Salicylic acid regulates polyamine biosynthesis during drought responses in oat

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Summary:
Salicylic acid (SA) is an important plant hormone involved in the regulation of plant development and growth, flowering and ripening, and also in biotic (rust, powdery mildew, etc.) and abiotic (drought, heat, salinity, etc.) stress responses. Its role in plant-pathogen interactions is widely documented. However, its role in response to abiotic stresses is not well understood.

In a previous metabolomic study, we observed a higher increase of SA content in the drought tolerant cultivar ('Patones') compared to the susceptible cultivar ('Flega') when the two oat cultivars were subjected to a gradual depletion of water in the soil. The increase of SA in the resistant genotype alleviated drought symptoms in part because of a reduction of stomatal conductance.

In the current work, we investigated whether the SA response was associated with changes in polyamine levels. Polyamines act as regulatory molecules in many fundamental regulatory processes, as well as in stress responses. However, there is little information on any direct SA-polyamine interaction during water deficit responses. We observed that SA regulated polyamine production through changes in the expression of the main genes of the polyamine pathway. Following exogenous SA application, we observed a down-regulation of the ADC gene and an up-regulation of the AdoMetDC gene. This led to reduced levels of putrescine, which is associated with plant senescence, and increased levels of spermine, which has been associated with drought tolerance in other species. Based on these results, we propose that salicylic acid modulates drought responses in oat by regulating polyamine content and biosynthesis.

Reference:

Sanchez-Martin, J., Heald, J., Kingston-Smith, A., Winters, A., Rubiales, D., Sanz, M., Muir, L.A.J., and Prats, E. (2015) A metabolomic study in oats (*Avena sativa*) highlights a drought tolerance mechanism based upon salicylate signalling pathways and the modulation of carbon, antioxidant and photo-oxidative metabolism. Plant Cell Envir. **38**(7) 1434-1452.