

## GEPHE SUMMARY

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

**Entry Status**  
Published

**GepheID**  
GP00000111

**Main curator**  
Martin

## PHENOTYPIC CHANGE

**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

**Synonyms**  
ARABIDOPSIS THALIANA GIBBERELLIN 20-OXIDASE 1; AT2301; ATGA20OX1; GA REQUIRING 5; GA5; GIBBERELLIN 20-OXIDASE; T30C3.90; T30C3\_90; 20ox1; At2301; At4g25420

**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

**UniProtKB Arabidopsis thaliana**  
Q39110

**GenebankID or UniProtKB**  
U20872

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

**Presumptive Null**  
Yes

**Molecular Type**  
Coding

**Aberration Type**  
Deletion

**Deletion Size**  
10-99 bp

**Molecular Details of the Mutation**  
-29bp at +426

**Experimental Evidence**  
Linkage Mapping

**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