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Application of a diffusion model to measure ion leakage of resurrection plant leaves undergoing desiccation

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ABSTRACT

Haberlea rhodopensis is a chlorophyll-retaining resurrection plant, which can survive desiccation to air dry state under both low light and sunny environments. Maintaining the integrity of the membrane during dehydration of resurrection plants is extremely important. In the present study, the diffusion model was improved and used for a first time to evaluate the changes in ion leakage through different cellular compartments upon desiccation of *H. rhodopensis* and to clarify the reasons for significant increase of electrolyte leakage from dry leaves. The applied diffusion approach allowed us to distinguish the performance of plants subjected to dehydration and subsequent rehydration under different light intensities. Well-hydrated (control) shade plants had lower and slower electrolyte leakage compared to control sun plants as revealed by lower values of phase amplitudes, lower rate constants and ion concentration. In well-hydrated and moderately dehydrated plants (50% relative water content, RWC) ion efflux was mainly due to leakage from apoplast. The electrolyte leakage sharply increased in severely desiccated leaves (8% RWC) from both sun and shade plants mainly due to ion efflux from symplast. After 1 day of rehydration the electrolyte leakage was close to control values, indicating fast recovery of plants. We suggest that the enhanced leakage in air-dried leaves should not be considered as damage but rather as a survival mechanism based on a reversible modification in the structure of cell wall, plasma