

GEPHE SUMMARY

	Gephebase Gene		GepheID
BCO2 = beta-carotene oxygenase 2 (<a +bco2+"beta-carotene+oxygenase+2"+#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase="+BCO2+"beta-carotene+oxygenase+2"+#gephebase-summary-title)	GP00002120		
	Entry Status	Santos	Main curator
Published			

PHENOTYPIC CHANGE

	Trait Category		
Morphology (<a +morphology"+#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait+Category=">https://www.gephebase.org/search-criteria?/and+Trait+Category="+Morphology"+#gephebase-summary-title)	Trait		
Coloration (ventral scales) (<a +coloration+(ventral+scales)+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait="+Coloration (ventral scales)+"#gephebase-summary-title)	Trait State in Taxon A		
Presence of yellow pigmentation	Trait State in Taxon B		
Absence of yellow: individuals have either orange or mosaic pigmentation (a mixture of orange and white)	Ancestral State		
Unknown	Taxonomic Status		
Intraspecific (<a +intraspecific"+#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status="+Intraspecific"+#gephebase-summary-title)			
	Taxon A		Taxon B
	Latin Name		Latin Name
Podarcis muralis (<a +podarcis+muralis"+#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Podarcis muralis"+#gephebase-summary-title)	Common Name		Common Name
Common wall lizard	Synonyms		Synonyms
Lacerrta muralis; Common wall lizard; Mauereidechse; Lacerrta muralis Dumeril & Bibron, 1893; Podarcis muralis (Dumeril & Bibron, 1839)	Rank		Rank
species	Lineage		Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Sauropsida; Sauria; Lepidosauria; Squamata; Bifurcata; Unidentata; Episquamata; Laterata; Lacertibaenia; Lacertidae; Lacertinae; Podarcis	Parent		Parent
Podarcis () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=42163)	NCBI Taxonomy ID		NCBI Taxonomy ID
64176 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=64176)	is Taxon A an Infrasppecies?		is Taxon B an Infrasppecies?
No			No

GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Mus musculus
Bco2	Synonyms		Q99NF1 (http://www.uniprot.org/uniprot/Q99NF1)
CMO2; Bcdo2; Bcmo2; B-diox-II	String		114585324 (https://www.ncbi.nlm.nih.gov/nucore/114585324)
10090.ENSMUSP00000112727 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=10090.ENSMUSP00000112727)	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
(<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: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>)

Presumptive Null

No (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=~No~#gephebase-summary-title>)

Molecular Type

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

Aberration Type

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

Molecular Details of the Mutation

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Experimental Evidence

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

Main Reference

Regulatory changes in pterin and carotenoid genes underlie balanced color polymorphisms in the wall lizard. (2019) (<https://pubmed.ncbi.nlm.nih.gov/30819892>)

Authors

Andrade P; Pinho C; PÃ©rez I de Lanuza G; Afonso S; Brejcha J; Rubin CJ; Wallerman O; Pereira P; Sabatino SJ; Bellati A; Pellitteri-Rosa D; Bosakova Z; Bunikis I; Carretero MA; Feiner N; Marsik P; PaupÃ©rio F; Salvi D; Soler L; While GM; Uller T; Font E; Andersson L; Carneiro M

Abstract

Reptiles use pterin and carotenoid pigments to produce yellow, orange, and red colors. These conspicuous colors serve a diversity of signaling functions, but their molecular basis remains unresolved. Here, we show that the genomes of sympatric color morphs of the European common wall lizard (*Podarcis muralis*), which differ in orange and yellow pigmentation and in their ecology and behavior, are virtually undifferentiated. Genetic differences are restricted to two small regulatory regions near genes associated with pterin [sepiapterin reductase (SPR)] and carotenoid [beta-carotene oxygenase 2 (BCO2)] metabolism, demonstrating that a core gene in the housekeeping pathway of pterin biosynthesis has been coopted for bright coloration in reptiles and indicating that these loci exert pleiotropic effects on other aspects of physiology. Pigmentation differences are explained by extremely divergent alleles, and haplotype analysis revealed abundant transspecific allele sharing with other lacertids exhibiting color polymorphisms. The evolution of these conspicuous color ornaments is the result of ancient genetic variation and cross-species hybridization.

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Additional References

RELATED GEPHE

Related Genes

1 (SPR) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~64176~/and+Trait=Coloration/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

