Aluminium-induced exudation of citrate from the root tip of *Zea mays* (L.): Are differential impacts of Al on citrate metabolism involved in genotypical differences?

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Abstract

The Aluminium-induced exudation of citrate of two maize cultivars differing in Al resistance was positively related to Al-resistance and confined to the apical 3-4 mm as determined by means of whole plant experiments and incubation of excised 1-mm root segments. The distribution of citrate in the root apex was examined with a longitudinal resolution of 1-mm. While Al treatment (2 h) had no effect on the citrate contents in the Al-resistant cultivar, a decrease in the apical citrate content was observed in the Al-sensitive cultivar. In order to study the underlying metabolic mechanisms for the effects observed, the influence of Al (2 h) on the specific activities of key enzymes of the carboxylic acid metabolism in the 5-mm root apex was determined. Aluminium led to a significant increase in malate dehydrogenase (MDH) and PEP carboxylase (PEPC) activities in the Al-resistant cultivar while citrate synthase (CS) activity only tended to increase. Aconitase (ACO) activity was enhanced in the Al-sensitive cultivar. The results presented here suggest that differential maintenance of citrate metabolism upon Al-exposure contributes to genotypical differences in the citrate exudation-mediated mechanism of Al resistance in *Zea mays* (L.).