**Environmental factors affecting rearing of Silkworm**

Silkworms have been domesticated or semi-domesticated insects for many centuries, as silkworms play an important role in the economy of men. The silkworm is by nature very delicate and sensitive to environmental conditions. Silkworm rearing is therefore aimed at producing very good quality cocoons of very high silk content utilizing the available optimum environmental conditions. The ecological factors, chiefly temperature, humidity, light and air during rearing show a significant effect in the growth of larvae and finally cocoon crop quality. However, other factors such as quality and quantity of the leaf supply and techniques of rearing adopted, such as feeding, cleaning, spacing etc also influence the rearing activity. The silkworm behavior in relation to various environmental conditions varies with different stages of growth, and a bad environment affects the growth of worms.

- **Temperature**: Silkworms are poikilotherms. Thus they change their body temperature according to the environmental temperature. Temperature has a direct effect on the various physiological activities of living organisms like other animals.

  The physiology of silkworm namely metabolic rate, activity of enzymes, nutrient conversion, digestion, assimilations, excretion, nervous stimulation, hormonal actions are influenced by environment temperature.

  The silkworm is capable of growing in temperatures ranging from 15 degree celsius to 40 degree celsius but from the physiological point of view, ideal temperature ranges from 20 degree celsius to 30 degree celsius.

The silkworm rearing is aimed to produce good quality cocoons for which an ideal and desirable temperature ranges from 23-28 degree celsius for getting maximum productivity. The effect of temperature on the physiology of silkworm during rearing can be divided into groups which are as follows:

a) Temperature which is harmless to growth of silkworm
b) Temperature which is favourable for the healthy growth of silkworms.
c) Temperature favourable for making good quality cocoons.

With the rise in temperature, metabolic activities of the worms are increased while they are slackened when temperature is low. Therefore, at high temperature the growth of larva is fast and consequently the duration of the larval period is shortened. On the other hand, growth becomes slow at low temperature with prolonged larval duration.

The chawki worms (Young aged larvae) are comparatively stronger and more resistant to humidity and temperature than the late aged worms. Thus, the young ones feed very actively and grow vigorously under high temperatures in humid conditions. As mentioned above the temperature has a direct correlation with the growth of silkworm, wide fluctuations are avoided as they are harmful. The maximum temperature for rearing in different instars is as follows:

| Age of worms' | Optimum temperature (degree C) |
|---|---|
| I | 26-28 |
| II | 26-28 |
| III | 24-26 |
| IV | 24-25 |
| V | 23-24 |

In case silkworms are reared in such a temperature introspective stadium, they are filled with rich nutrients, sufficient leaves so that maximum possible growth can be achieved.

- **Humidity**: The role of rearing humidity upon the growth and health of silkworm is similar to that of rearing temperature. Humidity helps to decrease the length of growing period of silkworm by accelerating the activity of physiological function. The pH value of blood is remarkably lower at high humidity 80-90 % than at low humidity 60% condition. Expiration of carbon dioxide increases with rise in humidity. On the contrary, low humidity prolongs the length of the growing period of larva. The combined effect of both temperature and humidity largely determines the satisfactory growth of the silkworms and production of quality cocoons. In this way both temperature and humidity are complementary to each other. The role of humidity affects both directly and indirectly. Directly involves to influence the physiology of silkworm larva when indirectly influences the rate of withering of leaves in larval beds. Therefore, suitable rearing must be determined while considering the following points.
    1. The optimum humidity for the growth of silkworm is about 75% of relative humidity. The early instars are resistant to high humidity with relatively little or no effect of change in the moisture. On the contrary, the late age instars are weak against high humidity suffering badly from the damage of humidity.
    2. In an extremely desiccated rearing room silkworms cannot eat Mulberry leaves owing to the withering of leaves. Then they become malnourished especially this problem occurs in early instars.
    3. If the air of the rearing room is too moist, it becomes favourable to grow the pathogens and microbes thus silkworms are apts to suffer from disease

Considering above factors, different humidity conditions are there for different instars:

| Age of worms | Humidity% |
|---|---|
| I | 85 |
| II | 85 |
| III | 80 |
| IV | 75 |
| V | 70 |

For knowing the percent of humidity of a rearing home hygrometer/ wet/dry thermometer and humidity chart are required.

- **Air**: Silkworms breathe through 18 spiracles on both sides of the body supplying the blood with oxygen through the trachea .This trachea distributes the oxygen to the body and at the same time unnecessary substances like carbon dioxide or water produced in the body are expelled through trachea. Therefore it is needless to say that fresh air is necessary for the life of a silkworm.

The air of the rearing room is contaminated by carbon dioxide, Sulfuric acid gas, carbon monoxide, ammonia, formaldehyde etc produced by the breath of man, silkworm or Mulberry leaves fermented by litter, burning of coal. These gases are injurious to silkworms.

When the gases increase in the beds and rearing room beyond the tolerance limits of worms become sluggish and do not feed.
The safe limit for silkworm rearing is 1-2% of co2, 1% of formaldehyde, 0.02% of SO2 & 0.1 % of ammonia in the era of rearing room. Young worms are less resistance to toxic gases though comparatively resistance to carbon dioxide. The productions of these gases are far less in early instars than in the late instars. The effect of SO2 causes prothetely in cocoon & makes cocoon quality worse and worsening the reliability of cocoon filaments. Ammonia (0.1%) in the room makes sericin insoluble while reeling.

- **Light**: There is no correlation between light and survival of silkworm, however the silkworms are photosensitive and generally tend to crawl towards dim light. They do not like either strong light or complete darkness to produce heavier cocoons than those of silkworms reared in dark condition. The appetite of silkworms is more in a light place than in a dark place. The larva comes up to the upper surface of the bed more quickly under light conditions than in a dark condition. However it is not advisable to rear in complete light or complete darkness. Silkworms fond of dim light of 15 to 20 lux avoid strong light and darkness. The late age worms thrive better in 16 hours light and 8 hours dark periods. Light helps in uniform distribution of Larvae in rearing beds. They are crowded and distributed in several layers in dark conditions compared to thin and even distribution in light conditions. Photoperiod influences on the early instars on the type of egg produced by the resulting moth.