atavve Namırtı, 2011).

FUTURE SCOPE

Different races o the silkworm are reared in different region according to their habitat and living nature. The most costly silkworm cultivated only in our India which in Muga silk. For this batter production and high yielding the government must make a Good and suitable Scheme. And the subsidy provided by government is making easy and reliable. The farmers of Northern India not much averred for Sericulture. The extension and benefits of the sericulture must more publish and added by the government. With this the farmers take interest on it.

— Influence of Environmental Factors on Nutritional Indices.

— Influence of Temperature on Reproductive Potential of Silkworm Moth.

— Influence of Temperature on Post cocoon Parameters.

— Innovations in Silkworm Rearing and Importance Recent Advance.

— Cultivation and Breeding Techniques for Increase Silk Productivity.

— Improving silk production by increasing silk gland size.

— Management of Nutritional and Climatic factors for Silkworm Rearing.

By finding thermotolerant silkworm breeds, some earlier studies addressed the selection of silkworm breeds with regard to thermotolerance. For the selection of possible thermotolerance parental resources for breeding programmes, a thorough understanding of the genetic foundation and variability in the expression of quantitative and qualitative genetic features during exposure to high temperatures is crucial.

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