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Red and blue light differentially impact retrograde signaling and photoprotection in rice

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Supplementary material

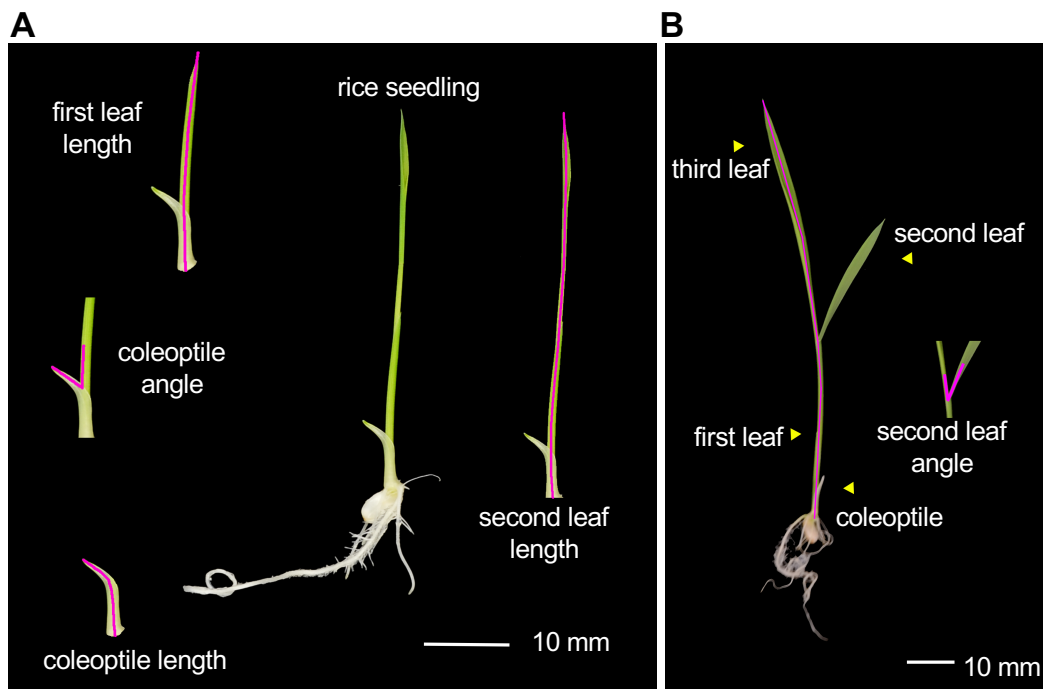


Figure S1. Morphological parameters measured in rice seedlings. Five (A) or seven (B) day-old grown Nipponbare seedlings were taken out of the jars, carefully positioned and pictured to measure coleoptile length and angle, the length of each leaf, and the second leaf declination as indicated using ImageJ software.

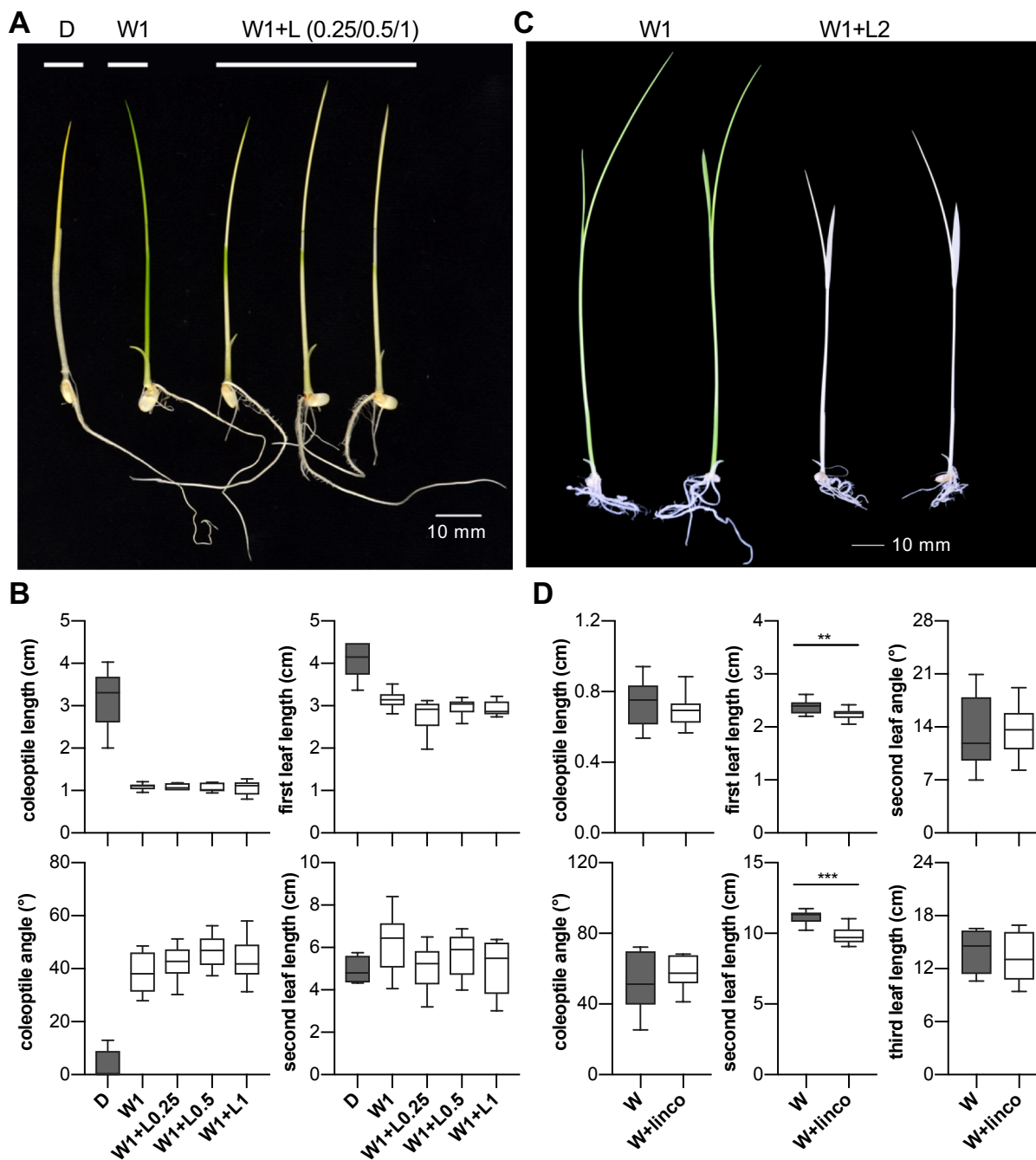


Figure S2. Eight day-old rice seedlings were grown in the dark (D) or low intensity light (white light, $1 \mu\text{mol m}^{-2} \text{s}^{-1}$) (W1) at 21°C in the presence of different lincomycin (L) concentrations as indicated. **A.** Representative rice seedlings grown under D, W1, and W1 with 0.25 mM (L0.25), 0.5 mM (L0.5), 1 mM (L1) lincomycin. **B.** Quantification of coleoptile angle, and coleoptile, first and second leaf length ($n = 10$) of seedlings grown as indicated in **A.** **C.** Representative rice seedlings grown under W1 with (L2) or without 2 mM lincomycin. **D.** Quantification of coleoptile angle, and coleoptile, first and second leaf length ($n = 16$) of seedlings grown as indicated in **C.** Student's t-test was used for the analysis between lincomycin treated and non-treated groups. Statistically significant differences were defined with P value < 0.05 . Asterisks denote statistically significant differences: P values < 0.05 (*), < 0.01 (**) and < 0.001 (***).

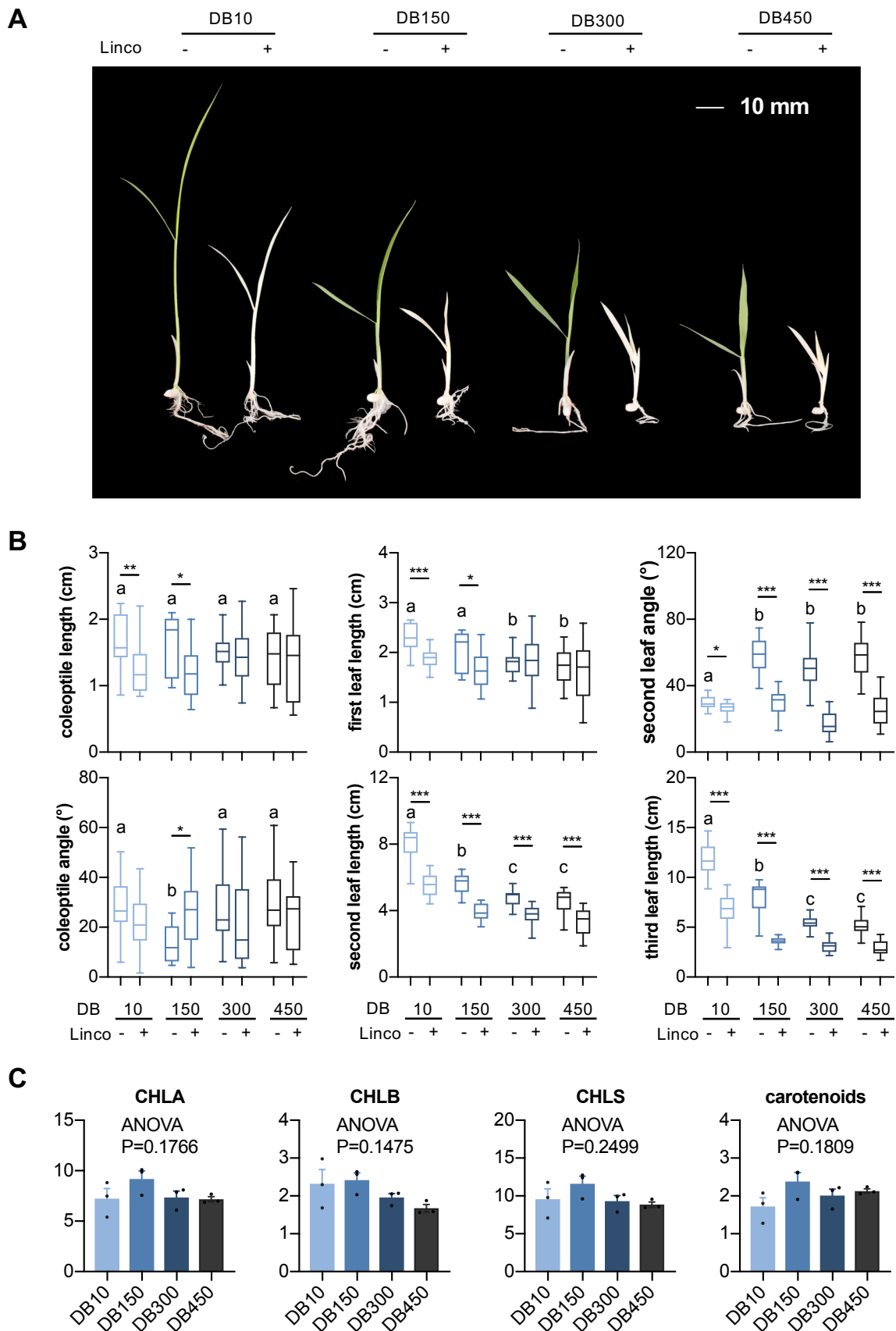


Figure S3. A. Representative 7 day-old rice seedlings grown at 28 °C under continuous dark (D) for 3 days and then transferred to blue light of different intensities: 10 ($\mu\text{mol m}^{-2} \text{s}^{-1}$ (DB10)), 150 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (DB150), 300 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (DB300), and 450 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (DB450). **B.** Quantification of coleoptile angle, and coleoptile, first, second and third leaf length, second leaf declination angle in seedlings ($n = 24$) grown as indicated in **A**.

Figure S3 (Cont.). C. Chlorophyll A (CHLA), chlorophyll B (CHLB), total chlorophylls (CHLS) and carotenoid content in seedlings grown under the conditions indicated in **A**. Data correspond to the mean \pm s.e.m. of independent biological triplicates. Multiple groups in **C** were analyzed by one-way ANOVA analysis. In **B**, different letters denote statistically significant differences among means of each lincomycin non-treated group by Tukey test, and student's t-test was used for the analysis between lincomycin treated and non-treated groups. Asterisks denote statistically significant differences: P values < 0.05 (*), < 0.01 (**) and < 0.001 (***).

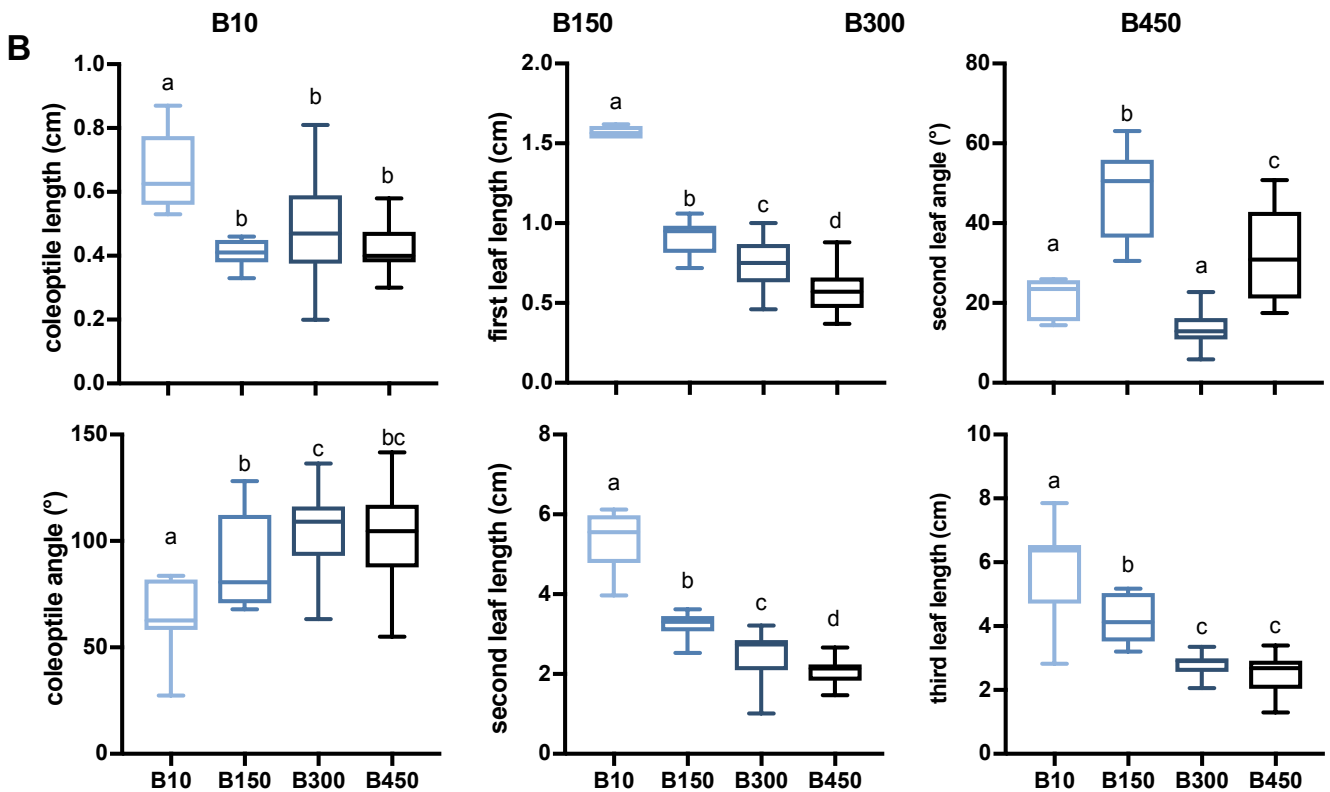
A

Figure S4. A. Representative 5 day-old rice seedling grown at 28 °C under continuous high blue (B) light of different intensities: 10 ($\mu\text{mol m}^{-2} \text{s}^{-1}$ (B10)), 150 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (B150), 300 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (B300), and 450 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (B450). **B.** Quantification of coleoptile and second leaf angle, and coleoptile, first, second and third leaf length in seedlings ($n = 8$ for B10 and B150, $n=30$ for B300 and B450) grown as indicated in A. In **B**, different letters denote statistically significant differences among means of each group by Tukey test.

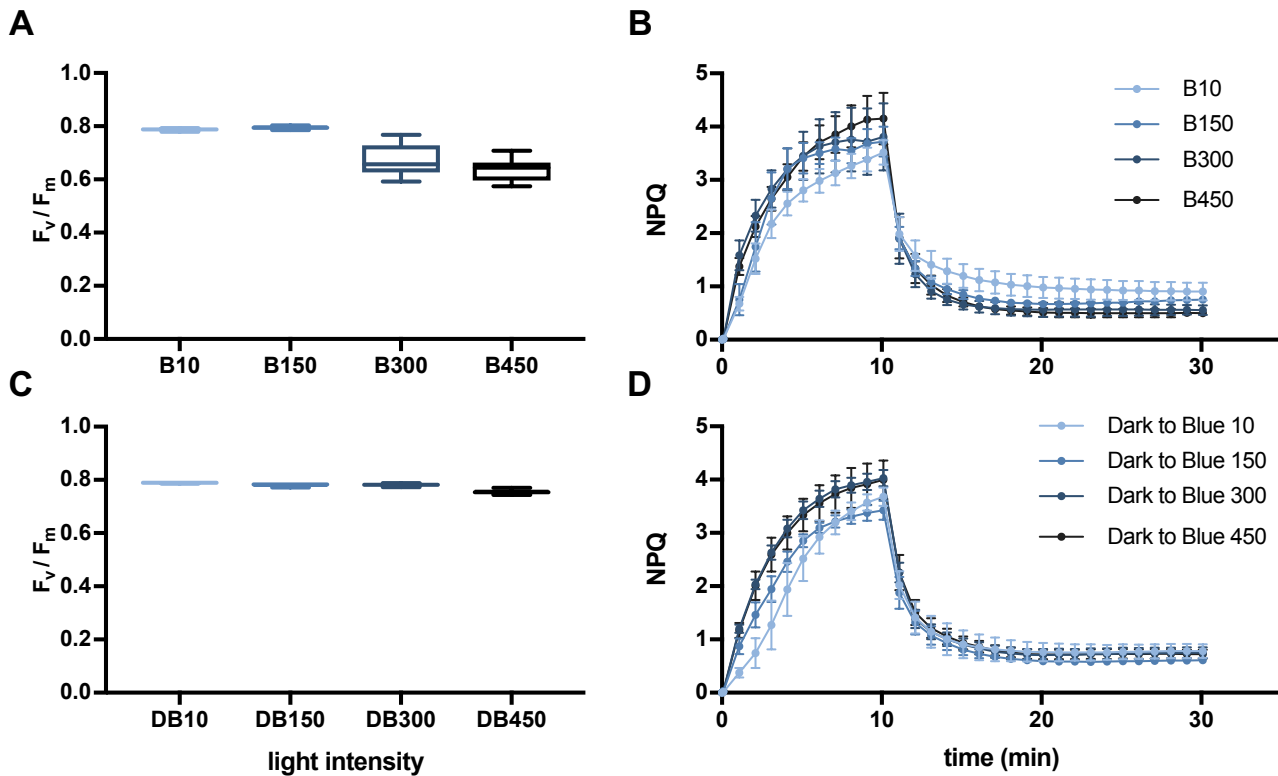


Figure S5. Photosynthesis efficiency and photoprotection capacities of rice seedlings grown in blue light. Rice seedlings were grown for 5 days (**A** and **B**) or first grown in dark for 3 days then transfer to blue light for 4 days (**C** and **D**) under different blue light: 10 ($\mu\text{mol m}^{-2} \text{s}^{-1}$ (B10)), 150 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (B150), 300 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (B300), and 450 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (B450) at 28 °C. **A.** Maximum quantum yield of PSII (F_v/F_m) of 5-day old seedlings. Chlorophyll fluorescence was measured after 30 min of dark adaptation using 800 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$ of actinic light. Values are the mean \pm SD of at least eight independent seedlings grown at the specified light conditions. **B.** NPQ induction (light) and relaxation (dark) of 5-day old seedlings. **C.** Maximum quantum yield of PSII (F_v/F_m) of 7-day old seedlings. **D.** NPQ induction (light) and relaxation (dark) of 7-day old seedlings.

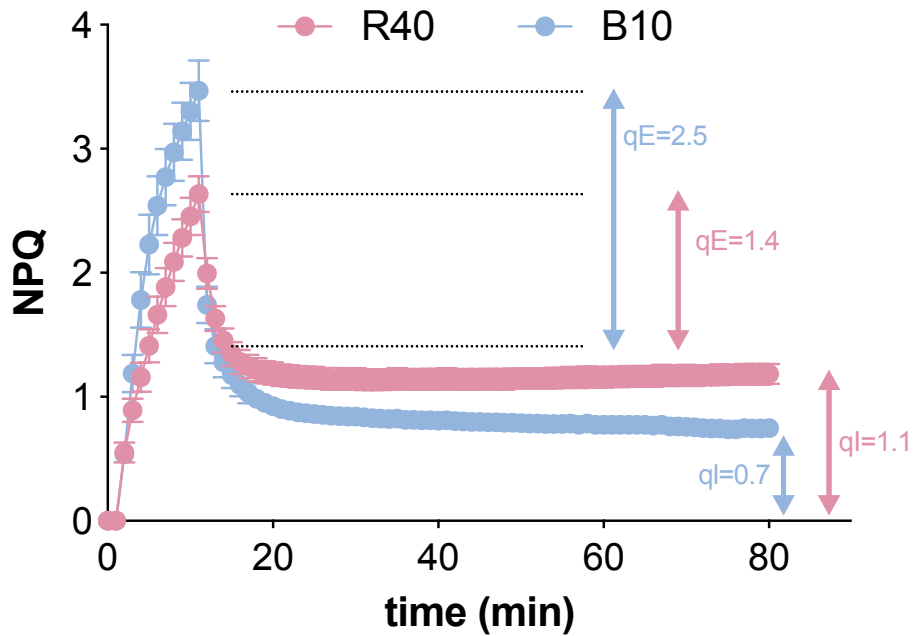


Figure S6. NPQ induction and relaxation kinetics of 6-day old low red (40 $\mu\text{mol m}^{-2} \text{s}^{-1}$) (R40) and low blue (10 $\mu\text{mol m}^{-2} \text{s}^{-1}$) (B10) grown seedlings at 28°C. Chlorophyll fluorescence was measured after 30 min of dark adaptation using 800 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$ of actinic light. Values are the mean \pm SD of six independent. The extent of NPQ components qE (energy quenching) and qI (photoinhibitory quenching) is indicated.