

GEPHE SUMMARY

	Gephebase Gene		GepheID
resistance to dieldrin (https://www.gephebase.org/search-criteria?/and+Gene Gephebase="resistance to dieldrin"#gephebase-summary-title)		GP00000974	
	Entry Status	Martin	Main curator
Published			

PHENOTYPIC CHANGE

	Trait Category		
Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category="Physiology"#gephebase-summary-title)			
	Trait		
Xenobiotic resistance (insecticide) (<a (insecticide)"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=" resistance="" xenobiotic="">https://www.gephebase.org/search-criteria?/and+Trait="Xenobiotic resistance (insecticide)"#gephebase-summary-title)			
	Trait State in Taxon A		
Drosophila melanogaster			
	Trait State in Taxon B		
Drosophila melanogaster - Rdl			
	Ancestral State		
Data not curated			
	Taxonomic Status		
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status="Intraspecific"#gephebase-summary-title)			
	Taxon A		Taxon B
	Latin Name		Latin Name
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)	
	Common Name		Common Name
fruit fly		fruit fly	
	Synonyms		Synonyms
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	
	Rank		Rank
species		species	
	Lineage		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		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		Parent
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)	
	NCBI Taxonomy ID		NCBI Taxonomy ID
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 Infraspecies?		is Taxon B an Infraspecies?
No		No	

GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Drosophila melanogaster
Rdl		P25123 (http://www.uniprot.org/uniprot/P25123)	
	Synonyms		GenebankID or UniProtKB
CG10537; CT29555; Dmel\CG10537; DmRdl; DmRDL; gaba; GABA; GABA-R; GABAR; GABA[[A]]; GABA[[A]] receptor; GABA[[A]]-R; GABA[[A]]R; LCCH1; Rdl1; rdl; RDL		U02042 (https://www.ncbi.nlm.nih.gov/nuccore/U02042)	
	String		
7227.FBpp0305970 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier= 7227.FBpp0305970)			
	Sequence Similarities		
Belongs to the ligand-gated ion channel (TC 1.A.9) family. Gamma-aminobutyric acid receptor (TC 1.A.9.5) subfamily.			
	GO - Molecular Function		
GO:0004890 : GABA-A receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004890)			

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

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

Ala302Ser - G9155164T

Experimental Evidence

Candidate Gene (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=~Candidate Gene~#gephebase-summary-title>)

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	-	-	-

Main Reference

A point mutation in a Drosophila GABA receptor confers insecticide resistance. (1993) (<https://pubmed.ncbi.nlm.nih.gov/8389005>)

Authors

Ffrench-Constant RH; Rocheleau TA; Steichen JC; Chalmers AE

Abstract

Vertebrates and invertebrates both have GABA (gamma-aminobutyric acid) as a major inhibitory neurotransmitter. GABAA receptors in vertebrates assemble as heteromultimers to form an integral chloride ion channel. These receptors are targets for drugs and pesticides and are also implicated in seizure-related diseases. Picrotoxinin (PTX) and cyclodiene insecticides are GABAA receptor antagonists which competitively displace each other from the same binding site. Insects and vertebrates showing resistance to cyclodienes also show cross-resistance to PTX. Previously, we used a field-isolated Drosophila mutant Rdl (Resistant to dieldrin) insensitive to PTX and cyclodienes to clone a putative GABA receptor. Here we report the functional expression and novel pharmacology of this GABA receptor and examine the functionality of a resistance-associated point mutation (alanine to serine) within the second membrane-spanning domain, the region thought to line the chloride ion channel pore. This substitution is found globally in Drosophila populations. This mutation not only identifies a single amino acid conferring

high levels of resistance to the important GABA receptor antagonist PTX but also, by conferring resistance to cyclodienes, may account for over 60% of reported cases of insecticide resistance.

Additional References

Expression of a *Drosophila* GABA receptor in a baculovirus insect cell system. Functional expression of insecticide susceptible and resistant GABA receptors from the cyclodiene resistance gene *Rdl*. (1993) (<https://pubmed.ncbi.nlm.nih.gov/8262177>)

A single-amino acid substitution in a gamma-aminobutyric acid subtype A receptor locus is associated with cyclodiene insecticide resistance in *Drosophila* populations. (1993) (<https://pubmed.ncbi.nlm.nih.gov/8095336>)

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

<http://flybase.org/reports/FBal0052119>