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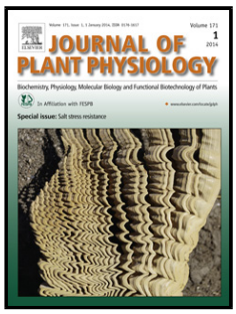

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Protection of photosynthesis in desiccation-tolerant resurrection plants

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Abstract

Inhibition of photosynthesis is a central, primary response that is observed in both desiccation-tolerant and desiccation-sensitive plants affected by drought stress. Decreased photosynthesis during drought stress can either be due to the limitation of carbon dioxide entry through the stomata and the mesophyll cells, due to increased oxidative stress or due to decreased activity of photosynthetic enzymes. Although the photosynthetic rates decrease in both desiccation-tolerant and sensitive plants during drought, the remarkable difference lies in the complete recovery of photosynthesis after rehydration in desiccation-tolerant plants. Desiccation of sensitive plants leads to irreparable damages of the photosynthetic membranes, in contrast the photosynthetic apparatus is deactivated during desiccation in desiccation-tolerant plants. Desiccation-tolerant plants employ different strategies to protect and/or maintain the structural integrity of the photosynthetic apparatus to reactivate photosynthesis upon water availability. Two major mechanisms are distinguished. Homoiochlorophyllous desiccation-tolerant plants preserve chlorophyll and thylakoid membranes and require active protection mechanisms, while poikilochlorophyllous plants degrade chlorophyll in a regulated manner but then require *de novo* synthesis during rehydration. Desiccation-tolerant plants, particularly homoiochlorophyllous plants, employ conserved and novel antioxidant enzymes/metabolites to minimize the oxidative damage and to protect the photosynthetic machinery. *De novo* synthesized, stress-induced proteins in combination with antioxidants are localized in chloroplasts and are important components of the protective network. Genome sequence informations provide some clues on selection of genes involved in protecting photosynthetic structures; e.g. ELIP genes (early light inducible