

GEPHE SUMMARY

	Gephebase Gene	GephelD
Acetylcholinesterase (Ace-2) (https://www.gephebase.org/search-criteria?/and+Gene	GP00002011	
Gephebase=^Acetylcholinesterase (Ace-2)^#gephebase-summary-title)		Main curator
	Entry Status	
Published	Courtier	

PHENOTYPIC CHANGE

Trait Category		
Physiology (https://www.gephebase.org/search-criteria?/and+Trait	Trait	
Category=^Physiology^#gephebase-summary-title)		
Xenobiotic resistance (insecticide) (https://www.gephebase.org/search-criteria?/and+Trait	Trait	
-Xenobiotic resistance (insecticide)^#gephebase-summary-title)		
	Trait State in Taxon A	
Drosophila melanogaster - sensitive	Trait State in Taxon B	
Drosophila melanogaster - resistant - Saltillo strain	Ancestral State	
Taxon A	Taxonomic Status	
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic		
Status=^Intraspecific^#gephebase-summary-title)		
Taxon A	Latin Name	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 melanogaster		
	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; Ephydriodea; 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	NCBI Taxonomy ID
7227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7227)		
	is Taxon A an Infraspecies?	is Taxon B an Infraspecies?
No		
	Taxon B Description	
	Saltillo strain	

GENOTYPIC CHANGE

Ace	Generic Gene Name	UniProtKB Drosophila melanogaster
	Synonyms	GenebankID or UniProtKB
AcChE; ace; ACE; ace-2;ache; AchE; AChE; CG17907; CHE; dAChE; dmAChE; DmAChE; Dmel\CG17907; Dm_ace; FBgn0000024; l(3)26; l(3)87Ed	P07140 (http://www.uniprot.org/uniprot/P07140)	
	String	
7227.FBpp0289713 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=7227.FBpp0289713)		
	Sequence Similarities	
Belongs to the type-B carboxylesterase/lipase family.		
GO:0042803 : protein homodimerization activity	GO - Molecular Function	

(<https://www.ebi.ac.uk/QuickGO/term/GO:0042803>)
 GO:0003990 : acetylcholinesterase activity
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0003990>)
 GO:0004104 : cholinesterase activity (<https://www.ebi.ac.uk/QuickGO/term/GO:0004104>)
 GO:0043199 : sulfate binding (<https://www.ebi.ac.uk/QuickGO/term/GO:0043199>)
 GO - Biological Process

GO:0006581 : acetylcholine catabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0006581>)
 GO:0001507 : acetylcholine catabolic process in synaptic cleft
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0001507>)
 GO:0007268 : chemical synaptic transmission
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0007268>)
 GO:0042426 : choline catabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0042426>)
 GO:0042331 : phototaxis (<https://www.ebi.ac.uk/QuickGO/term/GO:0042331>)
 GO - Cellular Component

GO:0005886 : plasma membrane (<https://www.ebi.ac.uk/QuickGO/term/GO:0005886>)
 GO:0005737 : cytoplasm (<https://www.ebi.ac.uk/QuickGO/term/GO:0005737>)
 GO:0031225 : anchored component of membrane
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0031225>)
 GO:0030054 : cell junction (<https://www.ebi.ac.uk/QuickGO/term/GO:0030054>)
 GO:0043083 : synaptic cleft (<https://www.ebi.ac.uk/QuickGO/term/GO:0043083>)

Mutation #1

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)	Presumptive Null
Coding (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title)	Molecular Type
SNP (https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title)	Aberration Type
Nonsynonymous	SNP Coding Change
Phe115Ser (position 78 in the corresponding mature Torpedo AChE). Tested in vitro in Xenopus oocytes	Molecular Details of the Mutation
Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title)	Experimental Evidence

Taxon A	Taxon B	Position
Codon	-	-
Amino-acid	Phe	Ser
		78

Resistance-associated point mutations in insecticide-insensitive acetylcholinesterase. (1994) (https://pubmed.ncbi.nlm.nih.gov/8016090)	Main Reference
Mutero A; Pralavorio M; Bride JM; Fournier D	Authors

Extensive utilization of pesticides against insects provides us with a good model for studying the adaptation of a eukaryotic genome to a strong selective pressure. One mechanism of resistance is the alteration of acetylcholinesterase (EC 3.1.1.7), the molecular target for organophosphates and carbamates. Here, we report the sequence analysis of the Ace gene in several resistant field strains of *Drosophila melanogaster*. This analysis resulted in the identification of five point mutations associated with reduced sensitivities to insecticides. In some cases, several of these mutations were found to be combined in the same protein, leading to different resistance patterns. Our results suggest that recombination between resistant alleles preexisting in natural populations is a mechanism by which insects rapidly adapt to new selective pressures.

Additional References

Mutation #2	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
Ile199Val (position 129 in the corresponding mature Torpedo AChE). Tested in vitro in Xenopus oocytes	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	Ile	Val
		129
Resistance-associated point mutations in insecticide-insensitive acetylcholinesterase. (1994) (https://pubmed.ncbi.nlm.nih.gov/8016090)	Main Reference	
Mutero A; Pralavorio M; Bride JM; Fournier D	Authors	
Extensive utilization of pesticides against insects provides us with a good model for studying the adaptation of a eukaryotic genome to a strong selective pressure. One mechanism of resistance is the alteration of acetylcholinesterase (EC 3.1.1.7), the molecular target for organophosphates and carbamates. Here, we report the sequence analysis of the Ace gene in several resistant field strains of <i>Drosophila melanogaster</i> . This analysis resulted in the identification of five point mutations associated with reduced sensitivities to insecticides. In some cases, several of these mutations were found to be combined in the same protein, leading to different resistance patterns. Our results suggest that recombination between resistant alleles preexisting in natural populations is a mechanism by which insects rapidly adapt to new selective pressures.	Abstract	
Mutations of acetylcholinesterase which confer insecticide resistance in <i>Drosophila melanogaster</i> populations. (2004) (https://pubmed.ncbi.nlm.nih.gov/15018651)	Additional References	

Mutation #3			
No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)		Presumptive Null	
Coding (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title)		Molecular Type	
SNP (https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title)		Aberration Type	
Nonsynonymous		SNP Coding Change	
Gly303Ala (position 227 in the corresponding mature Torpedo AChE). Tested in vitro in <i>Xenopus</i> oocytes		Molecular Details of the Mutation	
Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title)		Experimental Evidence	

Taxon A	Taxon B	Position
Codon	-	-
Amino-acid	Gly	Ala
		303
Resistance-associated point mutations in insecticide-insensitive acetylcholinesterase. (1994) (https://pubmed.ncbi.nlm.nih.gov/8016090)	Main Reference	
Mutero A; Pralavorio M; Bride JM; Fournier D	Authors	
Extensive utilization of pesticides against insects provides us with a good model for studying the adaptation of a eukaryotic genome to a strong selective pressure. One mechanism of resistance is the alteration of acetylcholinesterase (EC 3.1.1.7), the molecular target for organophosphates and carbamates. Here, we report the sequence analysis of the Ace gene in several resistant field strains of <i>Drosophila melanogaster</i> . This analysis resulted in the identification of five point mutations associated with reduced sensitivities to insecticides. In some cases, several of these mutations were found to be combined in the same protein, leading to different resistance patterns. Our results suggest that recombination between resistant alleles preexisting in natural populations is a mechanism by which insects rapidly adapt to new selective pressures.	Abstract	
Mutations of acetylcholinesterase which confer insecticide resistance in <i>Drosophila melanogaster</i> populations. (2004) (https://pubmed.ncbi.nlm.nih.gov/15018651)	Additional References	

Mutation #4			
No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)		Presumptive Null	
Coding (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title)		Molecular Type	
SNP (https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title)		Aberration Type	
Nonsynonymous		SNP Coding Change	
Phe368Tyr also named Phe330Tyr (position 288 in the corresponding mature Torpedo AChE). Tested in vitro in <i>Xenopus</i> oocytes		Molecular Details of the Mutation	
Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title)		Experimental Evidence	

Taxon A	Taxon B	Position
Codon	-	-
Amino-acid	Phe	Tyr
		368
Acetylcholinesterase. Two types of modifications confer resistance to insecticide. (1992) (https://pubmed.ncbi.nlm.nih.gov/1629220)	Main Reference	
Fournier D; Bride JM; Hoffmann F; Karch F	Authors	
Quantitative and qualitative changes in acetylcholinesterase confer resistance to insecticides. We have constructed several <i>Drosophila melanogaster</i> strains producing various amounts of enzyme by P-mediated transformation. Toxicological analysis of these strains demonstrates that resistance to organophosphorus insecticides is correlated with the amount of acetylcholinesterase in the central nervous system. Resistance may also be qualitatively determined. Comparison of the <i>Drosophila</i> acetylcholinesterase gene between a resistant strain caught in the wild and a wild type susceptible strain only revealed one nucleotide transition resulting in the replacement of a phenylalanine by a tyrosine. Flies mutant for acetylcholinesterase and rescued with a minigene mutagenized for this same transition produced an altered enzyme which renders flies resistant to pesticides.	Abstract	
Resistance-associated point mutations in insecticide-insensitive acetylcholinesterase. (1994) (https://pubmed.ncbi.nlm.nih.gov/8016090)	Additional References	
Mutations of acetylcholinesterase which confer insecticide resistance in <i>Drosophila melanogaster</i> populations. (2004) (https://pubmed.ncbi.nlm.nih.gov/15018651)		

RELATED GEPHE

Related Genes
 19 (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, Ugt86Dd, CHKov1) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=%7227%and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes
 4 ([https://www.gephebase.org/search-criteria?/or+Gene Gephebase=%Acetylcholinesterase \(Ace-2\)%and+Taxon ID=%7227%or+Gene Gephebase=%Acetylcholinesterase \(Ace-2\)%and+Taxon ID=%7227%#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene Gephebase=%Acetylcholinesterase (Ace-2)%and+Taxon ID=%7227%or+Gene Gephebase=%Acetylcholinesterase (Ace-2)%and+Taxon ID=%7227%#gephebase-summary-title))

EXTERNAL LINKS

COMMENTS

@SeveralMutationsWithEffect @Epistasis - <http://flybase.org/reports/FBal0295397> - <http://flybase.org/reports/FBal0295402> - <http://flybase.org/reports/FBal0295403> - <http://flybase.org/reports/FBal0295404>