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SALT TOLERANCE EFFECTS OF *SOLANUM CHEESMANIAE* HKT1;1 AND/OR HKT1;2 FUNCTION LOSS IN A RECIPROCAL GRAFTING TOMATO EXPERIMENT*

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HKT1-like Na^+ transporters play an important role in Na^+ and K^+ homeostasis and salt tolerance by removing Na^+ from the xylem controlling its accumulation in shoots (Asins et al. 2013). In previous studies, we used recombinant inbred lines (RILs) derived from *Solanum lycopersicum* cv. Cerasiform and *S. cheesmaniae*, a halotolerant wild species, combined with RNAi-induced loss-of-function in all *HKT1;1* and *HKT1;2* allelic variants. We showed that *HKT1;2 lycopersicum* and *cheesmaniae* alleles are functionally responsible for the major tomato QTL *Ikc7.1* related to Na^+/K^+ homeostasis in the aerial part of the plant under saline conditions (Asins et al. 2013; Jaime-Pérez et al. 2017). In the present study, we analyse the physiological impact of function loss in *cheesmaniae* alleles at the *HKT1;1* and *HKT1;2* loci in the roots and aerial parts of the tomato plant in order to determine the relative contributions of each locus in the different tissues to plant Na^+/K^+ homeostasis and subsequently to tomato salt tolerance. We generated different reciprocal rootstock/scion combinations with non-silenced, single RNAi-silenced lines for *ScHKT1;1* and *ScHKT1;2*, as well as doubly silenced lines, at both loci from a near isogenic line (NIL14), which is homozygous for the *S. cheesmaniae* haplotype in a genomic region (31.1 Mb) containing both HKT1 loci (Jaime-Pérez et al. 2017). Grafted combinations were cultivated with a Hoagland nutrient solution supplemented with 0 and 70 mM of NaCl under natural greenhouse conditions during the fall-spring season following the usual cultural practices of commercial greenhouse tomato production (Romero-Aranda et al. 2020). Our results show that salt treatment reduced vegetative growth and altered the Na^+/K^+ ratio in leaves and flowers, negatively affecting fruit production, particularly in graft combinations containing *ScHKT1;2*-silenced and double-*SlHKT1;2/ScHKT1;1* silenced lines, when used for both rootstock and scion. We concluded that the impact of the removal of Na^+ from the xylem by ScHKT1;2 in the aerial part of the plant can be even greater than that on Na^+ homeostasis at the root level in tomato under saline conditions. This suggests that ScHKT1;2 may also play a role in Na^+ phloem loading and consequently in determining Na^+ recirculation towards the root zone, as well as the salt content of sink tissues such as developing leaves, flowers and fruits.

Asins et al. (2013). Plant Cell and Environment 36: 1171-91. Jaime-Pérez et al. (2017) Plant Cell Environm 40, 658–671. Romero-Aranda et al. (2020) Plant Physiol Biochem 154, 341-352.
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