Biological Activity of Constitutively Active YX Alleles of Phytochrome in Plants

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ABSTRACT

Light-Independent Phytochrome Signaling

FULL DESCRIPTION

Plants possess numerous photoreceptor systems that perceive changes in light quality, light intensity, light direction and light duration (daylength) initiating molecular signal cascades that affect many physiological processes (*e.g.*, seed germination, internode and petiole elongation, timing of flowering, and senescence) that are collectively known as photomorphogenesis. Phytochromes are biliprotein photosensors that particularly distinguish between red-depleted shade light and red-enriched full sunlight, triggering an agronomically wasteful response known as the "shade avoidance syndrome". Shade avoidance responses not only decrease crop yield, due to early flowering and enhanced growth at the expense of grain/seed/fruit production, but also contribute to decreased seed germination, lodging and enhanced susceptibility to pathogens.

University of California, Davis, researchers have identified novel YX gain-of-function phytochrome mutants that confer "light-independent" constitutive activation. Plants expressing these phytochrome mutants lack shade avoidance responses and develop "as if they are grown in full sunlight", regardless of the ambient light quality.

APPLICATIONS

- Expression of these dominant gain-of-function "YX" phytochrome mutants in transgenic plants provides an effective means to alter photomorphogenesis, enabling genetic engineering of new varieties of crop plant species with desired light responsiveness

FEATURES/BENEFITS

Expressing the "YX" phytochromes in any transformable plant species provides an effective means to:

- Regulate photomorphogenesis by
- reducing yield losses due to shade avoidance responses;
- enhancing seed germination in low light and/or shade environments;
- modifying the timing of flowering; and
- tissue-specific expression.
- Propagate plant germplasm in total darkness for
- generation of dark-grown chlorophyll-deficient plant materials with novel nutritional, horticultural and/or agronomic properties; and
- expression of recombinant proteins in chlorophyll-deficient plant materials.
- Function as a selectible marker and/or fluorescent reporter for plant genetic transformation; and
- Function as a bilin-, porphyrin- or other tetrapyrrole ligand-regulated genetic reporter in plants.

RELATED MATERIALS

- Su YS and Lagarias JC. 2007. Light-Independent Phytochrome Signaling Mediated by Dominant GAF Domain Tyrosine Mutants of Arabidopsis Phytochromes in Transgenic Plants. Plant Cell. 19(7):2124-39.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,506,080	11/29/2016	2006-571

INVENTORS

- Lagarias, J Clark
- Su, Yi-Shin

OTHER INFORMATION

KEYWORDS

Phytochrome, photomorphogenesis, protein expression, gene expression reporter, light independent growth

CATEGORIZED AS

- **Agriculture & Animal Science**
  - Plant Traits
  - Plant Varieties
  - Transgenics
- **Biotechnology**
  - Other
- **Materials & Chemicals**
  - Biological

RELATED CASES

2006-571-0, 2001-274-0, 2004-550-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Constitutively Active Phytochrome A Alleles that Accelerate Flowering of Long-Day Plants Under Non-Inductive Photoperiods

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