

Forest understory plant responses to increased light and temperature: changes in functional traits and physiology

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Light availability is one of the key factors limiting plant growth in the forest herbaceous layer. Climate change and disturbances in stand structure may increase both temperature and the amount of light reaching the forest floor. Understanding how herbaceous plants respond to the interaction between increased light availability and warming is therefore crucial for predicting the future dynamics of forest ecosystems. In this study, we analysed the effects of light intensity and temperature on leaf functional traits and the state of the photosynthetic apparatus. *Galeobdolon luteum*, a common forest herb, was selected for this study. It is widespread in European deciduous forests and is well adapted to shade conditions. Specific leaf area (SLA), leaf dry mass content (LDMC), relative water content (RWC), Performance Index (PI), which expresses the efficiency of photosynthesis, and photosynthetic pigment content were assessed. Higher light intensity resulted in a significant decrease in SLA and an increase in LDMC, indicating the development of thicker and more structurally robust leaves. Moreover, the PI increased, suggesting physiological acclimation to increased light availability. However, with a simultaneous increase in light and temperature (29°C), a decrease in PI and chlorophyll b content was observed, as well as an increase in the chlorophyll a/b ratio, which may indicate photoinhibition and a reorganization of light-harvesting complexes.

The obtained results indicate that *Galeobdolon luteum* exhibits significant physiological plasticity in response to increased light availability. This response is also strongly dependent on temperature. At moderate temperatures, the plant showed signs of physiological acclimation to higher light intensity, whereas when the temperature increased to 29°C, acclimation abilities disappeared and signs of physiological stress appeared. This means that the interaction between temperature and light shifted from synergistic to antagonistic. The results show that the interaction between temperature and light intensity may play a key role in shaping the response of forest floor plants to changing environmental conditions, and that ongoing climate change may not only modify environmental conditions in forests but also influence the mechanisms regulating the functioning of plants in the herbaceous layer.

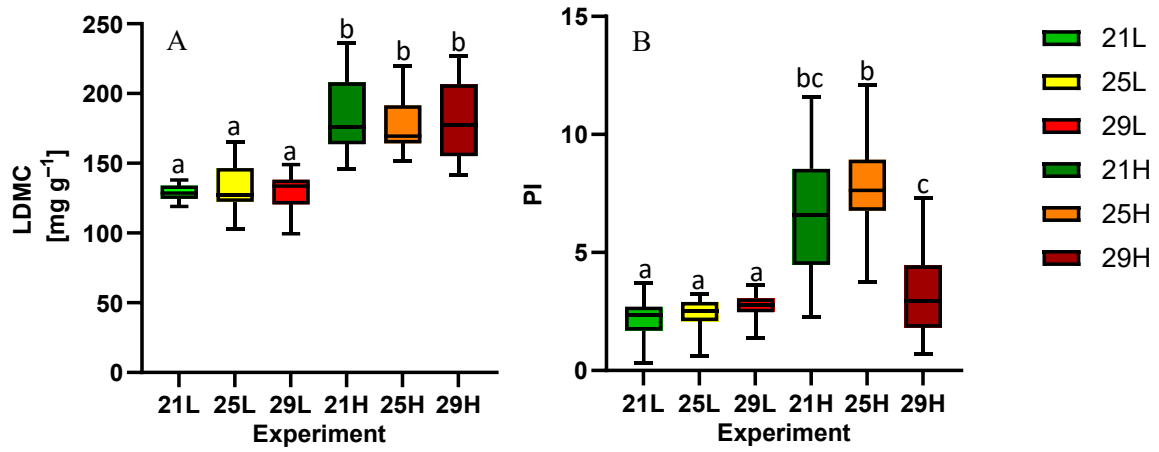


Fig. 1. Box plots showing: A – leaf dry mass content (LDMC) and B – Performance Index (PI) in different experimental treatments. Treatments are indicated by temperature (21–29°C) and light intensity level: L – low light level, H – high light level. Lowercase letters above the boxes denote significant differences between experimental treatments ($p < 0.05$)