

GEPHE SUMMARY

|                                                                                                                                                                                                                                                                                                   |                |        |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------|--------------|
|                                                                                                                                                                                                                                                                                                   | Gephebase Gene |        | GepheID      |
| dihydroflavonol reductase (DFR) ( <a href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=~dihydroflavonol+reductase+(DFR)^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=~dihydroflavonol+reductase+(DFR)^#gephebase-summary-title</a> ) | GP00000225     |        |              |
|                                                                                                                                                                                                                                                                                                   | Entry Status   | Martin | Main curator |
| Published                                                                                                                                                                                                                                                                                         |                |        |              |

PHENOTYPIC CHANGE

|                                                                                                                                                                                                                                                                                           |                             |                                                                                                                                                                                                                                                                                           |                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                                                                                                                                                                                                                                                                                           | Trait Category              |                                                                                                                                                                                                                                                                                           |                             |
| Morphology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait+Category=~Morphology^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait+Category=~Morphology^#gephebase-summary-title</a> )                                                        |                             | Trait                                                                                                                                                                                                                                                                                     |                             |
| Coloration (flowers) ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=~Coloration+(flowers)^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait=~Coloration+(flowers)^#gephebase-summary-title</a> )                                            |                             |                                                                                                                                                                                                                                                                                           |                             |
|                                                                                                                                                                                                                                                                                           | Trait State in Taxon A      |                                                                                                                                                                                                                                                                                           |                             |
| lochroma cyaneum; blue                                                                                                                                                                                                                                                                    |                             | Trait State in Taxon B                                                                                                                                                                                                                                                                    |                             |
| lochroma cyaneum; gesnerioides                                                                                                                                                                                                                                                            |                             |                                                                                                                                                                                                                                                                                           |                             |
|                                                                                                                                                                                                                                                                                           | Ancestral State             |                                                                                                                                                                                                                                                                                           |                             |
| Data not curated                                                                                                                                                                                                                                                                          |                             | Taxonomic Status                                                                                                                                                                                                                                                                          |                             |
| Intraspecific ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=~Intraspecific^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=~Intraspecific^#gephebase-summary-title</a> )                                           |                             |                                                                                                                                                                                                                                                                                           |                             |
|                                                                                                                                                                                                                                                                                           | Taxon A                     |                                                                                                                                                                                                                                                                                           | Taxon B                     |
|                                                                                                                                                                                                                                                                                           | Latin Name                  |                                                                                                                                                                                                                                                                                           | Latin Name                  |
| lochroma cyaneum ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~lochroma+cyaneum^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~lochroma+cyaneum^#gephebase-summary-title</a> )                              |                             | lochroma cyaneum ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~lochroma+cyaneum^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~lochroma+cyaneum^#gephebase-summary-title</a> )                              |                             |
|                                                                                                                                                                                                                                                                                           | Common Name                 |                                                                                                                                                                                                                                                                                           | Common Name                 |
| -                                                                                                                                                                                                                                                                                         |                             | -                                                                                                                                                                                                                                                                                         |                             |
|                                                                                                                                                                                                                                                                                           | Synonyms                    |                                                                                                                                                                                                                                                                                           | Synonyms                    |
| lochroma cyaneum (Lindl.) M.L.Green                                                                                                                                                                                                                                                       |                             | lochroma cyaneum (Lindl.) M.L.Green                                                                                                                                                                                                                                                       |                             |
|                                                                                                                                                                                                                                                                                           | Rank                        |                                                                                                                                                                                                                                                                                           | Rank                        |
| species                                                                                                                                                                                                                                                                                   |                             | species                                                                                                                                                                                                                                                                                   |                             |
|                                                                                                                                                                                                                                                                                           | Lineage                     |                                                                                                                                                                                                                                                                                           | Lineage                     |
| cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetales; asterids; lamiids; Solanales; Solanaceae; Solanoideae; Physaleae; lochroma |                             | cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetales; asterids; lamiids; Solanales; Solanaceae; Solanoideae; Physaleae; lochroma |                             |
|                                                                                                                                                                                                                                                                                           | Parent                      |                                                                                                                                                                                                                                                                                           | Parent                      |
| lochroma () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=304104">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=304104</a> )                                                                                                       |                             | lochroma () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=304104">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=304104</a> )                                                                                                       |                             |
|                                                                                                                                                                                                                                                                                           | NCBI Taxonomy ID            |                                                                                                                                                                                                                                                                                           | NCBI Taxonomy ID            |
| 362357 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=362357">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=362357</a> )                                                                                                                            |                             | 362357 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=362357">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=362357</a> )                                                                                                                            |                             |
|                                                                                                                                                                                                                                                                                           | is Taxon A an Intraspecies? |                                                                                                                                                                                                                                                                                           | is Taxon B an Intraspecies? |
| No                                                                                                                                                                                                                                                                                        |                             | No                                                                                                                                                                                                                                                                                        |                             |

GENOTYPIC CHANGE

|                                                                                                                                                                                                                  |                         |                                                                                                                        |                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------|
|                                                                                                                                                                                                                  | Generic Gene Name       |                                                                                                                        | UniProtKB Arabidopsis thaliana |
| DFRA                                                                                                                                                                                                             |                         | P51102 ( <a href="http://www.uniprot.org/uniprot/P51102">http://www.uniprot.org/uniprot/P51102</a> )                   |                                |
|                                                                                                                                                                                                                  | Synonyms                |                                                                                                                        | GenebankID or UniProtKB        |
| dihydroflavonol 4-reductase; DIHYDROFLAVONOL 4-REDUCTASE; DIHYDROKAEMPFEROL 4-REDUCTASE; M318; MJB21.18; MJB21_18; TT3; DFR; At5g42800                                                                           |                         | ADV03181 ( <a href="https://www.ncbi.nlm.nih.gov/nuccore/ADV03181">https://www.ncbi.nlm.nih.gov/nuccore/ADV03181</a> ) |                                |
|                                                                                                                                                                                                                  | String                  |                                                                                                                        |                                |
| 3702.AT5G42800.1 ( <a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=3702.AT5G42800.1">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=3702.AT5G42800.1</a> ) |                         |                                                                                                                        |                                |
|                                                                                                                                                                                                                  | Sequence Similarities   |                                                                                                                        |                                |
| Belongs to the NAD(P)-dependent epimerase/dehydratase family. Dihydroflavonol-4-reductase subfamily.                                                                                                             |                         |                                                                                                                        |                                |
|                                                                                                                                                                                                                  | GO - Molecular Function |                                                                                                                        |                                |
| GO:0016491 : oxidoreductase activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0016491">https://www.ebi.ac.uk/QuickGO/term/GO:0016491</a> )                                                               |                         |                                                                                                                        |                                |
| GO:0050662 : coenzyme binding ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0050662">https://www.ebi.ac.uk/QuickGO/term/GO:0050662</a> )                                                                      |                         |                                                                                                                        |                                |
| GO:0016616 : oxidoreductase activity, acting on the CH-OH group of donors, NAD or NADP as acceptor ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0016616">https://www.ebi.ac.uk/QuickGO/term/GO:0016616</a> ) |                         |                                                                                                                        |                                |

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

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

12 candidate a.a. substitution in cluding one at a residue known to influence substrate specificity

Experimental Evidence

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

|            | Taxon A | Taxon B | Position |
|------------|---------|---------|----------|
| Codon      | -       | -       | -        |
| Amino-acid | -       | -       | -        |

Main Reference

Gene loss and parallel evolution contribute to species difference in flower color. (2011) (<https://pubmed.ncbi.nlm.nih.gov/21551271>)

Authors

Smith SD; Rausher MD

Abstract

Although the importance of regulatory and functional sequence evolution in generating species differences has been studied to some extent, much less is known about the role of other types of genomic changes, such as fluctuation in gene copy number. Here, we apply analyses of gene function and expression of anthocyanin pigment pathway genes, as well as cosegregation analyses in backcross populations, to examine the genetic changes involved in the shift from blue to red flowers in Andean *Lochroma* (Solanaceae). We demonstrate that deletion of a gene coding for an anthocyanin pathway enzyme was necessary for the transition to red floral pigmentation. The downregulation of a second pathway gene was also necessary for the novel flower color, and this regulatory pattern parallels the genetic change in the two other red-flowered species in the sister family Convolvulaceae in which flower color change has been examined genetically. Finally, we document a shift in enzymatic function at a third locus, but the importance of this change in the transition to red flowers depends on the exact order with which the three changes occurred. This study shows that gene inactivation or loss can be involved in the origin of phenotypic differences between species, thereby restricting the possibility of reversion to the ancestral state. It also demonstrates that parallel evolution of red flowers in three different species occurs via a common developmental/regulatory change but by mutations in different genes.

Additional References

RELATED GEPHE

Related Genes

1 (flavonoid 3';5'-hydroxylase (F3'5'H)) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~362357~/and+Trait=Coloration/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS