

GEPHE SUMMARY

Rhg1 (https://www.gephebase.org/search-criteria/?and+Gene Gephebase=^Rhg1^#gephebase-summary-title)	Gephebase Gene	GP00002049	GepheID
	Entry Status	Courtier	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) (https://www.gephebase.org/search-criteria/?and+Trait=^Pathogen+resistance+(cyst+nematode)^#gephebase-summary-title)	Trait State in Taxon A
Glycine max - sensitive	Trait State in Taxon B
Glycine max - resistant - Rhg1a haplotype - "Peking-type" low-copy number; three or fewer Rhg1 repeats	Ancestral State
Taxon A	Taxonomic Status
Intraspecific (https://www.gephebase.org/search-criteria/?and+Taxonomic Status=^Intraspecific^#gephebase-summary-title)	

Taxon A	Latin Name	Taxon B	Latin Name
Glycine max (https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=^Glycine+max^#gephebase-summary-title)		Glycine max (https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=^Glycine+max^#gephebase-summary-title)	
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; Viridiplanteae; 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; Viridiplanteae; 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
is Taxon A an Infraspecies?		is Taxon B an Infraspecies?	
No		No	

GENOTYPIC CHANGE

rhg1s	Generic Gene Name	UniProtKB Glycine max
Rfs2; Rhg1; rhg1	Synonyms	GenebankID or UniProtKB
-	String	JN597009 (https://www.ncbi.nlm.nih.gov/nucleotide/JN597009)
-	Sequence Similarities	
GO:0005524 : ATP binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005524)	GO - Molecular Function	
GO:0004672 : protein kinase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004672)		
-	GO - Biological Process	
GO:0016021 : integral component of membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0016021)	GO - Cellular Component	

No (#gephebase-summary-title)	Presumptive Null
Cis-regulatory (#gephebase-summary-title)	Molecular Type
Insertion (#gephebase-summary-title)	Aberration Type
1-10 kb	Insertion Size
insertion of a copia retrotransposon within the gene Rhg1 Glyma.18G022500 (\pm -SNAP-encoding). This transposable element is intact and resides within intron 1; anti-sense to the rhg1-a \pm -SNAP open reading frame.	Molecular Details of the Mutation
Linkage Mapping (#gephebase-summary-title)	Experimental Evidence
The rhg1-a (Rhg1 low-copy) nematode resistance source harbors a copia-family retrotransposon within the Rhg1-encoded \pm -SNAP gene. (2019) (https://pubmed.ncbi.nlm.nih.gov/31468029/)	Main Reference
Bayless AM; Zapotocny RW; Han S; Grunwald DJ; Amundson KK; Bent AF	Authors
Soybean growers widely use the Resistance to Heterodera glycines 1 (Rhg1) locus to reduce yield losses caused by soybean cyst nematode (SCN). Rhg1 is a tandemly repeated four gene block. Two classes of SCN resistance-conferring Rhg1 haplotypes are recognized: rhg1-a ("Peking-type," low-copy number, three or fewer Rhg1 repeats) and rhg1-b ("PI 88788-type," high-copy number, four or more Rhg1 repeats). The rhg1-a and rhg1-b haplotypes encode \pm -SNAP (alpha-Soluble NSF Attachment Protein) variants \pm -SNAP LC and \pm -SNAP HC, respectively, with differing atypical C-terminal domains, that contribute to SCN resistance. Here we report that rhg1-a soybean accessions harbor a copia retrotransposon within their Rhg1 Glyma.18G022500 (\pm -SNAP-encoding) gene. We termed this retrotransposon "RAC," for Rhg1 alpha-SNAP copia. Soybean carries multiple RAC-like retrotransposon sequences. The Rhg1 RAC insertion is in the Glyma.18G022500 genes of all true rhg1-a haplotypes we tested and was not detected in any examined rhg1-b or Rhg1 (single-copy) soybeans. RAC is an intact element residing within intron 1, anti-sense to the rhg1-a \pm -SNAP open reading frame. RAC has intrinsic promoter activities, but overt impacts of RAC on transgenic \pm -SNAP LC mRNA and protein abundance were not detected. From the native rhg1-a RAC genomic context, elevated \pm -SNAP LC protein abundance was observed in syncytium cells, as was previously observed for \pm -SNAP HC (whose rhg1-b does not carry RAC). Using a SoySNP50K SNP corresponding with RAC presence, just ~42% of USDA accessions bearing previously identified rhg1-a SoySNP50K SNP signatures harbor the RAC insertion. Subsequent analysis of several of these putative rhg1-a accessions lacking RAC revealed that none encoded \pm -SNAPLC, and thus, they are not rhg1-a. rhg1-a haplotypes are of rising interest, with Rhg4, for combating SCN populations that exhibit increased virulence against the widely used rhg1-b resistance. The present study reveals another unexpected structural feature of many Rhg1 loci, and a selectable feature that is predictive of rhg1-a haplotypes.	Abstract
	Additional References

RELATED GEPHE

1 (Rhg4) (#gephebase-summary-title)	Related Genes
1 (#gephebase-summary-title)	Related Haplotypes

EXTERNAL LINKS

COMMENTS

@TE @Epistasis - The rhg1-a resistance is bolstered by an unlinked chromosome 8 locus; Rhg4; whose presence contributes to full strength "Peking" type soybean cyst nematode resistance.