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PhD Dissertation Defense

Entitled

GERMINATION AND SEEDLING GROWTH OF NATIVE UAE PLANT SPECIES: THE COMBINED EFFECTS OF ELEVATED CO2 AND TEMPERATURE

by

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Abstract

The dissertation offers an extensive analysis of the physiological adaptations and coping strategies of native plant species in the United Arab Emirates (UAE) to the elevated levels of atmospheric carbon dioxide (CO_2) and temperature, within the broader context of human-induced climate change. Given the arid climate of the UAE, understanding how native species respond to environmental stressors is critical for the preservation of biodiversity and the development of sustainable agricultural practices. This study focuses specifically on the germination and early growth stages of three crucial native species—*Senna italica, Prosopis cineraria*, *and Tephrosia nubica*—under controlled conditions that simulate future climatic scenarios. The aim is to comprehend the morphological and physiological adjustments that facilitate survival and growth in these species under elevated CO_2 (400 ppm ambient to 800 ppm) and temperature (35°C ambient to 50°C). Controlled growth chamber experiments were conducted to quantitatively assess changes in germination rates, seedling biomass accumulation, root and shoot length, and physiological stress markers, alongside hormonal analyses to understand the underlying mechanisms of adaptation or stress response. The study's quantitative results reveal a complex range of responses among the three focal species. *Senna italica* displayed a robust increase in germination rate by approximately 25% and seedling root elongation by 15% under elevated CO_2, suggesting a potential carbon fertilization effect. In contrast, *Prosopis cineraria* showed a significant enhancement in both germination rate and early seedling growth (20% increase in shoot length and 18% in biomass) primarily under combined elevated CO_2 and temperature conditions, indicating a synergistic adaptation to both stressors. *Tephrosia nubica* exhibited a mixed response upon exposure to elevated CO_2 levels, demonstrating a moderate increase in germination success by 10% but a negligible change in seedling growth parameters. This finding highlights the species-specific adaptive capacities and potential vulnerabilities of *Tephrosia nubica* under changing climatic conditions. This dissertation significantly advances our understanding of desert plant adaptation to climate change, providing critical insights into the resilience and adaptive capacities of *Senna italica*, *Prosopis cineraria*, and *Tephrosia nubica*. The study's findings emphasize the significance of species-specific research in predicting ecological responses to global climate change, informing targeted conservation strategies, and enhancing the resilience of agricultural systems in arid environments. By focusing on the germination and early growth stages, this research fills a critical gap in our knowledge of plant physiological responses to elevated CO_2 and temperature, thereby setting the stage for future studies on long-term adaptation and survival strategies. This dissertation offers critical insights into the resilience and adaptive capacities of *Senna italica, Prosopis cineraria*, and *Tephrosia nubica*, highlighting the importance of species-specific studies for predicting ecological responses to global climate change, informing targeted conservation strategies, and enhancing the resilience of agricultural systems in arid environments. By focusing on the germination and early growth stages, this research fills a critical gap in our knowledge of plant physiological responses to elevated CO_2 and temperature, setting the stage for future studies on long-term adaptation and survival strategies.

Keywords: Climate Change, CO_2 Elevation, Temperature, Germination, Seedling Growth, Native UAE Plant Species, Plant Adaptation, Arid Environments, Conservation, Sustainable Agriculture.