GENERAL INFORMATION

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MATERIALS & METHODS

study area	5n (measuring tower)
time period	May-October 2008
goal	Investigate how BVOCs and net photosynthesis (Pn) react to short-term temperature changes, for young beech trees under controlled conditions and for an adult beech tree under field conditions.
set-up	field measurements: beech next to the measuring tower - 1 branch at 24 m above ground level, facing west - 2008 - air temperature natural variation: 9-23°C growth chamber measurements (simulated natural daylight regime 8 am - 10 pm) - 2 potted beech trees (3-4 years old, 1.25 m tall) - 2007 - horizontal fixation of branches and leaves - temperature varied between days, from 17-27°C reference cuvette and two branch cuvettes (forest and growth chamber)
data collection	forest - photosynthetic photon flux density (PPFD) forest & growth chamber - air temperature, relative humidity, photosynthetically active radiation - simultaneous measurement of Pn and monoterpenoids (MT) - LAI (throughout the vegetation period) - chlorophyll content index (15 leaves per tree, left and right from the main vein)
remarks	only daytime values used (Pn and MT): 8 am – 10 pm (growth chamber) 6 am – 9 pm (forest) data measured every 4 s, average 1 min values recorded the ratio MT/Pn was used to quantify the fraction of assimilated C that was re-emitted into the atmosphere

ABSTRACT

Although biogenic volatile organic compounds (BVOCs) only represent a very limited fraction of the plant's carbon (C) budget, they play an important role in atmospheric chemistry for example as a precursor of tropospheric ozone. We performed a study comparing BVOC emissions of European beech (*Fagus sylvatica* L.) in controlled and natural environmental conditions. A young and adult beech tree was exposed to short-term temperature variations in growth room conditions and in an experimental forest, respectively. This study attempts to clarify how short-term temperature variations between days influenced the ratio between monoterpenoid (MT) emissions and net photosynthesis (Pn). Within a temperature range of 17-27°C and 13-23°C, the MT/Pn carbon ratio increased 10-30 fold for the growth room and forest, respectively. An exponential increasing trend between MT/Pn C ratio and air temperature was observed in both conditions. Beech trees re-emitted a low fraction of the assimilated C back into the atmosphere as MT: 0.01-0.12% and 0.01-0.30% with a temperature rise from 17 to 27°C and 13-23°C in growth room and forest conditions, respectively. However, the data showed that the MT/Pn C ratio of young and adult beech trees responded significantly to changes in temperature.

RESULTS

CCI values varied during the vegetation period, both in the growing chamber and in the forest: increasing CCI values during leaf development, decreasing CCI during leaf senescence.

The trees in the growth room received low PPFD levels. Net photosynthesis (Pn) and emissions of monoterpenoids (MT) showed diurnal patterns. Temperature had a clear impact on MT emissions: high temperatures caused higher emissions, MT emissions were low at low temperatures. Pn was less affected by temperature; Pn was highest at 21°C in the growth chamber, at 23°C in the forest.

In the growth chamber, there was no effect of the diurnal light pattern on the ratio MT/Pn. In the forest, MT/Pn increased during the day. The ratio MT/Pn increased with temperature for both the growth chamber and the field situation. The adult beech emitted a slightly higher fraction of C as MT than the young beeches.