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Regulation of Leaf Yellowing during Senescence in Higher Plants

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In higher plants, leaf yellowing during senescence results from chlorophyll (Chl) degradation in chloroplasts. However, little is known about how Chl degradation is tightly regulated in the constitutive presence of its catabolic enzymes in chloroplasts and vacuoles throughout plant development. Using the *stay green* (*sgr*) mutant in rice (*Oryza sativa*) that maintains leaf greenness during senescence, we identified *OsSGR* gene by map-based approach. *OsSGR* is a senescence-inducible gene encoding a novel chloroplast stroma protein. Transgenic rice plants overexpressing *OsSGR* produced yellowish-brown leaves, while transgenic *Arabidopsis* plants silencing *AtSGR1* and *AtSGR2* stayed green during leaf senescence, indicating that Chl degradation is regulated by the expression level of *SGR*. Leaf stay-greenness of the *sgr* mutant is caused by a failure to destabilize light-harvesting Chl-binding protein (LHCP) complexes in the thylakoid membranes during senescence. SGR interacts with chloroplast chlorophyllase (CpChlase), LHCPI, and LHCPII, suggesting the formation of the CpChlase-SGR-LHCP complexes in the stromal side of thylakoid membranes for Chl degradation. Thus, we propose that LHCPs lose their Chl-binding activity by the complex formation during senescence, which triggers the degradation of free Chls and empty LHCPs by preexisting Chlases and chloroplast proteases, respectively.

The purpose of this research was :

1. Cloning of *STAY GREEN* (*SGR*) gene in rice by map-based cloning.
2. Funtional analyses of SGR prtoein by several molecular biological methods and transgenic plants.
3. SGR mode of action for chlorophyll degradation during senescence in higher plants.