

GEPHE SUMMARY

ebony (https://www.gephebase.org/search-criteria?/and+GeneGephebase=~ebony~#gephebase-summary-title)	Gephebase Gene	GP00000253	GepheID
	Entry Status	Courtier	Main curator
	Published		

PHENOTYPIC CHANGE

		Trait Category	
Morphology (https://www.gephebase.org/search-criteria?/and+TraitCategory=~Morphology~#gephebase-summary-title)		Trait	
Coloration (posterior abdomen) (https://www.gephebase.org/search-criteria?/and+Trait=~Coloration (posterior abdomen)~#gephebase-summary-title)		Trait State in Taxon A	
Drosophila melanogaster -Uganda-Rwanda-Kenya; light		Trait State in Taxon B	
Drosophila melanogaster -Uganda-Rwanda; dark		Ancestral State	
Data not curated		Taxonomic Status	
Intraspecific (https://www.gephebase.org/search-criteria?/and+TaxonomicStatus=~Intraspecific~#gephebase-summary-title)			
Taxon A		Taxon B	
Drosophila melanogaster (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=~Drosophila melanogaster~#gephebase-summary-title)		Drosophila melanogaster (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=~Drosophila melanogaster~#gephebase-summary-title)	
fruit fly		fruit fly	
Sophophora melanogaster; fruit fly; Drosophila melanogaster Meigen, 1830; Sophophora melanogaster (Meigen, 1830); Drosophila melangaster		Sophophora melanogaster; fruit fly; Drosophila melanogaster Meigen, 1830; Sophophora melanogaster (Meigen, 1830); Drosophila melangaster	
species		species	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Diptera; Brachycera; Muscomorpha; Eremoneura; Cyclorrhapha; Schizophora; Acalyptratae; Ephydroidea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup		cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Diptera; Brachycera; Muscomorpha; Eremoneura; Cyclorrhapha; Schizophora; Acalyptratae; Ephydroidea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup	
melanogaster subgroup () - (Rank: species subgroup) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351)		melanogaster subgroup () - (Rank: species subgroup) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351)	
7227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227)		7227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227)	
is Taxon A an Intraspecies?		is Taxon B an Intraspecies?	
Yes		Yes	
Taxon A Description		Taxon B Description	
Drosophila melanogaster -Uganda-Rwanda-Kenya; light		Drosophila melanogaster -Uganda-Rwanda; dark	

GENOTYPIC CHANGE

		Generic Gene Name	
e		UniProtKB Drosophila melanogaster O76858 (http://www.uniprot.org/uniprot/O76858)	
ebony; CG3331		GenebankID or UniProtKB AJ224446 (https://www.ncbi.nlm.nih.gov/nuccore/AJ224446)	
-		String	
-		Sequence Similarities	
-		GO - Molecular Function	
GO:0000036 : acyl carrier activity (https://www.ebi.ac.uk/QuickGO/term/GO:0000036)			
GO:0003833 : beta-alanyl-dopamine synthase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0003833)			
GO:0031177 : phosphopantetheine binding			

(https://www.ebi.ac.uk/QuickGO/term/GO:0031177)

GO - Biological Process

- GO:0048085 : adult chitin-containing cuticle pigmentation
(https://www.ebi.ac.uk/QuickGO/term/GO:0048085)
- GO:0042417 : dopamine metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0042417)
- GO:0007623 : circadian rhythm (https://www.ebi.ac.uk/QuickGO/term/GO:0007623)
- 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:0043042 : amino acid adenylation by nonribosomal peptide synthase
(https://www.ebi.ac.uk/QuickGO/term/GO:0043042)
- GO:0007593 : chitin-based cuticle sclerotization
(https://www.ebi.ac.uk/QuickGO/term/GO:0007593)
- GO:0048067 : cuticle pigmentation (https://www.ebi.ac.uk/QuickGO/term/GO:0048067)
- GO:0001692 : histamine metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0001692)
- GO:0045475 : locomotor rhythm (https://www.ebi.ac.uk/QuickGO/term/GO:0045475)
- GO:0006583 : melanin biosynthetic process from tyrosine
(https://www.ebi.ac.uk/QuickGO/term/GO:0006583)
- GO:0048022 : negative regulation of melanin biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0048022)
- GO:0042440 : pigment metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0042440)

GO - Cellular Component

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

Mutation #1

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

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

Molecular Details of the Mutation

at least 5 substitutions within a 2.4kb enhancer that drives abdominal expression - 1st substitution

Experimental Evidence

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

Main Reference

Stepwise modification of a modular enhancer underlies adaptation in a Drosophila population. (2009) (https://pubmed.ncbi.nlm.nih.gov/20019281)

Authors

Rebeiz M; Pool JE; Kassner VA; Aquadro CF; Carroll SB

Abstract

The evolution of cis regulatory elements (enhancers) of developmentally regulated genes plays a large role in the evolution of animal morphology. However, the mutational path of enhancer evolution--the number, origin, effect, and order of mutations that alter enhancer function--has not been elucidated. Here, we localized a suite of substitutions in a modular enhancer of the ebony locus responsible for adaptive melanism in a Ugandan Drosophila population. We show that at least five mutations with varied effects arose recently from a combination of standing variation and new mutations and combined to create an allele of large phenotypic effect. We underscore how enhancers are distinct macromolecular entities, subject to fundamentally different, and generally more relaxed, functional constraints relative to protein sequences.

Additional References

Mutation #2

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

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

Molecular Details of the Mutation

at least 5 substitutions within a 2.4kb enhancer that drives abdominal expression - 2nd substitution

Experimental Evidence

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

Main Reference

Stepwise modification of a modular enhancer underlies adaptation in a Drosophila population. (2009) (https://pubmed.ncbi.nlm.nih.gov/20019281)

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Additional References

Mutation #3	
No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)	Presumptive Null
Cis-regulatory (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Cis-regulatory^#gephebase-summary-title)	Molecular Type
SNP (https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title)	Aberration Type
at least 5 substitutions within a 2.4kb enhancer that drives abdominal expression - 3rd substitution	Molecular Details of the Mutation
Linkage Mapping (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Linkage Mapping^#gephebase-summary-title)	Experimental Evidence
Stepwise modification of a modular enhancer underlies adaptation in a Drosophila population. (2009) (https://pubmed.ncbi.nlm.nih.gov/20019281)	Main Reference
Rebeiz M; Pool JE; Kassner VA; Aquadro CF; Carroll SB	Authors
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	Additional References

Mutation #4	
No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)	Presumptive Null
Cis-regulatory (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Cis-regulatory^#gephebase-summary-title)	Molecular Type
SNP (https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title)	Aberration Type
at least 5 substitutions within a 2.4kb enhancer that drives abdominal expression - 4th substitution	Molecular Details of the Mutation
Linkage Mapping (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Linkage Mapping^#gephebase-summary-title)	Experimental Evidence
Stepwise modification of a modular enhancer underlies adaptation in a Drosophila population. (2009) (https://pubmed.ncbi.nlm.nih.gov/20019281)	Main Reference
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	Additional References

Mutation #5	
No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)	Presumptive Null
Cis-regulatory (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Cis-regulatory^#gephebase-summary-title)	Molecular Type
SNP (https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title)	Aberration Type
at least 5 substitutions within a 2.4kb enhancer that drives abdominal expression - 5th substitution	Molecular Details of the Mutation
Linkage Mapping (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Linkage Mapping^#gephebase-summary-title)	Experimental Evidence
Stepwise modification of a modular enhancer underlies adaptation in a Drosophila population. (2009) (https://pubmed.ncbi.nlm.nih.gov/20019281)	Main Reference
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	Additional References

RELATED GEPHE

Related Genes

5 (bab, bab1, tan, yellow, wingless (wg)) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=^7227^/and+Trait=Coloration/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

2 (<https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^ebony^/and+Taxon ID=^7227^/or+Gene Gephebase=^ebony^/and+Taxon ID=^7227^#gephebase-summary-title>)

EXTERNAL LINKS

COMMENTS

@SeveralMutationsWithEffect - check also <http://flybase.org/reports/FBa0003294>