

Trehalose utilization in Orchidaceae family – unique among plants and conserved among orchids

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Trehalose is a common sugar widely distributed among almost all organisms. However, its role in plants remains enigmatic. Most of the plant species including orchids possess extremely small concentration of trehalose. This sugar works as a signaling molecule in plants and is therefore not suitable as major energy and carbon source. In our research we studied extraordinary ability of orchids to utilize trehalose as the sole source of carbon and energy. The utilization of trehalose by orchids has been previously observed, however no comprehensive study has been made on this phenomenon. We performed *in vitro* asymbiotic cultivation experiments focused on influence of trehalose on germination, mortality, growth and endogenous saccharide content of orchids from different subfamilies. Compared to sucrose and glucose, trehalose is a similarly metabolizable and suitable source of carbon and energy for all selected orchid species. Analysis of sugar content in medium after cultivation supports hypothesis that trehalose is cleaved into glucose extracellularly. Furthermore, trehalose utilization can be inhibited by trehalase specific inhibitor validamycin A. Orchid ability to utilize trehalose is contrasting with proposed general inability of plants to utilize this sugar and might be a consequence of fungi-orchid coevolution.