

GEPHE SUMMARY

	Gephebase Gene		GepheID
Waxy /GBSS (https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=Waxy+GBSS^#gephebase-summary-title)	GP00001201		
	Entry Status	Martin	Main curator
Published			

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 ssp. Viridis (wild)		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		Taxon B
	Latin Name		Latin Name
Setaria italica (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Setaria+italica^#gephebase-summary-title)		Setaria italica (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Setaria+italica^#gephebase-summary-title)	
	Common Name		Common Name
foxtail millet		foxtail millet	
	Synonyms		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.		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		Rank
species		species	
	Lineage		Lineage
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; Liliopsida; Petrosaviidae; commelinids; Poales; Poaceae; PACMAD clade; Panicoideae; Panicoideae; Paniceae; Cenchrinae; Setaria		cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; Liliopsida; Petrosaviidae; commelinids; Poales; Poaceae; PACMAD clade; Panicoideae; Panicoideae; Paniceae; Cenchrinae; Setaria	
	Parent		Parent
Setaria () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4554)		Setaria () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4554)	
	NCBI Taxonomy ID		NCBI Taxonomy ID
4555 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4555)		4555 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4555)	
	is Taxon A an Intraspecies?		is Taxon B an Intraspecies?
Yes		Yes	
	Taxon A Description		Taxon B Description
Setaria italica ssp. Viridis (wild)		Setaria italica waxy landraces	

GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Setaria italica
waxy		Q8L699 (http://www.uniprot.org/uniprot/Q8L699)	
	Synonyms		GenebankID or UniProtKB
GBSSI		AB089141 (https://www.ncbi.nlm.nih.gov/nucleotide/AB089141)	
-			
	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:0009501 : amyloplast (<https://www.ebi.ac.uk/QuickGO/term/GO:0009501>)

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

	Presumptive Null
Yes (#gephebase-summary-title)	
	Molecular Type
Coding (#gephebase-summary-title)	
	Aberration Type
Insertion (#gephebase-summary-title)	
	Insertion Size
1-10 kb	
	Molecular Details of the Mutation
Transposon insertion TS1-7 (Exon 3)	
	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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