GEPHE SUMMARY

Gephebase Gene

BCO2 = beta-carotene oxygenase 2 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^BCO2 = beta-carotene oxygenase 2^#gephebase-summary-title)

GepheID

GP00002387

Entry Status

Published

Main curator

Santos

PHENOTYPIC CHANGE

Trait Category

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

Trait

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

Trait State in Taxon A

less extensive carotenoid pigmentation

Trait State in Taxon B

more extensive carotenoid pigmentation

Ancestral State

Taxon A

Taxonomic Status

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

Taxon A

Latin Name

Setophaga pensylvanica (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Setophaga pensylvanica^#gephebase-summary-title)

Common Name

Chestnut-sided warbler

Synonyms

Dendroica pensylvanica; Chestnut-sided warbler; Setophaga pensylvanica (Linnaeus, 1766)

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Sauropsida; Sauria; Archelosauria; Archosauria; Dinosauria; Saurischia; Theropoda; Coelurosauria; Aves; Neognathae; Passeriformes; Passeroidea; Parulidae; Setophaga

Parent

Setophaga () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 182948)

NCBI Taxonomy ID

92122 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 92122)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

Setophaga petechia (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Setophaga petechia^#gephebase-summary-title)

Common Name

yellow warbler

Synonyms

Dendroica petechia; yellow warbler; Setophaga petechia (Linnaeus, 1766)

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Sauropsida; Sauria; Archelosauria; Archosauria; Dinosauria; Saurischia; Theropoda; Coelurosauria; Aves; Neognathae; Passeriformes; Passeroidea; Parulidae; Setophaga

Parent

Setophaga () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 182948)

NCBI Taxonomy ID

123631 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 123631)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

BCO2

Synonyms

BCDO2; B-DIOX-II

String

9606.ENSP00000350314 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=9606.ENSP00000350314)

Sequence Similarities

Belongs to the carotenoid oxygenase family.

GO - Molecular Function

GO:0046872 : metal ion binding (https://www.ebi.ac.uk/QuickGO/term/GO:0046872)
GO:0003834 : beta-carotene 15,15'-monooxygenase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0003834)
GO:0010436 : carotenoid dioxygenase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0010436)
GO:0004744 : retinal isomerase activity

UniProtKB Homo sapiens

Q9BYV7 (http://www.uniprot.org/uniprot/Q9BYV7)

GenebankID or UniProtKB

()

(https://www.ebi.ac.uk/QuickGO/term/GO:0004744)
GO:0102076 : beta,beta-carotene-9′,10′-cleaving oxygenase activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0102076)
GO:0016702 : oxidoreductase activity, acting on single donors with incorporation of molecular oxygen, incorporation of two atoms of oxygen
(https://www.ebi.ac.uk/QuickGO/term/GO:0016702)

GO - Biological Process

GO:0055114 : oxidation-reduction process
(https://www.ebi.ac.uk/QuickGO/term/GO:0055114)
GO:0001523 : retinoid metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0001523)
GO:0016121 : carotene catabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0016121)
GO:0042574 : retinal metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0042574)
GO:0016119 : carotene metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0016119)
GO:0016116 : carotenoid metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0016116)
GO:0051881 : regulation of mitochondrial membrane potential
(https://www.ebi.ac.uk/QuickGO/term/GO:0051881)
GO:2000377 : regulation of reactive oxygen species metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:2000377)
GO:0042573 : retinoic acid metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0042573)
GO:0016122 : xanthophyll metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0016122)

GO - Cellular Component

GO:0005739 : mitochondrion (https://www.ebi.ac.uk/QuickGO/term/GO:0005739)
GO:0005622 : intracellular (https://www.ebi.ac.uk/QuickGO/term/GO:0005622)
GO:0005759 : mitochondrial matrix (https://www.ebi.ac.uk/QuickGO/term/GO:0005759)

Presumptive Null

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

Molecular Type

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

Aberration Type

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

Molecular Details of the Mutation

-

Experimental Evidence

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

Main Reference

Pigmentation Genes Show Evidence of Repeated Divergence and Multiple Bouts of Introgression in Setophaga Warblers. (2021) (https://pubmed.ncbi.nlm.nih.gov/33259789)

Authors

Baiz MD; Wood AW; Brelsford A; Lovette IJ; Toews DPL

Abstract

Species radiations have long served as model systems in evolutionary biology. However, it has only recently become possible to study the genetic bases of the traits responsible for diversification and only in a small number of model systems. Here, we use genomes of 36 species of North, Central, and South American warblers to highlight the role of pigmentation genes-involved in melanin and carotenoid processing-in the diversification of this group. We show that agouti signaling protein (ASIP) and beta-carotene oxygenase 2 (BCO2) are predictably divergent between species that differ in the distribution of melanin and carotenoid in their plumages, respectively. Among species, sequence variation at ASIP broadly mirrors the species' phylogenetic history, consistent with repeated, independent mutations generating melanin-based variation. In contrast, BCO2 variation is highly discordant from the species tree, with evidence of cross-lineage introgression among species like the yellow warbler (Setophaga petechia) and magnolia warbler (S.Â magnolia) with extensive carotenoid-based coloration. We also detect introgression of a small part of the BCO2 coding region (<3 kb) in S.Â discolor and S.Â vitellina, including an amino acid substitution that is unique to warblers but otherwise highly conserved across birds. Lateral transfer of carotenoid-processing genes has been documented in arthropods, but introgression of BCO2 as demonstrated here-presumably adaptive-represents the first example of carotenoid gene transfer among vertebrates. These contrasting genomic patterns show that both independent evolution in a common set of genes and past hybridization have fueled plumage diversification in this colorful avian radiation.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

@Introgression