

GEPHE SUMMARY

	Gephebase Gene	GephelD
Early flowering1 (EL1) (https://www.gephebase.org/search-criteria/?and+Gene Gephebase=^Early flowering1 (EL1)^#gephebase-summary-title)	GP00001636	Main curator
	Entry Status	Prigent
Published		

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
Oryza sativa (https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=^Oryza+sativa^#gephebase-summary-title)	Latin Name	Latin Name
rice	Common Name	Common Name
rice; red rice; Oryza sativa L.	Synonyms	Synonyms
species	Rank	Rank
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; Liliopsida; Petrosaviidae; commelinids; Poales; Poaceae; BOP clade; Oryzoideae; Oryzeae; Oryzinae; Oryza	Lineage	Lineage
Orzya () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4527)	Parent	Parent
4530 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4530)	NCBI Taxonomy ID	NCBI Taxonomy ID
Yes	is Taxon A an Infraspecies?	is Taxon B an Infraspecies?
Middle-late-flowering Tongil-type (japonica/indica hybrid) rice Milyang23 (116 days)	Taxon A Description	Taxon B Description

GENOTYPIC CHANGE

HD16	Generic Gene Name	UniProtKB Oryza sativa subsp. japonica Q852Lo (http://www.uniprot.org/uniprot/Q852Lo)
CK1; EL1; Hd16; OsJ_12923; Os03g0793500; LOC_Os03g57940; OSJNBb0060J21.12	Synonyms	GenebankID or UniProtKB
39947.LOC_Os03g57940.1 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=39947.LOC_Os03g57940.1)	String	0
Belongs to the protein kinase superfamily. CK1 Ser/Thr protein kinase family. Casein kinase I subfamily.	Sequence Similarities	
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)	GO - Molecular Function	

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

Molecular Type

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

Aberration Type

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

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

	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) ([#gephebase-summary-title](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))

Related Haplotypes

1 ([#gephebase-summary-title](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^))

EXTERNAL LINKS

COMMENTS

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

