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Effects of climate change on early life history stages of selected montane forest species in Sri Lanka

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Global climate change has become a significant challenge for ecosystems across the world, as it alters the global temperature, and rainfall patterns and creates extreme weather events. It influences different components such as environmental, ecological, and socio-economic stability. Among the climatic factors, temperature and rainfall play a critical role in determining vegetation distribution and abundance. Montane and alpine forests located at higher altitudes are the most vulnerable terrestrial ecosystems to the current climate change. Surpassing the various life stages of plants, seed germination, and seedling establishment are the phases highly affected by climate change. The main objective of this research was to determine the effect of predicted high temperatures and drought stress on the early life history stages of plants in the montane forests of Sri Lanka. Seeds from *Eurya ceylanica* and *Hortonia floribunda* were obtained from the Knuckles Forest whereas *Exacum trinervium* and *Maesa indica* were collected from the Loolkandura estate. Then the effect of temperature and water potential were measured by their germination percentages and shoot-root lengths under different temperatures. Seeds collected from Knuckles Forest were incubated at different temperatures, such as 17^{o}C, 25^{o}C, and 30^{o}C on filter papers saturated with water, in Petri dishes. Seeds collected from Loolkandura were subjected to different temperatures (17^{o}C, 25^{o}C, and 30^{o}C) and an osmotic potential gradient (0 MPa, -0.25 MPa, -0.50 MPa, and -0.75 MPa) by dissolving different amounts of polyethylene glycol in distilled water. According to the results, except *M. indica* other species did not show germination until 30 days, but germinated upon the scarification and gibberellic acid treatment depicting they have seed dormancy. Although *E. ceylanica* germinated at all 3 temperatures, the highest shoot and root growth were observed at 25^{o}C showing that it can be adapted to the current warmer climate with moderate temperature increments. *H. floribunda* showed germination only at 25^{o}C with remarkable seedling growth revealing that high temperatures promote its seed germination and seedling establishment. *E. trinervium* showed poor germination only at 17^{o}C under -0.25MPa. Thus, other high temperatures are unfavorable for its germination. However, further studies are required to determine the precise climate effect on *E. trinervium*. *M. indica* had remarkable germination along with higher shoot and root growth at 17^{o}C. Hence, global warming demotes the *M. indica* seed germination and establishment. However, it had the potential to survive under moderate temperature increments up to 25^{o}C and water deficit conditions up to -0.25 MPa. *M. indica* seedlings can tolerate extended drought periods within their existing local range. But it is unable to survive in severe osmotic stress at -0.75 MPa and high-temperature conditions like 30^{o}C when its range shifts to other locations. Since *M. indica* is a pioneer species in Knuckles Forest and has adaptability for climatic warming in local regions, it can be used to promote ecological succession in fragmented areas of montane forests and improve its biodiversity.

Keywords: Extended drought, High temperature, *Maesa indica,* Water potential gradient