GEPHE SUMMARY

Gephebase Gene
Acetylcholinesterase (Ace-2) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Acetylcholinesterase (Ace-2)^#gephebase-summary-title)

GepheID
GP00000043

Entry Status
Published

Main curator
Martin

PHENOTYPIC CHANGE

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

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

Trait State in Taxon A
Musca domestica - sensitive

Trait State in Taxon B
Musca domestica- resistant 77M; CH2

Ancestral State
Taxon A

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

Taxon A

Latin Name
Musca domestica (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Musca domestica^#gephebase-summary-title)

Common Name
house fly

Synonyms
house fly; Musca domestica Linnaeus, 1758

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; Calyptratae; Muscoidea; Muscidae; Muscinae; Muscini; Musca; Musca

Parent
Musca () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 44052)

NCBI Taxonomy ID
7370 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7370)

is Taxon A an Infraspecies?
No

Taxon B

Latin Name
Musca domestica (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Musca domestica^#gephebase-summary-title)

Common Name
house fly

Synonyms
house fly; Musca domestica Linnaeus, 1758

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; Calyptratae; Muscoidea; Muscidae; Muscinae; Muscini; Musca; Musca

Parent
Musca () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 44052)

NCBI Taxonomy ID
7370 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7370)

is Taxon B an Infraspecies?
Yes

Taxon B Description
Musca domestica- resistant 77M; CH2

GENOTYPIC CHANGE

Generic Gene Name
Ace

Synonyms
AcChE; ace; ACE; ace-2; ache; AchE; AChE; CG17907; CHE; dAChE; dmAChE; DmAChE; Dmel\CG17907; Dm_ace; FBgn0000024; l(3)26; l(3)87Ed

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 - Molecular Function
GO:0042803 : protein homodimerization activity (https://www.ebi.ac.uk/QuickGO/term/GO:0042803)
GO:0003990 : acetylcholinesterase activity

UniProtKB Drosophila melanogaster
P07140 (http://www.uniprot.org/uniprot/P07140)

GenebankID or UniProtKB
ACM68725 (https://www.ncbi.nlm.nih.gov/nuccore/ACM68725)

(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)

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

Gly262Ala

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

Identification and characterization of mutations in housefly (Musca domestica) acetylcholinesterase involved in insecticide resistance. (2001) (https://pubmed.ncbi.nlm.nih.gov/11563981)

Authors

Walsh SB; Dolden TA; Moores GD; Kristensen M; Lewis T; Devonshire AL; Williamson MS

Abstract

Acetylcholinesterase (AChE) insensitive to organophosphate and carbamate insecticides has been identified as a major resistance mechanism in numerous arthropod species. However, the associated genetic changes have been reported in the AChE genes from only three insect species; their role in conferring insecticide insensitivity has been confirmed, using functional expression, only for those in Drosophila melanogaster. The housefly, Musca domestica, was one of the first insects shown to have this mechanism; here we report the occurrence of five mutations (Val-180-->Leu, Gly-262-->Ala, Gly-262-->Val, Phe-327-->Tyr and Gly-365-->Ala) in the AChE gene of this species that, either singly or in combination, confer different spectra of insecticide resistance. The baculovirus expression of wild-type and mutated housefly AChE proteins has confirmed that the mutations each confer relatively modest levels of insecticide insensitivity except the novel Gly-262-->Val mutation, which results in much stronger resistance (up to 100-fold) to certain compounds. In all cases the effects of mutation combinations are additive. The mutations introduce amino acid substitutions that are larger than the corresponding wild-type residues and are located within the active site of the enzyme, close to the catalytic triad. The likely influence of these substitutions on the accessibility of the different types of inhibitor and the orientation of key catalytic residues are discussed in the light of the three-dimensional structures of the AChE protein from Torpedo californica and D. melanogaster.

Additional References

RELATED GEPHE

Related Genes

5 (Acetylcholinesterase (Ace), CYP6D1, esterase isozyme E7 = E3, para (kdr), resistance to dieldrin) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7370^/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=^7370^/or+Gene Gephebase=^Acetylcholinesterase (Ace-2)^/and+Taxon ID=^7370^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS