Effect of betalain synthesis in transgenic plants of *Arabidopsis thaliana* on abiotic stress tolerance.

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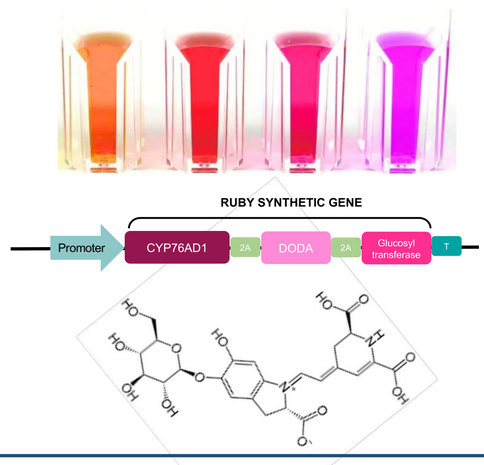
INTRODUCTION

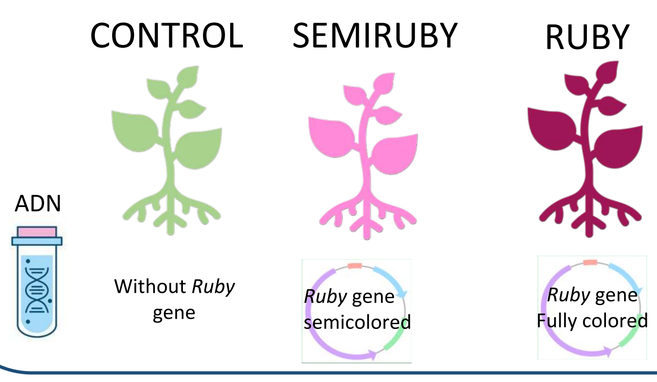
Water stress and saline stress significantly affect plant growth and yield. These stresses are expected to intensify increasingly due to global climate change. Betalain are water-soluble pigments with a high antioxidant capacity, characteristic of the order Caryophyllales, plants that predominate in arid regions and in saline soils, so they could play an important role against abiotic stress. To measure resistance to salinity and water stress, the *Ruby* gene, an artificial gene related to betalain synthesis, was selected and expressed in *Arabidopsis thaliana*.



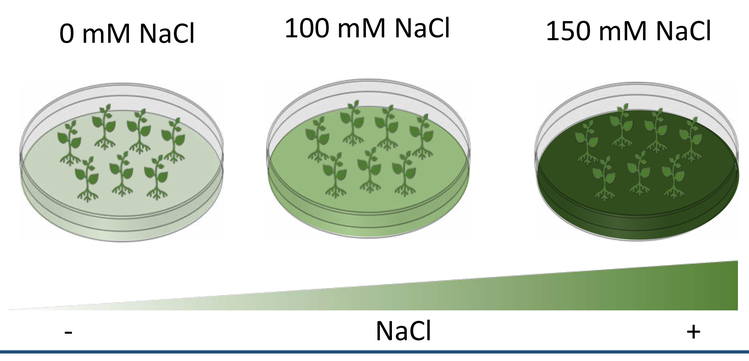
The objective of this project is to check whether the artificial synthesis of betalain (Ruby gene) in transgenic Arabidopsis plants has some implication in abiotic stress tolerance and can be used in plant genetic improvement against drought and salinity tolerance.

MATERIALS AND METHODS

Genotyping



Tolerance to salinity

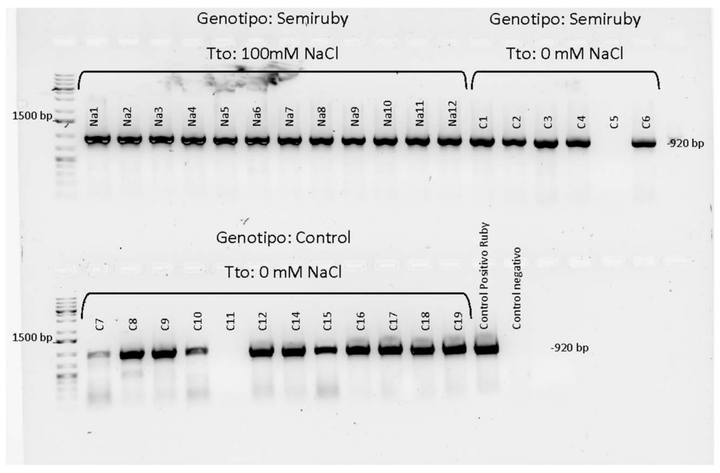


Drought tolerance

RESULTS

Phenotyping and Genotyping

Figura 1. Phenotype of the lines analysed. Plants with intermediate colouring or with some coloured parts were classified as SemiRuby plants.



Figur2 2. PCR genotyping of plants with Semiruby phenotype. The presence of the ruby gene corroborates the correct phenotyping of the plants. Plants that did not show the Ruby gene (C5 and C11) were excluded for the analysis of the drought and salinity treatments.

Tolerance to salinity

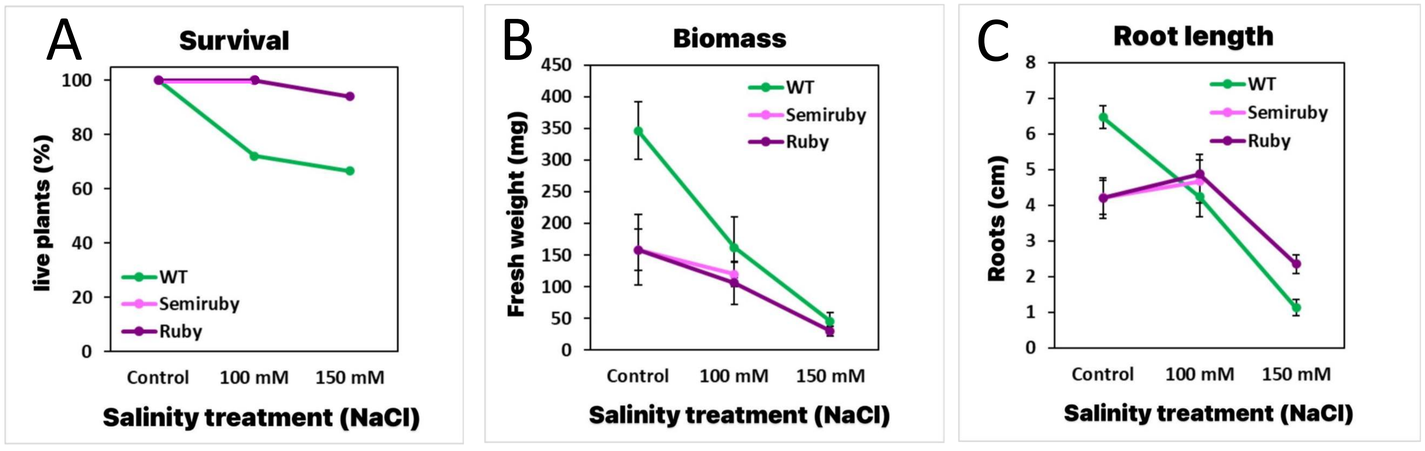


Figure 3. Effect of betalain synthesis under salt stress conditions. Survival rate of plants with Ruby (purple) and SemiRuby (pink) phenotypes compared to control plants (green) under different NaCl treatments (A). Effect of increasing NaCl concentration on plant biomass (B) and on root development and length (C)

Drought tolerance

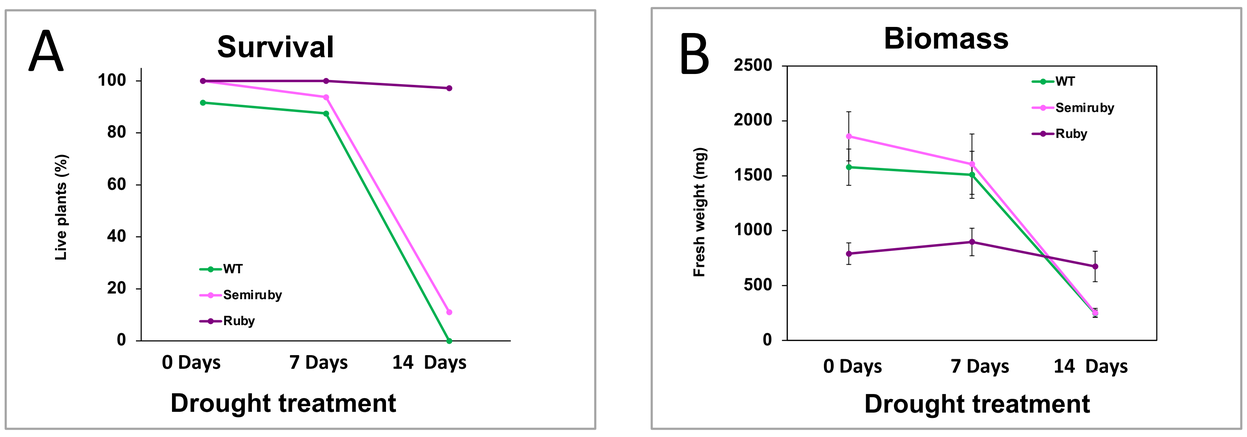


Figure 4. Effect of betalain synthesis under water stress conditions. Survival rate of plants with Ruby (purple) and SemiRuby (pink) phenotypes compared to control plants (green) under two water restriction treatments (A). Effect of 7 and 14 days of water restriction on biomass development in the different phenotypes (B)

CONCLUSIONS

- Plants with a high expression of the Ruby gene (Ruby phenotype) and high betalain content show a significant increase in tolerance to water stress (drought).
- The synthesis and presence of betalains in *Arabidopsis thaliana* confers greater tolerance to salt stress, the more extreme the stress conditions.
- The presence of the Ruby gene negatively affects plant biomass under low abiotic stress conditions, but not under the more extreme conditions of this experiment.
- Under salt stress conditions, the presence of the Ruby gene has a positive effect on plant root development.
- Although betalain synthesis confers greater tolerance to abiotic stress in terms of water restriction and high salinity, in the absence of stress it affects the correct development of the plant, especially biomass. For this reason, it would be advisable to look for other candidate genes that are capable of improving abiotic stress resistance without having a detrimental effect on the plant.

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