GEPHE SUMMARY

Gephebase Gene

Early flowering1 (EL1) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Early flowering1 (EL1)^#gephebase-summary-title)

GepheID

GP00001636

Entry Status

Published

Main curator

Prigent

PHENOTYPIC CHANGE

Trait Category

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

Trait

Flowering time (heading date) (https://www.gephebase.org/search-criteria?/and+Trait=^Flowering time (heading date)^#gephebase-summary-title)

Trait State in Taxon A

Middle-late-flowering Tongil-type (japonica/indica hybrid) rice Milyang23 (116 days)

Trait State in Taxon B

Early heading japonica rice H143 (78 days) and H75 (Hokkaido; Japan)

Ancestral State

Taxon A

Taxonomic Status

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

Taxon A

Latin Name

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

Common Name

rice

Synonyms

rice; red rice; Oryza sativa L.

Rank

species

Lineage

cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; Liliopsida; Petrosaviidae; commelinids; Poales; Poaceae; BOP clade; Oryzoideae; Oryzeae; Oryzinae; Oryza

Parent

Oryza () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4527)

NCBI Taxonomy ID

4530 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4530)

is Taxon A an Infraspecies?

Yes

Taxon A Description

Middle-late-flowering Tongil-type (japonica/indica hybrid) rice Milyang23 (116 days)

Taxon B

Latin Name

Oryza sativa Japonica Group (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Oryza sativa Japonica Group^#gephebase-summary-title)

Common Name

Japanese rice

Synonyms

Oryza sativa (japonica cultivar-group); Oryza sativa subsp. japonica; Japanese rice; Japonica rice; Oryza sativa (japonica culticar-group); Oryza sativa japonica; Oryza sativa ssp. japonica

Rank

no rank

Lineage

cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; Liliopsida; Petrosaviidae; commelinids; Poales; Poaceae; BOP clade; Oryzoideae; Oryzeae; Oryzinae; Oryza; Oryza sativa

Parent

Oryza sativa (rice) - (Rank: species) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4530)

NCBI Taxonomy ID

39947 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 39947)

is Taxon B an Infraspecies?

Yes

Taxon B Description

Early heading japonica rice H143 (78 days) and H75 (Hokkaido; Japan)

GENOTYPIC CHANGE

Generic Gene Name

HD16

Synonyms

CKI; EL1; Hd16; OsJ_12923; Os03g0793500; LOC_Os03g57940; OSJNBb0060J21.12

String

39947.LOC_Os03g57940.1 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=39947.LOC_Os03g57940.1)

Sequence Similarities

Belongs to the protein kinase superfamily. CK1 Ser/Thr protein kinase family. Casein kinase I subfamily.

GO - Molecular Function

GO:0005524 : ATP binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005524)
GO:0004674 : protein serine/threonine kinase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004674)

UniProtKB Oryza sativa subsp. japonica

Q852L0 (http://www.uniprot.org/uniprot/Q852L0)

GenebankID or UniProtKB

()

GO - Biological Process

GO:0009908 : flower development (https://www.ebi.ac.uk/QuickGO/term/GO:0009908)
GO:0009740 : gibberellic acid mediated signaling pathway (https://www.ebi.ac.uk/QuickGO/term/GO:0009740)
GO:0018105 : peptidyl-serine phosphorylation (https://www.ebi.ac.uk/QuickGO/term/GO:0018105)
GO:0006897 : endocytosis (https://www.ebi.ac.uk/QuickGO/term/GO:0006897)
GO:0048586 : regulation of long-day photoperiodism, flowering (https://www.ebi.ac.uk/QuickGO/term/GO:0048586)
GO:0040008 : regulation of growth (https://www.ebi.ac.uk/QuickGO/term/GO:0040008)
GO:0010476 : gibberellin mediated signaling pathway (https://www.ebi.ac.uk/QuickGO/term/GO:0010476)
GO:0018107 : peptidyl-threonine phosphorylation (https://www.ebi.ac.uk/QuickGO/term/GO:0018107)

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)

Presumptive Null

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

G476C p.Gly159Ala in the serine/threonine kinase domain leading to non-functional protein

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	-	-	-

Main Reference

Natural variation in Early flowering1 contributes to early flowering in japonica rice under long days. (2014) (https://pubmed.ncbi.nlm.nih.gov/23668360)

Authors

Kwon CT; Yoo SC; Koo BH; Cho SH; Park JW; Zhang Z; Li J; Li Z; Paek NC

Abstract

Natural variation in heading-date genes enables rice, a short-day (SD) plant, to flower early under long-day (LD) conditions at high latitudes. Through analysis of heading-date quantitative trait loci (QTL) with F7 recombinant inbred lines from the cross of early heading 'H143' and late heading 'Milyang23 (M23)', we found a minor-effect Early Heading3 (EH3) QTL in the Hd16 region on chromosome 3. We found that Early flowering1 (EL1), encoding casein kinase I (CKI), is likely to be responsible for the EH3/Hd16 QTL, because a missense mutation occurred in the highly conserved serine/threonine kinase domain of EL1 in H143. A different missense mutation was found in the EL1 kinase domain in Koshihikari. In vitro kinase assays revealed that EL1/CKI in H143 and Koshihikari are non-functional. In F7:9 heterogeneous inbred family-near isogenic lines (HNILs), HNIL(H143) flowered 13 days earlier than HNIL(M23) in LD, but not in SD, in which EL1 mainly acts as a LD-dependent flowering repressor, down-regulating Ehd1 expression. In the world rice collection, two types of non-functional EL1 variants were found in japonica rice generally cultivated at high latitudes. These results indicate that natural variation in EL1 contributes to early heading for rice adaptation to LD in temperate and cooler regions.

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Additional References

RELATED GEPHE

Related Genes

9 (DTH2, EARLY FLOWERING 3/Hd17, Hd1, Hd6a, PRR37 pseudoresponse regulator protein 37, se5, HEADING DATE 1, Ehd1 (Response regulator), Ghd7) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^4530^/and+Trait=Flowering time/or+Taxon ID=^39947^/and+Trait=Flowering time/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^Early flowering1 (EL1)^/and+Taxon ID=^4530^/or+Gene Gephebase=^Early flowering1 (EL1)^/and+Taxon ID=^39947^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS

@GxE Non-functional variants are associated with cultivars of high latitudes