GEPHE SUMMARY

Gephebase Gene
dihydroflavonol reductase (DFR) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^dihydroflavonol reductase (DFR)^#gephebase-summary-title)

GepheID
GP00000224

Entry Status
Published

Main curator
Martin

PHENOTYPIC CHANGE

Trait Category
Morphology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Morphology^#gephebase-summary-title)

Trait
Coloration (flowers) (https://www.gephebase.org/search-criteria?/and+Trait=^Coloration (flowers)^#gephebase-summary-title)

Trait State in Taxon A
Iochroma calycinum - blue morphs

Trait State in Taxon B
Iochroma calycinum - white morph

Ancestral State
Taxon A

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

Taxon A

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

Common Name
-

Synonyms
Iochroma calycinum Benth.

Rank
species

Lineage
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; asterids; lamiids; Solanales; Solanaceae; Solanoideae; Physaleae; Iochroma

Parent
Iochroma () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 304104)

NCBI Taxonomy ID
362353 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 362353)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
-

Synonyms
Iochroma calycinum Benth.

Rank
species

Lineage
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; asterids; lamiids; Solanales; Solanaceae; Solanoideae; Physaleae; Iochroma

Parent
Iochroma () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 304104)

NCBI Taxonomy ID
362353 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 362353)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
DFRA

Synonyms
dihydroflavonol 4-reductase; DIHYDROFLAVONOL 4-REDUCTASE; DIHYDROKAEMPFEROL 4-REDUCTASE; M318; MJB21.18; MJB21_18; TT3; DFR; At5g42800

String
3702.AT5G42800.1 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 3702.AT5G42800.1)

Sequence Similarities
Belongs to the NAD(P)-dependent epimerase/dehydratase family. Dihydroflavonol-4-reductase subfamily.

GO - Molecular Function
GO:0016491 : oxidoreductase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0016491)
GO:0050662 : coenzyme binding (https://www.ebi.ac.uk/QuickGO/term/GO:0050662)
GO:0016616 : oxidoreductase activity, acting on the CH-OH group of donors, NAD or NADP as acceptor (https://www.ebi.ac.uk/QuickGO/term/GO:0016616)

UniProtKB Arabidopsis thaliana
P51102 (http://www.uniprot.org/uniprot/P51102)

GenebankID or UniProtKB
()

GO:0045552 : dihydrokaempferol 4-reductase activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0045552)
GO:0047890 : flavanone 4-reductase activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0047890)

GO - Biological Process

GO:0009718 : anthocyanin-containing compound biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0009718)

GO - Cellular Component

GO:0042406 : extrinsic component of endoplasmic reticulum membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0042406)

Presumptive Null

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#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

10-99 bp

Molecular Details of the Mutation

33bp (11 a.a) deletion In coding sequence

Experimental Evidence

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

Main Reference

Genetic basis for a rare floral mutant in an Andean species of Solanaceae. (2015) (https://pubmed.ncbi.nlm.nih.gov/25667079)

Authors

Coburn RA; Griffin RH; Smith SD

Abstract

White forms of typically pigmented flowers are one of the most common polymorphisms in flowering plants. Although the range of genetic changes that give rise to white phenotypes is well known from model systems, few studies have identified causative mutations in natural populations.

Here we combine genetic studies, in vitro enzyme assays, and biochemical analyses to identify the mechanism underlying the loss of anthocyanin pigment production in the naturally occurring white-flowered morph of Iochroma calycinum (Solanaceae).

Comparison of anthocyanin gene sequences revealed a putative loss-of-function mutation, an 11 amino-acid deletion in dihydroflavonol 4-reductase (DFR), in the white morph. Functional assays of Dfr alleles from blue and white morphs demonstrated that this deletion results in a loss of enzymatic activity, indicating that the deletion could be solely responsible for the lack of pigment production. Consistent with this hypothesis, quantitative PCR showed no significant differences in expression of anthocyanin genes between the morphs. Also, thin layer chromatography confirmed that the white morph continues to accumulate compounds upstream of the DFR enzyme.

Collectively, these experiments indicate that the structural mutation at Dfr underlies the rare white flower morph of I. calycinum. This study is one of only a few examples where a flower color polymorphism is due to a loss-of-function mutation in the coding region of an anthocyanin enzyme. The rarity of such mutations in nature suggests that negative consequences prevent fixation across populations.

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Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS