New Phytologist Supporting Information

Article title: Tropical rainforest species have larger increases in temperature optima with warming than warm-temperate rainforest trees.

Authors: Choury Zineb, Wujeska-Klause Agnieszka, Bourne Aimee, Bown Nikki P, Tjoelker Mark G, Medlyn Belinda E, Crous Kristine Y

Article acceptance date: 21 February 2022

The following Supporting Information is available for this article:

Fig. S1 Relationships between leaf temperature ($T_{leaf}$) and leaf-to-air vapour pressure deficit (VPD) at different growth temperatures.

Fig. S2 Temperature responses of photosynthesis at the mean Ci (300 ppm) and different growth temperatures in six rainforest species from three different rainforest groups (means ± SE, n = 3) being (a-b) warm-temperate species in blue, (c-d) subtropical species in orange and (e-f) tropical species in red.

Fig. S3 Relationships between stomatal conductance ($g_s$) and vapour pressure deficit (VPD) at different growth temperatures (different symbols) (a-b) warm-temperate species in blue, (c-d) subtropical species in orange, and (e-f) tropical species in red.

Fig. S4 Means and standard errors between stomatal conductance measured at 25 °C ($g_s_{25}$) and different growth temperatures ($T_{growth}$) across six rainforest species.

Fig. S5 Relationships between $A_{measuredCi-A_{300}}$ and leaf temperature ($T_{leaf}$) at different growth temperatures (different symbols as in Fig. S1) in warm-temperate species (blue), subtropical species (orange), and tropical species (red) at each growth temperature.

Fig. S6 Temperature responses of the apparent maximum carboxylation ($V_{cmax}$) for each of six rainforest species measured in their respective growth temperatures (different symbols) at five
leaf temperatures ($T_{\text{leaf}}$) in three replicates per growth temperature (means ± SE). Parameter fits are shown in table 3.

**Fig. S7** Temperature response of the apparent maximum electron transport rate ($J_{\text{max}}$) for each of six rainforest species measured in their respective growth temperatures (different symbols) at five leaf temperatures ($T_{\text{leaf}}$) in three replicates per growth temperature (means ± SE). Parameter fits are shown in table 3.

**Fig. S8** a) Mean and standard errors of fitted values (3 replicates) of $J_{\text{max}}/V_{c_{\text{max}}}$ at a common leaf temperature (25 °C) as a function of six growth temperatures across three rainforest groups. b) $J_{\text{max}25}/V_{c_{\text{max}25}} = -0.04 \times T_{\text{growth}} + 3.03$ ($P = 0.01; R^2 = 0.20$).

**Fig. S9** The short-term temperature response of mitochondrial leaf respiration ($R_{\text{dark}}$) as a function of leaf temperature ($T_{\text{leaf}}$) measured at two different growth temperatures (different symbols) to assess the responses to +3.5 °C warming among rainforest groups. Associated fitted parameters are shown in Figure 6.
Fig. S1 Relationships between leaf temperature ($T_{\text{leaf}}$) and leaf-to-air vapour pressure deficit (VPD) at different growth temperatures (different symbols indicated in panel a) in six rainforest species being (a-b) warm-temperate species in blue, (c-d) subtropical species in orange, and (e-f) tropical species in red.
**Fig. S2** Temperature responses of photosynthesis at the mean Ci (300 ppm) and different growth temperatures in six rainforest species from three different rainforest groups (means ± SE, n = 3) being (a-b) warm-temperate species in blue, (c-d) subtropical species in orange and (e-f) tropical species in red. The different growth temperatures are represented by different symbols. The temperature response fits at each growth temperature is represented by different line types and colours: 17 °C: dotted, blue, 20.5 °C: dashed, cyan, 24 °C: solid, black, 27.5 °C: solid, grey, 31 °C: longdash, yellow, and 34.5 °C: dotdash, red.
Fig. S3 Relationships between stomatal conductance ($g_s$) and vapour pressure deficit (VPD) at different growth temperatures (different symbols) (a-b) warm-temperate species in blue, (c-d) subtropical species in orange, and (e-f) tropical species in red. The correlation between $g_s$ and VPD is significant for *T. laurina* ($g_s = -0.088 \times \text{VPD} + 0.35$, $R^2 = 0.43$, $P < 0.001$), *B. citriodora* ($g_s = -0.137 \times \text{VPD} + 0.607$, $R^2 = 0.26$, $P < 0.001$) and for *X. chrysanthus* ($g_s = -0.062 \times \text{VPD} + 0.301$, $R^2 = 0.12$, $P = 0.002$).
Fig. S4 Means and standard errors between stomatal conductance measured at 25 °C ($g_{s25}$) and different growth temperatures ($T_{growth}$) across six rainforest species. There were no significant relationships between $g_{s25}$ and growth temperature.
Fig. S5 Relationships between $A_{\text{measured}}$-$A_{300}$ and leaf temperature ($T_{\text{leaf}}$) at different growth temperatures (different symbols as in Fig. S1) in warm-temperate species (blue), subtropical species (orange), and tropical species (red) at each growth temperature. Out of 24 situations, there were only three significant relationships. The relationship between $A_{\text{measured}}$-$A_{300}$ and $T_{\text{leaf}}$ was significant for *C. laevigata* at 17°C ($R^2 = 0.52; P = 0.007$), for *B. citriodora* at 31°C ($R^2 = 0.24; P = 0.041$), and for *F. australis* at 27.5°C ($R^2 = 0.32; P = 0.013$).
Fig. S6 Temperature responses of the apparent maximum carboxylation ($V_{\text{cmax}}$) for each of six rainforest species measured in their respective growth temperatures (different symbols as in Fig. S1) at five leaf temperatures ($T_{\text{leaf}}$) in three replicates per growth temperature (means ± SE). (a-b) warm-temperate species in blue, (c-d) subtropical species in orange, and (e-f) tropical species in red. The temperature response fits at each growth temperature are represented by different line types and colours: 17 °C: dotted, blue, 20.5 °C: dashed, cyan, 24 °C: solid, black, 27.5 °C: solid, grey, 31 °C: longdash, yellow, and 34.5 °C: dotdash, red. Parameter fits are shown in table 3.
Fig. S7 Temperature response of the apparent maximum electron transport rate ($J_{\text{max}}$) for each of six rainforest species measured in their respective growth temperatures (different symbols) at five leaf temperatures ($T_{\text{leaf}}$) in three replicates per growth temperature (means ± SE). (a-b) warm-temperate species in blue, (c-d) subtropical species in orange, and (e-f) tropical species in red. The temperature response fits at each growth temperature is represented by different line types and colours: 17 °C: dotted, blue, 20.5 °C: dashed, cyan, 24 °C: solid, black, 27.5 °C: solid, grey, 31 °C: longdash, yellow, and 34.5 °C: dotdash, red. Parameter fits are shown in table 3.
Fig. S8 (a) Mean and standard errors of fitted values (3 replicates) of $J_{max}/V_{cmax}$ at a common leaf temperature (25 °C) as a function of six growth temperatures across three rainforest groups: warm-temperate in blue, subtropical in orange and tropical in red. (b) There was a strong relationship between $J_{max}$ and $V_{cmax}$ at a common leaf temperature (25° C), $J_{max25} = 1.036 \times V_{cmax25} + 30.31$ ($P < 0.001$, $R^2 = 0.45$).
Fig. S9 The short-term temperature response of mitochondrial leaf respiration ($R_{\text{dark}}$) as a function of leaf temperature ($T_{\text{leaf}}$) measured at two different growth temperatures (different symbols) to assess the responses to +3.5 °C warming among rainforest groups: (a-b) warm-temperate species in blue, (c-d) subtropical species in orange, and (e-f) tropical species in red. Each point and is the mean and standard error of three replicates. Associated fitted parameters are shown in Figure 6.