**Data accessibility**

All raw and processes data used in the publication, as well as analysis code are available in GitHub repository https://github.com/protonzilla/Hoh-et-ql-2022.

**Descriptions of data files in the repository:**

*Parents\_3conditions.csv*. CSV file containing molar percentage (mol%) of lipid compositions of two parent lines under three conditions. Data used in Figure 1, and Figures S2-S6.

Histogram\_with stats.ipynb: Jupyter Python for histogram of lipid compositions (Figure 2 A-D, Figure S7-S8).

Scatter plots.ipynb: Jupyter Notebook for scatter plots of lipid compositions and photosynthesis data (Figure 2 E-H).

Scatter plots\_genotype.ipynb: Jupyter Notebook for scatter plots of photosynthesis data grouped by different combinations of alleles (Figure 6).

Note: The input files for the above three notebooks is “Lipid\_fatty\_acids\_geno\_chr4\_9\_PS.csv” which includes lipid compositions, photosynthesis data and selected genetic information.

Quantitative trait loci (QTL) files (Figure 3-4, 8 and Figure S9-S10)

* LOD\_thresholds\_lipid\_classes.csv
* LOD\_threshold\_fattyacids.csvThreshold (levels of significance) determined by the number of permutations set at 1000 and a nominal significance cutoff of p < 0.05 over all replicates
* LOD\_longform\_fatty\_acids.csv
* LOD\_longform\_lipid\_classes.csv
* LOD files for lipid classes and fatty acids
* LOD\_longform\_lipid\_classes\_significant\_QTL.csv
* LOD\_longform\_fatty\_acids\_significant\_QTL.csv
* LOD files of QTL intervals (only above the threshold) for lipid classes and fatty acids
* Normalized\_LOD\_all\_fattyacids.csv
* Normalized\_LOD\_all\_lipidclasses.csv
* Normalized LOD for lipid classes and fatty acids. LOD was divided by its threshold, indicating that above one is QTL intervals.

R Notebooks

* effect\_plot\_FS.Rmd
* Box\_plot.Rmd

R notebook for effect plots and box plots (Figure 5)

Note: The input file for the above two notebooks is “LT\_PG16\_1t\_replicates\_geno\_rdr.csv” which includes PG 16:1t compositions and marker information.

*DEPI\_photosynthesis\_FAD4\_mutants.xlsx:* Excel spreadsheet containing photosynthetic responses data for FAD4 mutants set (Figure 7).