

GEPHE SUMMARY

engrailed (<a +engrailed+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase="+engrailed+"#gephebase-summary-title)	Gephebase Gene	GP00002428	GepheID
Published	Entry Status	Courtier	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 ; Batesian mimicry) (<a +coloration+(wing+;+batesian+mimicry)+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait="+Coloration+(wing+;+Batesian+mimicry)+"#gephebase-summary-title)	Trait		
Papilio dardanus - recessive hippocooides morph	Trait State in Taxon A		
Papilio dardanus - cenea morph	Trait State in Taxon B		
Taxon A	Ancestral State		
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)	Taxonomic Status		
	Taxon A		Taxon B
Papilio dardanus (<a +papilio+dardanus+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Papilio+dardanus+"#gephebase-summary-title)	Latin Name	Papilio dardanus (<a +papilio+dardanus+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Papilio+dardanus+"#gephebase-summary-title)	Latin Name
African swallowtail butterfly	Common Name	African swallowtail butterfly	Common Name
African swallowtail butterfly; flying handkerchief; mocker swallowtail butterfly; Papilio dardanus Brown, 1776	Synonyms	African swallowtail butterfly; flying handkerchief; mocker swallowtail butterfly; Papilio dardanus Brown, 1776	Synonyms
species	Rank	species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Endopterygota; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Dityisia; Obtectomera; Papilionoidea; Papilionidae; Papilioninae; Papilionini; Papilio	Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Endopterygota; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Dityisia; Obtectomera; Papilionoidea; Papilionidae; Papilioninae; Papilionini; Papilio	Lineage
Papilio () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7145)	Parent	Papilio () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7145)	Parent
77259 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=77259)	NCBI Taxonomy ID	77259 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=77259)	NCBI Taxonomy ID
Yes	is Taxon A an Intraspecies?	Yes	is Taxon B an Intraspecies?
Papilio dardanus - hippocooides morph	Taxon A Description	Papilio dardanus - cenea morph	Taxon B Description

GENOTYPIC CHANGE

en	Generic Gene Name	P02836 (http://www.uniprot.org/uniprot/P02836)	UniProtKB Drosophila melanogaster
V; 153867_at; Apa; CG9015; Dmel\CG9015; En; EN; en1; Eng; Engr; Engrailed; Engrailed/Invected; EnR; Es; spa2; spt	Synonyms	()	GenebankID or UniProtKB
7227.FBpp0087197 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0087197)	String		
Belongs to the engrailed homeobox family.	Sequence Similarities		
GO:0000977 : RNA polymerase II regulatory region sequence-specific DNA binding (https://www.ebi.ac.uk/QuickGO/term/GO:0000977)	GO - Molecular Function		

GO:0043565 : sequence-specific DNA binding
 (https://www.ebi.ac.uk/QuickGO/term/GO:0043565)
 GO:0000981 : DNA-binding transcription factor activity, RNA polymerase II-specific
 (https://www.ebi.ac.uk/QuickGO/term/GO:0000981)
 GO:0000978 : RNA polymerase II proximal promoter sequence-specific DNA binding
 (https://www.ebi.ac.uk/QuickGO/term/GO:0000978)
 GO:0001227 : DNA-binding transcription repressor activity, RNA polymerase II-specific
 (https://www.ebi.ac.uk/QuickGO/term/GO:0001227)

GO - Biological Process

GO:0007400 : neuroblast fate determination
 (https://www.ebi.ac.uk/QuickGO/term/GO:0007400)
 GO:0030182 : neuron differentiation (https://www.ebi.ac.uk/QuickGO/term/GO:0030182)
 GO:0045944 : positive regulation of transcription by RNA polymerase II
 (https://www.ebi.ac.uk/QuickGO/term/GO:0045944)
 GO:0006357 : regulation of transcription by RNA polymerase II
 (https://www.ebi.ac.uk/QuickGO/term/GO:0006357)
 GO:0000122 : negative regulation of transcription by RNA polymerase II
 (https://www.ebi.ac.uk/QuickGO/term/GO:0000122)
 GO:0010629 : negative regulation of gene expression
 (https://www.ebi.ac.uk/QuickGO/term/GO:0010629)
 GO:0043524 : negative regulation of neuron apoptotic process
 (https://www.ebi.ac.uk/QuickGO/term/GO:0043524)
 GO:0010468 : regulation of gene expression
 (https://www.ebi.ac.uk/QuickGO/term/GO:0010468)
 GO:0007474 : imaginal disc-derived wing vein specification
 (https://www.ebi.ac.uk/QuickGO/term/GO:0007474)
 GO:0007487 : anialia development (https://www.ebi.ac.uk/QuickGO/term/GO:0007487)
 GO:0035215 : genital disc development
 (https://www.ebi.ac.uk/QuickGO/term/GO:0035215)
 GO:0008406 : gonad development (https://www.ebi.ac.uk/QuickGO/term/GO:0008406)
 GO:0007367 : segment polarity determination
 (https://www.ebi.ac.uk/QuickGO/term/GO:0007367)
 GO:0035277 : spiracle morphogenesis, open tracheal system
 (https://www.ebi.ac.uk/QuickGO/term/GO:0035277)
 GO:0007472 : wing disc morphogenesis
 (https://www.ebi.ac.uk/QuickGO/term/GO:0007472)
 GO:0007411 : axon guidance (https://www.ebi.ac.uk/QuickGO/term/GO:0007411)
 GO:0035289 : posterior head segmentation
 (https://www.ebi.ac.uk/QuickGO/term/GO:0035289)
 GO:0035290 : trunk segmentation (https://www.ebi.ac.uk/QuickGO/term/GO:0035290)
 GO:0035224 : genital disc anterior/posterior pattern formation
 (https://www.ebi.ac.uk/QuickGO/term/GO:0035224)
 GO:0007418 : ventral midline development
 (https://www.ebi.ac.uk/QuickGO/term/GO:0007418)
 GO:0035288 : anterior head segmentation
 (https://www.ebi.ac.uk/QuickGO/term/GO:0035288)
 GO:0048099 : anterior/posterior lineage restriction, imaginal disc
 (https://www.ebi.ac.uk/QuickGO/term/GO:0048099)
 GO:0007386 : compartment pattern specification
 (https://www.ebi.ac.uk/QuickGO/term/GO:0007386)
 GO:0007388 : posterior compartment specification
 (https://www.ebi.ac.uk/QuickGO/term/GO:0007388)
 GO:0048100 : wing disc anterior/posterior pattern formation
 (https://www.ebi.ac.uk/QuickGO/term/GO:0048100)

GO - Cellular Component

GO:0005634 : nucleus (https://www.ebi.ac.uk/QuickGO/term/GO:0005634)

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

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

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

Association with many nucleotide changes in a cis-regulatory region of engrailed. The diverged region exhibits a discrete chromosomal inversion of 40 kb relative to the ancestral orientation that is associated with the cenea morph, but not with the bottom-recessive hippocooides morph or with non-mimetic allopatric populations.

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

Mimicry diversification in *Papilio dardanus* via a genomic inversion in the regulatory region of engrailed-inverted. (2020) (https://pubmed.ncbi.nlm.nih.gov/32345166)

Timmermans MJTN; Srivathsan A; Collins S; Meier R; Vogler AP

Polymorphic Batesian mimics exhibit multiple protective morphs that each mimic a different noxious model. Here, we study the genomic transitions leading to the evolution of different mimetic wing patterns in the polymorphic Mocker Swallowtail *Papilio dardanus*. We generated a draft genome (231 Mb over 30 chromosomes) and re-sequenced individuals of three morphs. Genome-wide single nucleotide polymorphism (SNP) analysis revealed elevated linkage disequilibrium and divergence between morphs in the regulatory region of engrailed, a developmental gene previously implicated in the mimicry switch. The diverged region exhibits a discrete chromosomal inversion (of 40 kb) relative to the ancestral orientation that is associated with the cenea morph, but not with the bottom-recessive hippocooides morph or with non-mimetic allopatric populations. The functional role of this inversion in the expression of the novel phenotype is currently unknown, but by preventing recombination, it allows the stable inheritance of divergent alleles enabling geographic spread and local coexistence of multiple adaptive morphs.

Presumptive Null

Molecular Type

Aberration Type

Molecular Details of the Mutation

Experimental Evidence

Main Reference

Authors

Abstract

RELATED GEPHE

No matches found.

Related Genes

No matches found.

Related Haplotypes

EXTERNAL LINKS

COMMENTS

@Inversion @SexualTrait - Only the females are mimetic. Both sexual dimorphism and female polymorphisms presumably are driven by negative frequency-dependent selection from predators.