GEPHE SUMMARY

Gephebase Gene

phytochrome A (PHYA) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^phytochrome A (PHYA)^#gephebase-summary-title)

Entry Status

Published

GepheID

GP00002104

Main curator

Courtier

PHENOTYPIC CHANGE

Trait #1

Trait Category

Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title)

Trait

Light sensitivity (https://www.gephebase.org/search-criteria?/and+Trait=^Light sensitivity^#gephebase-summary-title)

Trait State in Taxon A

photoperiod sensitive

Trait State in Taxon B

photoperiod insensitive

Trait #2

Trait Category

Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title)

Trait

High-altitude adaptation (https://www.gephebase.org/search-criteria?/and+Trait=^High-altitude adaptation^#gephebase-summary-title)

Trait State in Taxon A

-

Trait State in Taxon B

adapted to high altitude

Ancestral State

Taxon A

Taxonomic Status

Domesticated (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Domesticated^#gephebase-summary-title)

Taxon A

Latin Name

Glycine max (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Glycine max^#gephebase-summary-title)

Common Name

soybean

Synonyms

soybean; soybeans; Glycine max (L.) Merr.; Glycine max; cv. Wye

Rank

species

Lineage

cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; rosids; fabids; Fabales; Fabaceae; Papilionoideae; 50 kb inversion clade; NPAAA clade; indigoferoid/millettioid clade; Phaseoleae; Glycine; Soja

Parent

Soja () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 1462606)

NCBI Taxonomy ID

3847 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 3847)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

Glycine max (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Glycine max^#gephebase-summary-title)

Common Name

soybean

Synonyms

soybean; soybeans; Glycine max (L.) Merr.; Glycine max; cv. Wye

Rank

species

Lineage

cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; rosids; fabids; Fabales; Fabaceae; Papilionoideae; 50 kb inversion clade; NPAAA clade; indigoferoid/millettioid clade; Phaseoleae; Glycine; Soja

Parent

Soja () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 1462606)

NCBI Taxonomy ID

3847 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 3847)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name	UniProtKB Arabidopsis thaliana
PHYA	P14712 (http://www.uniprot.org/uniprot/P14712)
Synonyms	GenebankID or UniProtKB
ELONGATED HYPOCOTYL 8; F14J9.23; F14J9_23; FAR RED ELONGATED 1; FAR RED ELONGATED HYPOCOTYL 2; FHY2; FRE1; HY8; phytochrome A; At1g09570	()
String	
3702.AT1G09570.1 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 3702.AT1G09570.1)	
Sequence Similarities	
Belongs to the phytochrome family.	
GO - Molecular Function	
GO:0042802 : identical protein binding (https://www.ebi.ac.uk/QuickGO/term/GO:0042802) GO:0042803 : protein homodimerization activity (https://www.ebi.ac.uk/QuickGO/term/GO:0042803) GO:0003729 : mRNA binding (https://www.ebi.ac.uk/QuickGO/term/GO:0003729) GO:0004672 : protein kinase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004672) GO:0000155 : phosphorelay sensor kinase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0000155) GO:0031516 : far-red light photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0031516) GO:0009883 : red or far-red light photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0009883)	
GO - Biological Process	
GO:0009640 : photomorphogenesis (https://www.ebi.ac.uk/QuickGO/term/GO:0009640) GO:0006355 : regulation of transcription, DNA-templated (https://www.ebi.ac.uk/QuickGO/term/GO:0006355) GO:0009638 : phototropism (https://www.ebi.ac.uk/QuickGO/term/GO:0009638) GO:0018298 : protein-chromophore linkage (https://www.ebi.ac.uk/QuickGO/term/GO:0018298) GO:0017148 : negative regulation of translation (https://www.ebi.ac.uk/QuickGO/term/GO:0017148) GO:0010218 : response to far red light (https://www.ebi.ac.uk/QuickGO/term/GO:0010218) GO:0009584 : detection of visible light (https://www.ebi.ac.uk/QuickGO/term/GO:0009584) GO:0009630 : gravitropism (https://www.ebi.ac.uk/QuickGO/term/GO:0009630) GO:0017006 : protein-tetrapyrrole linkage (https://www.ebi.ac.uk/QuickGO/term/GO:0017006) GO:0010161 : red light signaling pathway (https://www.ebi.ac.uk/QuickGO/term/GO:0010161) GO:0046685 : response to arsenic-containing substance (https://www.ebi.ac.uk/QuickGO/term/GO:0046685) GO:0010201 : response to continuous far red light stimulus by the high-irradiance response system (https://www.ebi.ac.uk/QuickGO/term/GO:0010201) GO:0010203 : response to very low fluence red light stimulus (https://www.ebi.ac.uk/QuickGO/term/GO:0010203)	
GO - Cellular Component	
GO:0005737 : cytoplasm (https://www.ebi.ac.uk/QuickGO/term/GO:0005737) GO:0005634 : nucleus (https://www.ebi.ac.uk/QuickGO/term/GO:0005634) GO:0016604 : nuclear body (https://www.ebi.ac.uk/QuickGO/term/GO:0016604) GO:0016607 : nuclear speck (https://www.ebi.ac.uk/QuickGO/term/GO:0016607)	

Presumptive Null

Yes (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Yes^#gephebase-summary-title)

Molecular Type

Coding (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title)

Aberration Type

Insertion (https://www.gephebase.org/search-criteria?/and+Aberration Type=^Insertion^#gephebase-summary-title)

Insertion Size

1-10 kb

Molecular Details of the Mutation

insertion of a retrotransposon in exon 1 - The transposable element is SORE-1 = a novel Ty1/copia-like retrotransposon in soybean

Experimental Evidence

Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title)

Main Reference

Genetic redundancy in soybean photoresponses associated with duplication of the phytochrome A gene. (2008) (https://pubmed.ncbi.nlm.nih.gov/18780733)

Authors

Liu B; Kanazawa A; Matsumura H; Takahashi R; Harada K; Abe J

Abstract

Gene and genome duplications underlie the origins of evolutionary novelty in plants. Soybean, Glycine max, is considered to be a paleopolyploid species with a complex genome. We found multiple homologs of the phytochrome A gene (phyA) in the soybean genome and determined the DNA sequences of two paralogs designated GmphyA1 and GmphyA2. Analysis of the GmphyA2 gene from the lines carrying a recessive allele at a photoperiod insensitivity locus, E4, revealed that a Ty1/copia-like retrotransposon was inserted in exon 1 of the gene, which resulted in dysfunction of the gene. Mapping studies suggested that GmphyA2 is encoded by E4. The GmphyA1 gene was mapped to a region of linkage group O, which is homeologous to the region harboring E4 in linkage group I. Plants homozygous for the e4 allele were etiolated under continuous far red light, but the de-etiolation occurred partially, indicating that the mutation alone did not cause a complete loss of phyA function. The genetic redundancy suggests that the presence of duplicated copies of phyA genes accounts for the generation of photoperiod insensitivity, while protecting against the deleterious effects of mutation. Thus, this phenomenon provides a link between gene duplication and establishment of an adaptive

response of plants to environments.

Additional References

Adaptive evolution involving gene duplication and insertion of a novel Ty1/copia-like retrotransposon in soybean. (2009) (https://pubmed.ncbi.nlm.nih.gov/19629571)

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

@TE - There are two phyA genes in soybean so that this mutation alone does not cause a complete loss of phyA function. GmphyA2 that harbors the SORE-1 insertion was detected only in cultivated soybean lines grown in northern regions of Japan. This consistent with the notion that photoperiod insensitivity caused by the dysfunction of GmphyA2 is one of genetic changes that allowed soybean cultivation at high latitudes.