PB I -1 DEVELOPMENT OF BATHOCHROMIC PHYTOCHROMES FOR SHADE TOLERANCE IN PLANTS

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Phytochromes are red/far-red photoreceptors that mediate a variety of photomorphogenic processes in plants. Phytochromes are dimeric chromopeptides with two spectral photoisomers, the red-light absorbing Pr and far-red light absorbing Pfr forms. In nature, phytochromes recognize the ratio of red and far-red light (R: FR ratio) from incoming light, which changes the photoequilibrium of the Pr and Pfr forms to induce light responses including shade avoidance. Shade avoidance reactions in plants are comprised of multiple phenotypic changes including stem elongation, internodes growth, retardation of leaf growth, and floral induction resulting from the low R:FR ratio. Since the shade avoidance reactions induce a rapid and dramatic increase in the extension growth of stems and petioles at the expense of leaf growth, storage organ production, and reproductive development, it causes significant losses of crop yields. In the present study, we have developed bathochromic phytochromes in which Pr absorption spectra have been shifted to longer wavelength (i.e. bathochromism or red-shift), and studied the relationship between the photochemical characteristics and the biological functions of phytochromes by using transgenic *Arabidopsis* seedlings and plants. Our results showed that the biological functions of phytochromes are directly related to its photochemical properties and the more red-shifted a phyA mutant, the greater the shade tolerance it confers. Therefore, the bathochromic mutants confer shade tolerance to plants and its shade tolerance is dependent on the magnitude of the shift to longer wavelength in the Pr absorption spectrum.

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