



The contribution of different carbon sources to isoprene synthesis during and after drought in *Populus alba* leaves

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Isoprene (2-methyl-1,3-butadiene) is the most abundant hydrocarbon released by plants into the atmosphere. Environmental stress conditions strongly influence, and often stimulate, the metabolism and emission of isoprene. Drought stress in particular seems to have limited effect on isoprene emission, even when photosynthetic rates are severely inhibited. When drought stress is relieved, isoprene emission exceeds pre-stress rates (Sharkey and Loreto, 1993).

It has been previously demonstrated that isoprene is synthesized via the MEP pathway in the chloroplasts from dimethylallyl diphosphate (DMAPP) - derived mostly from photosynthetic intermediates - in a reaction catalysed by isoprene synthase (ISPS). Other studies, however, point out that under physiological conditions other carbon sources may as well contribute to isoprene emission from leaves (Schnitzler et al., 2004).

We have followed, in drought-stressed *Populus alba* leaves, the relationship between the isoprene emission, mRNA expression levels of isoprene synthase (ISPS) and changes in starch pools of leaves at different drought stress levels. We found that, even when no carbon is fixed by photosynthesis at a severe drought stress stage, isoprene is emitted at constant rates, similar to those observed in irrigated controls. Only 20 to 50% of the emitted isoprene was labelled by ¹³CO₂ after a 15 min exposure to air

containing the enriched CO₂ isotope. Re-watering of the severely stressed plants led to only partial recovery of photosynthesis, while stimulated isoprene emission to higher levels than in unstressed leaves. These results indicate that under severe drought stress conditions isoprene is largely made by a pathway independent on photosynthetic carbon metabolism. The results also suggest that the photosynthesis-independent pathway activated by drought stress may continue to contribute to the enhanced emission of isoprene in plants recovering from drought.

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