

GEPHE SUMMARY

	Gephebase Gene	GephelD
Acetylcholinesterase (Ace) (https://www.gephebase.org/search-criteria/?and+Gene	GP00000037	
Gephebase=^Acetylcholinesterase (Ace)^#gephebase-summary-title)		Main curator
Published	Entry Status	Martin

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 State in Taxon A	
Xenobiotic resistance (insecticide)^#gephebase-summary-title)		
Bactrocera oleae- sensitive	Trait State in Taxon B	
Bactrocera oleae - resistant	Ancestral State	
Taxon A	Taxonomic Status	
Intraspecific (https://www.gephebase.org/search-criteria/?and+Taxonomic		
Status="Intraspecific^#gephebase-summary-title)		
Taxon A		Taxon B
	Latin Name	Latin Name
Bactrocera oleae	(https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=Bactrocera+oleae^#gephebase-summary-title)	(https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=Bactrocera+oleae^#gephebase-summary-title)
	Common Name	Common Name
olive fruit fly	Synonyms	Synonyms
Bactrocera (Dacus) oleae; Bactrocera (Dacus) oleae; Dacus oleae; olive fruit fly; olive fly;		
Bactrocera oleae (Rossi, 1790)		
	Rank	Rank
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; Tephritoidea; Tephritidae; Dacinae; Dacini; Bactrocera; Dacus		
	Parent	Parent
Daculus () - (Rank: subgenus)		
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=69624)		
	NCBI Taxonomy ID	NCBI Taxonomy ID
104688		
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=104688)		
is Taxon A an Infraspecies?		is Taxon B an Infraspecies?
No		

GENOTYPIC CHANGE

Ace	Generic Gene Name	UniProtKB Drosophila melanogaster
	Synonyms	P07140 (http://www.uniprot.org/uniprot/P07140)
AcChE; ace; ACE; ace-2;ache; AchE; AChE; CG17907; CHE; dAChE; dmAChE; DmAChE; Dmel\CG17907; Dm_ace; FBgn0000024; l(3)26; l(3)87Ed		GenebankID or UniProtKB
7227.FBpp0289713	String	ABF55414 (https://www.ncbi.nlm.nih.gov/nuccore/ABF55414)
(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

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

I214V

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

214

Main Reference

Resistance-associated point mutations of organophosphate insensitive acetylcholinesterase, in the olive fruit fly *Bactrocera oleae*. (2002) (<https://pubmed.ncbi.nlm.nih.gov/12144698/>)

Authors

Vontas JG; Hejazi MJ; Hawkes NJ; Cosmidis N; Loukas M; Janes RW; Hemingway J

Abstract

A 2.2-kb full length cDNA containing an ORF encoding a putative acetylcholinesterase (AChE) precursor of 673 amino acid residues was obtained by a combined degenerate PCR and RACE strategy from an organophosphate-susceptible *Bactrocera oleae* strain. A comparison of cDNA sequences of individual insects from susceptible and resistant strains, coupled with an enzyme inhibition assay with omethoate, indicated a novel glycine-serine substitution (G488S), at an amino acid residue which is highly conserved across species (G396 of *Torpedocalifornica* AChE), as a likely cause of AChE insensitivity. This mutation was also associated with a 35-40% reduction in AChE catalytic efficiency. The I199V substitution, which confers low levels of resistance in *Drosophila*, was also present in *B. oleae* (I214V) and in combination with G488S produced up to a 16-fold decrease in insecticide sensitivity. This is the first agricultural pest where resistance has been associated with an alteration in AChE, which arises from point mutations located within the active site gorge of the enzyme.

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

G488S

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

Gly

Ser

488

Vontas JG; Hejazi MJ; Hawkes NJ; Cosmidis N; Loukas M; Janes RW; Hemingway J

Abstract

A 2.2-kb full length cDNA containing an ORF encoding a putative acetylcholinesterase (AChE) precursor of 673 amino acid residues was obtained by a combined degenerate PCR and RACE strategy from an organophosphate-susceptible *Bactrocera oleae* strain. A comparison of cDNA sequences of individual insects from susceptible and resistant strains, coupled with an enzyme inhibition assay with omethoate, indicated a novel glycine-serine substitution (G488S), at an amino acid residue which is highly conserved across species (G396 of *Torpedocalifornica* AChE), as a likely cause of AChE insensitivity. This mutation was also associated with a 35-40% reduction in AChE catalytic efficiency. The I199V substitution, which confers low levels of resistance in *Drosophila*, was also present in *B. oleae* (I214V) and in combination with G488S produced up to a 16-fold decrease in insecticide sensitivity. This is the first agricultural pest where resistance has been associated with an alteration in AChE, which arises from point mutations located within the active site gorge of the enzyme.

Additional References

RELATED GEPHE

Related Genes

1 (Acetylcholinesterase (Ace-2)) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=%104688%/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

1 ([https://www.gephebase.org/search-criteria?/or+Gene Gephebase=%Acetylcholinesterase \(Ace\)%/and+Taxon ID=%104688%/or+Gene Gephebase=%Acetylcholinesterase \(Ace\)%/and+Taxon ID=%104688%#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene Gephebase=%Acetylcholinesterase (Ace)%/and+Taxon ID=%104688%/or+Gene Gephebase=%Acetylcholinesterase (Ace)%/and+Taxon ID=%104688%#gephebase-summary-title))

EXTERNAL LINKS

COMMENTS

@SeveralMutationsWithEffect