Effect of low atmospheric pressure on diploid sexual and triploid apomictic dandelions (*Taraxacum officinale* agg.)

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Background and scientific objective

Altitudinal gradients are often used in plant ecology to infer how climatic parameters such as temperature and humidity affect plant performance and resistance. A potential confounding factor in such studies is atmospheric pressure, which decreases with altitude and may affect plant physiological parameters. Yet, to date, little is known about the impact of atmospheric pressure on most plant species, and information on resistance traits is even more scarce. To better understand how different atmospheric pressures affect plant growth and resistance, we used the species complex *Taraxacum officinale* agg. *T. officinale* defends itself against herbivorous insects through the formation of lacticifer cells, within which latex is stored under pressure. *T. officinale* latex contains bitter secondary metabolites such as taraxinic acid glucoside (TAG), which acts as a repellent. The fact that *T. officinale* occurs naturally at altitudes between zero and 1600 m above sea and that it forms a pressurized defense system makes it an ideal model to understand the impact of atmospheric pressure on plant performance and resistance as a function of plant evolutionary history.

Experimental Approach

We collected the seeds of diploid and triploid *Taraxacum officinale* agg. genotypes from different altitudes ranging from 300-1600 m above sea. We germinated them at the University of Bern. After 3 weeks, plants were transferred to four locations (Bern at 500 m.a.s.l., Adlemsried at 1000 m.a.s.l., Kleine Scheidegg at 2000 m.a.s.l. and Jungfraujoch research station at 3400 m.a.s.l.). Plants were grown under controlled conditions, with similar artificial lighting and comparable temperatures and humidity to be able to specifically study the impact of atmospheric pressure. To evaluate the performance of the different genotypes, we measured the growth of the plants every 15 days. At the end of the experiment (45 days), plants were harvested to quantify biomass production. Root latex was also collected to profile latex secondary metabolites by HPLC-MS. The ploidy level of the plants was measured by flow cytometry.

Results

Across genotypes, plants produced more roots at lower altitudes than higher ones (Fig. 1A). Likewise, the production of TAG, one of the most important and abundant chemical compounds in *T. officinale*, was negatively affected by altitude (Fig. 1B). Leaf growth, total root latex as well as the production of inositol phenolic esters were not affected by altitude (data not shown). A statistically significant interaction between the altitude where the genotypes were collected and the altitude at which they were grown was detected for TAG. These results suggest that atmospheric pressure influences growth and resistance in *T. officinale*, and that the impact on resistance traits depends on the evolutionary history of the species.

Internet data bases

http://www.ips.unibe.ch/research/interactions/index_eng.html

Collaborating partners / networks

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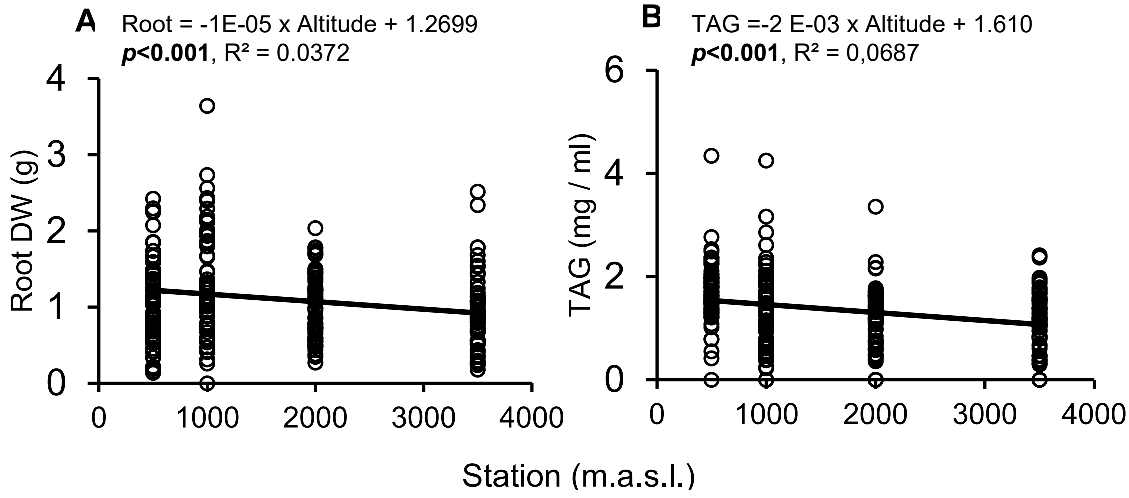

Figure 1. Plants grown under controlled environmental conditions at higher altitudes show reduced root growth and root defense metabolite production. Root production (A) and taraxinic acid glucoside production (B) are shown. Linear mixed models indicate significant effects of altitude on both parameters ($p<0.005$).