GEPHE SUMMARY

Gephebase Gene
AtGA20ox1 (=GA5=Sd1) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^AtGA20ox1 (=GA5=Sd1)^#gephebase-summary-title)

GepheID
GP00001243

Entry Status
Published

Main curator
Arnoult

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- Col0

Trait State in Taxon B
Arabidopsis thaliana- alpine population SAO

Ancestral State
Taxon A

Taxonomic Status
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intraspecific^#gephebase-summary-title)

Taxon A

Latin Name
Arabidopsis thaliana (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Arabidopsis thaliana^#gephebase-summary-title)

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) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 3701)

NCBI Taxonomy ID
3702 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 3702)

is Taxon A an Infraspecies?
Yes

Taxon A Description
Arabidopsis thaliana- Col0

Taxon B

Latin Name
Arabidopsis thaliana (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Arabidopsis thaliana^#gephebase-summary-title)

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) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 3701)

NCBI Taxonomy ID
3702 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 3702)

is Taxon B an Infraspecies?
Yes

Taxon B Description
Arabidopsis thaliana- alpine population SAO

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 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 3702.AT4G25420.1)

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

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)

UniProtKB Arabidopsis thaliana
Q39110 (http://www.uniprot.org/uniprot/Q39110)

GenebankID or UniProtKB
U20872 (https://www.ncbi.nlm.nih.gov/nuccore/U20872)

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)

Presumptive Null

Yes (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Yes^#gephebase-summary-title)

Molecular Type

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

Aberration Type

Deletion (https://www.gephebase.org/search-criteria?/and+Aberration Type=^Deletion^#gephebase-summary-title)

Deletion Size

1-9 bp

Molecular Details of the Mutation

-1bp at position 184 causing premature stop

Experimental Evidence

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

Main Reference

A Single Nucleotide Deletion in Gibberellin20-oxidase1 Causes Alpine Dwarfism in Arabidopsis. (2015) (https://pubmed.ncbi.nlm.nih.gov/25941313)

Authors

Luo Y; Dong X; Yu T; Shi X; Li Z; Yang W; Widmer A; Karrenberg S

Abstract

Alpine dwarfism is widely observed in alpine plant populations and often considered a high-altitude adaptation, yet its molecular basis and ecological relevance remain unclear. In this study, we used map-based cloning and field transplant experiments to investigate dwarfism in natural Arabidopsis (Arabidopsis thaliana) accessions collected from the Swiss Alps. A loss-of-function mutation due to a single nucleotide deletion in gibberellin20-oxidase1 (GA5) was identified as the cause of dwarfism in an alpine accession. The mutated allele, ga5-184, was found in two natural Arabidopsis populations collected from one geographic region at high altitude, but was different from all other reported ga5 null alleles, suggesting that this allele has evolved locally. In field transplant experiments, the dwarf accession with ga5-184 exhibited a fitness pattern consistent with adaptation to high altitude. Across a wider array of accessions from the Swiss Alps, plant height decreased with altitude of origin, but fitness patterns in the transplant experiments were variable and general altitudinal adaptation was not evident. In general, our study provides new insights into molecular basis and possible ecological roles of alpine dwarfism, and demonstrates the importance of the GA-signaling pathway for the generation of ecologically relevant variation in higher 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=^3702^/and+Trait=Plant size/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

19 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^AtGA20ox1 (=GA5=Sd1)^/and+Taxon ID=^3702^/or+Gene Gephebase=^AtGA20ox1 (=GA5=Sd1)^/and+Taxon ID=^3702^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS

31 populations with the same mutation; out of 43 total dwarfed population