EGU22-7442
https://doi.org/10.5194/egusphere-egu22-7442
EGU General Assembly 2022

The combined effect of light availability and drought on survival of two forest understory herb species

Josef Urban[1], Marie Matoušková[1], Roman Plichta[1], Roman Gebauer[1], Kateřina Houšková[1], Roman Vitásek[1], and Radim Hédl[2]
[1]Mendel University in Brno, Brno, Czechia (josef.urban@email.cz)
[2]Institute of Botany of the Czech Academy of Sciences, Brno, Czechia

Dense forest canopy influences understory microclimate by lowering the air and surface temperatures. It can mitigate the adverse effects of global climate change in forest communities. On the other hand, low light availability in dense forests is the main constraint for the understory species photosynthesis. And the resulting lack of carbohydrates may make herbs more vulnerable to increasing drought induced by climate change. Here we assessed the survival and ecophysiology of two morphologically similar but physiologically rather contrasting perennial herbs typical of temperate forest understories: isohydric *Asarum europaeum* and relatively anisohydric *Hepatica nobilis*. We emulated a summer drought period by growing adult plants of these two species in the greenhouse under 10% (simulating sparse forest) and 1% (simulating dense forest canopy) of outdoor light. Half of the individuals were subjected to water stress by withholding the watering until ca 50% mortality occurred. After the drought phase, we fully watered the plants and let them recover for one month.

The lowest predawn water potential measured during the experiment was -3.6 MPa, and the midday water potentials of plants in the sun were -5.4 and -8.1 MPa for *Asarum* and *Hepatica*, respectively. Light saturated photosynthesis (A_{sat}) of fully watered herbs was by more than 50% higher in the *Asarum* than in *Hepatica* at the end of the experiment. The two herbs plastically adjusted their A_{sat} to the light environment, so that A_{sat} of shaded *Hepatica* was by 38% and of shaded *Asarum* by 29% lower than in controls. After the period of drought, A_{sat} of stressed plants of both species grown in the lighter conditions fully recovered. In the shaded variant, however, only A_{sat} of *Hepatica* recovered but that of *Asarum* did not. Intrinsic water use efficiency (WUE_i) was higher in isohydric *Asarum* than in *Hepatica*. WUE_i was also higher in the herbs grown in light than in the shade. Specific dyeing to functional xylem indicated a higher proportion of conductive xylem (which means less damage by embolism) in plants grown in shade than in the light, in both species. To sum up, sufficient light may help some understory species to recover from severe water stress.