Optimization in Comfort Conditions of Silkworm Rearing House.

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Abstract- The seasonal variations within the environmental elements significantly have an effect on the constitution expression within the kind of makeup. The variations within the environmental conditions day to day and season to season emphasize the necessity of management of temperature and ratio for property cocoon production. This review paper discuss in details regarding the role of temperature and wetness on growth and development of silkworm as well as recent studies on heat shock macromolecule. The study conjointly highlights regarding the care to be needed throughout silkworm spinning and influence of temperature and wetness on post cocoon parameters of silkworm. The study enclosed future methods.

Keywords- temperature, humidity, air circulation, gases, light, and so forth.

1. INTRODUCTION

Sericulture is that the science that deals with the assembly of silk by rearing of silkworm. Silk is termed the queen of textiles attributable to its aglitter luster, softness, elegance, durability, and tensile properties and is discovered in China between 2600 and 2700 before Christ. Silk originating within the spit of associate insect could be a natural fibrous substance and is obtained from insect insects or cocoons spun by larvae called silkworm. The silk is most well liked overall alternative kinds of fibers attributable to it sre mark ready properties like water permeableness, heat resistance, coloring efficiency, and luster. Factors principally influence the physiology of insect's are temperature and wetness. Despite wide fluctuations in their surroundings, insects show an interesting vary of a adaptations to fluctuating environmental conditions and maintain their internal temperature and water content inside toler ready limits. Adaptation could be a advanced and dynamic state that wide differs from species to species. extant below dynamic setting in insects depends on diffusion, environs choice, environs modification, relationship with water, resistance to cold, diapause and organic process rate, sensitivity to environmental signals, and syntheses of form of molecules. The mulberry silkworm is extremely delicate, sensitive to environmental fluctuations, and unable to survive extreme natural fluctuation in temperature and wetness due to their long years of domestication since 5000 years. Thus, the ability to environmental conditions within the silkworm is sort of different from those of untamed silkworm and alternative insects. Temperature, humidity, air circulation, gases, light, then forth, show a significant interaction in their effect on the physiology of silkworm relying upon the mix of things and biological process stages affecting growth, development, productivity, and quality of silk. The paper discusses the optimum conditions of environmental factors needed for higher productivity in sericulture. This paper conjointly discusses the role of different environmental factors affecting the expansion, survivability, productivity, and illness incidence in silkworm

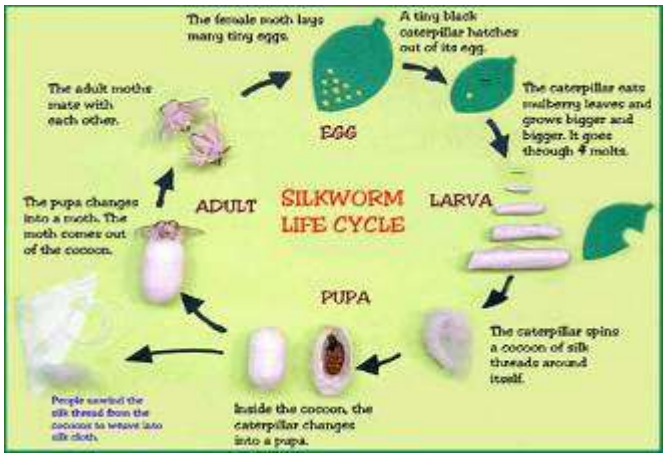


Fig.1: Life cycle of silkworm

2. PROBLEM STATEMENT

A silkworm-rearing house is the place where the silkworm is reared to produce cocoon. The cocoons quality is depend upon various environmental conditions like temperature, humidity, ventilation etc. But now a days various changes in climates create the difficulty in production of the cocoon. In summer days the temperature is very high that time the silkworm cannot produce cocoon properly. In winter days the temperature level goes below the normal temperature. so the production rate is reduce. Therefore the optimal environmental conditions are required for healthy growth of silkworm. Like proper maintained temperature and humidity, light or illumination (15-30 lux), proper ventilation and different bed areas in different stage of the silkworm growth.

2.1 Objective

Rearing Bed Area Requirement for Silkworms: -

Table 1: Rearing bed area for silkworm

Instar	Bed area for Multivoltine (sqm/sqft.)	Bed area for Bivoltine (sqm/sqft.)
First	1.50/15	1.75/17.5c
Second	4.50/45	5.25/52.5c
Third	9.00/90	12.00/120
Fourth	24.00/240	133.00/330
Fifth	50.00/500	77.00/700

A silkworm-rearing house should be well ventilated. Poor ventilation leads to humidity built up and accumulation of gases like carbon monoxide, carbon dioxide, ammonia, etc., which adversely affect the growth of silkworms and make them susceptible to diseases. The rearing bed area required for different races of the silkworms during different stages of growth is given below for 100 Dfls (2 Boxes) resulting in approximately 40,000 larvae. Rearing bed area required for silkworms during different stages for 40000 larva.

Young Age Silkworm Rearing House: -

The Young age silkworm rearing houses are often called as Chawki Rearing Centre (CRC). Adequate care in terms of temperature, relative humidity and hygienic conditions should be provided to young silkworms for their good and healthy growth. A CRC for brushing 5000-6000 dfls per batch consists of a rearing hall of 30' x 30', leaf storage room of 10 ' x 20' and anteroom of 10' x 10' size. Adequate ventilation in the rearing hall is recommended. A continuous water channel inside the rearing hall along the walls helps in keeping the ants away from silkworms and also maintaining the humidity. The windows should be fitted with wire mesh to avoid entry of uzi fly. The ceiling should be kept at 9'-10' from floor. In case of more roof height a false ceiling at 8' to 9' from floor helps in reducing the volume of air in the rearing hall so that required temperature and humidity can be maintained conveniently.

Late Age Silkworm Rearing House: -

The silkworm rearing house should be located on an elevated place to avoid moisture migration from floor to rearing house, provide good cross ventilation, facilitate drainage of the water at the time of cleaning and disinfection. 2. The rearing house should be north facing i.e., the windows face north and south. This will avoid direct entry of the sunlight into the rearing house. 3. Ventilators should be provided above and below the windows for air circulation inside the rearing house. 4. The rearing house should have cement flooring for maintaining hygiene. 5. A 10-15 cm deep channel inside all around the rearing hall should be provided to prevent entry of ants in the rearing area and also to drain out water at the time of cleaning and disinfection. During summer, the water in channel helps in increasing the humidity and cooling the air entering in through the lower ventilators.

Scope

Silkworm Rearing: - Silkworms during their larval period pass through 5 stages by under going four moults, the larval period is totally reared in a specially designed rearing shed. This is because the silk worms are susceptible to diseases. Therefore, it is also necessary to disinfect the rearing shed, equipment and rearing premises with formaldehyde solution, chlorine dioxide and bleaching powder before and after conducting of silkworm rearing for better harvest of cocoons.

3. LITERATURE REVIEW

The seasonal differences in the environmental components considerably affect the genotypic expression in the form of phenotypic output of silkworm crop such as cocoon weight, shell weight, and cocoon shell ratio. The variations in the environmental conditions day-to-day and season to season emphasize the need of management of temperature and relative humidity for sustainable cocoon production. The present review paper discuss in details about the role of temperature and humidity on growth and development of silkworm including recent studies on heat shock protein.In addition to this study emphasis on the role of various environmental factors on embryonic development of silkworm egg, nutritional indices of silkworm larva and reproductive potential of silkworm moth. The study also highlights about the care to be required during silkworm spinning and influence of temperature and humidity on post cocoon parameters of silkworm. The study included future strategies to be taken for the management climatic condition for successful cocoon crop. The paper covers 140 references connected with the topic. Role of Temperature on Growth of Silkworm [2] Temperature plays a vital role on the growth of the silk- worms. As silk worm sare cold blooded animals, temperature will have a direct effect on various physiological activities. In general, the early instar larvae are resistant to high temperature which also helps in improving survival rate and cocoon characters. The temperature has a direct correlation with the growth of silkworms; wide fluctuation of temperature is harmful to the development of silkworm. Rise in temperature increases various physiological functions and with a fall in temperature, the physiological activities are decreases. Increased temperature during silkworm rearing particularly in late instars accelerates larval growth and shortens the larval period. On the other hand, at low temperature, the growth is slow and larval period is prolonged. The optimum temperature for normal growth of silkworms is between 20◦C and 28 ◦C and the desirable temperature for maximum productivity ranges from 23◦C to 28 ◦C. Temperature above 30◦C directly affects the health of the worm. If the temperature is below 20◦C all the physiological activities are retarded, especially in early instars; as a result, worms become too weak and susceptible to various diseases.

Table 3: Effect of Temperature And Humidity On Silkworm.

Larval forms	Optimum temperature	Optimum humidity
Instar I	26 -28°C	75 - 85%

Instar II	26 -27°C	75 - 85%
Instar III	24 -26°C	70 - 75%
Instar IV	24 -25°C	70 - 75%
Instar V	23 -24°C	65 - 70%

Fig. 2 silkworm rearing house.

The effect of temperature on the growth and development of silkworm has been studied extensively; how ever, much attention has not been paid on the effect of temperature on embryonic development. It has been reported that in exothermic organisms, when rate of development is plotted against temperature, a sigmoidal curve is obtained with an almost linear correlation in central temperature range. Temperature is a parameter in developmental cycle, which can be manipulated experimentally, but its effect is very complex for interpretation. The physiological explanation for embryonic death after exposure to lethal temperature is likely to be highly complex and probably species specific. Improper egg incubation results in various problems during the hatching and rearing period. If silkworm eggis subjected to incubation at high temperature and low humidity the hatching of larvae severely affected. It is well known that the environmental conditions during embryonic development not only affect the diapauses nature of eggs but also larval/pupal duration, cocoon weight, and egg production . Among the development stage of silkworm, Bombyxmori, the egg stage has the lowest tolerance to high temperature. Temperature during incubation also affects voltinism character, as the embryonic stage is the most sensitive to temperature. Bivoltine eggs incubated at a temperature above 25◦C produce moths that lay hibernating eggs, while those incubated at lower temperature (below 25◦C) produce moths that lay mixed and fully nonhibernating eggs. Development rate is directly influenced by temperature and is modified by humidity. At high temperature the embryo grows faster up to the setae formation stage and succumbs to death as the yolk cannot be utilized in pace with the high rate of development and comes in way of normal development . Kittlans stated that temperature above 33◦C and abnormal cold treatment of embryos might also cause embryonic death or abnormal development. Cold treatment of silkworm (Bombyx mori) eggs leads to formation of tetraploid individuals, which lay large eggs . During silkworm egg incubation, it is important that humidity should be maintained at 80% on an average for normal growth of embryo. If humidity falls below 70% during incubation, the hatching invariably is low. A number of factors complicate the effect of humidity on respiration; most important of which is the water content of the insect.

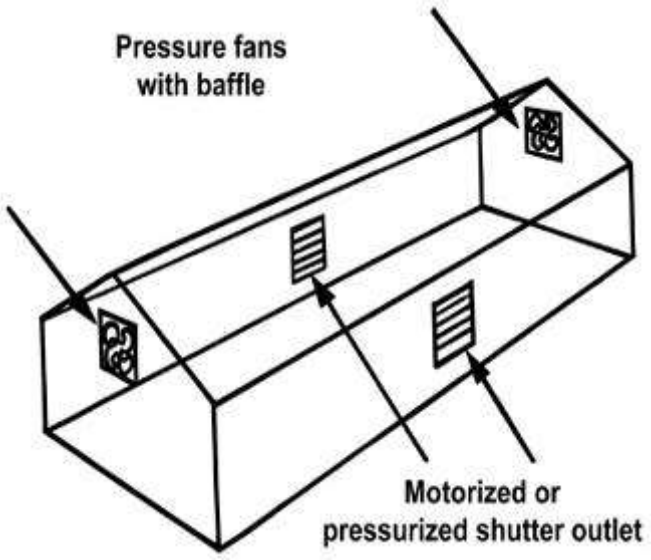
Constructional Parameter

Main Component:

- Pressure fan
- Exhaust fan
- Pressurized shutter outlet

Advantages

- Rapid and healthy growth of silkworm
- Best cocoon quality
- Increases disease resistance capacity of silkworm
- Less human efforts
- Less wastage of leaf provided to silkworm



Limitations

- The wall height in a rearing house should be minimum 10' on the sides and 14' at the center.
- An ante-room should be provided for washing hands and disinfecting legs before entering into the rearing area.
- Doors and windows should be fitted with wire mesh to avoid entry of uzi-fly into the rearing house.
- Water facility should be provided in a rearing house for cleaning/washing and disinfection and also for humidification purpose.
- The rearing house should have adequate lighting arrangements for working during night.
- Electrical points in the rearing house should be provided for using heaters, humidifiers, coolers and lighting the building for workers during night hours.
- Provisions must be made for exhaust fans for evacuating humidity from rearing house during rainy days.

- Arrangements should be made to ward off rats, lizards, etc. and avoid entry into the rearing house.
  Shade trees around the rearing house should be planted to protect the walls and the roof from afternoon sun.

3. METHODOLOGY

The optimum rearing temperature and relative humidity for different stages of the silkworms are as follows: Optimal Environmental Conditions for Silkworms: -

Table No.2 Optimal Environmental Conditions

Instar	Temperature	Humidity
1	27-28	85-90
2	27-28	85-90
3	26-27	75-80
4	25-26	70-75
5	25-26	70-75

When the temperature and relative humidity inside the rearing house are below optimum conditions, they are artificially raised through charcoal or electric heaters and running humidifiers. When the rearing room temperature and relative humidity are above the optimum conditions, arrangements for natural cooling through good ventilation or forced cooling through wet curtains on windows, air coolers or air- conditioners should be made besides covering the roof with mats made up of coconut fronds, grass etc. Light or Illumination:- Young Silkworms prefer dark or dim light [15-30 lux]. Light intensity influences the even distribution of the larvae in the rearing bed. Silkworms are crowded in dark place in the rearing bed. Ventilation in Rearing Shed:- In order to provide optimum environmental conditions like temperature and humidity during rearing period a separate rearing shed should be constructed with a size of 20‟ x 40‟ x 15‟ (L x B x H) OR 30‟x18‟13‟(L x B x H). Free cross ventilation must be ensured by providing more no. of windows. Late Age Rearing: - The 3rd, 4th and 5th stage of silkworm rearing is called late age rearing.

5. CONCLISION

A comparison of the improved technique of rearing with the conventional method of rearing will show clearly that under the improved technique, the leaf produced is most efficiently utilized since the leaf cocoon ratio works out to be 15-20:1 as against 2O-25:1 or even more in the case of conventional method of rearing. Further, for producing the same quantity of cocoon crop, the seed required is just half. Also the cocoon produced is of such superior quality that a premium price of 30 to 50 per cent more can be easily obtained in the cocoon markets for the cocoons obtained in the improved technique of rearing. Thus, the new technique helps the seri culturists to obtain both higher yields as well as higher prices for the cocoons produced. It may also be mentioned in this connection that the seri culturists used to lose on an average one crop out of every three or four crops and crop failures are regular features under the conventional method of rearing, whereas in the case of improved technique, the crop failures are very rare and almost completely eliminated. Even if here were to be any disease infection, it does not result in the total loss of the crop and to a large extent the crop is saved. The crop is generally successful and the effective rate of rearing reaches 70-80% and above, and this for bumper harvests. Thus, it may be seen that the mainly accounts adoption of the improved technique of rearing as recommended by the institute is an essential step in sericulture practice which would ensure sustained production of bumper crops.

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