

resistance to dieldrin (https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=%5Cresistance+to+dieldrin%5C#gephebase-summary-title)	Gephebase Gene	GP00002452	GepheID
Published	Entry Status	Courtier	Main curator

Physiology (https://www.gephebase.org/search-criteria?/and+Trait+Category=~Physiology^#gephebase-summary-title)		Trait Category
Xenobiotic resistance (insecticide) (https://www.gephebase.org/search-criteria?/and+Trait=~Xenobiotic resistance (insecticide)^#gephebase-summary-title)		Trait
Drosophila melanogaster		Trait State in Taxon A
Drosophila melanogaster - Rdl		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	
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)	Latin Name
fruit fly	fruit fly	Common Name
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	Synonyms
species	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; 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	Lineage
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)	Parent
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)	NCBI Taxonomy ID
No	No	is Taxon A an Intraspecies?

Rdl	Generic Gene Name	UniProtKB Drosophila melanogaster
CG10537; CT29555; Dmel\CG10537; DmRdl; DmRDL; gaba; GABA; GABA-R; GABA _r ; GABA[[A]]; GABA[[A]] receptor; GABA[[A]]-R; GABA[[A]]R; LCCH1; Rdl1; rdl; RDL	Synonyms	GenebankID or UniProtKB
7227.FBpp0305970 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier= 7227.FBpp0305970)	String	
Belongs to the ligand-gated ion channel (TC 1.A.9) family. Gamma-aminobutyric acid receptor (TC 1.A.9.5) subfamily.	Sequence Similarities	
GO:0004890 : GABA-A receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004890)	GO - Molecular Function	

GO:0022851 : GABA-gated chloride ion channel activity
(<https://www.ebi.ac.uk/QuickGO/term/GO:0022851>)
GO:0030594 : neurotransmitter receptor activity
(<https://www.ebi.ac.uk/QuickGO/term/GO:0030594>)

GO - Biological Process

GO:0007165 : signal transduction (<https://www.ebi.ac.uk/QuickGO/term/GO:0007165>)
GO:0007268 : chemical synaptic transmission
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007268>)
GO:0034220 : ion transmembrane transport
(<https://www.ebi.ac.uk/QuickGO/term/GO:0034220>)
GO:0042493 : response to drug (<https://www.ebi.ac.uk/QuickGO/term/GO:0042493>)
GO:0050877 : nervous system process
(<https://www.ebi.ac.uk/QuickGO/term/GO:0050877>)
GO:0042391 : regulation of membrane potential
(<https://www.ebi.ac.uk/QuickGO/term/GO:0042391>)
GO:0006811 : ion transport (<https://www.ebi.ac.uk/QuickGO/term/GO:0006811>)
GO:0042048 : olfactory behavior (<https://www.ebi.ac.uk/QuickGO/term/GO:0042048>)
GO:0030431 : sleep (<https://www.ebi.ac.uk/QuickGO/term/GO:0030431>)
GO:0009612 : response to mechanical stimulus
(<https://www.ebi.ac.uk/QuickGO/term/GO:0009612>)
GO:0002121 : inter-male aggressive behavior
(<https://www.ebi.ac.uk/QuickGO/term/GO:0002121>)
GO:0050805 : negative regulation of synaptic transmission
(<https://www.ebi.ac.uk/QuickGO/term/GO:0050805>)
GO:0042749 : regulation of circadian sleep/wake cycle
(<https://www.ebi.ac.uk/QuickGO/term/GO:0042749>)
GO:0090328 : regulation of olfactory learning
(<https://www.ebi.ac.uk/QuickGO/term/GO:0090328>)

GO - Cellular Component

GO:0016021 : integral component of membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0016021>)
GO:0005886 : plasma membrane (<https://www.ebi.ac.uk/QuickGO/term/GO:0005886>)
GO:0005887 : integral component of plasma membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0005887>)
GO:0030054 : cell junction (<https://www.ebi.ac.uk/QuickGO/term/GO:0030054>)
GO:0030425 : dendrite (<https://www.ebi.ac.uk/QuickGO/term/GO:0030425>)
GO:0043005 : neuron projection (<https://www.ebi.ac.uk/QuickGO/term/GO:0043005>)
GO:0030424 : axon (<https://www.ebi.ac.uk/QuickGO/term/GO:0030424>)
GO:0045211 : postsynaptic membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0045211>)
GO:0045202 : synapse (<https://www.ebi.ac.uk/QuickGO/term/GO:0045202>)
GO:0034707 : chloride channel complex
(<https://www.ebi.ac.uk/QuickGO/term/GO:0034707>)
GO:0032589 : neuron projection membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0032589>)
GO:0032809 : neuronal cell body membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0032809>)

	Presumptive Null
No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=~No~#gephebase-summary-title)	
	Molecular Type
Gene Amplification (https://www.gephebase.org/search-criteria?/and+Molecular Type=~Gene Amplification~#gephebase-summary-title)	
	Aberration Type
Insertion (https://www.gephebase.org/search-criteria?/and+Aberration Type=~Insertion~#gephebase-summary-title)	
	Insertion Size
100-1000 kb	
	Molecular Details of the Mutation
113-kb duplication containing one WT copy of Rdl and a second copy with two point mutations: an Ala(301) to Ser resistance mutation and Met(360) to Ile replacement. Individuals with this duplication exhibit intermediate dieldrin resistance compared with single copy Ser(301) homozygotes and reduced temperature sensitivity and altered RNA editing associated with the resistant allele. Ectopic recombination between Roo transposable elements is involved in generating this genomic rearrangement. The duplication phenotypes were confirmed by construction of a transgenic artificial duplication integrating the 55.7-kb Rdl locus with a Ser(301) change into an Ala(301) background.	
	Experimental Evidence
Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=~Candidate Gene~#gephebase-summary-title)	
	Main Reference
Gene duplication in the major insecticide target site, Rdl, in Drosophila melanogaster. (2013) (https://pubmed.ncbi.nlm.nih.gov/23959864)	
	Authors
Remnant EJ; Good RT; Schmidt JM; Lumb C; Robin C; Daborn PJ; Batterham P	

Abstract

The Resistance to Dieldrin gene, Rdl, encodes a GABA-gated chloride channel subunit that is targeted by cyclodiene and phenylpyrazole insecticides. The gene was first characterized in Drosophila melanogaster by genetic mapping of resistance to the cyclodiene dieldrin. The 4,000-fold resistance observed was due to a single amino acid replacement, Ala(301) to Ser. The equivalent change was subsequently identified in Rdl orthologs of a large range of resistant insect species. Here, we report identification of a duplication at the Rdl locus in D. melanogaster. The 113-kb duplication contains one WT copy of Rdl and a second copy with two point mutations: an Ala(301) to Ser resistance mutation and Met(360) to Ile replacement. Individuals with this duplication exhibit intermediate dieldrin resistance compared with single copy Ser(301) homozygotes, reduced temperature sensitivity, and altered RNA editing associated with the resistant allele. Ectopic recombination between Roo transposable elements is involved in generating this genomic rearrangement. The duplication phenotypes were confirmed by construction of a transgenic, artificial duplication integrating the 55.7-kb Rdl locus with a Ser(301) change into an Ala(301) background. Gene duplications can contribute significantly to the evolution of insecticide resistance, most commonly by increasing the amount of gene product produced. Here however, duplication of the Rdl target site creates permanent heterozygosity, providing unique potential for adaptive mutations to accrue in one copy, without abolishing the endogenous role of an essential gene.

Additional References

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 irre (kire), para (kdr), PHGPx, 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

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

EXTERNAL LINKS

COMMENTS

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