

GEPHE SUMMARY

	Gephebase Gene	GephelD
ebony (https://www.gephebase.org/search-criteria/?and+GeneGephebase=%22ebony%22#gephebase-summary-title)	GP00000253	Main curator
Published	Entry Status	Courtier

PHENOTYPIC CHANGE

	Trait Category	
Morphology (https://www.gephebase.org/search-criteria/?and+TraitCategory=%22Morphology%22#gephebase-summary-title)	Trait	
Coloration (posterior abdomen) (https://www.gephebase.org/search-criteria/?and+Trait=%22Coloration+(posterior+abdomen)%22#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=%22Intraspecific%22#gephebase-summary-title)		

Taxon A	Latin Name	Taxon B	Latin Name
Drosophila melanogaster (https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=%22Drosophila+melanogaster%22#gephebase-summary-title)		Drosophila melanogaster (https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=%22Drosophila+melanogaster%22#gephebase-summary-title)	
fruit fly	Common Name	fruit fly	Common Name
Sophophora melanogaster; fruit fly; Drosophila melanogaster Meigen, 1830; Sophophora melanogaster (Meigen, 1830); Drosophila melangaster	Synonyms	Sophophora melanogaster; fruit fly; Drosophila melanogaster Meigen, 1830; Sophophora melanogaster (Meigen, 1830); Drosophila melangaster	Synonyms
species	Rank	species	Rank
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; Ephydriodea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup	Lineage	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; Ephydriodea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup	Lineage
melanogaster subgroup () - (Rank: species subgroup) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32351)	Parent	melanogaster subgroup () - (Rank: species subgroup) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32351)	Parent
7227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7227)	NCBI Taxonomy ID	7227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7227)	NCBI Taxonomy ID
Yes	is Taxon A an Infraspecies?	Yes	is Taxon B an Infraspecies?
Drosophila melanogaster -Uganda-Rwanda-Kenya; light	Taxon A Description	Drosophila melanogaster -Uganda-Rwanda; dark	Taxon B Description

GENOTYPIC CHANGE

e	Generic Gene Name	UniProtKB Drosophila melanogaster
ebony; CG3331	Synonyms	GenebankID or UniProtKB
-	String	AJ224446 (https://www.ncbi.nlm.nih.gov/nuccore/AJ224446)
-	Sequence Similarities	
GO:0000036 : acyl carrier activity (https://www.ebi.ac.uk/QuickGO/term/GO:0000036)	GO - Molecular Function	
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 adenylylation 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=%22No%22#gephebase-summary-title)	Presumptive Null
Cis-regulatory (https://www.gephebase.org/search-criteria/?and+Molecular+Type=%22Cis-regulatory%22#gephebase-summary-title)	Molecular Type
SNP (https://www.gephebase.org/search-criteria/?and+Aberration+Type=%22SNP%22#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=%22Linkage+Mapping%22#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=%22No%22#gephebase-summary-title)	Presumptive Null
Cis-regulatory (https://www.gephebase.org/search-criteria/?and+Molecular+Type=%22Cis-regulatory%22#gephebase-summary-title)	Molecular Type
SNP (https://www.gephebase.org/search-criteria/?and+Aberration+Type=%22SNP%22#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=%22Linkage+Mapping%22#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=%22No%22#gephebase-summary-title)	Presumptive Null
Cis-regulatory (https://www.gephebase.org/search-criteria/?and+Molecular+Type=%22Cis-regulatory%22#gephebase-summary-title)	Molecular Type
SNP (https://www.gephebase.org/search-criteria/?and+Aberration+Type=%22SNP%22#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=%22Linkage+Mapping%22#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%27%20and%20Trait=Coloration%20and%20groupHaplotypes=true%23gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Taxon%20ID=%7227%27%20and%20Trait=Coloration%20and%20groupHaplotypes=true%23gephebase-summary-title))

Related Haplotypes

2 ([https://www.gephebase.org/search-criteria?/or+Gene Gephebase=%7ebony%27%20and%20Taxon ID=%7227%27%20or%20Gene Gephebase=%7ebony%27%20and%20Taxon ID=%7227%27%23gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene%20Gephebase=%7ebony%27%20and%20Taxon%20ID=%7227%27%20or%20Gene%20Gephebase=%7ebony%27%20and%20Taxon%20ID=%7227%27%23gephebase-summary-title))

EXTERNAL LINKS

COMMENTS

@SeveralMutationsWithEffect - check also <http://flybase.org/reports/FBal0003294>