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GROWTH RESPONSES OF HIBISCUS ROSA-SINENSIS TO VARYING TEMPERATURE REGIMES: A COMPARATIVE EVALUATION

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ABSTRACT

Temperature is a critical abiotic factor influencing plant growth, metabolic processes, and reproductive development. The present study investigates the comparative growth performance and adaptive responses of Hibiscus rosa-sinensis under different temperature regimes. Plants were maintained under controlled conditions representing low (15°C), optimal (25°C), and high (35°C) temperature ranges. Growth attributes such as plant height, leaf number, leaf area, and flower production were evaluated along with physiological indicators including chlorophyll stability and visible stress symptoms.

The findings revealed that plants grown under the optimal temperature range (25°C) exhibited significantly enhanced vegetative growth, improved chlorophyll retention, and increased flowering compared to those exposed to low and high temperatures. Lower temperature conditions resulted in reduced growth rate and delayed flowering, whereas higher temperatures induced chlorophyll degradation, wilting, and decreased floral output. Although Hibiscus rosa-sinensis demonstrated adaptive plasticity across varying thermal environments, prolonged exposure to temperature extremes negatively affected overall plant vigor and ornamental quality.

This study underscores the importance of maintaining optimal thermal conditions for maximizing growth and reproductive efficiency in Hibiscus and provides valuable insights for climate-resilient horticultural management.

Keywords: Hibiscus Rosa-Sinensis, Temperature Stress, Thermal Adaptation, Plant Growth, Chlorophyll Content, Abiotic Stress, Ornamental Horticulture, Climate Resilience

INTRODUCTION

Scientific name: Hibiscus rosa sinensis

Common name: China rose

Tamil name: Sembaruthi

China rose or "Queen of tropics" is often a popular name for the gorgeous flowering plant Hibiscus rosa sinensis, as it is mainly found in south-east china and some islands in the Pacific and Indian Ocean. The genus Hibiscus, belonging to the family Malvaceae,

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comprises over 200 species of flowering plants widely distributed across tropical, subtropical, and temperate regions. Among the most cultivated species are Hibiscus rosa-sinensis (tropical hibiscus) and Hibiscus syriacus (rose of Sharon). These species are valued for their ornamental beauty, medicinal properties, and ecological importance.

Temperature is one of the most critical environmental factors influencing plant growth, development, and productivity. It affects physiological processes such as photosynthesis, respiration, transpiration, enzyme activity, and nutrient uptake. Since hibiscus species originate from regions with varying climatic conditions, they exhibit different adaptive responses to temperature fluctuations. Tropical species generally thrive in warm climates, while temperate species demonstrate greater tolerance to cooler environments.

Understanding how different hibiscus species adapt to various temperature ranges is essential for improving cultivation practices, especially in the context of global climate change. Rising temperatures and unpredictable weather patterns can significantly impact flowering time, biomass production, and overall plant health. A comparative study of temperature adaptations in hibiscus can provide valuable insights into species-specific growth patterns, optimal temperature conditions, and stress tolerance mechanisms.

This study aims to analyze and compare the growth responses of selected hibiscus species under different temperature regimes. By examining morphological, physiological, and developmental parameters, the research seeks to identify optimal growth temperatures and evaluate the adaptive strategies that enable hibiscus plants to survive and thrive across diverse climatic conditions.

MATERIALS AND METHODS

PLANT MATERIAL COLLECTION

Uniform, healthy saplings of Hibiscus rosa-sinensis (3–4 months old) were obtained from a certified nursery. Plants were acclimatized under ambient conditions for two weeks before experimentation.

EXPERIMENTAL DESIGN

The experiment was conducted using a Completely Randomized Design (CRD) with three temperature treatments:

T_1: Low temperature -15°C

T_2: Optimal temperature -25°C

T_3: High temperature -35°C

Each treatment consisted of five replicates, with individual plants grown in 25 cm diameter pots containing a soil:sand:compost mixture (2:1:1).

GROWTH CONDITIONS

Temperature conditions were maintained in controlled greenhouse compartments. Relative humidity and temperature were monitored daily using digital thermometers. All plants received uniform irrigation and natural photoperiod (12–14 h light). The experimental period lasted eight weeks.

GROWTH AND PHYSIOLOGICAL PARAMETERS

Morphological observations included plant height (cm), number of leaves, leaf area (cm^2), and number of flowers per plant. Chlorophyll content was estimated using the acetone extraction method and spectrophotometric analysis. Visual stress symptoms such as wilting, chlorosis, and bud drop were recorded.

STATISTICAL ANALYSIS

Data were analysed using one-way ANOVA. Mean differences among treatments were considered significant at $p < 0.05$.

RESULTS

VEGETATIVE GROWTH

Plants grown under optimal temperature (25°C) exhibited significantly greater plant height, leaf number, and leaf area compared to other treatments. Low temperature reduced growth rate and delayed leaf expansion.

FLOWERING RESPONSE

Maximum flower production was recorded in T_2 (25°C). High-temperature treatment resulted in premature bud drop and reduced flowering frequency.

CHLOROPHYLL CONTENT

Chlorophyll concentration was highest under optimal temperature conditions. Significant chlorophyll degradation was observed under high-temperature stress, indicating impaired photosynthetic efficiency.

STRESS SYMPTOMS

Plants exposed to 35°C exhibited visible wilting, leaf scorching, and reduced vigour. Lowtemperature plants showed slower development, but fewer severe stress symptoms compared to high-temperature treatment.

DISCUSSION

The study demonstrates that temperature significantly influences both vegetative and reproductive performance in Hibiscus rosa-sinensis. Optimal temperature conditions enhanced metabolic activity, resulting in improved growth and flowering. Reduced performance at low temperature may be attributed to decreased enzymatic and photosynthetic activity. Conversely, high-temperature stress likely disrupted cellular metabolism, accelerated chlorophyll degradation, and increased transpiration rates, leading to reduced plant vigour.

The results align with previous findings that supra-optimal temperatures negatively impact ornamental plant quality. The observed phenotypic plasticity indicates moderate adaptability; however, sustained exposure to thermal extremes compromises growth efficiency.

These findings are particularly relevant under current climate change scenarios, emphasizing the need for controlled cultivation environments to sustain ornamental plant productivity.

CONCLUSION

The study identified 25°C as the optimal temperature range for maximizing growth and flowering in Hibiscus rosa-sinensis. Both low and high temperature conditions adversely affected vegetative development, chlorophyll stability, and reproductive output. Maintaining suitable thermal conditions is essential for improving ornamental quality and ensuring sustainable cultivation practices.

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REFERENCES

Apel, K., and Hirt, H. (2004). Reactive Oxygen Species: Metabolism, Oxidative Stress, and Signal Transduction. Annual Review of Plant Biology, 55, 373–399. https://doi.org/10.1146/annurev.arplant.55.031903.141701

Bita, C. E., and Gerats, T. (2013). Plant Tolerance to High Temperature in a Changing Environment: Scientific Fundamentals and Production of Heat Stress-Tolerant Crops. Frontiers in Plant Science, 4, Article 273. https://doi.org/10.3389/fpls.2013.00273

George, E. F., Hall, M. A., and De Klerk, G.-J. (2008). Plant Propagation by Tissue Culture: Volume 1. The Background (3rd ed.). Springer.

Hasanuzzaman, M., Nahar, K., Alam, M. M., Roychowdhury, R., and Fujita, M. (2013). Physiological, Biochemical, and Molecular Mechanisms of Heat Stress Tolerance in Plants. International Journal of Molecular Sciences, 14(5), 9643–9684. https://doi.org/10.3390/ijms14059643

Mittler, R. (2006). Abiotic Stress, the Field Environment, and Stress Combination. Trends in Plant Science, 11(1), 15–19. https://doi.org/10.1016/j.tplants.2005.11.002

Murashige, T., and Skoog, F. (1962). A Revised Medium for Rapid Growth and Bioassays with Tobacco Tissue Cultures. Physiologia Plantarum, 15(3), 473–497. https://doi.org/10.1111/j.1399-3054.1962.tb08052.x

Shah, N. H., and Paulsen, G. M. (2003). Interaction of Drought and High Temperature on Photosynthesis and Grain-Filling of Wheat. Journal of Agronomy and Crop Science, 189(1), 1–6. https://doi.org/10.1046/j.1439-037X.2003.00003.x

Suzuki, N., Rivero, R. M., Shulaev, V., Blumwald, E., and Mittler, R. (2014). Abiotic and Biotic Stress Combinations. New Phytologist, 203(1), 32–43. https://doi.org/10.1111/nph.12797

Taiz, L., Zeiger, E., Møller, I. M., and Murphy, A. (2015). Plant Physiology and Development (6th ed.). Sinauer Associates.

Wahid, A., Gelani, S., Ashraf, M., and Foolad, M. R. (2007). Heat Tolerance in Plants: An Overview. Environmental and Experimental Botany, 61(3), 199–223. https://doi.org/10.1016/j.envexpbot.2007.05.011