

Trehalase in orchid mycorrhiza: colocalization with pelotons and gene multiplication

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Orchids rely on mycorrhiza, especially during the stage of heterotrophic protocorms. At this stage, fungi provide orchids with energy, carbon and other nutrients. It is unknown which compounds ensure the energy and carbon transfers.

To address the question, we selected *Dactylorhiza majalis* and *Ceratobasidium* sp. as the main model species. We focused on disaccharide trehalose which was hypothesized previously to play a role in carbon and energy transfers. Utilization of this saccharide depends on trehalase action and we therefore sought to localize trehalase in mycorrhizal tissues. We developed a histochemical trehalase localization method. Our results show, that trehalase activity tightly colocalizes with mycorrhizal structures. The same pattern was observed in completely heterotrophic protocorms as well as in roots of adult plants. In addition to this, we searched trehalase genes in embryophyta and reconstructed their phylogeny. We identified trehalase gene multiplication in *Dactylorhiza majalis* possessing five trehalase paralogs. Strikingly, no such multiplication occurred in other orchid subfamilies.

The results suggest that fungal trehalose can be hydrolysed by trehalase directly in mycorrhizal tissue, which could be reflected by trehalase gene multiplication.

The work was supported by Ministry of Education, Youth and Sports of the Czech Republic (project NPU1: LO1417).