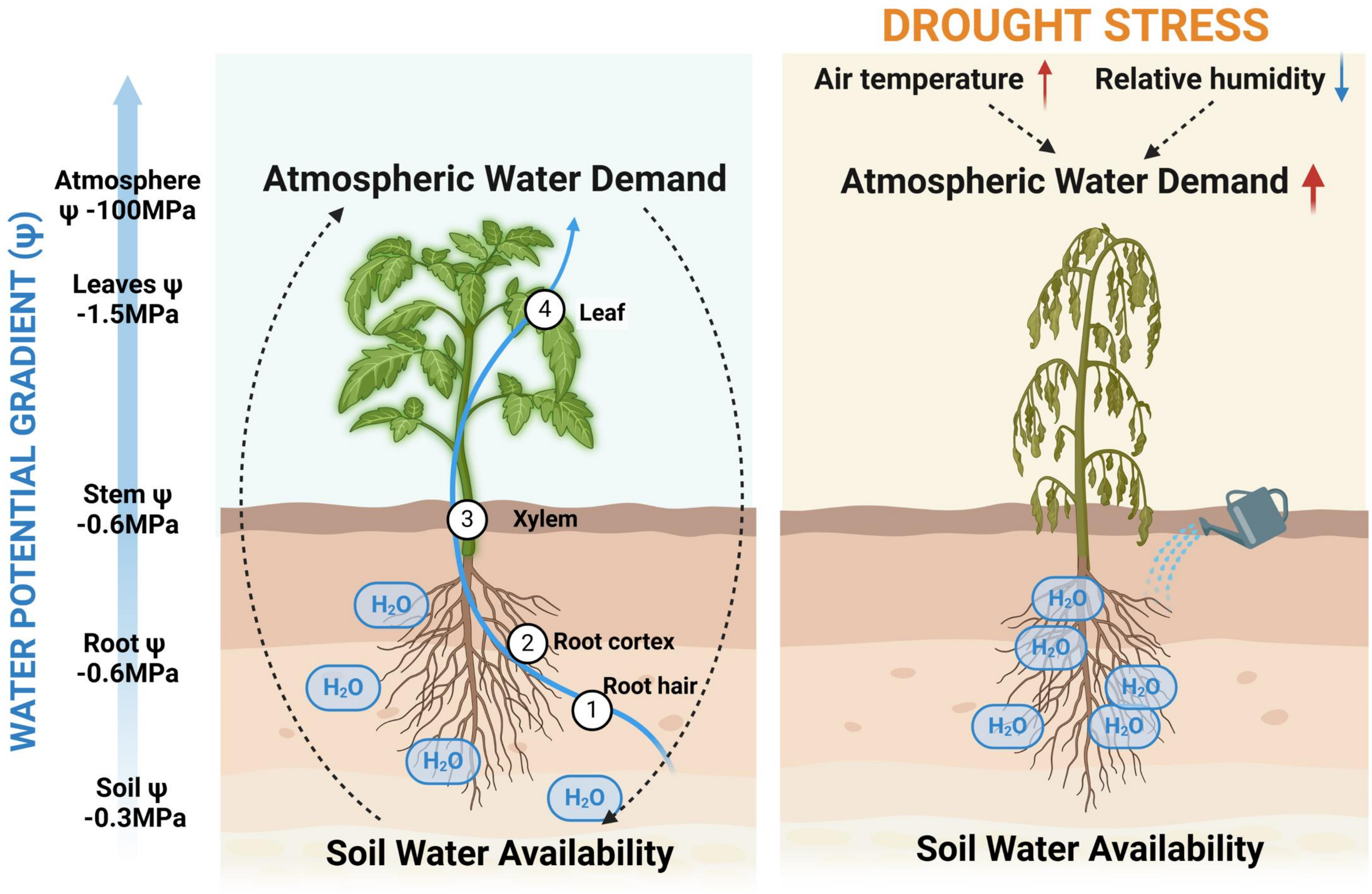
The air is dry: a quest to safeguard plants from a hotter and drier future (DRY-AIR)

The Increasing Evaporative Demand: A Driver of Drought?



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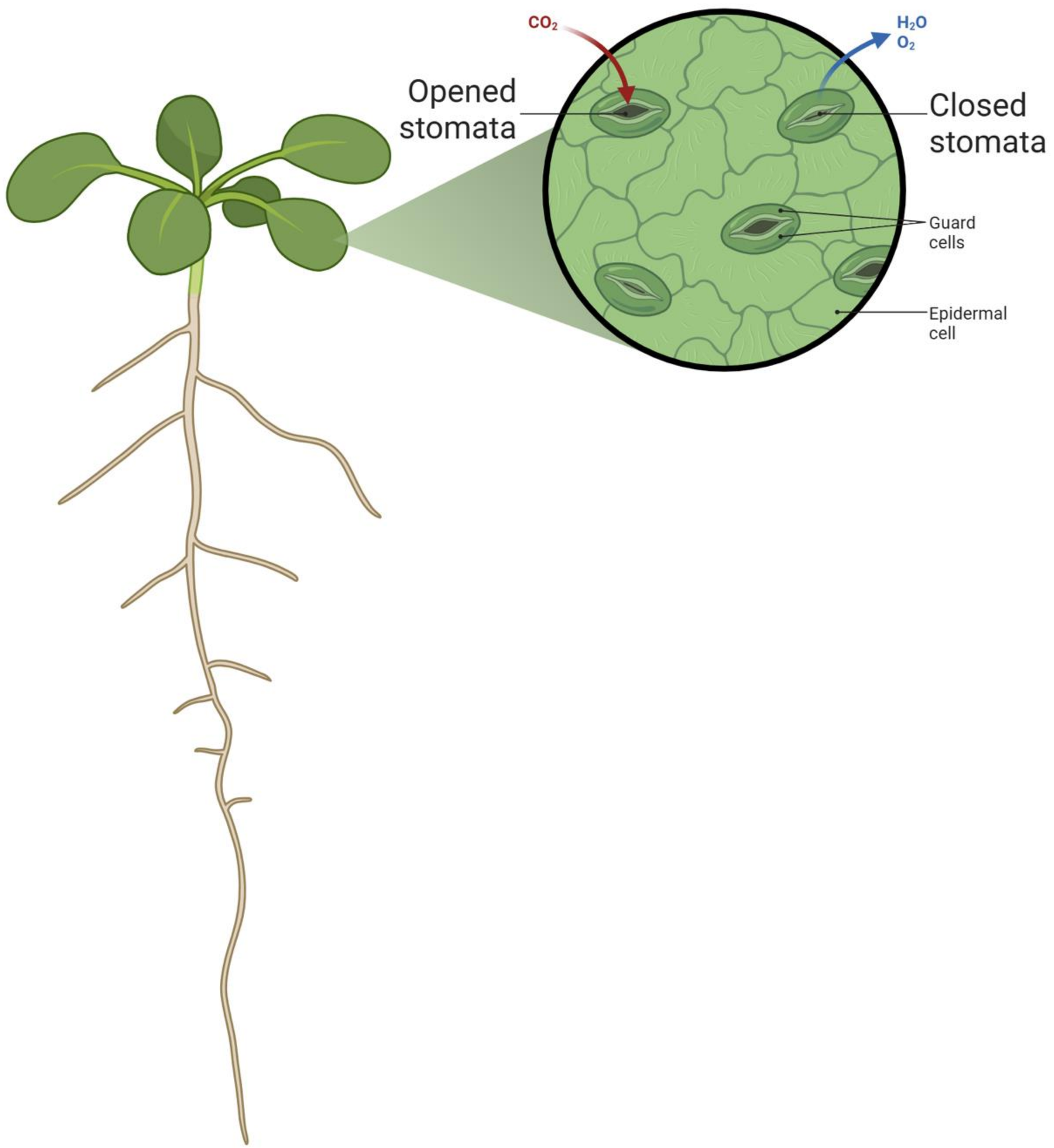


ABA

PYR/RCARs

PP2Cs

OST1

Activation of anion channels

Anion efflux and Stomatal closure

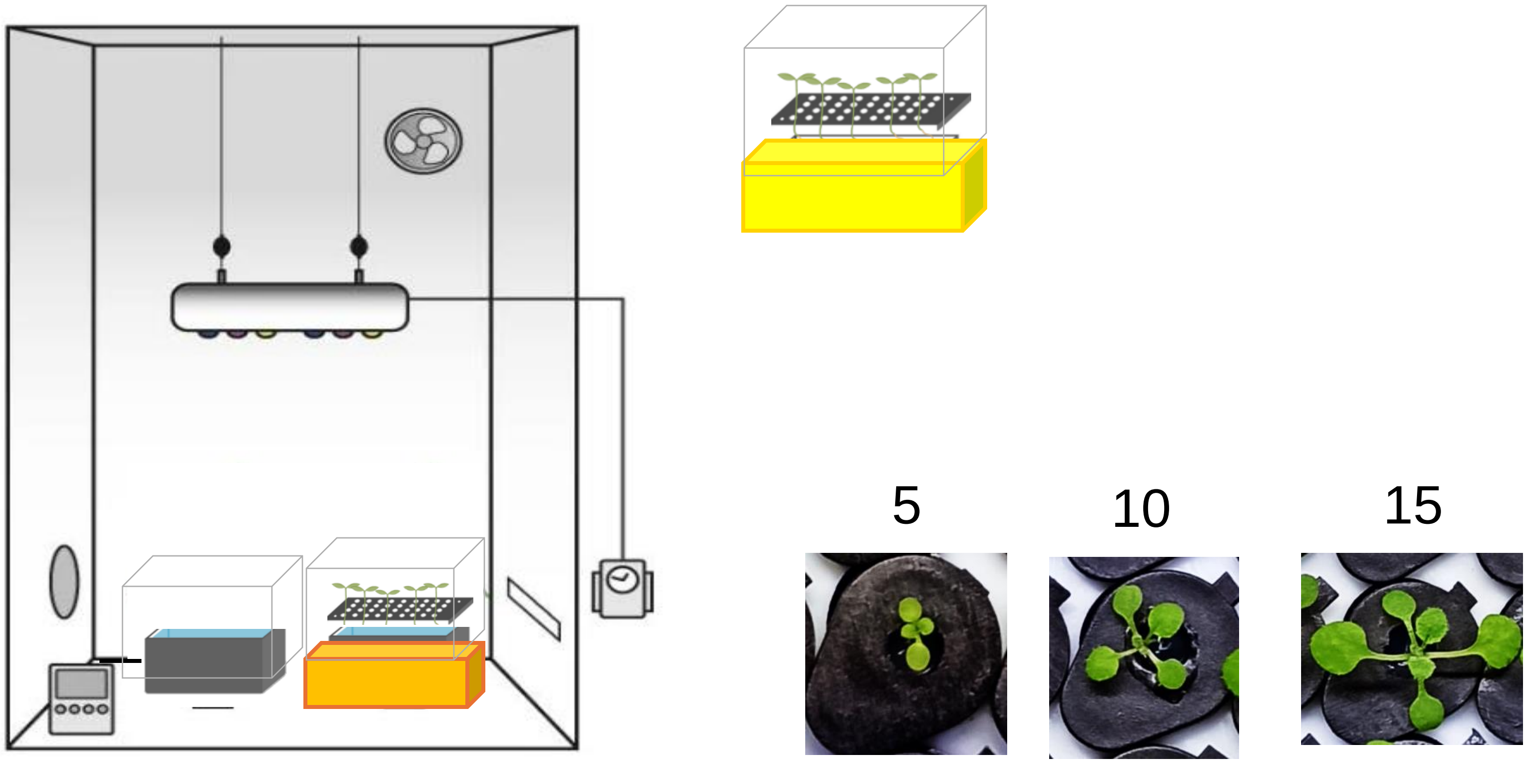
Aims of the Project

- **Isolate the effects of air drought stress** from other environmental factors, such as soil moisture depletion and temperature, to specifically assess its impact on plant responses

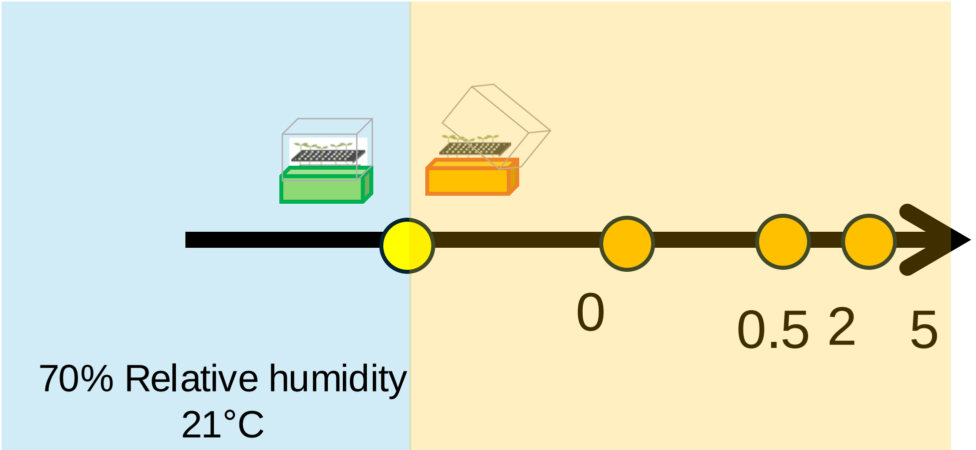
- **Identify early physiological and molecular responses** to air drought, focusing on short timeframes to capture rapid stress perception and signaling events

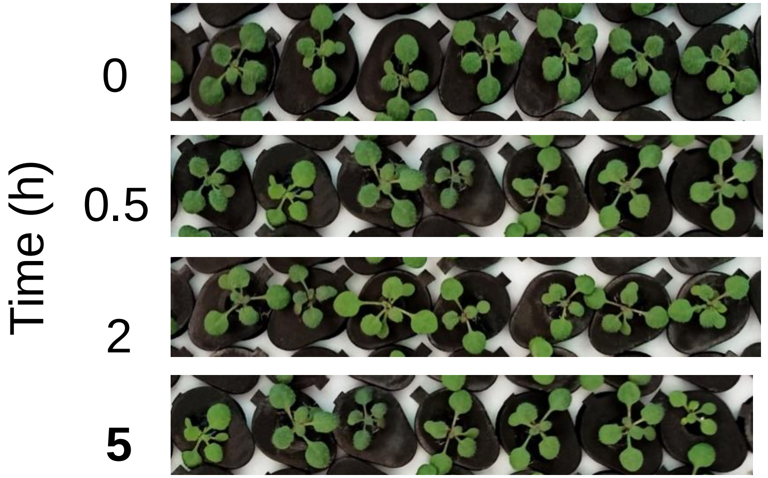
- **Investigate shoot-to-root communication** under air drought conditions, exploring how shoot-initiated signals regulate root responses and contribute to whole-plant adaptation.

Experimental system

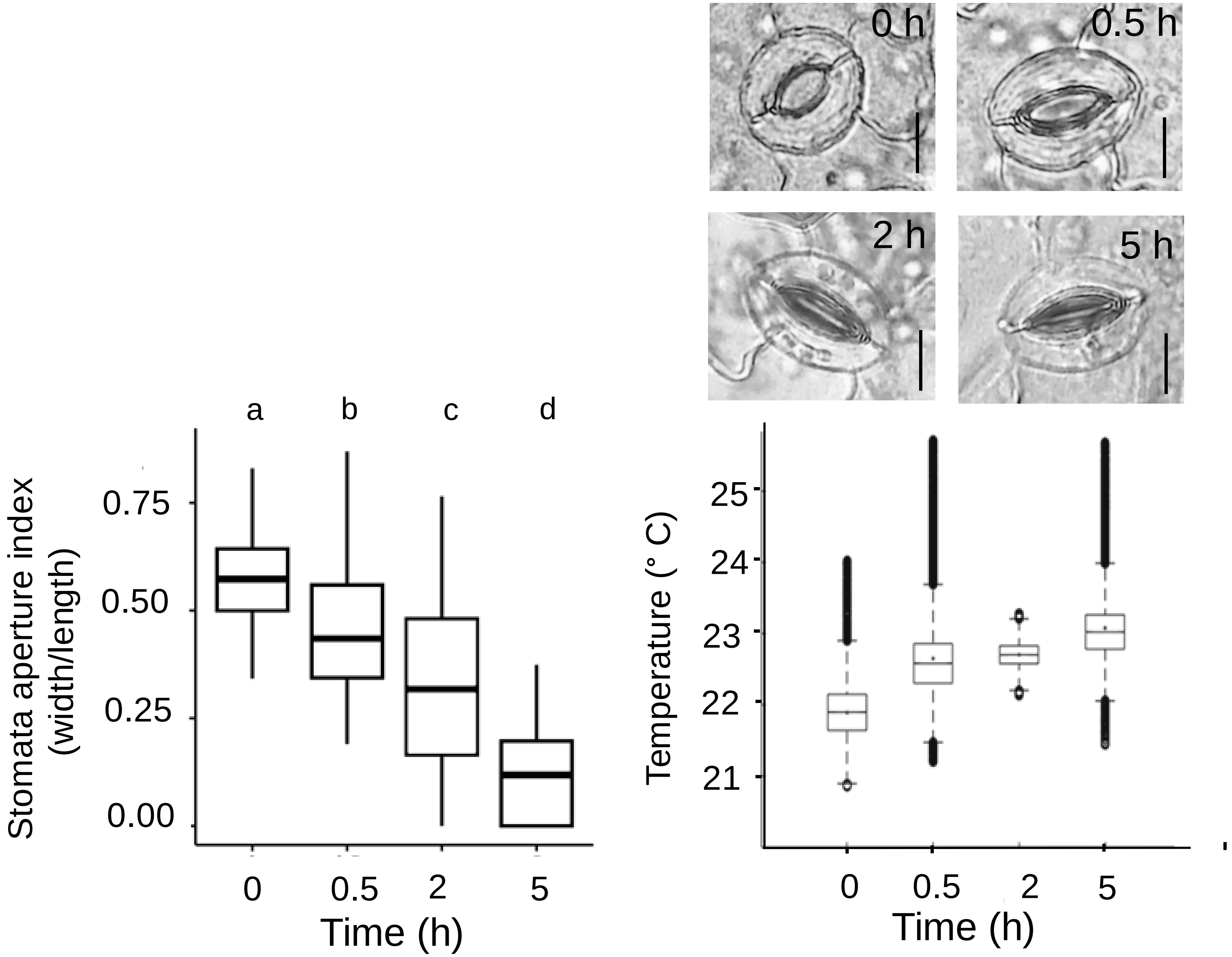


Experimental setup

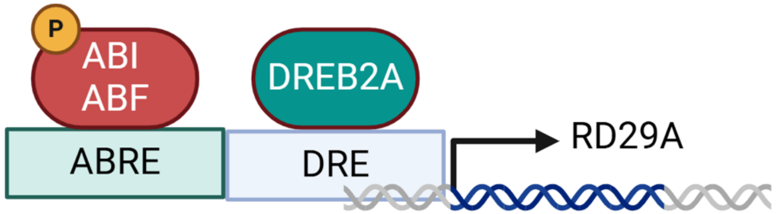


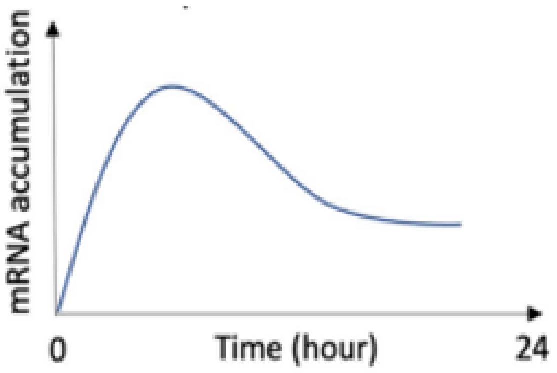


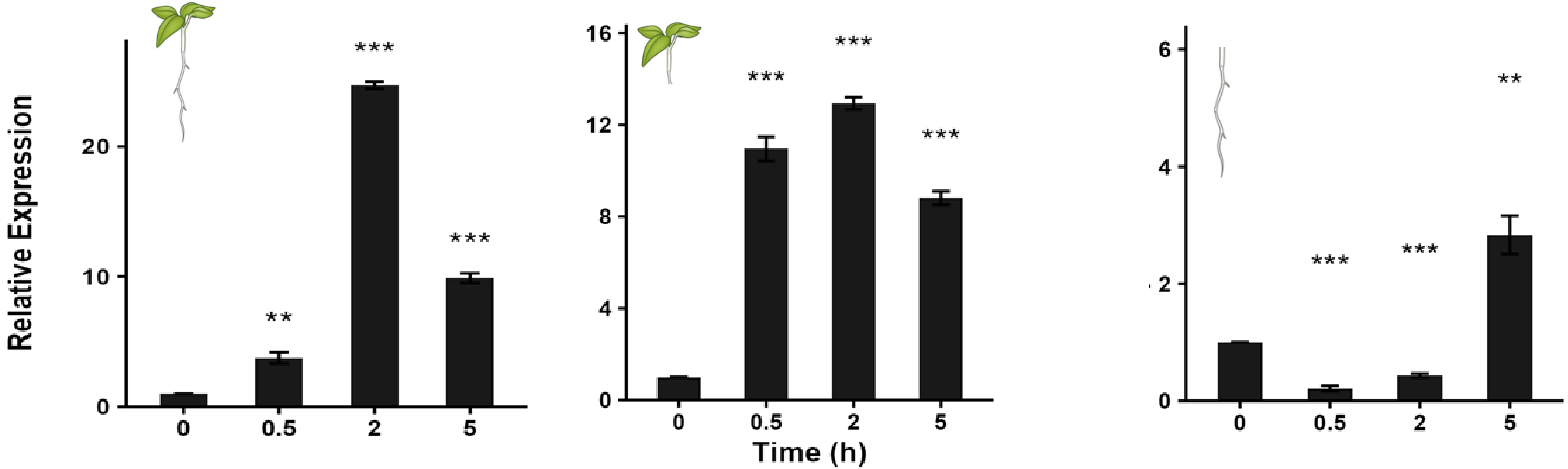
Low humidity does not induce macroscopic changes but closes stomata over time



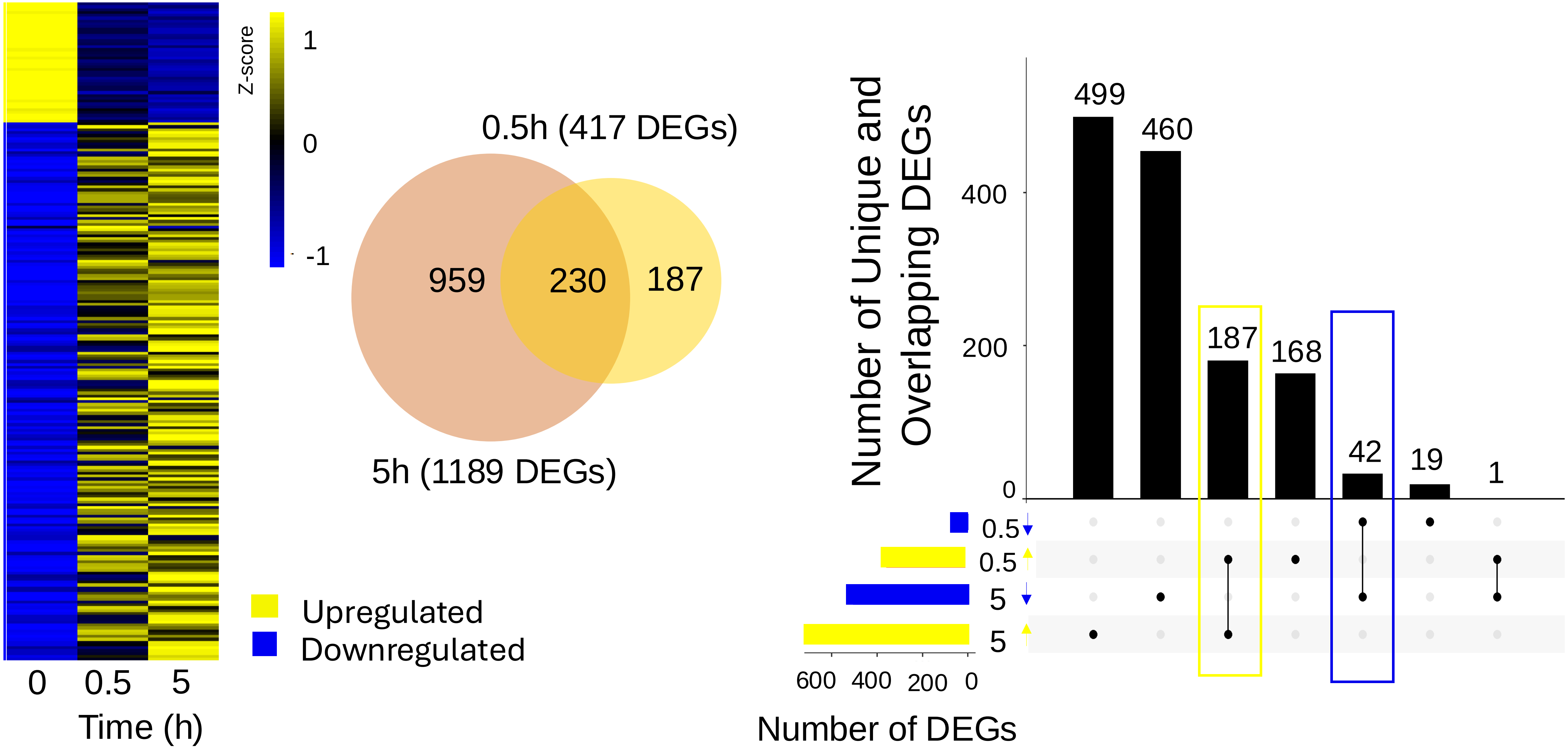
Low humidity rapidly induces *RD29A* expression in the shoot



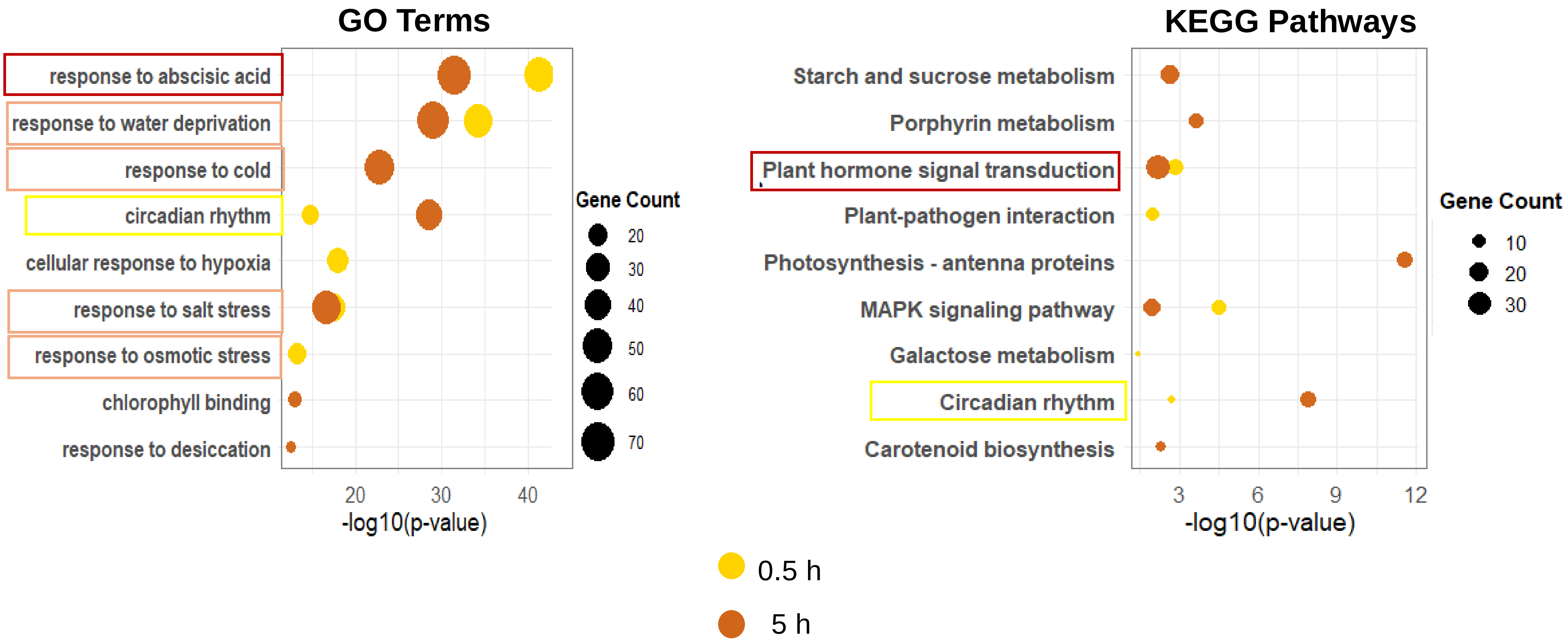




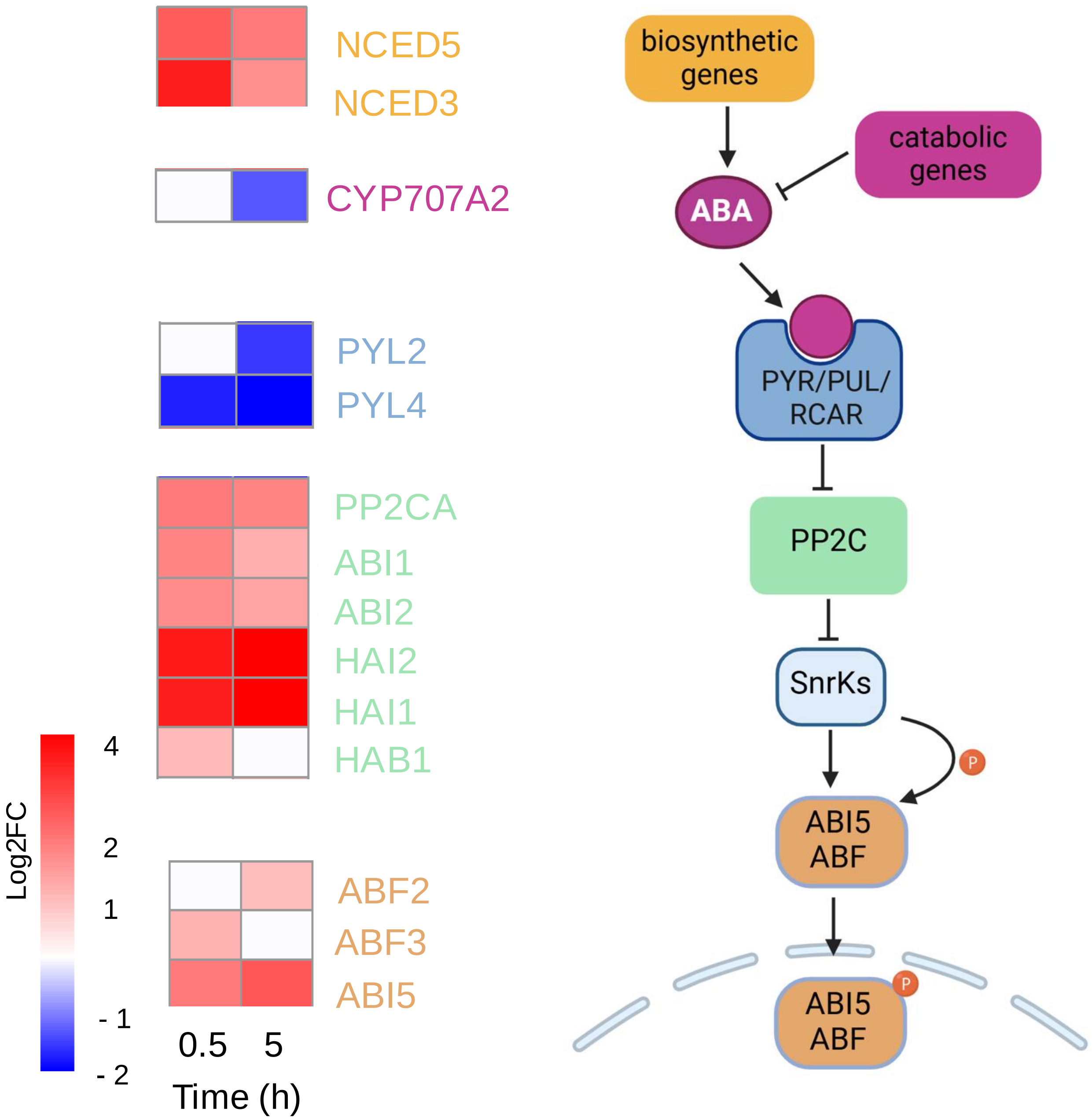
Low humidity triggers rapid but sustained transcriptional changes in the shoot



Specific pathways are affected by low humidity at both time points



ABA signaling is already active 30’ post stress onset



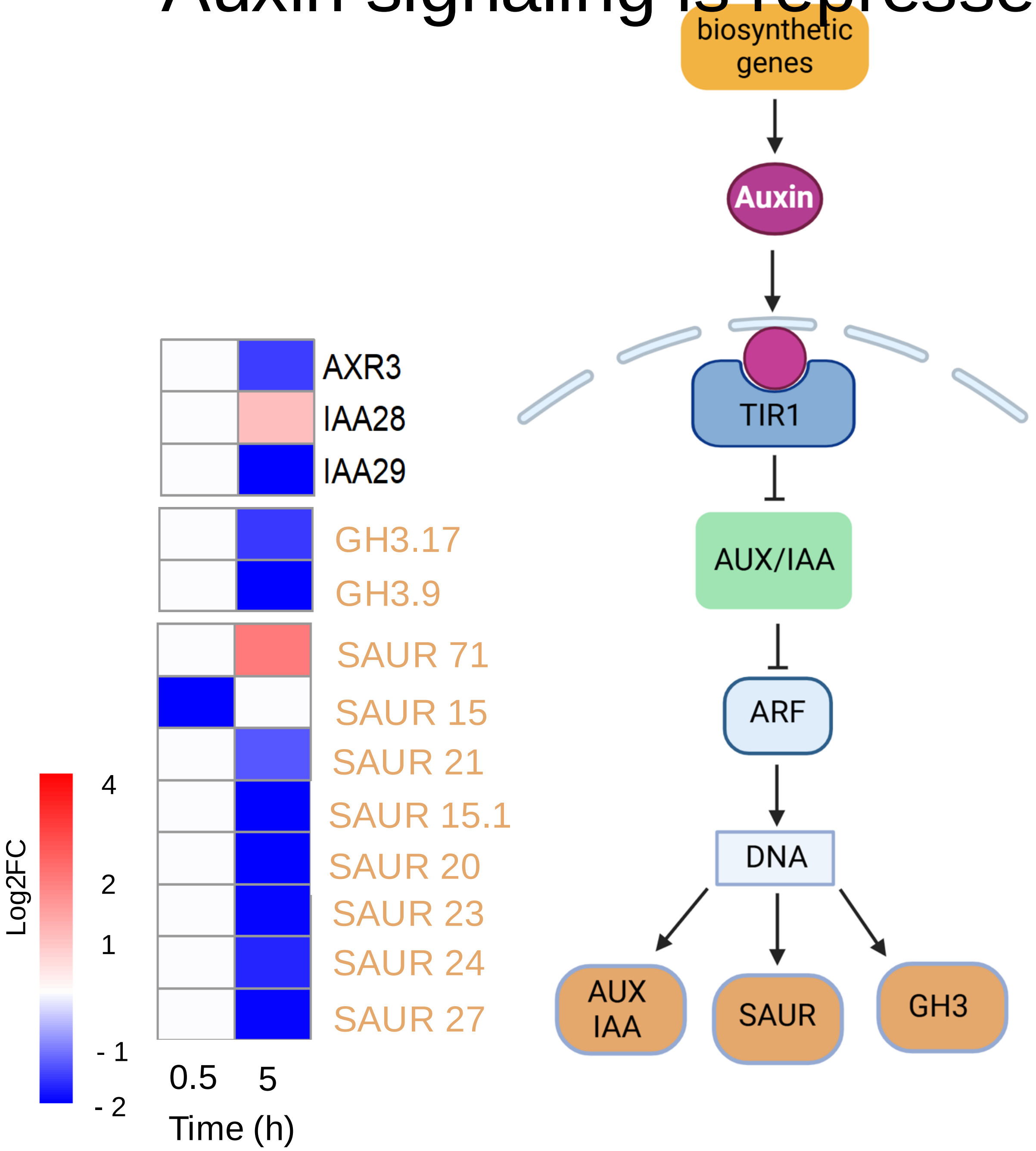
Negative feedback regulation of ABA signaling

?? Chi regola NCED5 e NCED3? Chi regola ABF3 e 5?

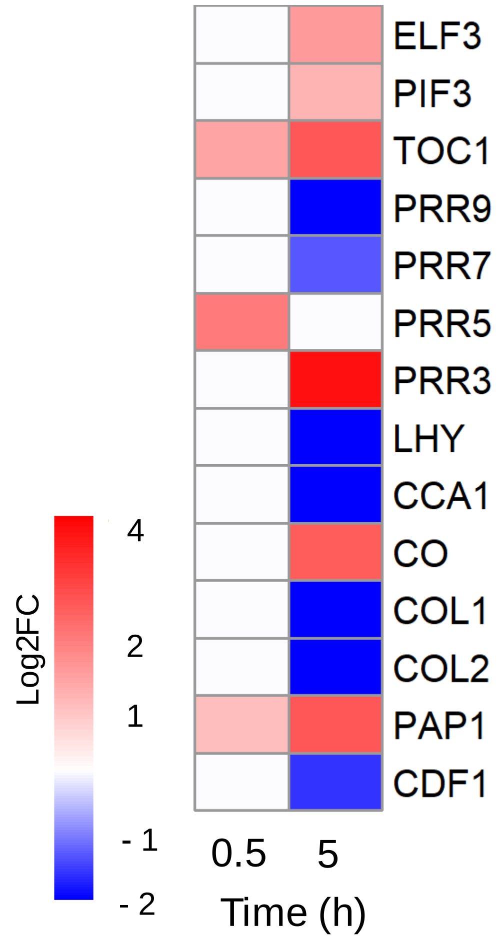
Menzionare che abi5 e’ un gene SWIM, e che swin trova altr geni ABA tipo pp2c

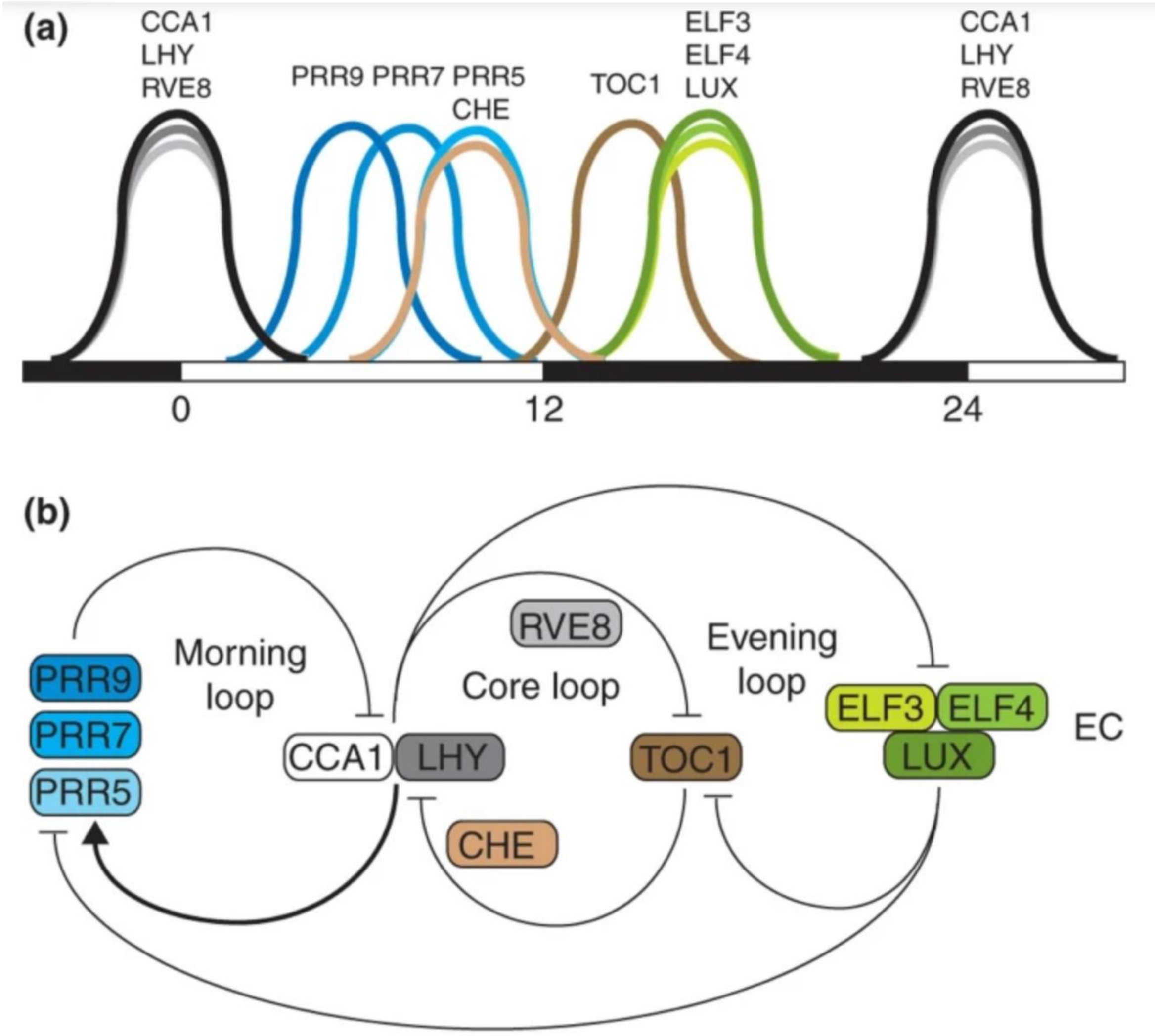
Merlot et al. *Plant j* (2001); Wang et al. *New Phytologist* (2018);Vieira et al. (2024)

Auxin signaling is repressed at 5 hours post stress onset



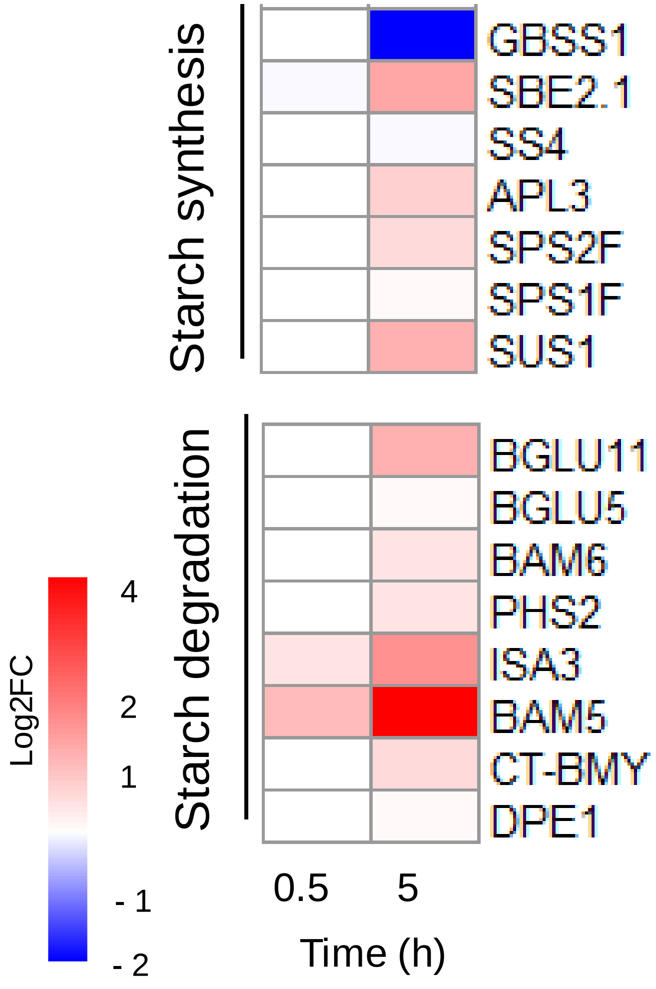
Circadian clock reprogramming in response to low humidity stress

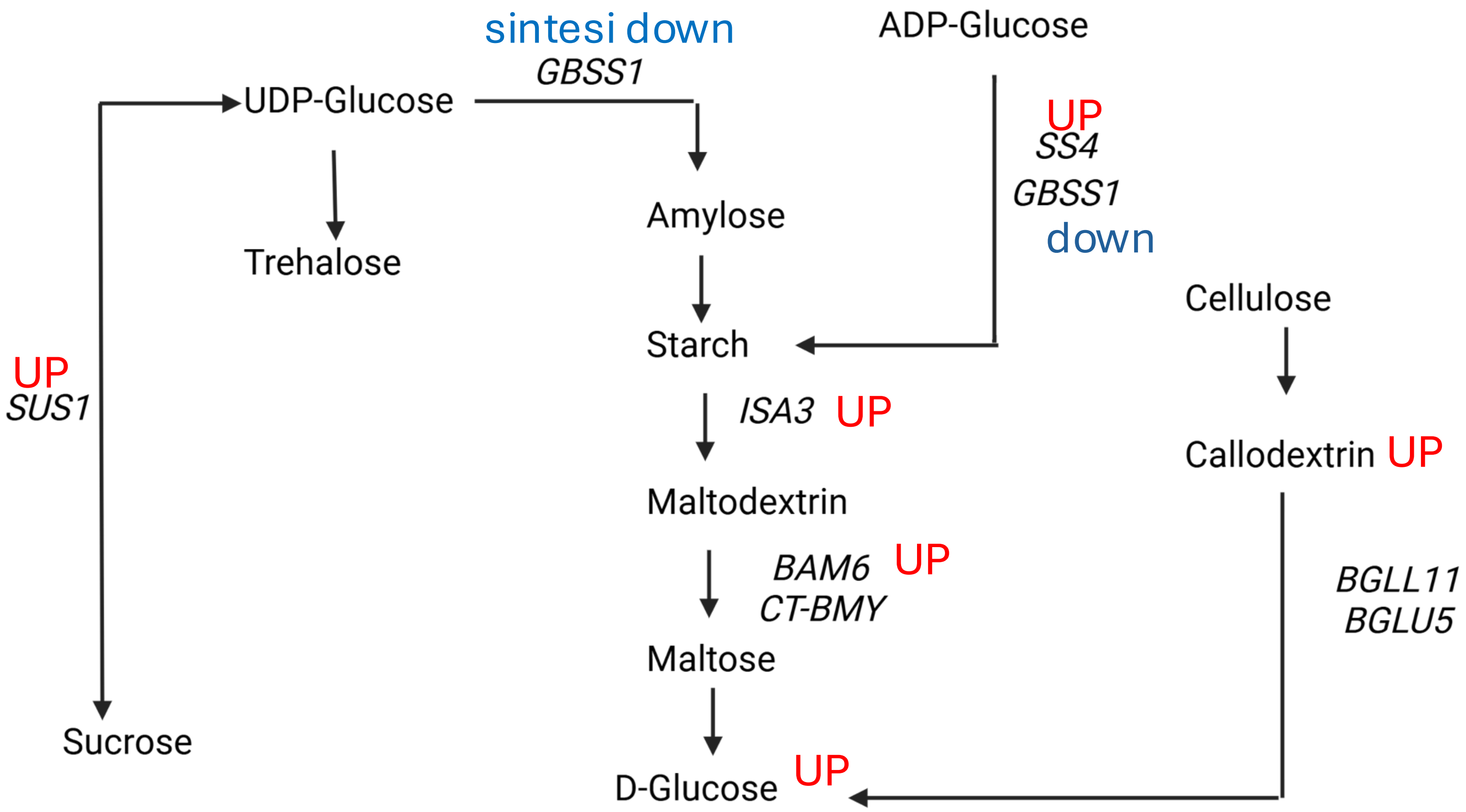




ABF3 reprime CCA e LHY. Qual’e’ l’effetto netto sul ritmo circadiano? E’ legato alla risposta stomatica?

Reorganization of starch metabolism under low humidity stress

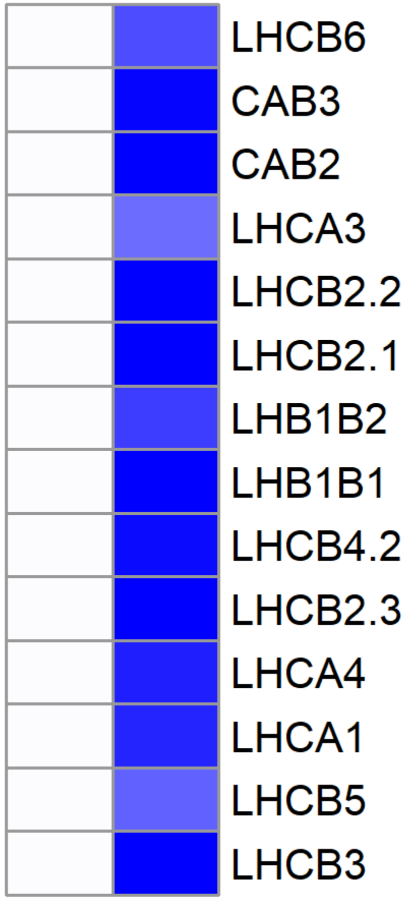


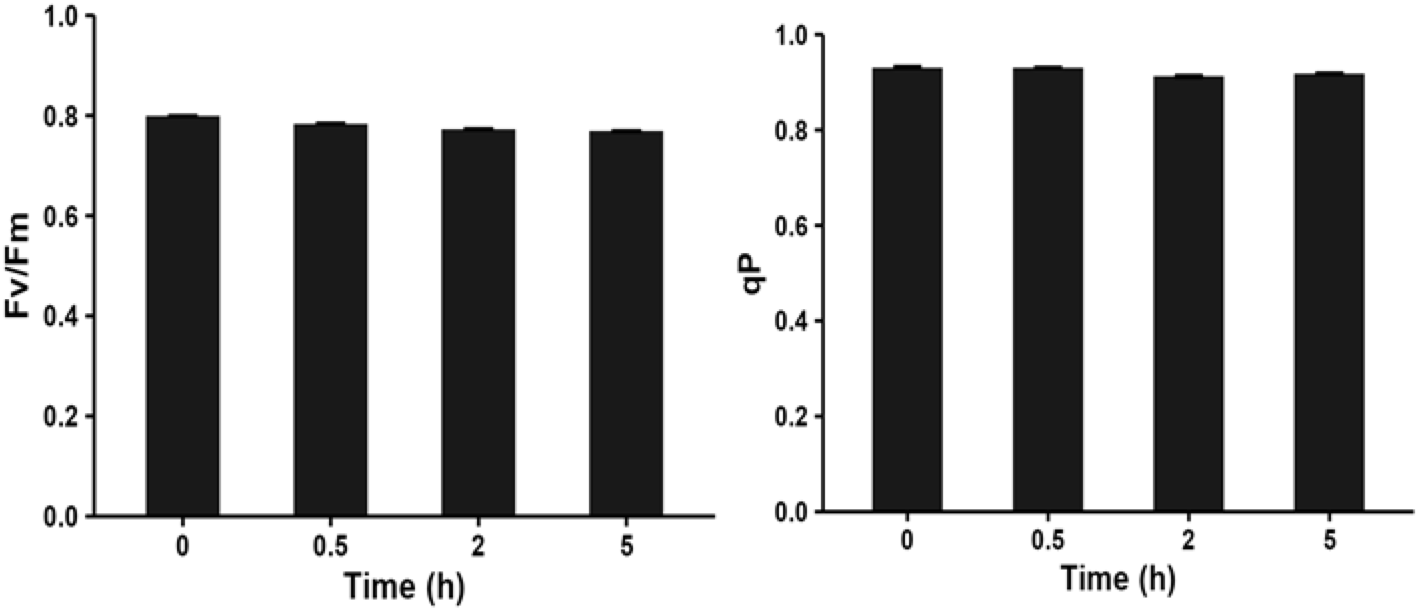


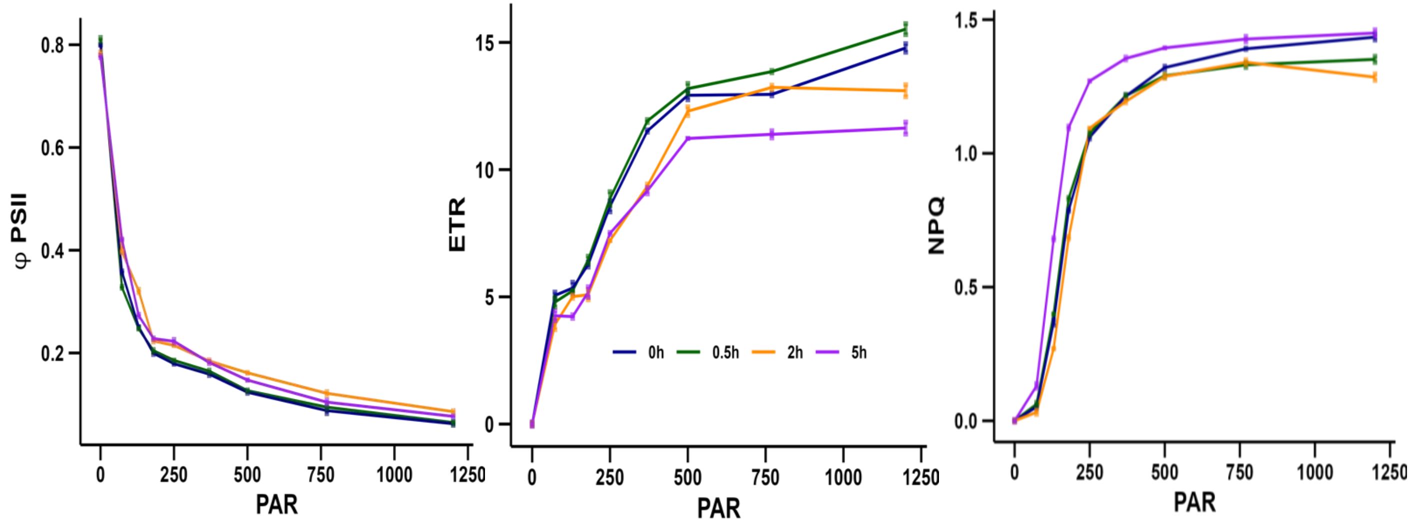
This analysis highlights a **rebalancing between starch synthesis and degradation**, with a probable **increase in the mobilization of energy reserves**, suggesting a **metabolic adaptation to high VPD conditions**.

VPD does not induce macroscopic changes but closes stomata over time

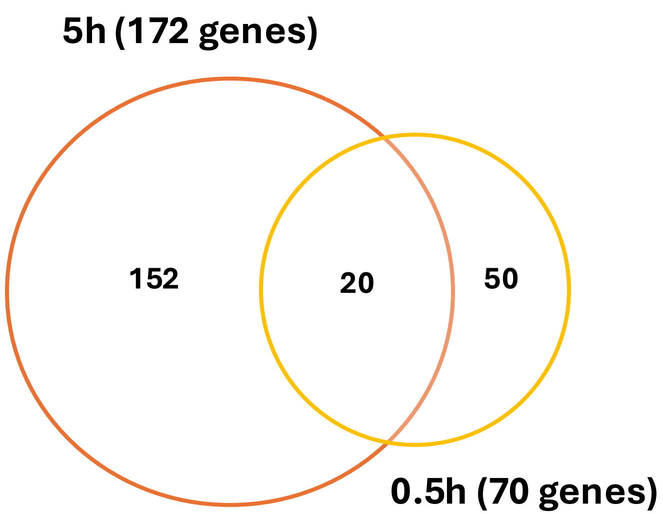
Perche' proprio il fotosistema 2?



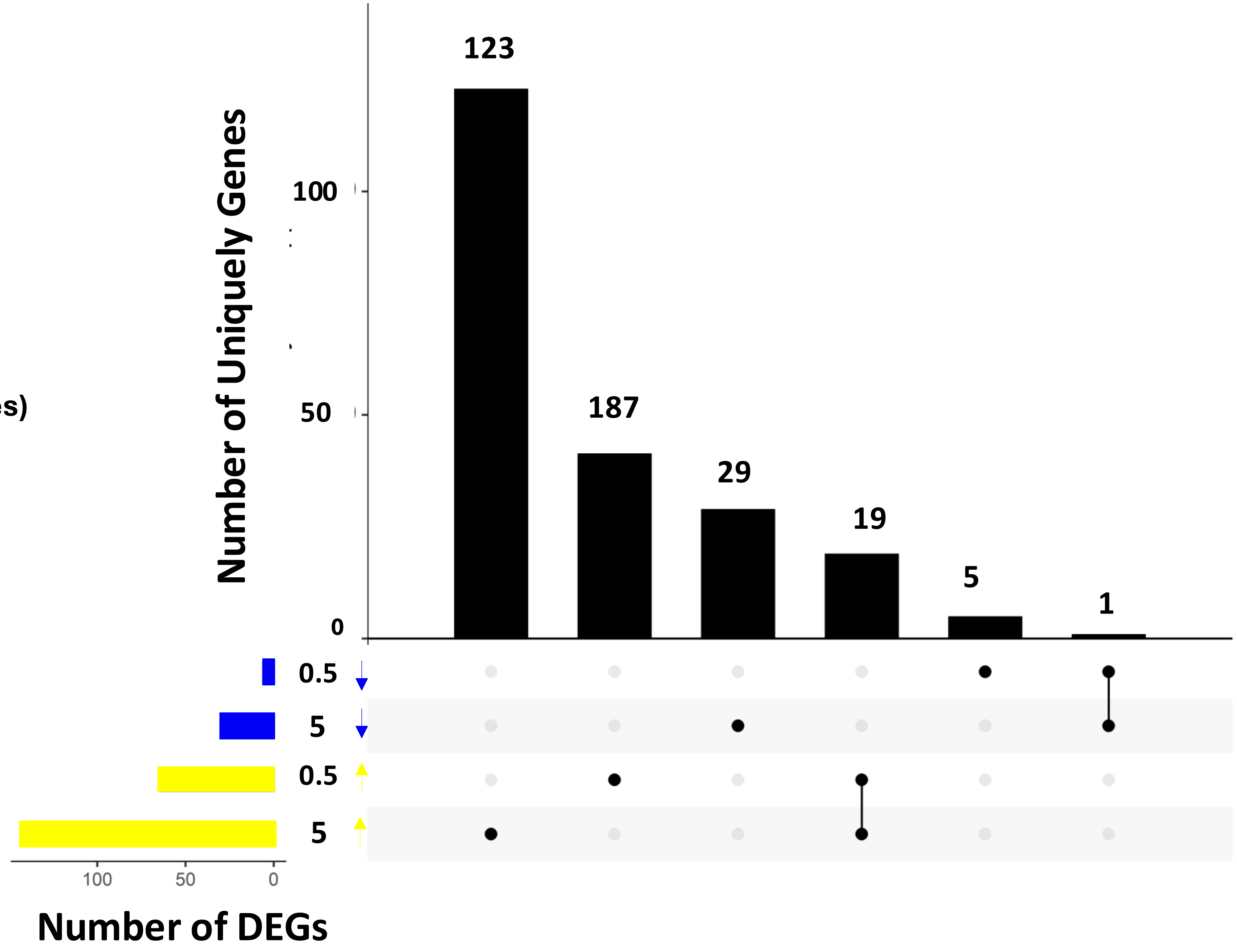




VPD stress triggers rapid and sustained transcriptional changes in roots

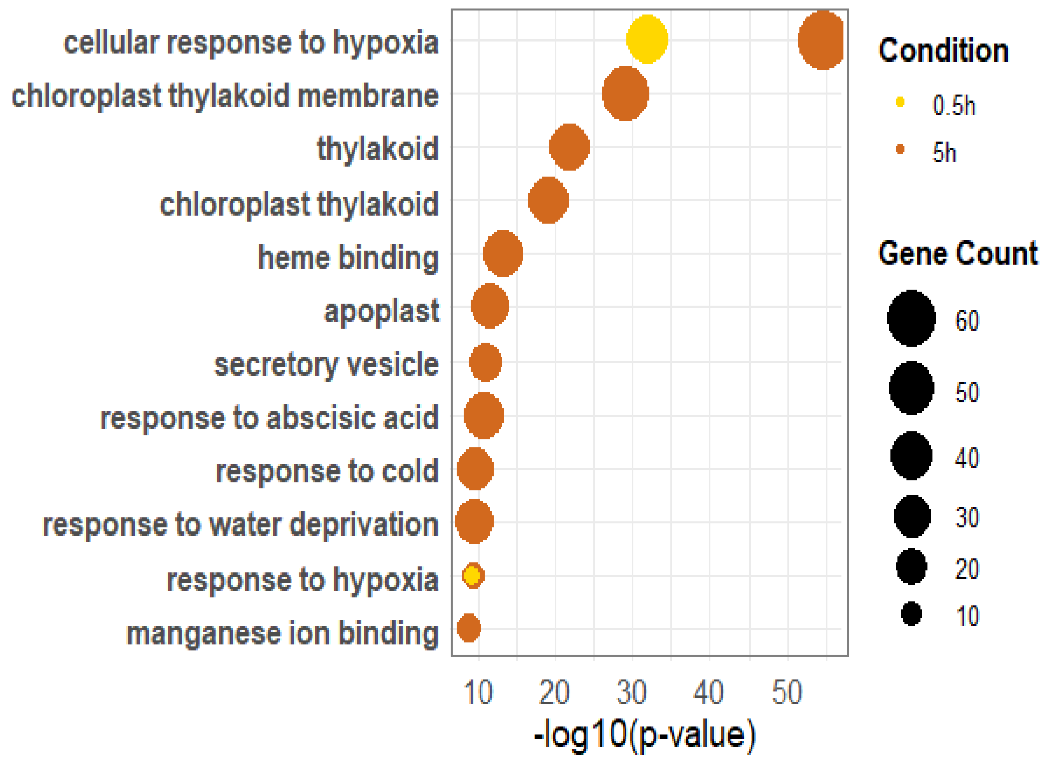


Eliminare dato a 30’ ?
Confrontare dati root con shoot

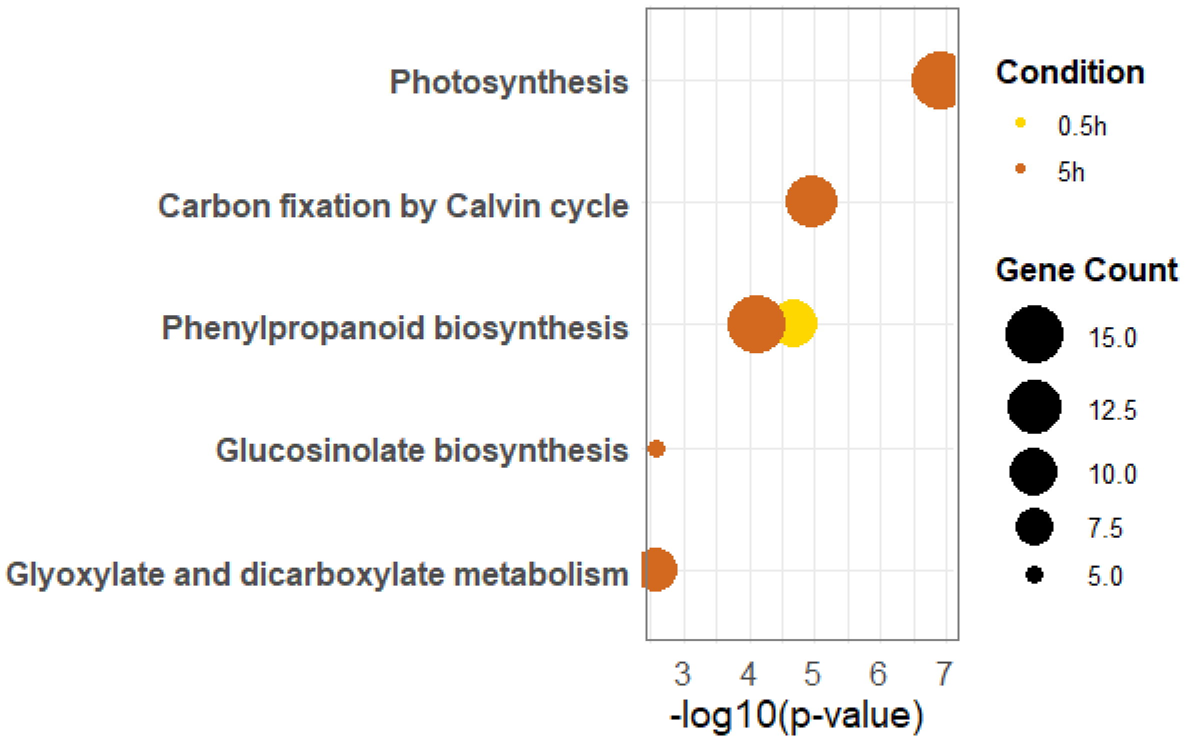


GO and KEGG Enrichment reveal key pathways in roots under VPD stress

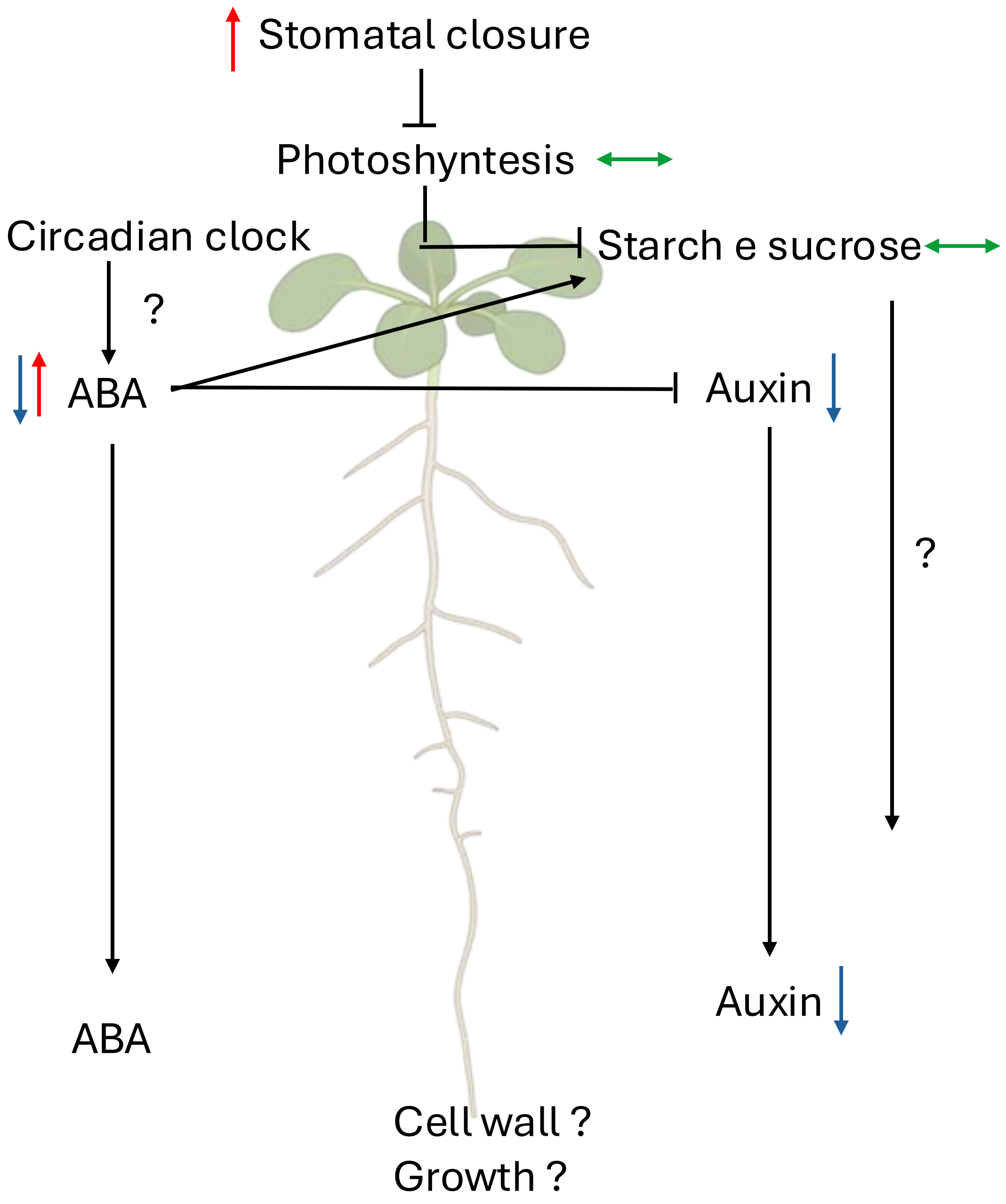
GO Terms



KEGG Pathways



Conclusions and future prospective



- Final RNA-seq analysis of root samples, including all biological replicates

- Characterization of ABA biosynthesis (*aba2-1*) and signaling (*abi1-1*) mutants, combined with RT-qPCR analysis of auxin-related genes in shoots and roots

- Investigation of auxin (DR5::GUS) and ABA (6XABRE, Abacus2s) reporter lines to analyze hormonal dynamics under low air humidity conditions

- Grafting experiments between wild-type and mutant seedlings to assess shoot-to-root signaling and hormonal crosstalk in response to high VPD