

GEPHE SUMMARY

	Gephebase Gene	GephelD
AtGA20ox1 (=GA5=Sd1) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^AtGA20ox1 (=GA5=Sd1)"#gephebase-summary-title)	GP00000120	Main curator
	Entry Status	Martin
Published		

PHENOTYPIC CHANGE

	Trait Category	
Morphology (https://www.gephebase.org/search-criteria?/and+Trait Category="Morphology">#gephebase-summary-title)	Trait	
Plant size (dwarfism) (https://www.gephebase.org/search-criteria?/and+Trait=^Plant size (dwarfism)#gephebase-summary-title)	Trait State in Taxon A	
Arabidopsis thaliana - Col	Trait State in Taxon B	
Arabidopsis thaliana - dwarf accession (see manuscript)	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
Arabidopsis thaliana (#gephebase-summary-title)	Arabidopsis thaliana (#gephebase-summary-title)	
thale cress	Common Name	Common Name
thale cress; mouse-ear cress; thale-cress; Arabidopsis thaliana (L.) Heynh.; Arabidopsis thaliana (thale cress); Arabidopsis_thaliana; Arbisopsis thaliana; thale kress	Synonyms	Synonyms
species	Rank	Rank
	Lineage	Lineage
cellular organisms; Eukaryota; Viriplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; rosids; malvids; Brassicales; Brassicaceae; Camelinae; Arabidopsis		
Arabidopsis () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=3701)	Parent	Parent
3702 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=3702)	NCBI Taxonomy ID	NCBI Taxonomy ID
Yes	is Taxon A an Infraspecies?	is Taxon B an Infraspecies?
Arabidopsis thaliana - Col	Taxon A Description	Taxon B Description
Arabidopsis thaliana - dwarf accession (see manuscript)		

GENOTYPIC CHANGE

	Generic Gene Name	UniProtKB Arabidopsis thaliana
GA20OX1	Synonyms	GenebankID or UniProtKB
ARABIDOPSIS THALIANA GIBBERELLIN 20-OXIDASE 1; AT2301; ATGA20OX1; GA REQUIRING 5; GA5; GIBBERELLIN 20-OXIDASE; T30C3_90; T30C3_90; 20ox1; At2301; At4g25420	Q39110 (http://www.uniprot.org/uniprot/Q39110)	U20872 (https://www.ncbi.nlm.nih.gov/nuccore/U20872)
3702.AT4G25420.1 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=3702.AT4G25420.1)	String	
Belongs to the iron/ascorbate-dependent oxidoreductase family. GA20OX subfamily.	Sequence Similarities	
GO - Molecular Function		
GO:0046872 : metal ion binding (https://www.ebi.ac.uk/QuickGO/term/GO:0046872)		
GO:0051213 : dioxygenase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0051213)		

GO:0045544 : gibberellin 20-oxidase activity

(<https://www.ebi.ac.uk/QuickGO/term/GO:0045544>)

GO - Biological Process

GO:0009908 : flower development (<https://www.ebi.ac.uk/QuickGO/term/GO:0009908>)

GO:0009740 : gibberellic acid mediated signaling pathway

(<https://www.ebi.ac.uk/QuickGO/term/GO:0009740>)

GO:0009686 : gibberellin biosynthetic process

(<https://www.ebi.ac.uk/QuickGO/term/GO:0009686>)

GO:0048366 : leaf development (<https://www.ebi.ac.uk/QuickGO/term/GO:0048366>)

GO:0009739 : response to gibberellin

(<https://www.ebi.ac.uk/QuickGO/term/GO:0009739>)

GO:0048575 : short-day photoperiodism, flowering

(<https://www.ebi.ac.uk/QuickGO/term/GO:0048575>)

GO:0009826 : unidimensional cell growth

(<https://www.ebi.ac.uk/QuickGO/term/GO:0009826>)

GO - Cellular Component

GO:0005737 : cytoplasm (<https://www.ebi.ac.uk/QuickGO/term/GO:0005737>)

Mutation #1

Presumptive Null

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

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

G919A

Experimental Evidence

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

Taxon A

Taxon B

Position

Codon

-

-

-

Amino-acid

Gly

Ala

919

Main Reference

Arabidopsis semidwarfs evolved from independent mutations in GA20ox1, ortholog to green revolution dwarf alleles in rice and barley. (2013)

(<https://pubmed.ncbi.nlm.nih.gov/24023067>)

Authors

Barboza L; Effgen S; Alonso-Blanco C; Kooke R; Keurentjes JJ; Koornneef M; AlcÁzar R

Abstract

Understanding the genetic bases of natural variation for developmental and stress-related traits is a major goal of current plant biology. Variation in plant hormone levels and signaling might underlie such phenotypic variation occurring even within the same species. Here we report the genetic and molecular basis of semidwarf individuals found in natural *Arabidopsis thaliana* populations. Allelism tests demonstrate that independent loss-of-function mutations at GA locus 5 (GA5), which encodes gibberellin 20-oxidase 1 (GA20ox1) involved in the last steps of gibberellin biosynthesis, are found in different populations from southern, western, and northern Europe; central Asia; and Japan. Sequencing of GA5 identified 21 different loss-of-function alleles causing semidwarfness without any obvious general tradeoff affecting plant performance traits. GA5 shows signatures of purifying selection, whereas GA5 loss-of-function alleles can also exhibit patterns of positive selection in specific populations as shown by Fay and Wu's H statistics. These results suggest that antagonistic pleiotropy might underlie the occurrence of GA5 loss-of-function mutations in nature. Furthermore, because GA5 is the ortholog of rice SD1 and barley Sdw1/Denso green revolution genes, this study illustrates the occurrence of conserved adaptive evolution between wild *A.thaliana* and domesticated plants.

Additional References

Mutation #2

Presumptive Null

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

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

G243E

Experimental Evidence

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

Taxon A

Taxon B

Position

Codon

-

-

-

Amino-acid

Gly

Glu

243

Arabidopsis semidwarfs evolved from independent mutations in GA20ox1, ortholog to green revolution dwarf alleles in rice and barley. (2013)
(<https://pubmed.ncbi.nlm.nih.gov/24023067/>)

Authors

Barboza L; Effgen S; Alonso-Blanco C; Kooke R; Keurentjes JJ; Koornneef M; AlcÁizar R

Abstract

Understanding the genetic bases of natural variation for developmental and stress-related traits is a major goal of current plant biology. Variation in plant hormone levels and signaling might underlie such phenotypic variation occurring even within the same species. Here we report the genetic and molecular basis of semidwarf individuals found in natural *Arabidopsis thaliana* populations. Allelism tests demonstrate that independent loss-of-function mutations at GA locus 5 (GA5), which encodes gibberellin 20-oxidase 1 (GA20ox1) involved in the last steps of gibberellin biosynthesis, are found in different populations from southern, western, and northern Europe; central Asia; and Japan. Sequencing of GA5 identified 21 different loss-of-function alleles causing semidwarfness without any obvious general tradeoff affecting plant performance traits. GA5 shows signatures of purifying selection, whereas GA5 loss-of-function alleles can also exhibit patterns of positive selection in specific populations as shown by Fay and Wu's H statistics. These results suggest that antagonistic pleiotropy might underlie the occurrence of GA5 loss-of-function mutations in nature. Furthermore, because GA5 is the ortholog of rice SD1 and barley Sdw1/Denso green revolution genes, this study illustrates the occurrence of conserved adaptive evolution between wild *A.thaliana* and domesticated plants.

Additional References

RELATED GEPHE

Related Genes

2 (ACD6 = ACCELERATED CELL DEATH 6, phytochrome D (PHYD)) ([https://www.gephebase.org/search-criteria?/or+Taxon ID=%273702%27/and+Trait=Plant size/and+groupHaplotypes=true#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Taxon%20ID=%273702%27/and+Trait=Plant%20size/and+groupHaplotypes=true#gephebase-summary-title))

Related Haplotypes

19 ([https://www.gephebase.org/search-criteria?/or+Gene Gephebase=%27AtGA20ox1 \(%27GA5=Sd1\)%27/and+Taxon ID=%273702%27/or+Gene Gephebase=%27AtGA20ox1 \(%27GA5=Sd1\)%27/and+Taxon ID=%273702%27#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene%20Gephebase=%27AtGA20ox1%20(%27GA5=Sd1%27)%27/and+Taxon%20ID=%273702%27/or+Gene%20Gephebase=%27AtGA20ox1%20(%27GA5=Sd1%27)%27/and+Taxon%20ID=%273702%27#gephebase-summary-title))

EXTERNAL LINKS

COMMENTS