

Webinar « Photosynthesis and Metabolism »

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Manganese excess and deficiency study in *Marchantia polymorpha* : effect on Photosynthesis

Manganese (Mn) is a fundamental element for plant growth, in particular for its involvement in photosynthesis. It forms, at the photosystem II donor side, the oxygen evolving complex (OEC) catalyzing water oxidation. Mn deficiency and excess are known factors affecting crop yields mainly because of their impact on photosynthetic activity. The use of *Marchantia polymorpha*, a liverwort, made it possible to study the impact of the two stresses on a single organism. Its simple anatomy compared to higher plants allowed the use of super-resolution microscopy. We have developed a culture technique on a solid medium to study excess and deficiency in wild-type plants. We have shown that both stresses affect the shape of chloroplasts as well as their thylakoids structure. Non-favourable Mn concentrations disrupt photosynthetic activity by changing the PSI/PSII ratio. Deficiency results in increased dissipation of excess light energy as heat most likely due to an increase of the activity of cyclic electron flow. Finally, we have performed for the first time a metabolomics analysis on *Marchantia polymorpha*. Mn excess leads to an increase in certain metabolites allowing protection against heavy metals. Mn deficiency causes a sharp decrease in 10 essential amino acids. Both conditions strongly affect the activity of antioxidant enzymes.

