GEPHE SUMMARY

Gephebase Gene

Aldehyde dehydrogenase (Aldh) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Aldehyde dehydrogenase (Aldh)^#gephebase-summary-title)

GepheID

GP00002007

Entry Status

Published

Main curator

Courtier

PHENOTYPIC CHANGE

Trait Category

Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title)

Trait

Xenobiotic resistance (alcohol) (https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic resistance (alcohol)^#gephebase-summary-title)

Trait State in Taxon A

Drosophila melanogaster - Leu allele - ethanol-susceptible

Trait State in Taxon B

Drosophila melanogaster - The Aldh Phe allele causes faster turnover of acetaldehyde than the ancestral AldhLeu allele, increases in frequency in laboratory populations selected for ethanol resistance and occurs at higher frequency in ethanol-resistant temperate populations than in ethanol-susceptible tropical populations.

Ancestral State

Taxon A

Taxonomic Status

Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intraspecific^#gephebase-summary-title)

Taxon A

Latin Name

Drosophila melanogaster (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Drosophila melanogaster^#gephebase-summary-title)

Common Name

fruit fly

Synonyms

Sophophora melanogaster; fruit fly; Drosophila melanogaster Meigen, 1830; Sophophora melanogaster (Meigen, 1830); Drosophila melangaster

Rank

species

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; Ephydroidea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup

Parent

melanogaster subgroup () - (Rank: species subgroup) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351)

NCBI Taxonomy ID

7227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

Drosophila melanogaster (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Drosophila melanogaster^#gephebase-summary-title)

Common Name

fruit fly

Synonyms

Sophophora melanogaster; fruit fly; Drosophila melanogaster Meigen, 1830; Sophophora melanogaster (Meigen, 1830); Drosophila melangaster

Rank

species

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; Ephydroidea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup

Parent

melanogaster subgroup () - (Rank: species subgroup) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351)

NCBI Taxonomy ID

7227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

Aldh

Synonyms

146084_at; ACDH; ALDH; ALDHA1; CG 3752; CG3752; DmALDH; Dmel\CG3752; Dmel_CG3752

String

7227.FBpp0079406 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0079406)

Sequence Similarities

Belongs to the aldehyde dehydrogenase family.

GO - Molecular Function

UniProtKB Drosophila melanogaster

Q9VLC5 (http://www.uniprot.org/uniprot/Q9VLC5)

GenebankID or UniProtKB

()

GO:0008774 : acetaldehyde dehydrogenase (acetylating) activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008774)
GO:0004029 : aldehyde dehydrogenase (NAD) activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004029)
GO:0043878 : glyceraldehyde-3-phosphate dehydrogenase (NAD+) (non-phosphorylating) activity (https://www.ebi.ac.uk/QuickGO/term/GO:0043878)

GO - Biological Process

GO:0006117 : acetaldehyde metabolic process (https://www.ebi.ac.uk/QuickGO/term/GO:0006117)
GO:1901215 : negative regulation of neuron death (https://www.ebi.ac.uk/QuickGO/term/GO:1901215)
GO:0045471 : response to ethanol (https://www.ebi.ac.uk/QuickGO/term/GO:0045471)
GO:0006090 : pyruvate metabolic process (https://www.ebi.ac.uk/QuickGO/term/GO:0006090)

GO - Cellular Component

GO:0005737 : cytoplasm (https://www.ebi.ac.uk/QuickGO/term/GO:0005737)
GO:0005739 : mitochondrion (https://www.ebi.ac.uk/QuickGO/term/GO:0005739)
GO:0005759 : mitochondrial matrix (https://www.ebi.ac.uk/QuickGO/term/GO:0005759)

Presumptive Null

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

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

L479F C9391311T

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	CTC	TTC	9391311
Amino-acid	Leu	Phe	479

Main Reference

A worldwide polymorphism in aldehyde dehydrogenase in Drosophila melanogaster: evidence for selection mediated by dietary ethanol. (2008) (https://pubmed.ncbi.nlm.nih.gov/18070084)

Authors

Fry JD; Donlon K; Saweikis M

Abstract

Clinally varying traits in Drosophila melanogaster provide good opportunities for elucidating the genetic basis of adaptation. Resistance to ethanol, a natural component of D. melanogaster's breeding sites, increases with latitude on multiple continents, indicating that the trait is under selection. Although the well-studied Alcohol dehydrogenase (Adh) polymorphism makes a contribution to the clines, it accounts for only a small proportion of the phenotypic variation. We describe an amino acid replacement polymorphism in Aldehyde dehydrogenase (Aldh), the gene encoding the second enzyme in the ethanol degradation pathway, that shows hallmarks of also contributing to the clines. The derived Aldh allele, like the Adh-Fast allele, increases in frequency in laboratory populations selected for ethanol resistance, and increases in frequency with latitude in wild populations. Moreover, strains with the derived allele have significantly higher ALDH enzyme activity with acetaldehyde (the breakdown product of ethanol) as a substrate than strains with the ancestral allele. As is the case with the Adh-Fast allele, chromosomes with the derived Aldh allele show markedly reduced molecular variation in the vicinity of the replacement polymorphism compared to those with the ancestral allele, suggesting a single, relatively recent origin. Nonetheless, the Aldh polymorphism differs from the Adh polymorphism in that the ethanol-associated allele remains in relatively low frequency in most populations. We present evidence that this is likely to be the result of a trade-off in catalytic activity, with the advantage of the derived allele in acetaldehyde detoxification being offset by a disadvantage in detoxification of other aldehydes.

Additional References

RELATED GEPHE

Related Genes

19 (Acetylcholinesterase (Ace-2), alcohol dehydrogenase (Adh), CG11699, Cyp12d1, Cyp28d1, Cyp28d1-Cyp28d2, cyp6d2, cyp6g1, glutamate-gated chloride channel (GluCl), GSS (glutathione synthetase), GSTE1-E10 cluster, kin of irre (kire), para (kdr), PHGPx, resistance to dieldrin, RnrS, SOD1, Ugt86Dd, CHKov1) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7227^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

Probably a trade-off in catalytic activity; with the advantage of the derived allele in acetaldehyde detoxification being offset by a disadvantage in detoxification of other aldehydes. http://flybase.org/reports/FBal0176415 http://flybase.org/reports/FBal0176416