## GEPHE SUMMARY

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

GepheID
GP00001198

Entry Status
Published

Main curator
Martin

## PHENOTYPIC CHANGE

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
Setaria italica low-amylose landraces

Trait State in Taxon B
Setaria italica waxy landraces

Ancestral State
Taxon A

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

### Taxon A

Latin Name
Setaria italica (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Setaria italica^#gephebase-summary-title)

Common Name
foxtail millet

Synonyms
Chaetochloa italica; Panicum italicum; Setaria viridis subsp. italica; foxtail millet; Chaetochloa italica (L.) Scribn.; Panicum italicum L.; Setaria italica (L.) P.Beauv.; Setaria viridis subsp. italica (L.) Briq.

Rank
species

Lineage
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; Liliopsida; Petrosaviidae; commelinids; Poales; Poaceae; PACMAD clade; Panicoideae; Panicodae; Paniceae; Cenchrinae; Setaria

Parent
Setaria () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4554 )

NCBI Taxonomy ID
4555 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4555 )

is Taxon A an Infraspecies?
No

### Taxon B

Latin Name
Setaria italica (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Setaria italica^#gephebase-summary-title)

Common Name
foxtail millet

Synonyms
Chaetochloa italica; Panicum italicum; Setaria viridis subsp. italica; foxtail millet; Chaetochloa italica (L.) Scribn.; Panicum italicum L.; Setaria italica (L.) P.Beauv.; Setaria viridis subsp. italica (L.) Briq.

Rank
species

Lineage
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; Liliopsida; Petrosaviidae; commelinids; Poales; Poaceae; PACMAD clade; Panicoideae; Panicodae; Paniceae; Cenchrinae; Setaria

Parent
Setaria () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4554 )

NCBI Taxonomy ID
4555 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4555 )

is Taxon B an Infraspecies?
No

## GENOTYPIC CHANGE

Generic Gene Name
waxy

Synonyms
GBSSI

String
-

Sequence Similarities
Belongs to the glycosyltransferase 1 family. Bacterial/plant glycogen synthase subfamily.

GO - Molecular Function
GO:0004373 : glycogen (starch) synthase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004373)

GO - Biological Process
GO:0019252 : starch biosynthetic process (https://www.ebi.ac.uk/QuickGO/term/GO:0019252)

GO - Cellular Component
GO:0009501 : amyloplast (https://www.ebi.ac.uk/QuickGO/term/GO:0009501)

UniProtKB Setaria italica
Q8L699 (http://www.uniprot.org/uniprot/Q8L699)

GenebankID or UniProtKB
AB089141 (https://www.ncbi.nlm.nih.gov/nuccore/AB089141)

GO:0009507 : chloroplast (https://www.ebi.ac.uk/QuickGO/term/GO:0009507)

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

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

Insertion Size

1-10 kb

Molecular Details of the Mutation

Transposon insertion TSI-11 (Intron 12)

Experimental Evidence

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

Main Reference

Diverse origins of waxy foxtail millet crops in East and Southeast Asia mediated by multiple transposable element insertions. (2005) (https://pubmed.ncbi.nlm.nih.gov/16133169)

Authors

Kawase M; Fukunaga K; Kato K

Abstract

The naturally occurring waxy and low-amylose variants of foxtail millet and other cereals, like rice and barley, originated in East and Southeast Asia under human selection for sticky foods. Mutations in the GBSS1 gene for granule-bound starch synthase 1 are known to be associated with these traits. We have analyzed the gene in foxtail millet, and found that, in this species, these traits were originated by multiple independent insertions of transposable elements and by subsequent secondary insertions into these elements or deletion of parts of the elements. The structural analysis of transposable elements inserted in the GBSS1 gene revealed that the non-waxy was converted to the low-amylose phenotype once, while shifts from non-waxy to waxy occurred three times, from low amylose to waxy once and from waxy to low amylose once. The present results, and the geographical distribution of different waxy molecular types, strongly suggest that these types originated independently and were dispersed into their current distribution areas. The patterns of GBSS1 variation revealed here suggest that foxtail millet may serve as a key to solving the mystery of the origin of waxy-type cereals in Asia. The GBSS1 gene in foxtail millet provides a new example of the evolution of a gene involved in the processes of domestication and its post-domestication fate under the influence of human selection.

Additional References

## RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

5 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^Waxy /GBSS^/and+Taxon ID=^4555^/or+Gene Gephebase=^Waxy /GBSS^/and+Taxon ID=^4555^#gephebase-summary-title)

## EXTERNAL LINKS

## COMMENTS

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