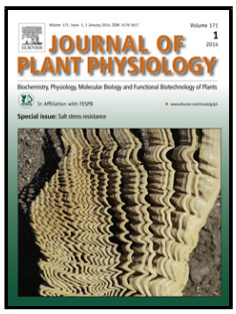

Title: Mg-dechelation of chlorophyll *a* by Stay-Green activates chlorophyll *b* degradation through expressing Non-Yellow Coloring 1 in *Arabidopsis thaliana*

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Title Page

Title: Mg-dechelation of chlorophyll a by Stay-Green activates chlorophyll b degradation through expressing Non-Yellow Coloring 1 in Arabidopsis thaliana

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Abstract

The first step in chlorophyll *a* degradation is the extraction of the central Mg. This reaction is catalyzed by Mg-dechelatase encoded by *Stay-Green* (*SGR*) in land plants. SGR extracts Mg from chlorophyll *a* but not from chlorophyll *b*, and chlorophyll *b* must be converted to chlorophyll *a* before degradation. The first reaction of the chlorophyll *b* to chlorophyll *a* conversion is catalyzed by chlorophyll *b* reductase. Non-Yellow Coloring 1 (NYC1) and NYC1 like (NOL) are isozymes of chlorophyll *b* reductase. When *SGR* was transiently overexpressed in *Arabidopsis*, both chlorophyll *a* and *b* were degraded, suggesting that the chlorophyll *b* to chlorophyll *a* conversion is activated by *SGR* overexpression. To examine the involvement of chlorophyll *b* reductases in SGR-induced chlorophyll *b* degradation, *SGR* was transiently overexpressed in *nyc1*, *nol*, and *nyc1 nol* double mutants by dexamethasone treatment. It was found that in the wild type and *nol* mutant, chlorophyll *a* and *b* were degraded and all the chlorophyll-binding proteins decreased. Meanwhile, in *nyc1* and *nyc1 nol* mutants, chlorophyll *b* degradation was suppressed and the light-harvesting complex of photosystem II remained. The mRNA and protein levels of NYC1 increased after *SGR* overexpression in wild type plants. These results suggest that Mg-dechelation of chlorophyll *a* by SGR activates chlorophyll *b* degradation by inducing the expression of *NYC1*. This is an effective regulation of a metabolic pathway.

Keywords: stay green, chlorophyll degradation, Arabidopsis thaliana