

GEPHE SUMMARY

Rgh4 (https://www.gephebase.org/search-criteria/?and+Gene Gephebase=Rgh4^#gephebase-summary-title)	Gephebase Gene	GP00001049	GepheID
	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	
Pathogen resistance (cyst nematode; parasite) (https://www.gephebase.org/search-criteria/?and+Trait=Pathogen+resistance+(cyst+nematode%3B+parasite)^#gephebase-summary-title)		Trait State in Taxon A	
Glycine max - sensitive		Trait State in Taxon B	
Glycine max - resistant - "Peking-type"		Ancestral State	
Data not curated		Taxonomic Status	
Domesticated (https://www.gephebase.org/search-criteria/?and+Taxonomic Status=Domesticated^#gephebase-summary-title)			
Taxon A		Taxon B	
Glycine max (https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=Glycine+max^#gephebase-summary-title)	Latin Name	Glycine max (https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=Glycine+max^#gephebase-summary-title)	Latin Name
soybean	Common Name	soybean	Common Name
soybean; soybeans; Glycine max (L.) Merr.; Glycine max; cv. Wye	Synonyms	soybean; soybeans; Glycine max (L.) Merr.; Glycine max; cv. Wye	Synonyms
species	Rank	species	Rank
cellular organisms; Eukaryota; Viriplantae; Streptophytina; Embryophytina; Tracheophytina; Euphyllophyta; Spermatophytina; Magnoliophytina; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; rosids; fabids; Fabales; Fabaceae; Papilionoideae; 50 kb inversion clade; NPAAA clade; indigoferoid/millettoid clade; Phaseoleae; Glycine; Soja	Lineage	cellular organisms; Eukaryota; Viriplantae; Streptophytina; Embryophytina; Tracheophytina; Euphyllophyta; Spermatophytina; Magnoliophytina; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; rosids; fabids; Fabales; Fabaceae; Papilionoideae; 50 kb inversion clade; NPAAA clade; indigoferoid/millettoid clade; Phaseoleae; Glycine; Soja	Lineage
Soja () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=1462606)	Parent	Soja () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=1462606)	Parent
3847 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=3847)	NCBI Taxonomy ID	3847 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=3847)	NCBI Taxonomy ID
No	is Taxon A an Infraspecies?	No	is Taxon B an Infraspecies?

GENOTYPIC CHANGE

SHMT	Generic Gene Name	K4FZF8 (http://www.uniprot.org/uniprot/K4FZF8)	UniProtKB Glycine max
-	Synonyms	JQ714079 (https://www.ncbi.nlm.nih.gov/nuccore/JQ714079)	GenebankID or UniProtKB
-	String		
Belongs to the SHMT family.	Sequence Similarities		
GO:0008168 : methyltransferase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008168)	GO - Molecular Function		
GO:0030170 : pyridoxal phosphate binding (https://www.ebi.ac.uk/QuickGO/term/GO:0030170)			
GO:0004372 : glycine hydroxymethyltransferase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004372)			
		GO - Biological Process	

GO:0019264 : glycine biosynthetic process from serine

(<https://www.ebi.ac.uk/QuickGO/term/GO:0019264>)

GO:0035999 : tetrahydrofolate interconversion

(<https://www.ebi.ac.uk/QuickGO/term/GO:0035999>)

GO - Cellular Component

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

Mutation #1

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

Presumptive Null

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

Molecular Type

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

Aberration Type

Nonsynonymous

SNP Coding Change

R130P (G-to-C) and Y358N (T-to-A)

Molecular Details of the Mutation

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

Experimental Evidence

Taxon A	Taxon B	Position
Codon	-	-
Amino-acid	Arg	Pro
		130

Main Reference

A soybean cyst nematode resistance gene points to a new mechanism of plant resistance to pathogens. (2012) (<https://pubmed.ncbi.nlm.nih.gov/23235880>)

Authors

Liu S; Kandoth PK; Warren SD; Yeckel G; Heinz R; Alden J; Yang C; Jamai A; El-Mellouki T; Juvale PS; Hill J; Baum TJ; Cianzio S; Whitham SA; Korkin D; Mitchum MG; Meksem K

Abstract

Soybean (*Glycine max* (L.) Merr.) is an important crop that provides a sustainable source of protein and oil worldwide. Soybean cyst nematode (*Heterodera glycines Ichinohe*) is a microscopic roundworm that feeds on the roots of soybean and is a major constraint to soybean production. This nematode causes more than US\$1 billion in yield losses annually in the United States alone, making it the most economically important pathogen on soybean. Although planting of resistant cultivars forms the core management strategy for this pathogen, nothing is known about the nature of resistance. Moreover, the increase in virulent populations of this parasite on most known resistance sources necessitates the development of novel approaches for control. Here we report the map-based cloning of a gene at the *Rhg4* (for resistance to *Heterodera glycines* 4) locus, a major quantitative trait locus contributing to resistance to this pathogen. Mutation analysis, gene silencing and transgenic complementation confirm that the gene confers resistance. The gene encodes a serine hydroxymethyltransferase, an enzyme that is ubiquitous in nature and structurally conserved across kingdoms. The enzyme is responsible for interconversion of serine and glycine and is essential for cellular one-carbon metabolism. Alleles of *Rhg4* conferring resistance or susceptibility differ by two genetic polymorphisms that alter a key regulatory property of the enzyme. Our discovery reveals an unprecedented plant resistance mechanism against a pathogen. The mechanistic knowledge of the resistance gene can be readily exploited to improve nematode resistance of soybean, an increasingly important global crop.

Additional References

Mutation #2

No (https://www.gephebase.org/search-criteria/?and+Presumptive+Null=%No%#gephebase-summary-title)	Presumptive Null
Coding (https://www.gephebase.org/search-criteria/?and+Molecular+Type=%Coding%#gephebase-summary-title)	Molecular Type
SNP (https://www.gephebase.org/search-criteria/?and+Aberration+Type=%SNP%#gephebase-summary-title)	Aberration Type
Nonsynonymous	SNP Coding Change
R130P (G-to-C) and Y358N (T-to-A)	Molecular Details of the Mutation
Linkage Mapping (https://www.gephebase.org/search-criteria/?and+Experimental+Evidence=%Linkage+Mapping%#gephebase-summary-title)	Experimental Evidence

Additional References

Taxon A	Taxon B	Position
Codon	-	-
Amino-acid	Tyr	Asn
		358

Main Reference

A soybean cyst nematode resistance gene points to a new mechanism of plant resistance to pathogens. (2012) (<https://pubmed.ncbi.nlm.nih.gov/23235880>)

Authors

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approaches for control. Here we report the map-based cloning of a gene at the Rhg4 (for resistance to *Heterodera glycines* 4) locus, a major quantitative trait locus contributing to resistance to this pathogen. Mutation analysis, gene silencing and transgenic complementation confirm that the gene confers resistance. The gene encodes a serine hydroxymethyltransferase, an enzyme that is ubiquitous in nature and structurally conserved across kingdoms. The enzyme is responsible for interconversion of serine and glycine and is essential for cellular one-carbon metabolism. Alleles of Rhg4 conferring resistance or susceptibility differ by two genetic polymorphisms that alter a key regulatory property of the enzyme. Our discovery reveals an unprecedented plant resistance mechanism against a pathogen. The mechanistic knowledge of the resistance gene can be readily exploited to improve nematode resistance of soybean, an increasingly important global crop.

Additional References

RELATED GEPHE

1 (Rhg1) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=%3847%20and+Trait=Pathogen resistance%20and+groupHaplotypes=true#gephebase-summary-title>)

Related Genes

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

@Epistasis - The full strength "Peking" type soybean cyst nematode resistance phenotype is due to the combination of alleles rhg1a (chromosome 18) and Rhg4 (chromosome 8).