

## GEPHE SUMMARY

Ugt86Dd ( <a href="https://www.gephebase.org/search-criteria/?and+GeneGephebase=^Ugt86Dd">#gephebase-summary-title)</a>	Gephebase Gene	GP00001406	GephelD
Published	Entry Status	Prigent	Main curator

## PHENOTYPIC CHANGE

Trait Category			
Physiology ( <a href="https://www.gephebase.org/search-criteria/?and+TraitCategory=^Physiology">#gephebase-summary-title)</a>	Trait		
Xenobiotic resistance (nicotine ; larval stage) ( <a ?and+taxonomicstatus='^Intraspecific"' href="https://www.gephebase.org/search-criteria/?and+Trait=^Xenobiotic+resistance+(nicotine+;+larval+stage)+#gephebase-summary-title)&lt;/a&gt;&lt;/td&gt;&lt;td&gt;Trait State in Taxon A&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;/tr&gt; &lt;tr&gt; &lt;td&gt;Drosophila melanogaster more resistant to nicotine&lt;/td&gt;&lt;td&gt;Trait State in Taxon B&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;/tr&gt; &lt;tr&gt; &lt;td&gt;Drosophila melanogaster less resistant to nicotine&lt;/td&gt;&lt;td&gt;Ancestral State&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;/tr&gt; &lt;tr&gt; &lt;td&gt;Taxon A&lt;/td&gt;&lt;td&gt;Taxonomic Status&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;/tr&gt; &lt;tr&gt; &lt;td&gt;Intraspecific (&lt;a href=" https:="" search-criteria="" www.gephebase.org="">#gephebase-summary-title)</a>			
Taxon A		Taxon B	
Drosophila melanogaster ( <a href="https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=^Drosophila+melanogaster">#gephebase-summary-title)</a> )	Latin Name	Drosophila melanogaster ( <a href="https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=^Drosophila+melanogaster">#gephebase-summary-title)</a> )	Latin Name
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; Ephydrioidea; 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; Ephydrioidea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup	Lineage
melanogaster subgroup () - (Rank: species subgroup) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351</a> )	Parent	melanogaster subgroup () - (Rank: species subgroup) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351</a> )	Parent
7227 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227</a> )	NCBI Taxonomy ID	7227 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227</a> )	NCBI Taxonomy ID
No	is Taxon A an Infraspecies?	No	is Taxon B an Infraspecies?

## GENOTYPIC CHANGE

Ugt86Dd	Generic Gene Name	UniProtKB Drosophila melanogaster
AC 006491D; CG6633; Dmel\CG6633; Dmel\_CG6633	Synonyms	GenebankID or UniProtKB
7227.FBpp0112233 ( <a href="http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0112233">http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0112233</a> )	String	53507 ( <a href="https://www.ncbi.nlm.nih.gov/nuccore/53507">https://www.ncbi.nlm.nih.gov/nuccore/53507</a> )
Belongs to the UDP-glycosyltransferase family.	Sequence Similarities	
GO:0015020 : glucuronosyltransferase activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0015020">https://www.ebi.ac.uk/QuickGO/term/GO:0015020</a> )	GO - Molecular Function	
GO:0008194 : UDP-glycosyltransferase activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0008194">https://www.ebi.ac.uk/QuickGO/term/GO:0008194</a> )		

## GO - Biological Process

## GO - Cellular Component

GO:0016021 : integral component of membrane  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0016021>)  
 GO:0043231 : intracellular membrane-bounded organelle  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0043231>)

Presumptive Null

Yes (<https://www.gephebase.org/search-criteria?/and+Presumptive+Null=%Yes%#gephebase-summary-title>)

Molecular Type

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

Aberration Type

Deletion (<https://www.gephebase.org/search-criteria?/and+Aberration+Type=%Deletion%#gephebase-summary-title>)

Deletion Size

10-99 bp

Molecular Details of the Mutation

22-bp frameshift deletion in Ugt86Dd - CRISPR-induced deletions in Ugt86Dd lead to a large reduction in resistance

Experimental Evidence

Association Mapping (<https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=%Association+Mapping%#gephebase-summary-title>)

Main Reference

Fine-mapping nicotine resistance loci in Drosophila using a multiparent advanced generation inter-cross population. (2014) (<https://pubmed.ncbi.nlm.nih.gov/25236448>)

Authors

Marriage TN; King EG; Long AD; Macdonald SJ

Abstract

Animals in nature are frequently challenged by toxic compounds, from those that occur naturally in plants as a defense against herbivory, to pesticides used to protect crops. On exposure to such xenobiotic substances, animals mount a transcriptional response, generating detoxification enzymes and transporters that metabolize and remove the toxin. Genetic variation in this response can lead to variation in the susceptibility of different genotypes to the toxic effects of a given xenobiotic. Here we use *Drosophila melanogaster* to dissect the genetic basis of larval resistance to nicotine, a common plant defense chemical and widely used addictive drug in humans. We identified quantitative trait loci (QTL) for the trait using the DSPR (*Drosophila Synthetic Population Resource*), a panel of multiparental advanced intercross lines. Mapped QTL collectively explain 68.4% of the broad-sense heritability for nicotine resistance. The two largest-effect loci contributing 50.3 and 8.5% to the genetic variation-map to short regions encompassing members of classic detoxification gene families. The largest QTL resides over a cluster of ten UDP-glucuronosyltransferase (UGT) genes, while the next largest QTL harbors a pair of cytochrome P450 genes. Using RNAseq we measured gene expression in a pair of DSPR founders predicted to harbor different alleles at both QTL and showed that Ugt86Dd, Cyp28d1, and Cyp28d2 had significantly higher expression in the founder carrying the allele conferring greater resistance. These genes are very strong candidates to harbor causative, regulatory polymorphisms that explain a large fraction of the genetic variation in larval nicotine resistance in the DSPR.

Copyright © 2014 by the Genetics Society of America.

Additional References

Naturally Segregating Variation at Ugt86Dd Contributes to Nicotine Resistance in *Drosophila melanogaster*. (2017) (<https://pubmed.ncbi.nlm.nih.gov/28743761>)

## RELATED GEPHE

## Related Genes

19 (Acetylcholinesterase (Ace-2), alcohol dehydrogenase (Adh), Aldehyde dehydrogenase (Aldh), CG11699, Cyp12d1, Cyp28d1, Cyp28d1-Cyp28d2, cyp6d2, cyp6g1, glutamate-gated chloride channel (GluCl), GSS (glutathione synthetase), GSTE1-E10 cluster, kin of ire (kire), para (kdr), PHGPx, resistance to dieldrin, RnrS, SOD1, CHKov1)  
 (<https://www.gephebase.org/search-criteria?/or+Taxon+ID=%7227%20and+Trait=Xenobiotic+resistance/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

No matches found.

## EXTERNAL LINKS

## COMMENTS

QTL mapping identified a cluster of 10 UDP-glucuronosyltransferase (UGT) genes. The candidate gene was identified according to induction of its expression in presence of nicotine. The effect of the deletion was tested using CRISPR in resistant lines. Despite this major effect of the deletion the allele appears to be very rare in wild-caught populations and likely explains only a small fraction of the natural variation for the trait.