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Involvement of the light-harvesting complex in cation regulation of excitation energy distribution in chloroplasts â˜† â˜†â˜†

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Abstract

A highly purified light-harvesting pigment-protein complex (LHC) was obtained by fractionation of cation-depleted chloroplast membranes using the nonionic detergent, Triton X-100. The isolated LHC had a chlorophyll ab ratio of 1.2 and exhibited no photochemical activity. SDS-polyacrylamide gel electrophoresis of the LHC revealed three polypeptides in the molecular weight classes of 23, 25, and 30 Ã— 10^3. Antibodies were prepared against the LHC and their specificity was established. The effect of the Î±-LHC (antibodies to LHC) on salt-mediated changes in PS I and PS II photochemistry, Chl Î± fluorescence inductions, and 77 Â°K fluorescence emission spectra was investigated. The results show that: (i) The Mg^{2+}-induced 20% decrease in photosystem I (PS I) quantum yield observed in control chloroplasts was blocked by the ... Mg^{2+}-induced 70% increase in photosystem II

(PS II) quantum yield of control chloroplasts was reduced 35% for plastids in the presence of Î±-LHC antibody, (iii) The Mg^{2+}-induced increase in room-temperature variable fluorescence was reduced 60% by Î±-LHC antibody, (iv) The Mg^{2+}-induced increase in the F685F730 emission peak ratio at 77 Â°K was inhibited 50% in the presence of Î±-LHC antibody. These results provide direct evidence for the involvement of the light-harvesting complex in cation regulation of energy redistribution between the photosystems. The fact that the Î±-LHC antibody does not fully block Mg^{2+}-induced PS II increases or chlorophyll fluorescence increases supports the concept that Mg^{2+} has two mechanisms of action: one effect on energy distribution and a second direct effect on photosystem II centers.

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