Supplementary Material 1 for

Growth and actual leaf temperature modulate CO2-responsiveness of monoterpene emissions from Holm oak in opposite ways

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**Table S1**

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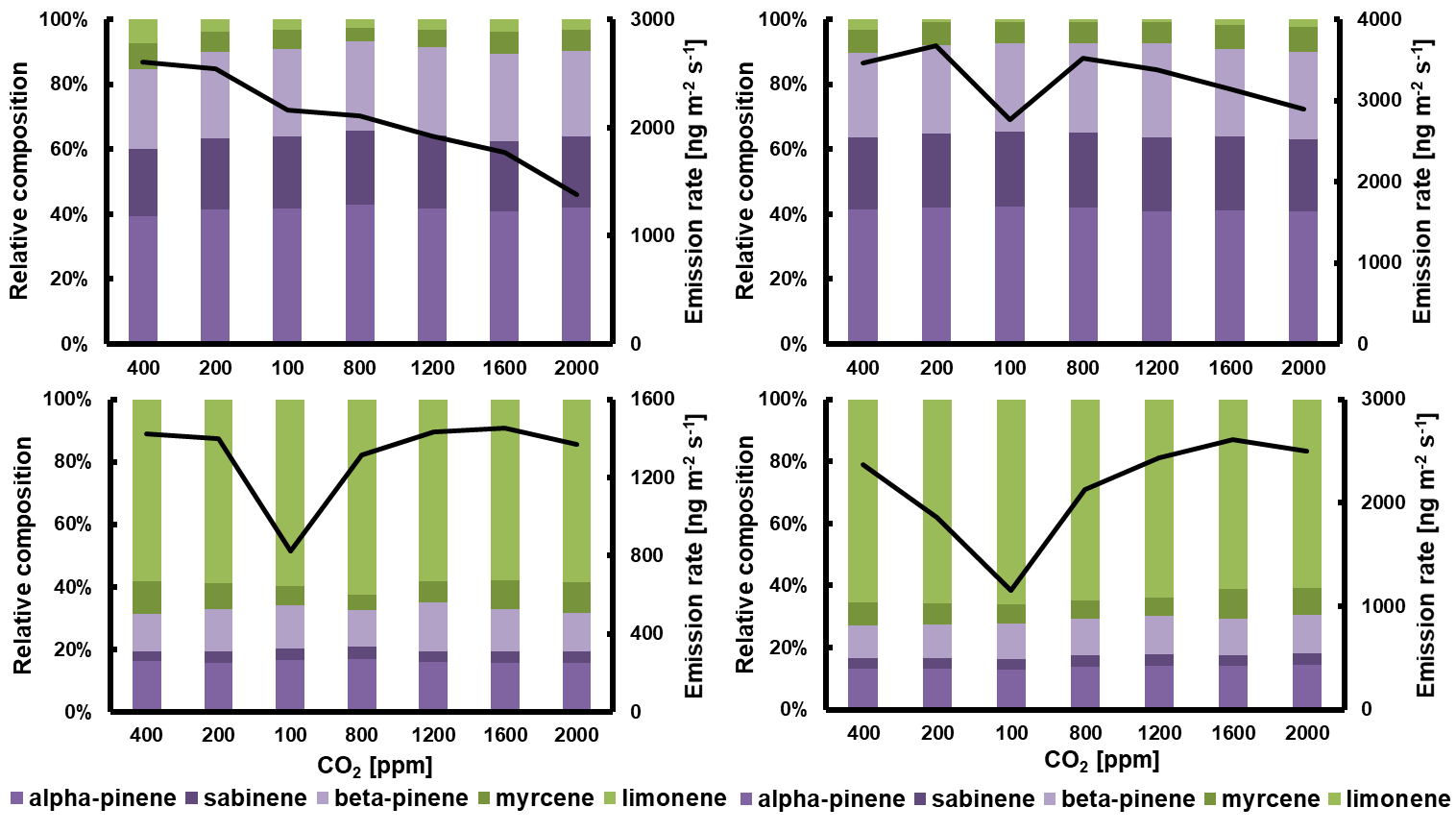
**Table S2**

**Figure S8**

**Table S1.** Monthly averages of daily mean, minima, and maxima temperatures (°C) recorded over three years by the CEFE Institute meteorological station in Montpellier, France (<https://websie.cefe.cnrs.fr/d_meteo/>).



**30°C 35°C**

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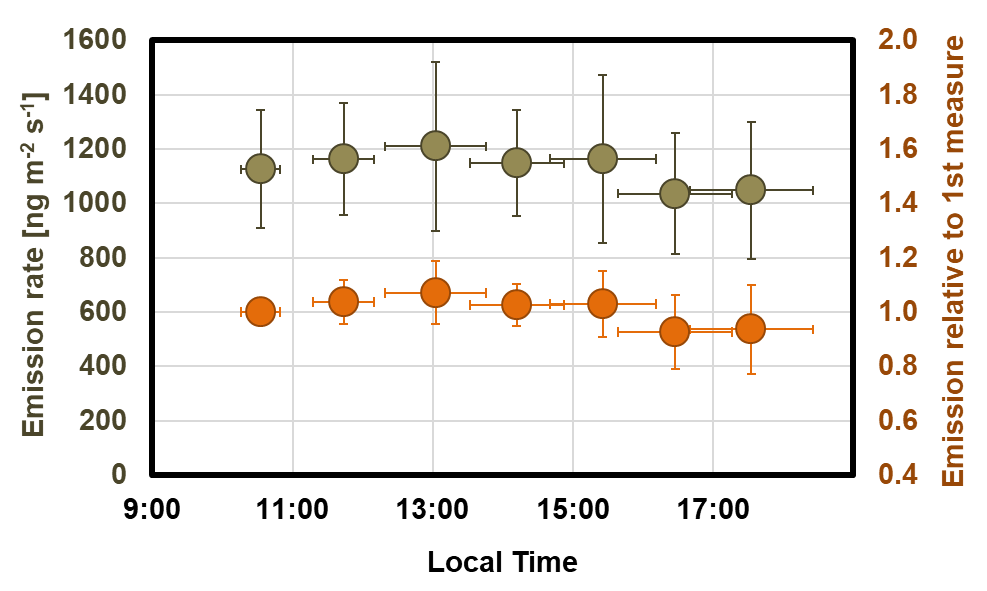
**Figure S2.** Examples of the response of foliar monoterpene emissions to changes in [CO2] starting from 400 ppm going down to 100 and then up to 2000 ppm. The upper panels show the responses of a *Quercus ilex* sapling predominantly emitting pinenes plus sabinene and the lower panels of another sapling predominantly emitting limonene. CO2-responses were measured once at 30 °C (left panels) and once at 35°C (right panels) each time on different leaves of the same sapling. The line graphs in black show the emission rate (ng m-2 s-1) of the sum of the 5 major compounds and the columns their percentage contributions to the sum. The figure exemplary illustrate that the emission composition remained mostly unchanged during CO2-ramping and hence that single monoterpenes responded similarly to CO2. Note that minor variations can be attributed to imprecisions in the background subtraction, in particular for limonene, which co-eluted with a C8-alcohol present in the background in rather variable amounts.



**Figure S3.** Foliar monoterpene emissions of *Quercus ilex* saplings producing predominantly -, -pinene and sabinene (Pinene chemotype, left columns) or limonene and myrcene (Limonene/Myrcene chemotype, right columns). The upper graph shows the mean emission rates (+ SD) of the sum of these five major compounds and the lower graph the mean percentage fractions (+ SD) of each class to the total sum of emitted monoterpenes. The mean emission rates of the Pinene and Limonene/Myrcene chemotypes were not significantly different (t-test, P = 0.80, n = 17 and 9).



**Figure S4:** Comparison of *Quercus ilex* emission responses to high CO2 per chemotype. Each dot shows the mean emission rates normalized to the initial emission rate at 400 ppm CO2 (µ E>400E400-1) measured on individual leaves during CO2-ramping to high [CO2] at assay temperatures of 30 and 35 °C. There is no significant difference between the responses of the two chemotypes at either assay temperature.

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**Figure S5.** Diel variation (mean ± SE, n = 3 plants) of monoterpene emissions of Holm oak leaves measured at constant temperature (30 °C), incident light (1000 µmol m-2 s-1 PPFD) and [CO2] (400 ppm). Emissions rates are given in absolute values (bronze dots, left y-axis) and in relative values normalized to the first measurement (orange dots, right y-axis). The results do not provide evidence that the emissions are subject to a consistent endogenous circadian rhythm.



**Figure S6.** Relative monoterpene emission (a, e), CO2-assimilation (b, f), electron transport rate (c, g) and non-photochemical quenching (d, h) against leaf internal CO2-concentration (Ci) measured during CO2-ramping at assay temperatures of 30°C (left panels) and 35°C (right panels). Data were normalized by devising the individual data of a CO2-ramping curve by its first value measured at 400 ppm CO2. Colors of the dots denote the temperature and CO2-regimes, in which plants have been grown.

**Table S2.** Mean ± SD of variables measured during the CO2-ramping experiments at two assay temperatures of 30 °C (blue) and 35 °C (red) on QI saplings grown from seeds in four CO2/temperature regimes. Mean toto are the average values of all four growth populations. Asterisks (\*) indicate significant differences among the four growth populations based on ANOVA and Kruskal-Wallis statistical tests, with the number of asterisks denoting the significance level (\*\*\* P <0.001, \*\* 0.001 < P ≤ 0.01, \* 0.01 < P < 0.05) and the lowercase superscripts denoting the populations that are different from each other. Mean20 and Mean25 are the averages per growth temperature from pooled growth CO2 data, and Mean400 and Mean800 averages per growth [CO2] from pooled growth temperature data. Uppercase superscripts T and C denote significant effects of growth temperature and growth [CO2] based on Student or Mann-Whitney tests with the number of superscripts indicating the significance level. For abbreviations, calculations and the experimental protocol, please see main article section 2.

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|  |  |  |  |  |  |  |  |  |  |
| Growth: | 400/20 | 800/20 | 400/25 | 800/25 | Mean toto | Mean 20 | Mean 25 | Mean 400 | Mean 800 |
|  |  |  |  |  |  |  |  |  |  |
| Number of leaves | 32.3±14.2**ab** | 38.8±7.5**ab** | 25.0±3.8**a** | 40.9±10.9**b** | 34.3±11.1**\*** | 35.9±10.7 | 33.5±11.5 | 27.9±9.5**CC** | 40.0±9.3**CC** |
| [Chloro] | 825±155  859±219 | 713±39  707±14 | 762±101  741±104 | 757±86  825±87 | 761±98  783±129 | 763±115  783±165 | 759±89  783±101 | 787±122  793±165 | 739±71  773±88 |
| LMA | 164±21  161±28 | 178±13  164±18 | 156±15  150±12 | 168±12  174±16 | 166±17  162±20 | 170±19  163±23 | 162±15  162±18 | 159±20(**C)**  156±22**(C)** | 171±14(**C)**  170±16**(C)** |
| Rini | 0.89±0.42  0.69±0.26 | 0.67±0.21  1.09±0.55 | 0.48±0.24  0.57±0.29 | 1.04±0.40  1.08±0.39 | 0.78±0.38  0.85±0.42 | 0.77±0.32  0.89±0.45 | 0.78±0.43  0.83±0.42 | 0.65±0.37  0.62±0.27**C** | 0.89±0.37  1.08±0.43**C** |
| Fv/Fmini | 0.80±0.02  0.80±0.02 | 0.79±0.02  0.80±0.02 | 0.79±0.02  0.78±0.05 | 0.80±0.02  0.79±0.03 | 0.79±0.02  0.79±0.03 | 0.79±0.02  0.80±0.02 | 0.79±0.02  0.78±0.04 | 0.79±0.02  0.79±0.04 | 0.79±0.02  0.79±0.03 |
| EF400 | 1272±482  1676±484 | 2082±557  1925±667 | 1505±286  1484±600 | 1808±661  2090±699 | 1626±575  1781±605 | 1584±638  1776±542 | 1669±526  1787±693 | 1372±413**C**  1589±521 | 1922±609**C**  2017±647 |
| A400 | 8.9±4.2  8.4±2.7 | 9.6±2.9  10.0±4.0 | 7.5±2.7  7.7±5.0 | 11.2±2.7  11.7±2.9 | 9.4±3.4  9.4±3.7 | 9.2±3.7  9.0±3.2 | 9.5±3.2  9.7±4.4 | 8.3±3.6  8.1±3.7 | 10.6±2.8  11.0±3.3 |
| G400 | 111±80  75±31 | 87±25  87±44 | 75±42  76±67 | 129±37  120±31 | 103±55  89±45 | 102±64  80±35 | 104±47  98±55 | 96±67  76±48 | 112±38  105±39 |
| ETR400 | 107±20  120±8 | 122±17  124±19 | 101±18  106±30 | 116±23  135±26 | 112±20  121±24 | 115±19  122±14 | 109±21  120±30 | 104±18  112±23 | 119±20  130±23 |
| NPQ400 | 2.58±0.51  2.61±0.08 | 2.11±0.75  2.38±0.91 | 2.48±0.52  2.23±0.23 | 2.15±0.59  1.97±0.58 | 2.31±0.59  2.28±0.54 | 2.32±0.66  2.50±0.61 | 2.30±0.56  2.10±0.44 | 2.52±0.49  2.40±0.26 | 2.13±0.63  2.16±0.73 |
| C-loss400 | 1.13±0.59  2.90±0.56 | 1.49±0.20  2.04±0.71 | 1.52±0.49  2.14±0.78 | 1.07±0.49  1.72±0.28 | 1.27±0.50  2.25±0.73 | 1.27±0.50  2.56±0.74 | 1.28±0.52  1.93±0.59 | 1.3±0.57  2.56±0.74**C** | 1.24±0.43  1.86±0.51**C** |
| É-loss400 | 0.46±0.12  0.73±0.23 | 0.64±0.10  0.86±0.24 | 0.60±0.14  0.75±0.23 | 0.57±0.23  0.84±0.19 | 0.57±0.17  0.80±0.21 | 0.56±0.14  0.79±0.23 | 0.58±0.19  0.80±0.21 | 0.54±0.14  0.74±0.22 | 0.60±0.18  0.85±0.20 |
| ETR/A400 | 13.8±5.6  15.4±5.6 | 13.2±2.0  13.4±3.2 | 14.1±2.2  16.6±6.8 | 10.7±2.6  11.7±1.2 | 12.8±3.3  14.2±4.7 | 13.5±3.7  14.4±4.3 | 12.3±2.9  14.1±5.3 | 14.0±3.7  16.0±5.9 | 11.7±2.6  12.4±2.3 |
| µE<400E400-1 | 0.96±0.09  0.88±0.10 | 0.98±0.12  0.94±0.21 | 1.05±0.18  0.91±0.25 | 1.12±0.22  0.92±0.13 | 1.03±0.16  0.91±0.16 | 0.97±0.10  0.91±0.15 | 1.09±0.19  0.92±0.19 | 1.00±0.13  0.90±0.17 | 1.06±0.19  0.93±0.16 |
| µE>400E400-1 | 0.87±0.10  0.93±0.10 | 0.84±0.16  1.03±0.03 | 0.67±0.20  1.00±0.20 | 0.73±0.10  0.92±0.08 | 0.78±0.16  0.97±0.12 | 0.86±0.12**TT**  0.97±0.09 | 0.71±0.15**TT**  0.96±0.15 | 0.79±0.18  0.96±0.15 | 0.78±0.13  0.97±0.08 |
| µA<400A400-1 | 0.31±0.05  0.31±0.05 | 0.37±0.05  0.31±0.05 | 0.33±0.03  0.29±0.04 | 0.32±0.03  0.28±0.05 | 0.33±0.04  0.30±0.04 | 0.33±0.06  0.31±0.04 | 0.33±0.03  0.29±0.04 | 0.32±0.04  0.30±0.04 | 0.34±0.04  0.30±0.05 |
| µA>400A400-1 | 1.47±0.40  1.81±0.43 | 1.75±0.48  1.58±00.25 | 1.40±0.29  1.15±0.30 | 136±0.13  1.46±0.29 | 1.48±0.35  1.51±0.40 | 1.58±0.43  1.72±0.37**T** | 1.38±0.21  1.30±0.32**T** | 1.44±0.35  1.51±0.04 | 1.52±0.36  1.51±0.03 |
| µG<400G400-1 | 1.08±0.48  1.42±0.29 | 1.34±0.43  1.29±0.21 | 1.30±0.34  1.09±0.14 | 1.03±0.09  1.11±0.15 | 1.17±0.37  1.23±0.25 | 1.18±0.46  1.37±0.26**TT** | 1.16±0.26  1.10±0.14**TT** | 1.18±0.42  1.27±0.28 | 1.16±0.31  1.19±0.19 |
| µG>400G400-1 | 0.36±0.20  0.46±0.12 | 0.47±0.20  0.41±0.10 | 0.43±0.17  0.27±0.05 | 0.31±0.04  0.32±0.07 | 0.39±0.16  0.37±0.11 | 0.41±0.20  0.44±0.11**TT** | 0.37±0.13  0.30±0.07**TT** | 0.39±0.18  0.37±0.14 | 0.38±0.15  0.36±0.09 |
| µETR<400 ETR400-1 | 0.69±0.03  0.70±0.02 | 0.76±0.05  0.73±0.08 | 0.73±0.05  0.66±0.08 | 0.72±0.06  0.68±0.07 | 0.73±0.05  0.69±0.07 | 0.73±0.06  0.71±0.05 | 0.72±0.06  0.67±0.07 | 0.71±0.05  0.67±0.06 | 0.74±0.06  0.70±0.07 |
| µETR>400 ETR400-1 | 1.16±0.09  1.22±0.06 | 1.15±0.16  1.18±0.10 | 1.00±0.10  1.09±0.18 | 1.02±0.09  1.10±0.11 | 1.07±0.13  1.14±0.12 | 1.16±0.13**TT**  1.20±0.08 | 1.01±0.09 **TT**  1.10±0.14 | 1.06±0.13  1.15±0.15 | 1.07±0.14  1.13±0.11 |
| µNPQ<400 NPQ400-1 | 1.25±0.13  1.25±0.03 | 1.35±0.15  1.31±0.20 | 1.34±0.22  1.34±0.17 | 1.41±0.20  1.51±0.19 | 1.35±0.18  1.36±0.18 | 1.31±0.15  1.28±0.14 | 1.38±0.20  1.43±0.19 | 1.31±0.19  1.30±0.13 | 1.38±0.18  1.42±0.21 |
| µNPQ>400 NPQ400-1 | 0.84±0.13**ab**  0.67±0.08 | 0.78±0.11**a**  0.76±0.09 | 1.02±0.11**b**  0.91±0.09 | 0.96±0.08**b**  0.87±0.08 | 0.91±0.14**\*\***  0.81±0.12 | 0.80±0.12**TT**  0.72±0.10**TTT** | 0.99±0.10**TT**  0.89±0.08**TTT** | 0.95±0.15  0.80±0.15 | 0.88±0.15  0.82±0.09 |
| µETR/A<400  ETR/A400-1 | 2.69±0.28  2.58±0.33 | 2.50±0.46  3.15±0.86 | 2.82±0.42  2.82±0.52 | 2.78±0.17  3.23±0.24 | 2.71±0.34  2.95±0.54 | 2.59±0.38  2.86±0.67 | 2.80±0.29  3.03±0.44 | 2.77±0.35  2.72±0.44 | 2.67±0.34  3.19±0.55 |
| µETR/A>400 ETR/A400-1 | 0.70±0.11  0.61±0.08 | 0.69±0.12  0.77±0.06 | 0.75±0.12  1.00±0.16 | 0.76±0.07  0.78±0.11 | 0.73±0.10  0.80±0.21 | 0.69±0.11  0.69±0.11**T** | 0.75±0.09  0.89±0.17**T** | 0.73±0.11  0.83±0.24 | 0.73±0.10  0.77±0.09 |
| Fv/Fm | 0.10±0.03  0.08±0.01 | 0.07±0.01  0.07±0.01 | 0.13±0.04  0.11±0.05 | 0.12±0.05  0.07±0.05 | 0.11±0.04  0.08±0.04 | 0.08±0.03**T**  0.07±0.01 | 0.12±0.04**T**  0.09±0.05 | 0.12±0.04  0.09±0.04 | 0.10±0.05  0.07±0.04 |
| R | 0.95±0.61  1.22±0.86 | 0.73±0.73  0.76±0.85 | 1.13±0.99  1.11±0.79 | 0.43±0.86  0.65±0.30 | 0.78±0.82  0.93±0.70 | 0.82±0.65  0.99±0.83 | 0.75±0.95  0.88±0.61 | 1.05±0.82  1.16±0.77 | 0.56±0.78  0.77±0.56 |

(C) significantly different when data of both assay temperatures were pooled



**Figure S8.** Panel (a) shows the individual normalised ETR/A ratios (ETR/ACO2 ETR/A400-1) versus leaf internal [CO2] (Ci) measured during 26 CO2-response curves at an assay temperatures of 30°C (inserted graph: same data in logarithmic scale). Colors of the dots denote the temperature and CO2-regimes, in which plants have been grown. Panels (b) and (c) show respectively plots of normalised ETR/A ratios (ETR/ACO2 ETR/A400-1) and normalised ETR (ETRCO2 ETR400-1) versus normalised emission E (ECO2 E400-1, y-axes) measured during ramping to high CO2 (800, 1200, 1600 and 2000 ppm CO2). Values were normalised by dividing the data of a series by its initial value measured at 400 ppm [CO2]). Mean normalised values to low and high CO2 and associated correlations are given respectively in Table S2 (see above) and Table S3b in Supplement 2.