

## GEPHE SUMMARY

	Gephebase Gene	GephelD
Acetylcholinesterase (Ace) ( <a href="https://www.gephebase.org/search-criteria?/and+Gene">https://www.gephebase.org/search-criteria?/and+Gene</a> Gephebase=^Acetylcholinesterase (Ace)^#gephebase-summary-title)	GP00000045	Main curator
Published	Entry Status	Martin

## PHENOTYPIC CHANGE

	Trait Category	
Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait">https://www.gephebase.org/search-criteria?/and+Trait</a> Category=^Physiology^#gephebase-summary-title)	Trait	
Xenobiotic resistance (insecticide) ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic+resistance+(insecticide)^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic+resistance+(insecticide)^#gephebase-summary-title</a> )	Trait State in Taxon A	
Bactrocera dorsalis- sensitive	Trait State in Taxon B	
Bactrocera dorsalis- artificially selected for resistance	Ancestral State	
Taxon A	Taxonomic Status	
Intraspecific ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic">https://www.gephebase.org/search-criteria?/and+Taxonomic</a> Status=^Intraspecific^#gephebase-summary-title)		
Taxon A	Latin Name	Taxon B
Bactrocera dorsalis ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Bactrocera+dorsalis^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Bactrocera+dorsalis^#gephebase-summary-title</a> )		Bactrocera dorsalis ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Bactrocera+dorsalis^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Bactrocera+dorsalis^#gephebase-summary-title</a> )
oriental fruit fly	Common Name	oriental fruit fly
Bactrocera (Bactrocera) dorsalis; Bactrocera (Bactrocera) invadens; Bactrocera invadens; Bactrocera papayae; Bactrocera philippinensis; oriental fruit fly; Philippines fruit fly; papaya fruit fly; Bactrocera dorsalis (Hendel, 1912); Bactrocera invadens Drew, Tsuruta & White, 2005; Bactrocera philippinensis Drew & Hancock, 1994	Synonyms	Bactrocera (Bactrocera) dorsalis; Bactrocera (Bactrocera) invadens; Bactrocera invadens; Bactrocera papayae; Bactrocera philippinensis; oriental fruit fly; Philippines fruit fly; papaya fruit fly; Bactrocera dorsalis (Hendel, 1912); Bactrocera invadens Drew, Tsuruta & White, 2005; Bactrocera philippinensis Drew & Hancock, 1994
Rank		Rank
species	Lineage	species
cellular organisms; Eukaryota; Opistokonta; 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; Bactrocera; Bactrocera dorsalis complex	cellular organisms; Eukaryota; Opistokonta; 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; Bactrocera; Bactrocera dorsalis complex	
Bactrocera dorsalis complex () - (Rank: no rank) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 98805">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 98805</a> )	Parent	Bactrocera dorsalis complex () - (Rank: no rank) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 98805">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 98805</a> )
27457 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 27457">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 27457</a> )	NCBI Taxonomy ID	27457 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 27457">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 27457</a> )
No	is Taxon A an Infraspecies?	is Taxon B an Infraspecies?

## GENOTYPIC CHANGE

	Generic Gene Name	UniProtKB Drosophila melanogaster
Ace	Synonyms	P07140 ( <a href="http://www.uniprot.org/uniprot/P07140">http://www.uniprot.org/uniprot/P07140</a> )
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	GenebankID or UniProtKB AAO06900 ( <a href="https://www.ncbi.nlm.nih.gov/nuccore/AAO06900">https://www.ncbi.nlm.nih.gov/nuccore/AAO06900</a> )
7227.FBpp0289713 ( <a href="http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0289713">http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0289713</a> )	Sequence Similarities	
Belongs to the type-B carboxylesterase/lipase family.	GO - Molecular Function	
GO:0042803 : protein homodimerization activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0042803">https://www.ebi.ac.uk/QuickGO/term/GO:0042803</a> )		

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 ( <a href="https://www.gephebase.org/search-criteria?/and+Presumptive+Null=^No^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Presumptive+Null=^No^#gephebase-summary-title</a> )	Presumptive Null
Coding ( <a href="https://www.gephebase.org/search-criteria?/and+Molecular+Type=^Coding^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Molecular+Type=^Coding^#gephebase-summary-title</a> )	Molecular Type
SNP ( <a href="https://www.gephebase.org/search-criteria?/and+Aberration+Type=^SNP^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Aberration+Type=^SNP^#gephebase-summary-title</a> )	Aberration Type
Nonsynonymous	SNP Coding Change
I214V + G488S (+ possibly Q643R)	Molecular Details of the Mutation
Candidate Gene ( <a href="https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=^Candidate+Gene^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=^Candidate+Gene^#gephebase-summary-title</a> )	Experimental Evidence

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

Main Reference  
Mutations in the acetylcholinesterase gene of *Bactrocera dorsalis* associated with resistance to organophosphorus insecticides. (2006) (<https://pubmed.ncbi.nlm.nih.gov/16651186>)  
Authors  
Hsu JC; Haymer DS; Wu WJ; Feng HT

Abstract  
Mutations in the gene encoding the enzyme acetylcholinesterase (AChE) of the oriental fruit fly, *Bactrocera dorsalis*, associated with resistance to an organophosphorus insecticide have been characterized. Three point mutations producing nonsynonymous changes in the predicted amino acid sequence of the product of the *B. dorsalis* ace gene in resistant vs. susceptible flies have been identified. One of these changes is unique to *B. dorsalis* while the other two occur at sites that are identical to mutations previously described for another *Bactrocera* species. Although the precise role of the third mutation is not clearly established, the independent origin of two identical alterations in these two species strongly supports the idea proposed previously that molecular changes associated with insecticide resistance in key genes and enzymes such as AChE are largely constrained to a limited number of sites. The results obtained here also suggest that the widespread use of organophosphorus insecticides will likely lead to a predictable acquisition of resistance in wild populations of *B. dorsalis* as well as other pest species. For surveys of *B. dorsalis* populations that may develop resistance, diagnostic tests using PCR-RFLP based methods for detecting the presence of all three mutations in individual flies are described.

Additional References

#### Mutation #2

No ( <a href="https://www.gephebase.org/search-criteria?/and+Presumptive+Null=^No^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Presumptive+Null=^No^#gephebase-summary-title</a> )	Presumptive Null
Coding ( <a href="https://www.gephebase.org/search-criteria?/and+Molecular+Type=^Coding^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Molecular+Type=^Coding^#gephebase-summary-title</a> )	Molecular Type
SNP ( <a href="https://www.gephebase.org/search-criteria?/and+Aberration+Type=^SNP^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Aberration+Type=^SNP^#gephebase-summary-title</a> )	Aberration Type
Nonsynonymous	SNP Coding Change
I214V + G488S (+ possibly Q643R)	Molecular Details of the Mutation
Candidate Gene ( <a href="https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=^Candidate+Gene^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=^Candidate+Gene^#gephebase-summary-title</a> )	Experimental Evidence

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Gly	Ser	488
Mutations in the acetylcholinesterase gene of <i>Bactrocera dorsalis</i> associated with resistance to organophosphorus insecticides. (2006) ( <a href="https://pubmed.ncbi.nlm.nih.gov/16651186">https://pubmed.ncbi.nlm.nih.gov/16651186</a> )			Main Reference
Hsu JC; Haymer DS; Wu WJ; Feng HT			Authors
<p>Mutations in the gene encoding the enzyme acetylcholinesterase (AChE) of the oriental fruit fly, <i>Bactrocera dorsalis</i>, associated with resistance to an organophosphorus insecticide have been characterized. Three point mutations producing nonsynonymous changes in the predicted amino acid sequence of the product of the <i>B. dorsalis</i> ace gene in resistant vs. susceptible flies have been identified. One of these changes is unique to <i>B. dorsalis</i> while the other two occur at sites that are identical to mutations previously described for another <i>Bactrocera</i> species. Although the precise role of the third mutation is not clearly established, the independent origin of two identical alterations in these two species strongly supports the idea proposed previously that molecular changes associated with insecticide resistance in key genes and enzymes such as AChE are largely constrained to a limited number of sites. The results obtained here also suggest that the widespread use of organophosphorus insecticides will likely lead to a predictable acquisition of resistance in wild populations of <i>B. dorsalis</i> as well as other pest species. For surveys of <i>B. dorsalis</i> populations that may develop resistance, diagnostic tests using PCR-RFLP based methods for detecting the presence of all three mutations in individual flies are described.</p>			Abstract
			Additional References

## RELATED GEPHE

Related Genes
1 (nAChR) ( <a href="https://www.gephebase.org/search-criteria?/or+Taxon ID=^27457^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title">https://www.gephebase.org/search-criteria?/or+Taxon ID=^27457^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title</a> )
Related Haplotypes

No matches found.

## EXTERNAL LINKS

## COMMENTS

The I214V substitution observed here in *B. dorsalis* is identical to one of the changes reported in the altered AChE enzyme described for a strain of *B. oleae* exhibiting high levels of organophosphate resistance (Vontas et al., 2002). This change is also equivalent to the I199V substitution in *Drosophila* (Mutero et al., 1994). The G488S substitution seen in *B. dorsalis* is also identical to a second change in the AChE enzyme structure in resistant *B. oleae* flies (Vontas et al., 2002). This substitution (G488) is also equivalent to the G396 in torpedo, or G474 in *Drosophila*.