Isoprene emission from *Populus tremula* as depending on CO_2 and O_2 concentration in air

B. Rasulov[1], K. Hüve[1], S. Noe[1], Ü. Niinemets[1, 2]

[1] Institute of Molecular and Cell Biology, University of Tartu, Riia 23, 51010 Tartu, Estonia.
[2] Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences, Kreutzwaldi 1, 51014 Tartu, Estonia

Although isoprene synthesis in plants is dependent on photosynthetic activity, enhanced CO_2 concentrations are known to inhibite isoprene emission. A reason for reduced isoprene emissions at higher than ambient CO_2 concentrations may be competition for phosphoenolpyruvate (e.g. Rosenstiel et al., 2003), which is on the one hand a precursor of isoprene, on the other hand used by cytosolic phosphoenolpyruvate carboxylase. A significant inverse relation between the isoprene emission rate and the activity of phosphoenolpyruvate carboxylase was observed by Loreto et al. (2007). Results shown by the latter author indicate also, however, that the regulation of isoprene emission is still more complicated. Mitochondrial respiration, which is using phosphoenolpyruvate, is not directly related to isoprene emission. Further, the clear decrease of isoprene emission with rising CO_2 concentration, that is usually observed (e.g. Sharkey et al. 1991), can not always be confirmed (e.g. Centritto et al. 2004).

We conducted experiments with young aspen (*Populus tremula* L.) trees (well known as a strong isoprene emitting species) with the upper plant parts enclosed in a flow-through glass chamber, with controlled concentrations of carbon dioxide and oxygen. CO_2 dependence of isoprene emission was measured between 0 and 1300 ppm CO_2 in air, which showed an isoprene emission maximum at about 100 ppm, or, if plotted against net CO_2 uptake measured simultaneously, around CO_2 compensation point. A reduced O_2 concentration (2%) resulted in an increased isoprene emission at ambient, but not at high CO_2 concentrations in air. When CO_2 was removed from the gas stream, isoprene emission continued at an only slightly reduced level. A predarkened plant, however, when illuminated under 0 ppm CO_2, showed very low isoprene emission.

Global change scenarios suggest a more or less pronounced increase of atmospheric CO_2 concentration. The results presented here can further illuminate the metabolic background of isoprene emission under current and possible future CO_2 concentrations.