ABSTRACT

Abiotic stress, and more specifically salinity and drought, are environmental problems that have huge impact on global food production, especially in semi-arid areas such as the Mediterranean countries including the Valencia region. Little progress has been made in the development of crops tolerant to drought and salinity. The problem has two aspects: tolerance to toxic cations such as sodium and tolerance to osmotic stress.

In order to approach the first one we have screened tagged-mutant collections in the model plant *Arabidopsis thaliana* to identify lines tolerant to toxic cations. We have used as toxic cation norspermidine, a non-physiological polyamine that only acts as a toxic cation because it has no osmotic effects at the concentrations employed. This polycation enters the cell through unidentified system strongly dependent on the electrical potential of the plasma membrane. As this biophysical parameter is determined by the relative activities of the H^+-ATPase pump and secondary ion transport of K^+ and anions, norspermidine tolerant mutants could allow us to identify regulators of these transporters. We have scrreened 110.000 mutant lines (around 700.000 seeds) from 3 transcriptional activation mutant collections and 2 loss of function mutant collections in *Arabidopsis thaliana*. In this way, we have obtained numerous confirmed mutants tolerant to this polycation, with 2 - 6 fold germination percentage than the control line.

In order to approach tolerance to osmotic stress, we have expressed the *HSR1* gene from *Candida tropicalis* in the model plant *Arabidopsis thaliana* to evaluate its effect on plant drought tolerance. This gene was isolated from a gene library of *Candida tropicalis* strain NCYC2512 by screening for the identification of halotolerant genes in the yeast *Saccharomyces cereviasiae*. Arabidopsis transgenic plants expressing *CtHSR1* from its own promoter exhibited tolerance to osmotic stress in two different assays: seed germination inhibited by NaCl and manitol and drought tolerance of adult plants in the greenhouse. Differences in osmotic potential were observed under normal growth conditions in the transgenic lines and we measure an increase in proline content between 1.4 and 1.8 fold, compared to control plants. Transcriptomic analysis indicated that HSR1 induces multiple transcription factors involved in response to stress. Hormone analysis detected an increase of jasmonic acid, hormone involved in biotic stress tolerance.