

Genetic Basis of Non-Photochemical Quenching and Photosystem II Efficiency Responses to Chilling in the Biomass Crop Miscanthus

Background/Objective

Miscanthus holds a promise as a biocrop due to its high yield, perenniality and ability to grow on infertile soils. This study was conducted to (1) quantify variation in response of photosynthesis-related traits to chilling in a *M. sacchariflorus* diversity panel consisting of 209 accessions in six genetic groups that had previously revealed great variation in biomass yield and yield component traits, (2) elucidate the physiological mechanisms of chilling-tolerant photosynthesis in this species, and (3) identify genomic regions and candidate genes that confer chilling-tolerant physiology.

Approach

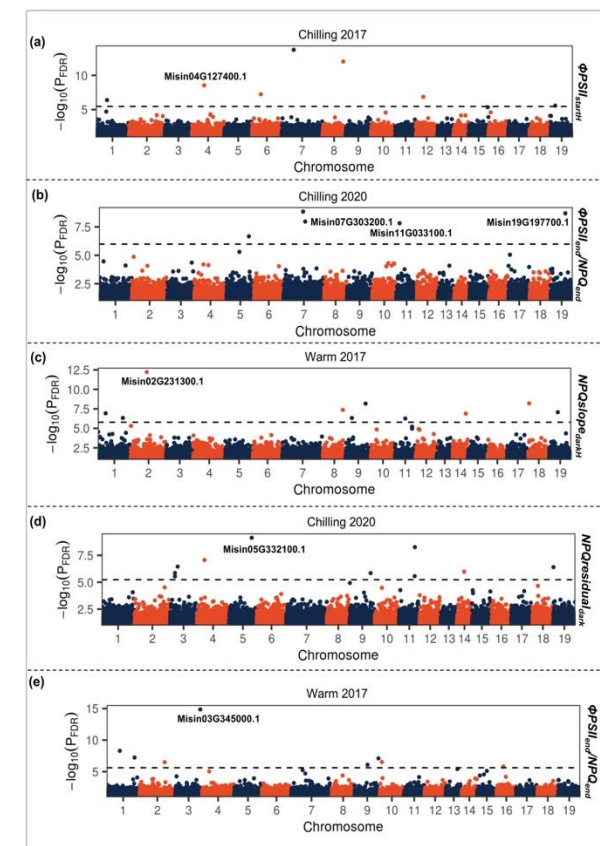
Using a semi-high-throughput method, we phenotyped 209 *M. sacchariflorus* genotypes belonging to six genetic groups for non-photochemical quenching (NPQ) and photosystem II efficiency (Φ PSII) kinetics under warm and chilling treatments in three growing seasons.

Results

Notably, our results indicated that after chilling treatment, all *M. sacchariflorus* genetic groups increased the NPQ induction rate. Under chilling, the Korea/NE China/Russia 2x and N China 2x groups stood out for the highest NPQ rate in light and the highest steady-state NPQ in light.

Significance/Impacts

We demonstrated that semi-high-throughput imaging of leaf disc fluorescence in 96-well plates can be successfully deployed to screen a germplasm panel for NPQ and Φ PSII under chilling treatment. Enhanced chilling adaptation could expand the growing season and thus productivity or enlarge the range of growing locations.



Results of genome-wide association studies (GWAS) highlighting seven promising candidate genes near SNPs that had highly significant associations ($p < 0.01$) with photosynthesis traits

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