

GEPHE SUMMARY

cortex (<a +cortex+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase="+cortex+"#gephebase-summary-title)	Gephebase Gene	GP00001805	GepheID
Published	Entry Status	Martin	Main curator

PHENOTYPIC CHANGE

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 Category		
Coloration (wing) (<a +coloration+(wing)+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait="+Coloration+(wing)+"#gephebase-summary-title)	Trait		
Heliconius - wirlid-type pattern	Trait State in Taxon A		
Heliconius - ivory mutant - white wing	Trait State in Taxon B		
Taxon A	Ancestral State		
Domesticated (<a +domesticated+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status="+Domesticated+"#gephebase-summary-title)	Taxonomic Status		
	Taxon A		Taxon B
Heliconius melpomene (<a +heliconius+melpomene+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Heliconius+melpomene+"#gephebase-summary-title)	Latin Name	Heliconius melpomene (<a +heliconius+melpomene+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Heliconius+melpomene+"#gephebase-summary-title)	Latin Name
postman butterfly	Common Name	postman butterfly	Common Name
postman butterfly; common postman; Heliconius melpomene (Linnaeus, 1758)	Synonyms	postman butterfly; common postman; Heliconius melpomene (Linnaeus, 1758)	Synonyms
species	Rank	species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea; Nymphalidae; Heliconiinae; Heliconiini; Heliconius	Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea; Nymphalidae; Heliconiinae; Heliconiini; Heliconius	Lineage
Heliconius () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33416)	Parent	Heliconius () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33416)	Parent
34740 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34740)	NCBI Taxonomy ID	34740 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34740)	NCBI Taxonomy ID
No	is Taxon A an Intraspecies?	No	is Taxon B an Intraspecies?

GENOTYPIC CHANGE

cort	Generic Gene Name	Q960N3 (http://www.uniprot.org/uniprot/Q960N3)	UniProtKB Drosophila melanogaster
CG11330; cor; Cort; Dmel\CG11330	Synonyms	()	GenebankID or UniProtKB
7227.FBpp0078949 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0078949)	String		
Belongs to the WD repeat CORT family.	Sequence Similarities		
GO:0010997 : anaphase-promoting complex binding (https://www.ebi.ac.uk/QuickGO/term/GO:0010997)	GO - Molecular Function		
GO:0097027 : ubiquitin-protein transferase activator activity (https://www.ebi.ac.uk/QuickGO/term/GO:0097027)			
GO:0048477 : oogenesis (https://www.ebi.ac.uk/QuickGO/term/GO:0048477)	GO - Biological Process		

GO:0045143 : homologous chromosome segregation
 (https://www.ebi.ac.uk/QuickGO/term/GO:0045143)
 GO:0031145 : anaphase-promoting complex-dependent catabolic process
 (https://www.ebi.ac.uk/QuickGO/term/GO:0031145)
 GO:0007349 : cellularization (https://www.ebi.ac.uk/QuickGO/term/GO:0007349)
 GO:0007343 : egg activation (https://www.ebi.ac.uk/QuickGO/term/GO:0007343)
 GO:0007144 : female meiosis I (https://www.ebi.ac.uk/QuickGO/term/GO:0007144)
 GO:0007147 : female meiosis II (https://www.ebi.ac.uk/QuickGO/term/GO:0007147)
 GO:0007143 : female meiotic nuclear division
 (https://www.ebi.ac.uk/QuickGO/term/GO:0007143)
 GO:0007279 : pole cell formation (https://www.ebi.ac.uk/QuickGO/term/GO:0007279)
 GO:1905786 : positive regulation of anaphase-promoting complex-dependent catabolic
 process (https://www.ebi.ac.uk/QuickGO/term/GO:1905786)
 GO:1904668 : positive regulation of ubiquitin protein ligase activity
 (https://www.ebi.ac.uk/QuickGO/term/GO:1904668)

GO - Cellular Component

GO:0005737 : cytoplasm (https://www.ebi.ac.uk/QuickGO/term/GO:0005737)

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

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

Deletion Size

10-100 kb

Molecular Details of the Mutation

78-kb deletion in the 5â€² region of the cortex gene that includes a facultative 5â€²UTR exon detected in larval wing disk transcriptomes. Phenotypic effect confirmed by CRISPR mutagenesis of this exon. The ivory deletion causes the loss of 1 of 2 promoters.

Experimental Evidence

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

Main Reference

A large deletion at the cortex locus eliminates butterfly wing patterning. (2022) (https://pubmed.ncbi.nlm.nih.gov/35099556)

Authors

Hanly JJ; Livraghi L; Heryanto C; McMillan WO; Jiggins CD; Gilbert LE; Martin A

Abstract

As the genetic basis of natural and domesticated variation has been described in recent years, a number of hotspot genes have been repeatedly identified as the targets of selection, *Heliconius* butterflies display a spectacular diversity of pattern variants in the wild and the genetic basis of these patterns has been well-described. Here, we sought to identify the mechanism behind an unusual pattern variant that is instead found in captivity, the ivory mutant, in which all scales on both the wings and body become white or yellow. Using a combination of autozygosity mapping and coverage analysis from 37 captive individuals, we identify a 78-kb deletion at the cortex wing patterning locus, a gene which has been associated with wing pattern evolution in *H. melpomene* and 10 divergent lepidopteran species. This deletion is undetected among 458 wild *Heliconius* genomes samples, and its dosage explains both homozygous and heterozygous ivory phenotypes found in captivity. The deletion spans a large 5' region of the cortex gene that includes a facultative 5'UTR exon detected in larval wing disk transcriptomes. CRISPR mutagenesis of this exon replicates the wing phenotypes from coding knock-outs of cortex, consistent with a functional role of ivory-deleted elements in establishing scale color fate. Population demographics reveal that the stock giving rise to the ivory mutant has a mixed origin from across the wild range of *H. melpomene*, and supports a scenario where the ivory mutation occurred after the introduction of cortex haplotypes from Ecuador. Homozygotes for the ivory deletion are inviable while heterozygotes are the targets of artificial selection, joining 40 other examples of allelic variants that provide heterozygous advantage in animal populations under artificial selection by fanciers and breeders. Finally, our results highlight the promise of autozygosity and association mapping for identifying the genetic basis of aberrant mutations in captive insect populations.

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Additional References

RELATED GEPHE

Related Genes

2 (Optix, WntA) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^34740^/and+Trait=Coloration/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^cortex^/and+Taxon ID=^34740^/or+Gene Gephebase=^cortex^/and+Taxon ID=^34740^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS

@Parallelism

