DELLA-dependent salt stress tolerance network

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DELLAs are central regulators of gibberellin (GA) signaling, which work at repression of GA-regulated gene expression. These GRAS proteins bind the DNA recognition domain of many different families of transcription factors, and sequester these regulators into an inactive complex unable to bind to DNA[1]. Physical interaction of DELLAs with light-regulated PHYTOCHROME INTERACTING FACTOR 3 and 4 (PIF3 and PIF4) and the BR-signaling BRI1-EMS-SUPPRESSOR1/ BRASSINAZOLE-RESISTANT1 (BES1/BZR1) factors suppresses plant growth, by blocking PIFs and BES1/BZR1 dependent co-activation of multiple cell wall-remodeling and auxin-signaling related genes, required for cell elongation[2-4]. Growth restraint imposed by the DELLAs correlates with increased tolerance to drought, salt and cold stress. Although growth inhibition was accepted to contribute to this response, more recent studies showed that DELLAs play an active role in stress survival, by activating the expression of genes involved in ABA-signaling and ROS protection[5,7]. To gain molecular insight into this DELLA-dependent stress activation pathway we screened a collection of TF- overexpressor lines for their ability to confer increased tolerance to salt stress, in the presence of GAs. Several regulators previously reported to orchestrate abiotic stress responses to, were in this way identified. Remarkably, nearly one third of these factors were observed to physically interact with the DELLAs, and these repressors bind in many of these factors a different region than the DNA recognition motif, in agreement with DELLAs activating their downstream targets. Moreover, mapping of the DELLA interaction domain showed that interaction did not involve the LHR1 heptad repeat, implicated in PIFs and BES1/BZR1 interaction, but the DELLA domain or C-terminal end. This indicates that it should be feasible identifying DELLA mutations that impair PIF and BES1/BZR1 interaction, but not affect binding to these stress-related factors. We propose that expression of stable forms of the DELLAs carrying these mutations will confer increased tolerance to drought and salt stress, without a negative effect in plant growth. Characterization of these lines will be instrumental to improve our understanding of the DELLA-dependent stress pathways, and in plant breeding, useful to select new genotypes in which stress-tolerance is uncoupled from growth restraint.

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