GEPHE SUMMARY

Gephebase Gene

Chalk5 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Chalk5^#gephebase-summary-title)

GepheID

GP00001309

Entry Status

Published

Main curator

Courtier

PHENOTYPIC CHANGE

Trait #1

Trait Category

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

Trait

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

Trait State in Taxon A

Oryza sativa - H94

Trait State in Taxon B

Oryza sativa - Zhenshan 97

Trait #2

Trait Category

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

Trait

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

Trait State in Taxon A

Oryza sativa - H94

Trait State in Taxon B

Oryza sativa - Zhenshan 97

Trait #3

Trait Category

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

Trait

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

Trait State in Taxon A

Oryza sativa - H94

Trait State in Taxon B

Oryza sativa - Zhenshan 97

Ancestral State

Data not curated

Taxonomic Status

Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intraspecific^#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

Taxon B

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

Oryza sativa - H94

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 B an Infraspecies?

Yes

Taxon B Description

Oryza sativa - Zhenshan 97

GENOTYPIC CHANGE

Generic Gene Name

Chalk5

Synonyms

Osl_18536

String

39946.BGIOSGA018774-PA
(http://string-db.org/newstring_cgi/show_network_section.pl?identifier=
39946.BGIOSGA018774-PA)

Sequence Similarities

-

GO - Molecular Function

GO:0009678 : hydrogen-translocating pyrophosphatase activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0009678)
GO:0004427 : inorganic diphosphatase activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0004427)

GO - Biological Process

GO:1902600 : proton transmembrane transport
(https://www.ebi.ac.uk/QuickGO/term/GO:1902600)

GO - Cellular Component

GO:0016021 : integral component of membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0016021)

UniProtKB Oryza sativa subsp. indica

A2Y0L3 (http://www.uniprot.org/uniprot/A2Y0L3)

GenebankID or UniProtKB

AK107275.1 (https://www.ncbi.nlm.nih.gov/nuccore/AK107275.1)

Presumptive Null

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

Molecular Type

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

Aberration Type

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

Molecular Details of the Mutation

Two candidate SNPs at positions -721 and - 485 in promoter region

Experimental Evidence

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

Main Reference

Chalk5 encodes a vacuolar H(+)-translocating pyrophosphatase influencing grain chalkiness in rice. (2014) (https://pubmed.ncbi.nlm.nih.gov/24633159)

Authors

Li Y; Fan C; Xing Y; Yun P; Luo L; Yan B; Peng B; Xie W; Wang G; Li X; Xiao J; Xu C; He Y

Abstract

Grain chalkiness is a highly undesirable quality trait in the marketing and consumption of rice grain. However, the molecular basis of this trait is poorly understood. Here we show that a major quantitative trait locus (QTL), Chalk5, influences grain chalkiness, which also affects head rice yield and many other quality traits. Chalk5 encodes a vacuolar H(+)-translocating pyrophosphatase (V-PPase) with inorganic pyrophosphate (PPi) hydrolysis and H(+)-translocation activity. Elevated expression of Chalk5 increases the chalkiness of the endosperm, putatively by disturbing the pH homeostasis of the endomembrane trafficking system in developing seeds, which affects the biogenesis of protein bodies and is coupled with a great increase in small vesicle-like structures, thus forming air spaces among endosperm storage substances and resulting in chalky grain. Our results indicate that two consensus nucleotide polymorphisms in the Chalk5 promoter in rice varieties might partly account for the differences in Chalk5 mRNA levels that contribute to natural variation in grain chalkiness.

Additional References

RELATED GEPHE

Related Genes

5 (DEP1, OsCKX2=Gn1a, OsSPL14 / WFP, THOUSAND-GRAIN WEIGHT 6 (TGW6), Waxy /GBSS) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^4530^/and+Trait=Grain chalkiness/or+Taxon ID=^4530^/and+Trait=Amylose content/or+Taxon ID=^4530^/and+Trait=Grain yield/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

@Pleiotropy Several affected traits: 80.5% lower grain chalkiness rate; leading to a 37.9% increase in head rice yield (Fig. 2c); a 2.7% decrease in amylose content; a decrease of 4.1 mm in gel length and an increase of 11.4 mg/g in total protein content ; non-null