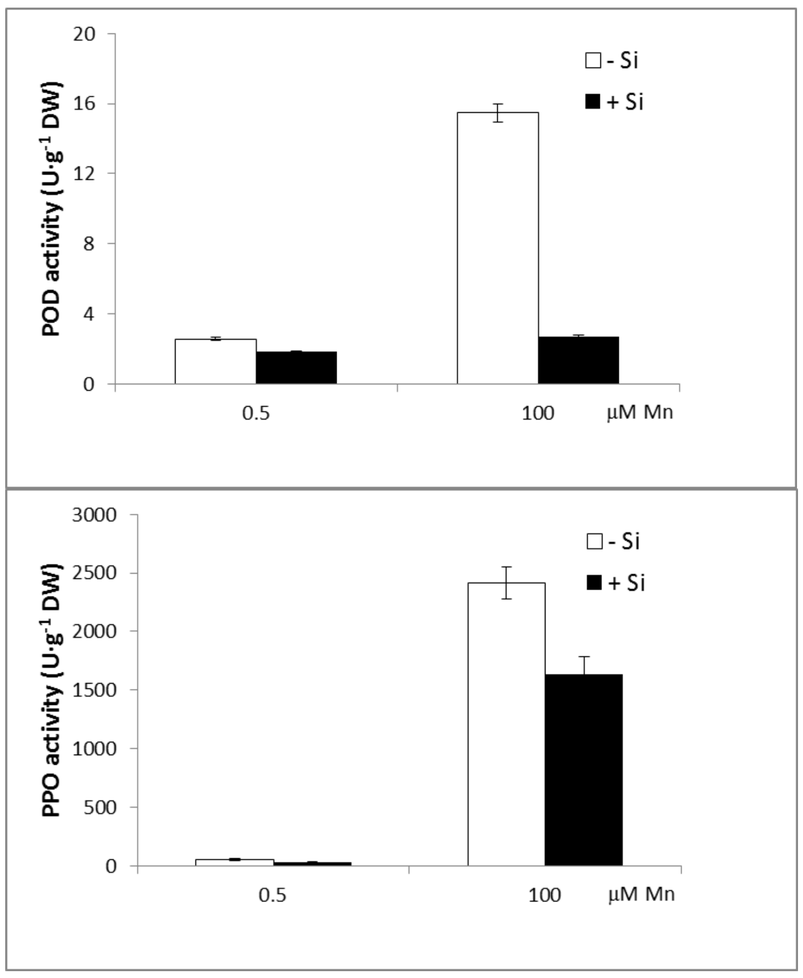
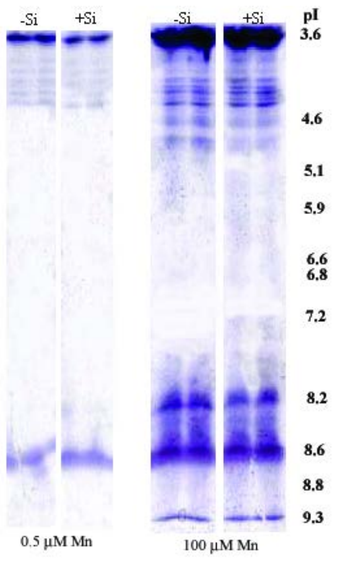
Silicon alleviated manganese toxicity in cucumber by cell wall compartmentation

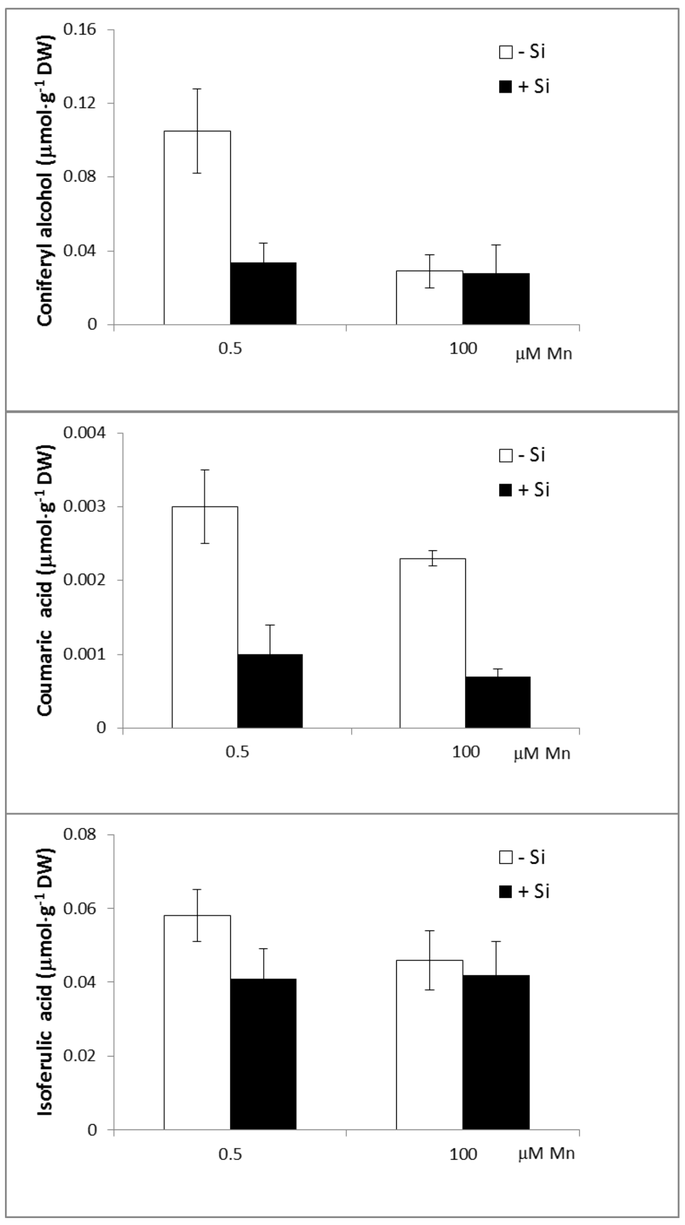
Jelena Dragišić Maksimović, Vuk Maksimović
Institute for Multidisciplinary Research, University of Belgrade, Serbia

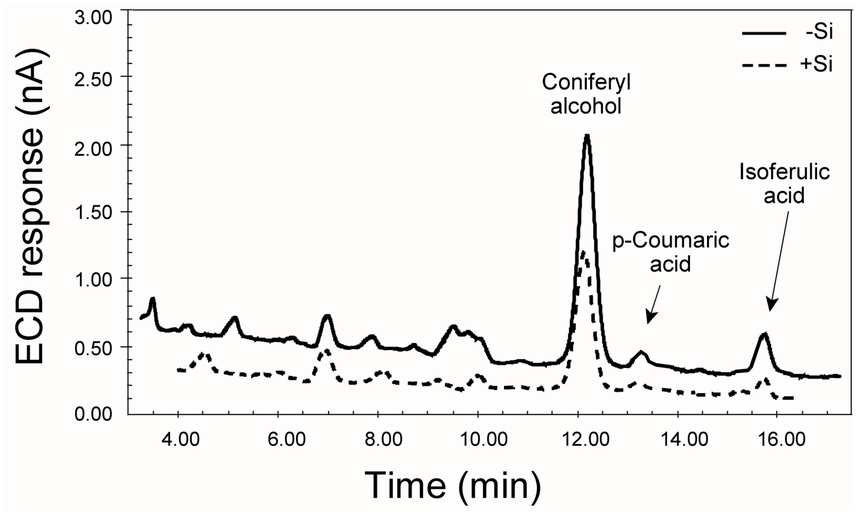
The root exudate constituents (phenolics and enzymes) of cucumber (*Cucumis sativus* L.) plants grown in Mn-free and Mn-contaminated nutrient solutions (0.5 and 100 μM, respectively) with (+Si) or without silicon (–Si) supplied as 1.5 mM silicic acid were investigated. High external Mn supply induced both growth inhibition of the whole plant and the appearance of Mn-toxicity symptoms in the leaves, while the simultaneous application of Si alleviated toxicity symptoms.

At high Mn supply, increased concentrations of phenolic compounds (e.g., coniferyl alcohol, *p*-coumaric and isoferulic acid), as plant-borne substrates for peroxidase (POD) and polyphenol oxidases (PPO), in –Si plants were in agreement with enhanced POD and PPO activities. The activities of both enzymes were kept at a lower level in +Si plants grown at higher Mn concentrations.









MAJOR FINDINGS:

- Si nutrition modulates the metabolism and utilization of phenolic compounds, most probably, by formation of Si-polyphenol complexes and their subsequent cross-linking with the cell wall polymers.
- In –Si plants increased activity of the PPO and POD/H_2O_2 systems lead to the formation of highly reactive compounds, while in +Si plants, lignin biosynthesis is favored.

This work was supported by the Serbian Ministry of Education, Science and Technological Development (Grant No 173040).