

Impact Of Temperature In Mulberry Sericulture

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Introduction

The 'Sericulture' is derived from the Greek word 'sericos' meaning 'silk' and 'culture' meaning 'rearing'. Sericulture is the systematic practice of breeding silkworms on a large scale to produce silk. Bombyx mori mulberry silkworm is monophagous and it is completely dependent on the mulberry host plant (Morus spp) for their survival of their life. It encompasses the cultivation of food plants for the worms, nurturing them to spin cocoons from consumed leaves, extracting silk threads from the cocoons, and weaving these threads into fabric. Climate change refers to abrupt changes in the climatic pattern such as temperature variation, erratic rainfall etc, which significantly impact the overall sericultural productivity which affects the socio-economic status of the rural livelihood. Climate change disrupts the traditional sericulture practices as the global temperature continues to rise and seasonal patterns shift, it becomes imperative to understand the extent of climate change's influence on sericulture and devise robust adaptive measures.

Climate sensitivity in sericulture

Mulberry plant growth

Although mulberry can be cultivated across diverse environmental conditions, the optimal growth occurs at temperature ranging between 24°C and 28°C, with well-distributed annual rainfall between 600 mm to 2500 mm. Additionally, an atmospheric humidity level of 65% to 80% is considered ideal for its development. Climatic variations affecting various physiological processes not only photosynthesis, respiration, transpiration but also influencing sprouting, flowering and dormancy cycles.

High temperature stress

High temperature especially above 40°C significantly decreases the photosynthetic rates and stomatal conductance leading to reduced transpiration and potential wilting and also prolonged exposure to high temperatures can reduce the leaf yield and total dry matter accumulation.

Low Temperature Stress

A number of processes can be slowed down or stopped by temperatures below the ideal range. The growth and sprouting of the buds are generally not obtained at temperature below 13°C.

Silkworm Growth and Development

The Mulberry Silkworm (Bombyx mori) is a poikilotherm, which is highly sensitive to environmental temperature. The most suitable and optimum temperature for rearing of mulberry silkworm is ranged from 24°C to 26°C. For the early instar, the temperature and humidity requirement is comparatively higher than the late age silkworm. As being silkworm ectothermic, are highly sensitive to the climatic fluctuations to adverse conditions like high temperature especially in the later larval instars with excessive humidity leading to the poor growth in the developmental period which leads to the formation of lower quality cocoons ultimately reduced silk content.

Disease and Pest Dynamics

Warmer and more humid climatic conditions significantly contribute to the increased incidence and spread of various pathogens, including viruses, bacteria, and fungi, as well as silkworm pests. Under such climate-induced stress, flacherie, grasserie, and muscardine diseases have shown a marked rise in prevalence, adversely affecting silkworm health and productivity. Additionally, elevated temperatures have facilitated the expansion of mulberry host plant pests like mealybugs and thrips into new regions. These pests not only compromise the quality of mulberry leaves but also lead to substantial reductions in leaf yield, thereby negatively impacting the overall efficiency and sustainability of sericulture.

Soil Health

Climate change significantly affects the soil health in sericulture by altering temperature and rainfall patterns, leading to change in the soil moisture and nutrient availability, which in turn impact the mulberry cultivation and ultimately silkworm health and silk production. Extreme rainfall exacerbated increases erosion of the topsoil leads to a decline in the soil fertility, reducing its capacity to grow healthy mulberry plants. Change in the climatic condition can affect the population and the activities of beneficial micro-organisms, which can affect the host plant growth.

Socioeconomic implications

Climate change significantly affects the socio-economic aspects of sericulture. Altered temperature disrupts silkworm rearing and mulberry cultivation, lowering the yield and quality of the silk directly reduces income for sericultural farmers leading to the livelihood insecurity and poverty.

Suggestions to mitigate the effect of climate change

In response to the pressing challenges posed by global warming, it is essential to expand afforestation efforts with a focus on attaining carbon neutrality, rather than intensifying carbon-negative outcomes. Equally important is the advancement of cold-and drought-tolerant mulberry cultivars to ensure the sustainability of sericulture under shifting climate conditions. Parallel to this, breeding silkworm strains capable of adapting to higher temperatures and increased humidity is crucial, as these environmental stressors are becoming increasingly prevalent.

To mitigate the impact of rising temperatures and moisture levels-conditions that accelerate the proliferation of silkworm pathogens-a robust and efficient disease prevention and management framework must be established. Moreover, it is necessary to develop adaptive strategies for regulating temperature and humidity and carbon dioxide levels during both the silkworm rearing and cocoon formation phases. Furthermore, creating favourable economic conditions for farmers is vital to promote active participation and stimulate investment in improving infrastructure for mulberry cultivation and silkworm rearing. This can be achieved through targeted policy interventions, such as financial incentives, subsidies, and capacity-building programs. Empowering farmers with the necessary technical knowledge and resources will facilitate the adoption of sustainable and climate-resilient practices in sericulture.

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