LIGHT SPECIFIC UBIQUITINATION AND DEGRADATION OF PHYTOCHROME A

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Introduction

Phytochromes are a well-characterized family of plant photoreceptors that regulate many aspects of plant growth and development. Phytochromes are dimeric proteins with each approximately 120 kDa subunit contains a linear tetrapyrrole chromophore covalently bound to a conserved internal cysteine via a thioether linkage (Furuya, 1993; Quail et al., 1995). The photomorphogenic responses are initiated by switching phytochromes between two photointerconvertible forms, a red light absorbing Pr(max = 660 nm) form and a far-red light absorbing Pfr (max = 730 nm) form. Phytochromes subunit are known to have two structural sub-domains, a globular amino terminal chromophore binding domain (~ 65 kDa) and a structurally extended carboxy terminal domain (~60 kDa), which are connected by a flexible and protease sensitive hinge region (Quail, 1997 ; Wagner et al., 1996 ; Lapko et al., 1998). Each domain has its unique functions. The N-terminal domain of phytochromes carries the light sensory motifs required for light signal transduction and perceive light signals of red/far-red wavelength quality, intensity, duration and direction (Wagner et al., 1996). The C-terminal domain contains the dimerization sites and regulatory sites for down stream light signal transduction (Quail et al., 1995). Plants regulate their growth and developmental responses to exploit available light conditions through a complex interplay of phytochrome isoforms. Proper function of phytochromes requires interactions of the biologically active Pfr forms with their associated sensory transduction chains and mechanisms that establish an appropriate level of each phytochrome as well (Smith, 1995; Clough and Vierstra, 1997). Of the five isoforms (phytochrome A through E), the phytochrome A is the most abundant in the dark as a Pr form. However, phytochrome A rapidly degraded when it is converted into Pfr form by light treatment (Clough and Vierstra, 1997). In contrast, phytochromes B through E are expressed at low levels regardless of light conditions and stable in both Pr and Pfr forms. Therefore phytochromes are divided into light-labile and light-stable. About 99% of expressed phytochromes pools in etiolated seedlings are