

## GEPHE SUMMARY

**Gephebase Gene**  
AtGA20ox1 (=GA5=5d1)

**Entry Status**  
Published

**GepheID**  
GP00000121

**Main curator**  
Martin

## PHENOTYPIC CHANGE

### Trait #1

**Trait Category**  
Morphology

**Trait**  
Plant size (dwarfism)

**Trait State in Taxon A**  
Arabidopsis thaliana - Col

**Trait State in Taxon B**  
Arabidopsis thaliana - dwarf accession (see manuscript)

### Trait #2

**Trait Category**  
Morphology

**Trait**  
Plant size (dwarfism)

**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

### Taxon A

#### Latin Name

*Arabidopsis thaliana*

#### Common Name

thale cress

#### Synonyms

thale cress; mouse-ear cress; thale-cress; Arabidopsis thaliana (L.) Heynh.; Arabidopsis thaliana (thale cress); Arabidopsis...thaliana; Arbisopsis thaliana; thale kress

#### Rank

species

#### Lineage

cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; rosids; malvids; Brassicales; Brassicaceae; Camelineae; Arabidopsis

#### Parent

Arabidopsis () - (Rank: genus)

#### NCBI Taxonomy ID

3702

#### is Taxon A an Intraspecies?

Yes

#### Taxon A Description

Arabidopsis thaliana - Col

### Taxon B

#### Latin Name

*Arabidopsis thaliana*

#### Common Name

thale cress

#### Synonyms

thale cress; mouse-ear cress; thale-cress; Arabidopsis thaliana (L.) Heynh.; Arabidopsis thaliana (thale cress); Arabidopsis...thaliana; Arbisopsis thaliana; thale kress

#### Rank

species

#### Lineage

cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; rosids; malvids; Brassicales; Brassicaceae; Camelineae; Arabidopsis

#### Parent

Arabidopsis () - (Rank: genus)

#### NCBI Taxonomy ID

3702

#### is Taxon B an Intraspecies?

Yes

#### Taxon B Description

Arabidopsis thaliana - dwarf accession (see manuscript)

## GENOTYPIC CHANGE

**Generic Gene Name**

GA20OX1

UniProtKB Arabidopsis thaliana

Q39110

**Synonyms**

ARABIDOPSIS THALIANA GIBBERELLIN 20-OXIDASE 1; AT2301; ATGA20OX1; GA REQUIRING 5; GAS; GIBBERELLIN 20-OXIDASE; T30C3.90; T30C3\_90; 20ox1; At2301; At4g25420

**GenebankID or UniProtKB**

U20872

**String**

3702.AT4G25420.1

**Sequence Similarities**

Belongs to the iron/ascorbate-dependent oxidoreductase family. GA20OX subfamily.

**GO - Molecular Function**

GO:0046872 : metal ion binding  
 GO:0051213 : dioxygenase activity  
 GO:0045544 : gibberellin 20-oxidase activity

**GO - Biological Process**

GO:0009908 : flower development  
 GO:0009740 : gibberellic acid mediated signaling pathway  
 GO:0009686 : gibberellin biosynthetic process  
 GO:0048366 : leaf development  
 GO:0009739 : response to gibberellin  
 GO:0048575 : short-day photoperiodism, flowering  
 GO:0009826 : unidimensional cell growth

**GO - Cellular Component**

GO:0005737 : cytoplasm

**Mutation #1****Presumptive Null**

No

**Molecular Type**

Coding

**Aberration Type**

SNP

**SNP Coding Change**

Nonsynonymous

**Molecular Details of the Mutation**

C940G

**Experimental Evidence**

Linkage Mapping

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Cys	Gly	940

**Main Reference**

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

**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

**Molecular Type**

Coding

**Aberration Type**

SNP

**SNP Coding Change**

Nonsynonymous

**Molecular Details of the Mutation**

P250R

Experimental Evidence

Linkage Mapping

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Pro	Arg	250

Main Reference

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

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

RELATED GEPHE

Related Genes

2 (ACD6 = ACCELERATED CELL DEATH 6, phytochrome D (PHYD))

Related Haplotypes

19

COMMENTS