Carotenoid Metabolism & Mycorrhiza

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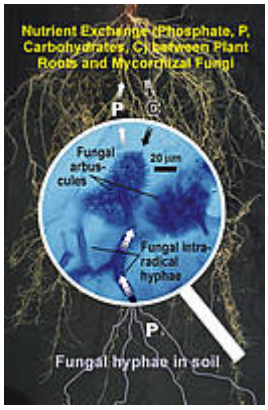
Carotenoids are derived from the linear tetraterpene phytoene (C40), which is assembled from isoprenoid units generated by the methylerythritol phosphate (MEP) pathway (Fig. 1A). Carotenoids are vital not only in their intact form but also constitute a reservoir for the biogenesis of many carotenoid cleavage products (apocarotenoids) through tailoring by specific enzymes (Fig. 1B). Apocarotenoids can be pigments, aroma or scent compounds as well as regulatory molecules (phytohormones) or compounds with unknown functions. Two types of apocarotenoids termed strigolactones (SLs) and cyclohexenone (CH)-/mycorradicin(MR) derivatives play a role in the arbuscular mycorrhizal (AM) symbiosis. The mutually beneficial AM association between plant roots and fungi facilitates mineral nutrient uptake from soil for plants and provides plant carbohydrate resources for the AM fungi. The most important interface for symbiotic mineral acquisition are fungal arbuscules - highly branched hyphal structures inside root cortex cells. Historically, MR is the chromophore of the long-known “yellow pigment” of mycorrhizal roots, whose function is still elusive. Apocarotenoids of the SL-type are exuded into the rhizosphere to support root colonization by AM fungi through induction of hyphal branching. Whereas SL deficiency does not appear to affect arbuscules, interference with CH/MR biosynthesis has shown them to be altered. The group is interested in elucidating the biosynthesis and function of these and y other potentially AM-relevant apocarotenoids and strives to contribute to a better general understanding of carotenoid biosynthesis and cleavage as well as of plant mineral nutrition



The figure shows a scheme of mycorrhiza-mediated nutrient exchange in roots. Hyphae of arbuscular mycorrhizal fungi pervade the soil and collect nutrients, particularly phosphate (P), passing them down to the plant. Nutrient uptake from the fungus to the plant root occurs through arbuscules, which develop as highly ramified tiny „trees“ in the cells of the inner root cortex. Form there nutrients can further be transferred to the shoot. As a trade-off in the mutualistic symbiosis the fungus receives carbohydrates (C) from the plant.