Ascorbate oxidation level determines the hormone balance during the interaction between parasitic root-knot nematodes and rice

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Ascorbate, vitamin C (AsA), is the major antioxidant buffer in the plant apoplast and becomes oxidized to dehydroascorbate during the oxidative burst phenomenon, caused by environmental challenges or pathogen attack. mRNA-seq studies on root knot nematode (*M. graminicola)*-induced galls and giant cells in rice roots, revealed that genes involved in ascorbate biosynthesis, oxidation/reduction and transport are differentially expressed, in comparison with uninfected rice root cells. This research was set-up to investigate the role of AsA in the interaction between plants and these sedentary nematodes. First, HPLC-UV measurements of AsA showed a specific accumulation of AsA in galls at 3 and 7 days after infection, while the remainder of the infected root system contained similar AsA levels as uninfected roots. Infection experiments on rice plants 24h after external application with 20 mM AsA and/or 20 U/ml Ascorbate oxidase, showed that oxidized AsA, but not reduced AsA, triggers a strong defense response against root knot nematodes. These data were validated by infection experiments on AsA biosynthesis mutants and AsA peroxidase mutants, all showing increased susceptibility. Hormone measurements (UHPLC-HRMS) on these mutants revealed disturbances in their hormonal profile, mainly in their root jasmonate and auxin levels, which could explain their enhanced susceptibility. Collectively, our data point to a role for oxidized ascorbate in hormone biosynthesis and plant defense in the course of the rice-root-knot nematode interaction.

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