Investigating the molecular mechanism of photoprotection, qH, in *Arabidopsis thaliana*

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Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av teknologi doktorsexamen framläggs till offentligt förvar i Lilla hörsalen, KBC huset 08 december 2023, kl. 09:00. Avhandlingen kommer att förvaras på engelska.

Fakultetsopponent:

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Photoprotection mechanisms in plants play a crucial role in maintaining photosystem integrity and preventing photooxidative damage. In this study, we aimed to identify new molecular players involved in the qH process, a sustained photoprotective mechanism. We performed a forward genetic screen to select mutants with altered phenotype related to non-photochemical quenching (NPQ) and photosynthetic parameters. The mutants were classified into three main classes based on their NPQ phenotype, further subcategorized by photosynthetic parameters and chlorophyll content. Whole genome sequencing and mapping-by-sequencing approaches were employed to identify putative causative genes for the observed phenotypes. Potential causative mutations were retrieved by direct allelic comparison, gene ontology analysis, or mapping-by-sequencing. Sanger sequencing was utilized to validate the identified mutations and immunoblot analysis to confirm the protein accumulation disruptions in the mutants.

We found in the genetic screen multiple putative genes altering qH. We investigated the role in qH of two of them, low photosystem II accumulation 1 (LPA1) and photosynthesis affected mutant 68 (PAM68). Mutants lacking LPA1 or PAM68 exhibit lower NPQ compared to the parental line soq1 npq4. We show that photosystem II (PSII) integrity is important for qH to occur. We also used a reverse genetic screen to decrypt the involvement of the different PSII antennae in qH. We demonstrated that qH can occur in the trimeric antennae, independent of a specific major antenna. Surprisingly, mutants with decreased or without major antennae accumulation still exhibited active qH to a high level. We found that qH can occur in the minor antennae in these mutants. However, qH is decreased in the soq1 lhcb6 mutant. Our findings provide novel insights into the molecular players and mechanism underlying photoprotective qH.