

GEPHE SUMMARY

yellow (https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=~yellow~#gephebase-summary-title)	Gephebase Gene	GP00002430	GepheID
Published	Entry Status	Courtier	Main curator

PHENOTYPIC CHANGE

Morphology (https://www.gephebase.org/search-criteria?/and+Trait+Category=~Morphology~#gephebase-summary-title)	Trait Category		
Coloration (wing) (https://www.gephebase.org/search-criteria?/and+Trait=~Coloration+(wing)~#gephebase-summary-title)	Trait		
Danaus chrysippus - chrysippus morph - orange background with black forewing tip - formerly bbcc	Trait State in Taxon A		
Danaus chrysippus - orientis morph - brown background with black forewing tip - formerly BBcc	Trait State in Taxon B		
Data not curated	Ancestral State		
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=~Intraspecific~#gephebase-summary-title)	Taxonomic Status		
	Taxon A		Taxon B
	Latin Name		Latin Name
Danaus chrysippus (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Danaus+chrysippus~#gephebase-summary-title)	Latin Name	Danaus chrysippus (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Danaus+chrysippus~#gephebase-summary-title)	Latin Name
African queen	Common Name	African queen	Common Name
Anosia chrysippus; African queen; common tiger; lesser wanderer; plain tiger; Danaus chrysippus (Linnaeus, 1758); Danaus chryssippus	Synonyms	Anosia chrysippus; African queen; common tiger; lesser wanderer; plain tiger; Danaus chrysippus (Linnaeus, 1758); Danaus chryssippus	Synonyms
species	Rank	species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Dityrsia; Obtectomera; Papilionoidea; Nymphalidae; Danainae; Danaini; Danaina; Danaus; Anosia	Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Dityrsia; Obtectomera; Papilionoidea; Nymphalidae; Danainae; Danaini; Danaina; Danaus; Anosia	Lineage
Anosia () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=151543)	Parent	Anosia () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=151543)	Parent
151541 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=151541)	NCBI Taxonomy ID	151541 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=151541)	NCBI Taxonomy ID
Yes	is Taxon A an Intraspecies?	Yes	is Taxon B an Intraspecies?
Danaus chrysippus - chrysippus morph	Taxon A Description	Danaus chrysippus - orientis morph	Taxon B Description

GENOTYPIC CHANGE

y	Generic Gene Name	P09957 (http://www.uniprot.org/uniprot/P09957)	UniProtKB Drosophila melanogaster
CG3757; Dmel\CG3757; EG:125H10.2; T6; Y	Synonyms		GenebankID or UniProtKB
7227.FBpp0070070 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0070070)	String		
Belongs to the major royal jelly protein family.	Sequence Similarities		
-	GO - Molecular Function		

GO - Biological Process

- GO:0042438 : melanin biosynthetic process (<https://www.ebi.ac.uk/QuickGO/term/GO:0042438>)
- GO:0048082 : regulation of adult chitin-containing cuticle pigmentation (<https://www.ebi.ac.uk/QuickGO/term/GO:0048082>)
- GO:0048066 : developmental pigmentation (<https://www.ebi.ac.uk/QuickGO/term/GO:0048066>)
- GO:0048067 : cuticle pigmentation (<https://www.ebi.ac.uk/QuickGO/term/GO:0048067>)
- GO:0006583 : melanin biosynthetic process from tyrosine (<https://www.ebi.ac.uk/QuickGO/term/GO:0006583>)
- GO:0048065 : male courtship behavior, veined wing extension (<https://www.ebi.ac.uk/QuickGO/term/GO:0048065>)
- GO:0060179 : male mating behavior (<https://www.ebi.ac.uk/QuickGO/term/GO:0060179>)

GO - Cellular Component

- GO:0005737 : cytoplasm (<https://www.ebi.ac.uk/QuickGO/term/GO:0005737>)
- GO:0005576 : extracellular region (<https://www.ebi.ac.uk/QuickGO/term/GO:0005576>)
- GO:0070451 : cell hair (<https://www.ebi.ac.uk/QuickGO/term/GO:0070451>)

Presumptive Null

No ([https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title](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](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](https://www.gephebase.org/search-criteria?/and+Aberration+Type=^Unknown^#gephebase-summary-title))

Molecular Details of the Mutation

A cluster of SNPs most strongly associated with background colour (B locus) is found just upstream of the gene yellow and a phylogenetic network for a 30-kb region around yellow groups individuals nearly perfectly by phenotype; although some individuals classed as heterozygous were intermingled with homozygotes.

Experimental Evidence

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

Main Reference

Whole-chromosome hitchhiking driven by a male-killing endosymbiont. (2020) (<https://pubmed.ncbi.nlm.nih.gov/32108180>)

Authors

Martin SH; Singh KS; Gordon IJ; Omufwoko KS; Collins S; Warren IA; Munby H; Brattström O; Traut W; Martins DJ; Smith DAS; Jiggins CD; Bass C; Ffrench-Constant RH

Abstract

Neo-sex chromosomes are found in many taxa, but the forces driving their emergence and spread are poorly understood. The female-specific neo-W chromosome of the African monarch (or queen) butterfly *Danaus chrysippus* presents an intriguing case study because it is restricted to a single 'contact zone' population, involves a putative colour patterning supergene, and co-occurs with infection by the male-killing endosymbiont *Spiroplasma*. We investigated the origin and evolution of this system using whole genome sequencing. We first identify the 'BC supergene', a broad region of suppressed recombination across nearly half a chromosome, which links two colour patterning loci. Association analysis suggests that the genes yellow and arrow in this region control the forewing colour pattern differences between *D. chrysippus* subspecies. We then show that the same chromosome has recently formed a neo-W that has spread through the contact zone within approximately 2,200 years. We also assembled the genome of the male-killing *Spiroplasma*, and find that it shows perfect genealogical congruence with the neo-W, suggesting that the neo-W has hitchhiked to high frequency as the male-killer has spread through the population. The complete absence of female crossing-over in the Lepidoptera causes whole-chromosome hitchhiking of a single neo-W haplotype, carrying a single allele of the BC supergene and dragging multiple non-synonymous mutations to high frequency. This has created a population of infected females that all carry the same recessive colour patterning allele, making the phenotypes of each successive generation highly dependent on uninfected male immigrants. Our findings show how hitchhiking can occur between the physically unlinked genomes of host and endosymbiont, with dramatic consequences.

Additional References

RELATED GEPHE

Related Genes

1 (arrow) ([https://www.gephebase.org/search-criteria?/or+Taxon ID=^151541^/and+Trait=Coloration/and+groupHaplotypes=true#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Taxon+ID=^151541^/and+Trait=Coloration/and+groupHaplotypes=true#gephebase-summary-title))

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

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