

Supplementary Figures

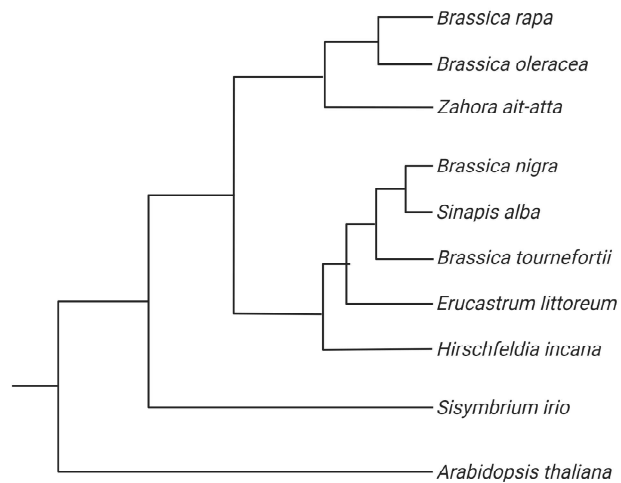


Figure S1: **Summary of the phylogenetic relationships between the ten species employed in this study.** The tree branches reflect phylogenetic proximity but do not inform on divergence times. The relationship presented in this plot are based on coherence between plastome-based reconstructions of the phylogeny of the Brassicaceae family (Hendriks *et al.*, 2022) and the Brassiceae tribe belonging to the family Arias and Pires (2012).

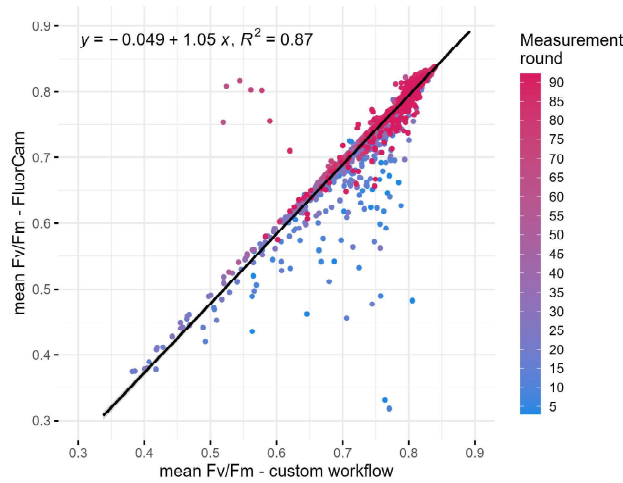


Figure S2: **Correlation between plant-wide dark-adapted F_v/F_m measurements obtained after masking with the standard settings for the PSI FluorCam software and masking with our custom workflow.** The color scale is referred to measurement rounds, with lower numbers corresponding to measurements conducted in earlier stages of the experiment.

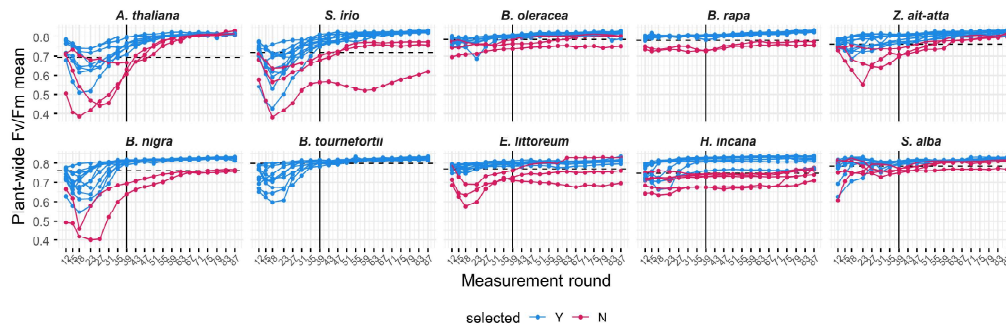


Figure S3: **Selection of plants based on F_v/F_m values measured at 26 DAS_s.** Each set of dots, and the line connecting them, represents a single plant's mean F_v/F_m measured during various days (i.e., measurement rounds). The round conducted at 26 DAS_s (round 39) is represented by the solid black line. The dashed lines represent the per-species selection threshold, calculated as $Mean(F_v/F_m)_{\text{species}} - 0.5 * StDev(F_v/F_m)_{\text{species}}$. Blue points and lines identify plants that were selected to be part of downstream analysis.

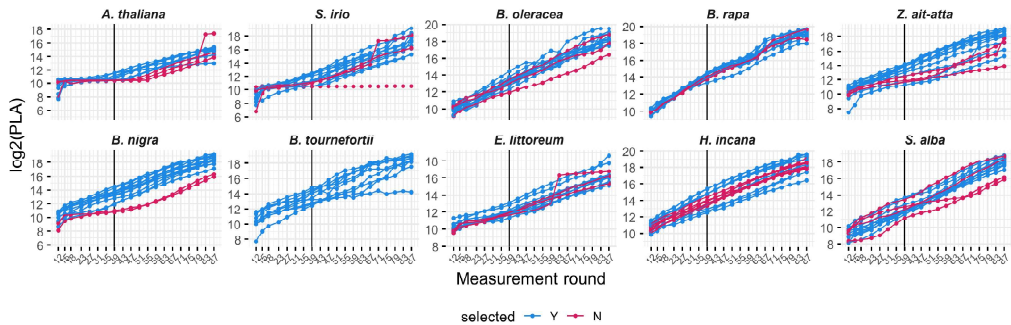


Figure S4: **Projected Leaf Areas (PLAs) of plants, and selection as described for Figure S3.**

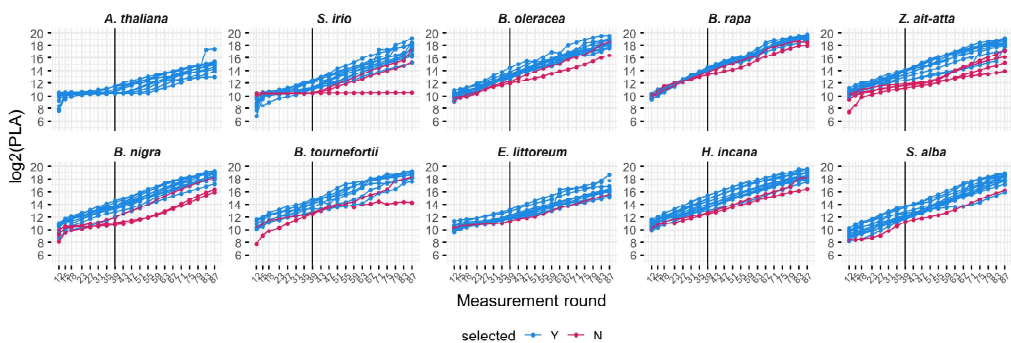


Figure S5: **Selection of plants based on PLAs calculated from F_v/F_m images taken at 26 DAS_s.** Each set of dots, and the line connecting them, represents a single plant's mean area measured during various days (i.e, measurement rounds). The round conducted at 26 DAS_s (round 39) is represented by the solid black line. Blue points and lines identify plants that were selected to be part of downstream analysis.

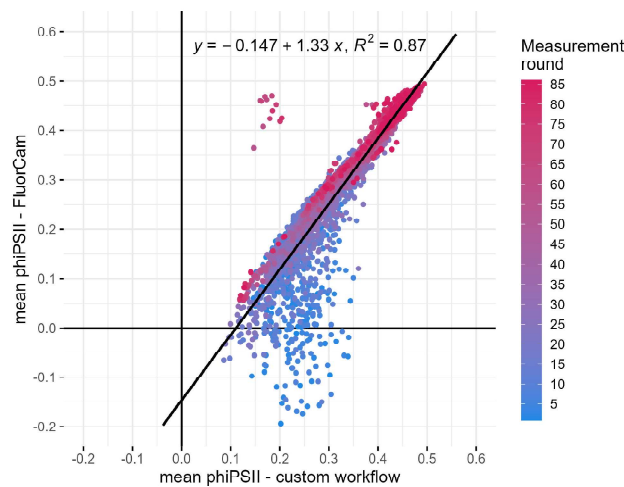


Figure S6: **Correlation between plant-wide ΦPSII measurements obtained after masking with the standard settings for the PSI FluorCam software and masking with our custom workflow.** The color scale is referred to measurement rounds, with lower numbers corresponding to measurements conducted in earlier stages of the experiment.

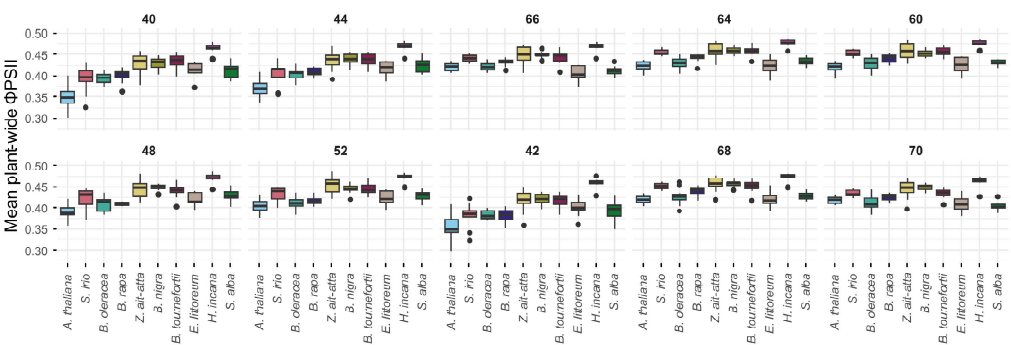


Figure S7: **Per-species boxplots of plant-wide mean ΦPSII values measured during the ten imaging rounds resulting in the highest heritability.** Information on significance of differences is available in Table S4.

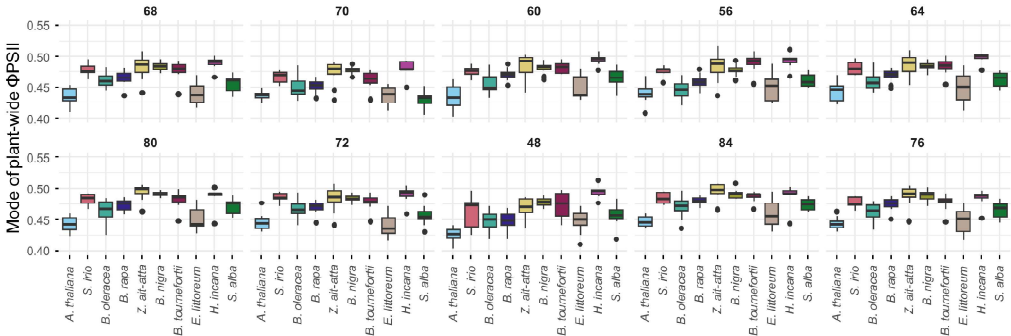


Figure S8: **Per-species boxplots of plant-wide mode Φ PSII values measured during the ten imaging rounds resulting in the highest heritability.**Information on significance of differences is available in Table S4.

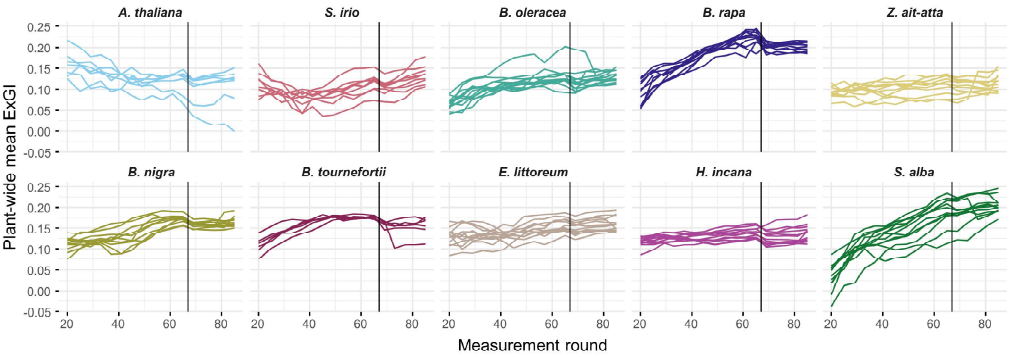


Figure S9: **Time series of plant-wide mean Excess Green Index (ExGI).** Each line represents one plant. Data on the left of the solid vertical line is not affected by the technical issue, while data on the right is.

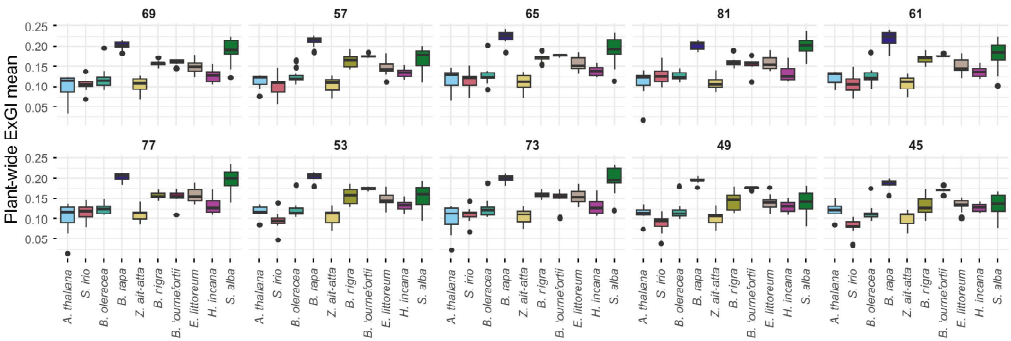


Figure S10: **Per-species boxplots of plant-wide mean Excess Green Index (ExGI) values.** The ten imaging rounds (round number identified by the numbers above plots) resulting in the highest heritability (h^2) are presented. Information on significance of differences is available in Table S10.

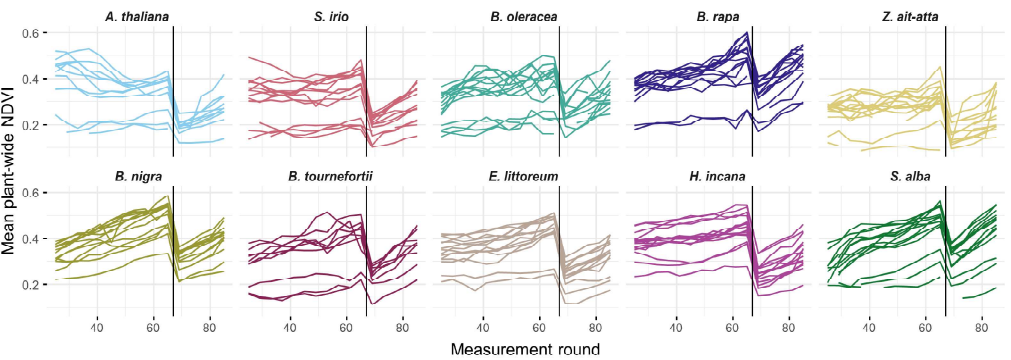


Figure S11: **Time series of plant-wide Normalised Difference Vegetation Index (NDVI).** Each line represents one plant. Data on the left of the solid vertical line is not affected by the technical issue, while data on the right is.

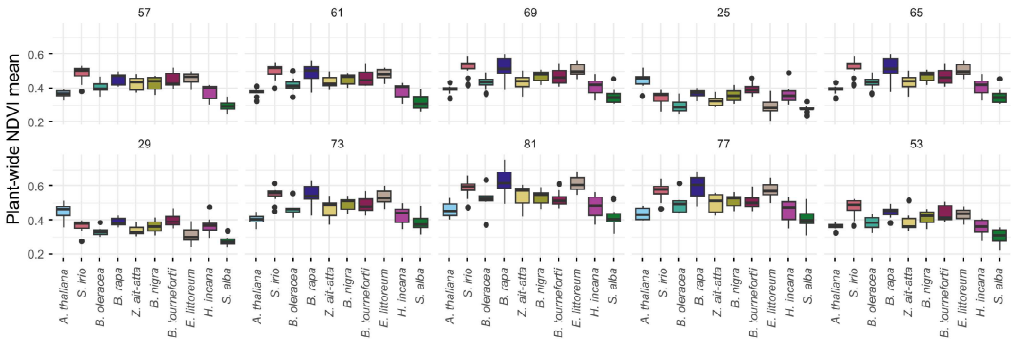


Figure S12: **Per-species boxplots of plant-wide mean Normalized Difference Vegetation Index (NDVI) values.** The ten imaging rounds (round number identified by the numbers above plots) resulting in the highest heritability (h^2) are presented. Information on significance of differences is available in Table S13.

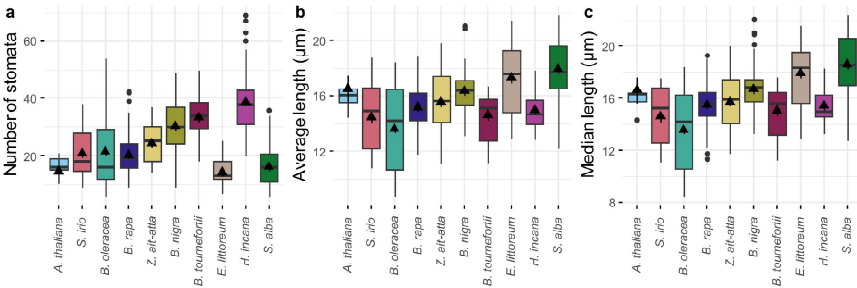


Figure S13: **Per-species boxplots of parameters measured for stomata on the adaxial side of leaves.** (a) The average number of stomata counted per-species, based on counts obtained from all images generated from samples for that species, each measuring 0.09 mm², (b) the average length of the major axis of stomata measured per-species, based on counts obtained from all images generated from samples for that species, (c) and the median length of the major axis of stomata measured per-species, based on counts obtained from all images generated from samples for that species. The “▲” symbols represent Estimated Marginal Means (EMMs) derived from mixed linear models accounting for block design, and their associated error bars represent the standard error of EMMs. A Compact Letter Display of significant differences between EMMs is available in Table S15.

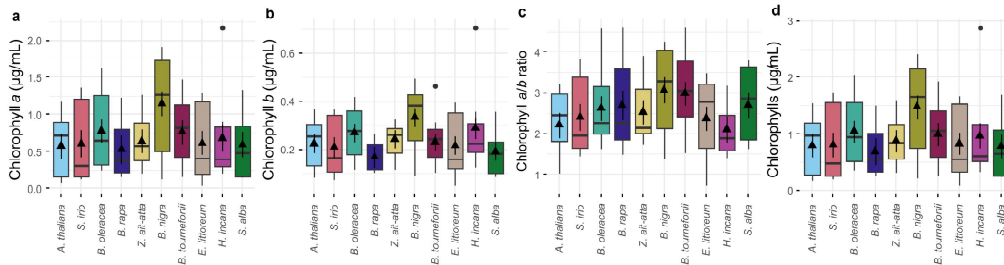


Figure S14: Per-species boxplots of parameters relating to chlorophylls, as measured by spectrophotometry. (a) The per-sample chlorophyll *a* concentration, expressed as μg of chlorophyll per mL of DMF extract; (b) the per-sample chlorophyll *b* concentration (μg chlorophyll/mL DMF extract); (c) the per-sample chlorophyll *a*/chlorophyll *b* ratio, (d) and the per-sample total chlorophyll concentration (μg chlorophyll/mL DMF extract). The “▲” symbols represent Estimated Marginal Means (EMMs) derived from mixed linear models accounting for block design, and their associated error bars represent the standard error of EMMs.

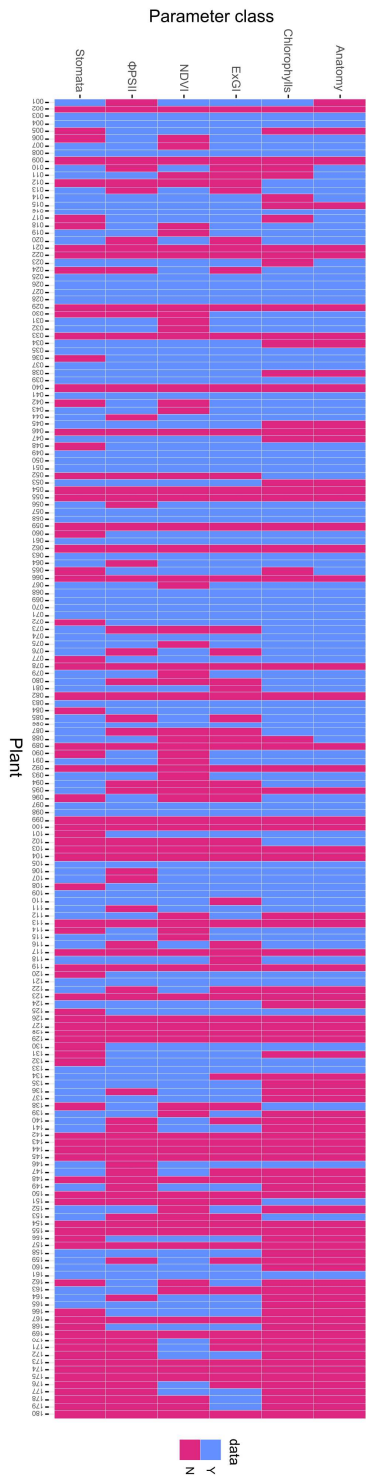


Figure S15: **Heatmap of data availability for each plant sown for the study.** Each row represents all parameters resulting from the same measurement methodology (e.g., all leaf anatomical parameters were derived from the same samples and therefore are presented as a single row). Each column represents one plant sown at the beginning of the experiment.

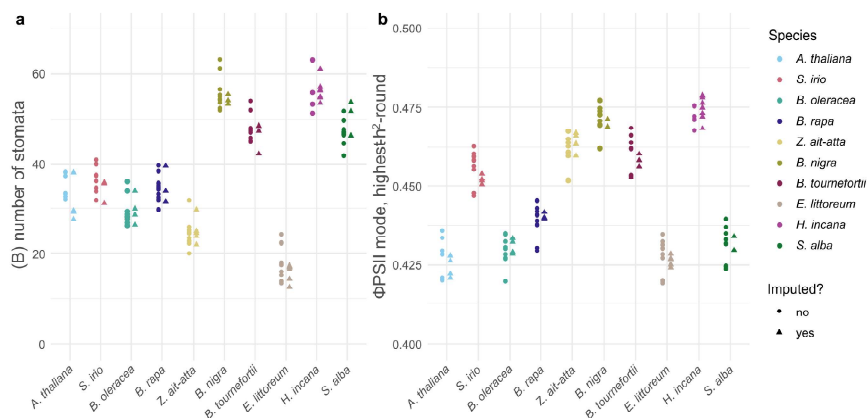


Figure S16: **The effect of Factor Analysis of Mixed Data (FAMD)-based imputation of missing values on two of the twenty-one parameters measured during this work.** Measured values for (a) the number of stomata on the abaxial side of leaves and (b) the mode of Φ PSII from the round resulting in highest heritability are shown as filled circles. Imputed values are shown as triangles.

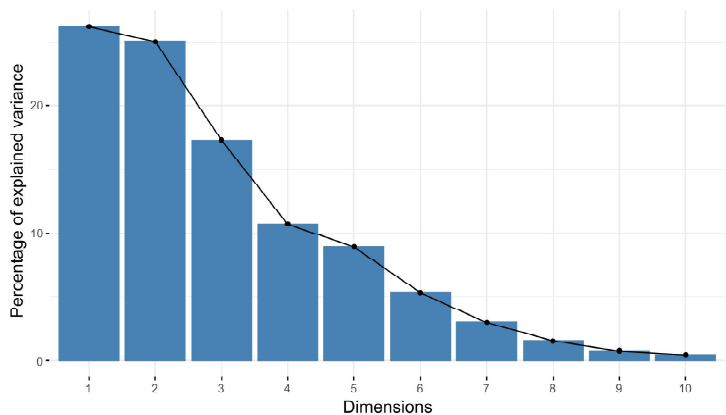


Figure S17: **Scree plot representing the percentage of variance (eigenvalue) explained by each Principal Component of the PCA conducted on the dataset of predicted observations for all parameters of this study.**

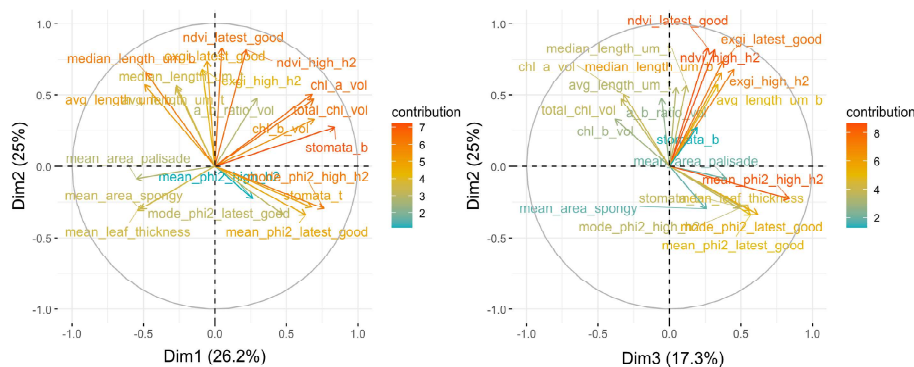


Figure S18: PCA loadings for the various descriptive variables.

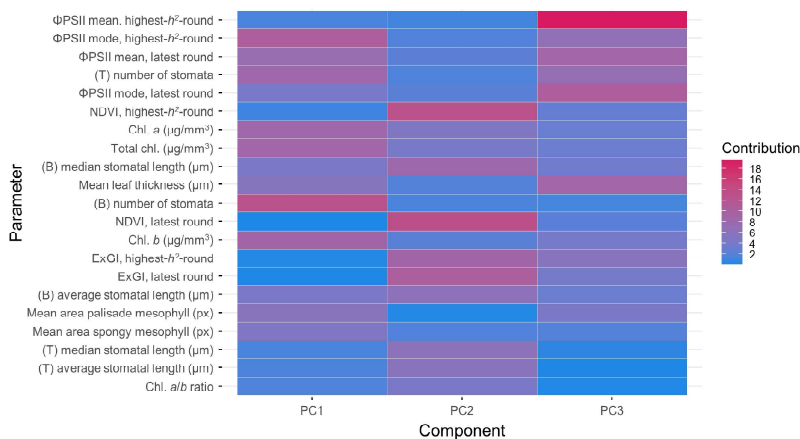


Figure S19: Heatmap of contributions of measured parameters across the first three principal components of the PCA.

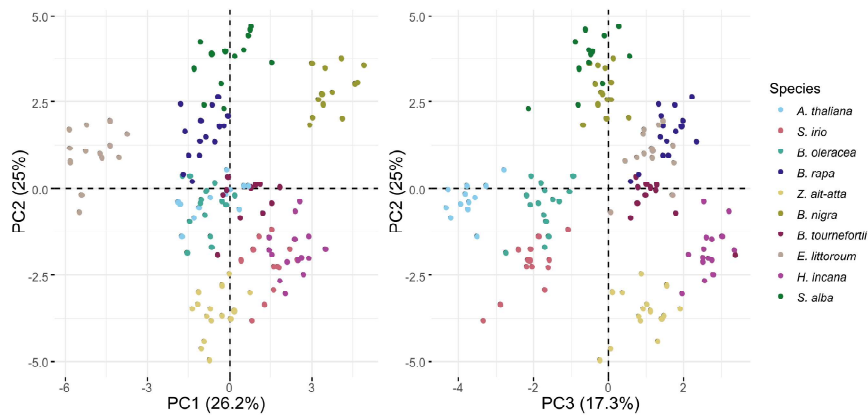


Figure S20: **PCA plots for the first and second component, and the second and third component.** The percentages of variance explained by each principal component are indicated between brackets.

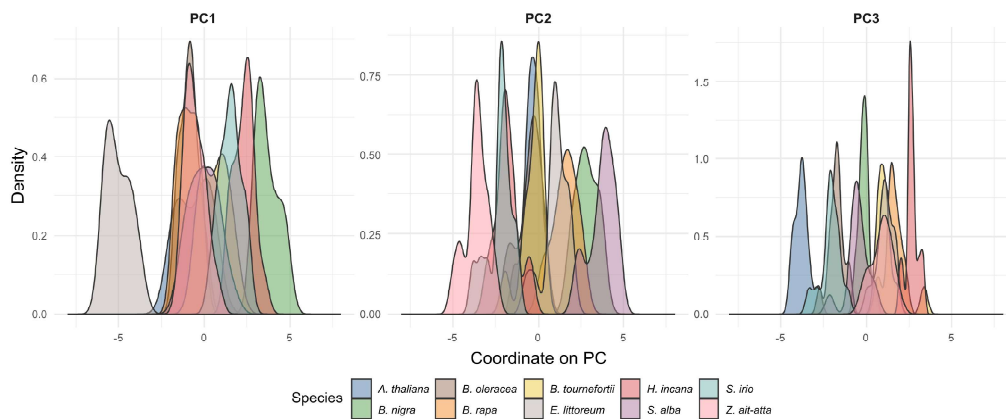


Figure S21: **An alternative representation of PCA results.** Per-species density plots of the coordinates of each individual on each of the first three principal components.

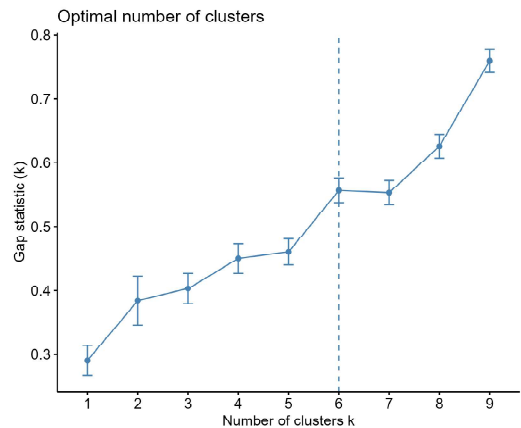


Figure S22: **Determination of optimal number of clusters for k-means clustering of our whole dataset by Gap Statistics.**

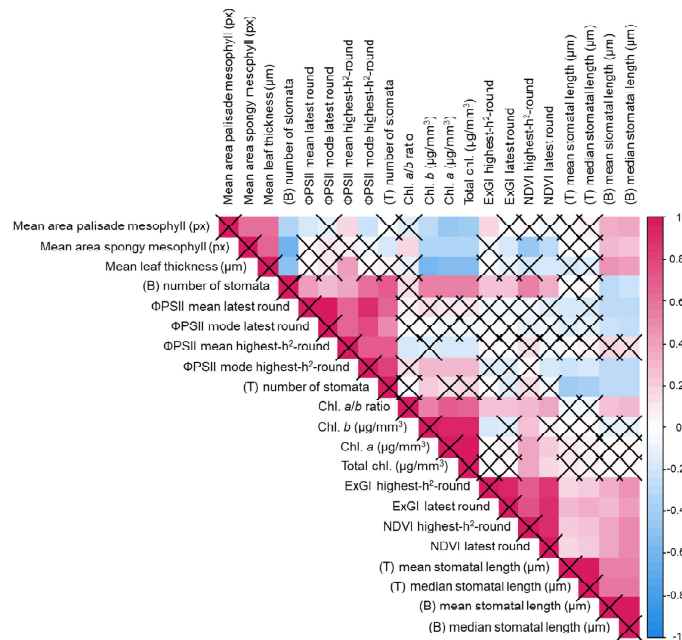


Figure S23: **Results of correlation analysis conducted for the twenty-one measured parameters.** The color scale represents the value of the Pearson correlation coefficient (r). Crossed-out tiles correspond to correlations with $p > 0.05$.

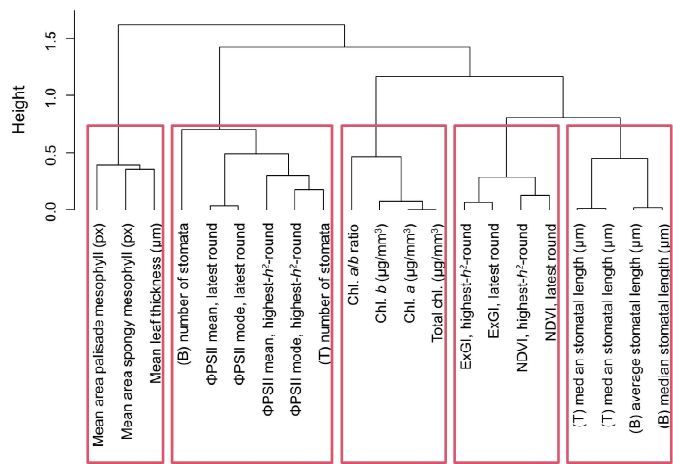


Figure S24: **Results of hierarchical clustering conducted on measured parameters, based on Pearson dissimilarity ($1 - r$).** The boxes represent five clusters in which the dendrogram can be divided into.

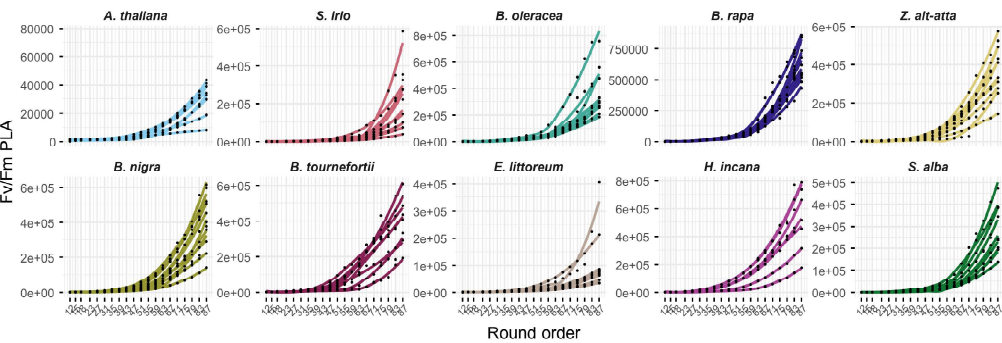


Figure S25: **Projected Leaf Areas (px) of the 95 plants selected for analysis over the course of the experiment.** Per-plant trends in plant areas were modelled with the locally estimated scatterplot smoothing (LOESS) method. Based on these curves, all plants appear to be in their exponential growth phase.

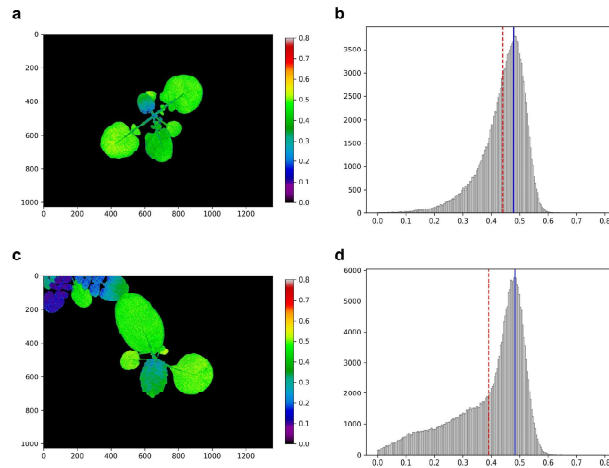


Figure S26: **Examples of the robustness of mode over mean statistics for ΦPSII .** (a) Reconstructed false-color image of a plant with a developing leaf showing lower ΦPSII values and (b) the impact of this on mean (red dashed line) ΦPSII ; as shown by the histogram of per-pixel ΦPSII values, the mean deviates substantially from the mode. (c) and (d) present a similar situation, in this case due to the overlap of leaves from a plant showing much lower ΦPSII values; even in this situation, the ΦPSII mode is a good representation of overall plant performance.

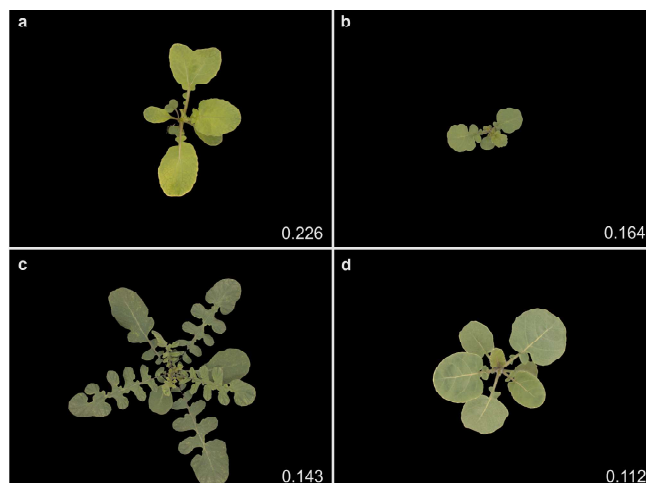


Figure S27: **Examples of RGB images taken on plants from different species during the same imaging round, complete with the per-species estimated marginal mean (EMM) for the Excess Green Index (ExGI).** (a) *B. rapa*, (b) *E. littoreum*, (c) *H. incana*, (d) *Z. ait-atta*.