

## GEPHE SUMMARY

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

<p>Physiology (<a href="https://www.gephebase.org/search-criteria?/and+Trait">https://www.gephebase.org/search-criteria?/and+Trait</a>)  Category=<sup>^</sup>Physiology<sup>^</sup>#gephebase-summary-title</p> <p>Xenobiotic resistance (insecticide) (<a href="https://www.gephebase.org/search-criteria?/and+Trait=&lt;sup&gt;^&lt;/sup&gt;Xenobiotic resistance (insecticide)&lt;sup&gt;^&lt;/sup&gt;#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait=<sup>^</sup>Xenobiotic resistance (insecticide)<sup>^</sup>#gephebase-summary-title</a>)</p> <p>Bactrocera dorsalis- sensitive</p> <p>Bactrocera dorsalis- artificially selected for resistance</p> <p>Taxon A</p> <p>Intraspecific (<a href="https://www.gephebase.org/search-criteria?/and+Taxonomic">https://www.gephebase.org/search-criteria?/and+Taxonomic</a>)  Status=<sup>^</sup>Intraspecific<sup>^</sup>#gephebase-summary-title</p>	<p>Trait Category</p> <p>Trait</p> <p>Trait State in Taxon A</p> <p>Trait State in Taxon B</p> <p>Ancestral State</p> <p>Taxonomic Status</p>	<p>Taxon A</p> <p>Latin Name</p> <p>Bactrocera dorsalis  (<a href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=&lt;sup&gt;^&lt;/sup&gt;Bactrocera dorsalis&lt;sup&gt;^&lt;/sup&gt;#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=<sup>^</sup>Bactrocera dorsalis<sup>^</sup>#gephebase-summary-title</a>)</p> <p>Common Name</p> <p>oriental fruit fly</p> <p>Synonyms</p> <p>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 &amp; White, 2005; Bactrocera philippinensis Drew &amp; Hancock, 1994</p> <p>Rank</p> <p>species</p> <p>Lineage</p> <p>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; Acalyptera; Tephritoidea; Tephritidae; Dacinae; Dacini; Bactrocera; Bactrocera; Bactrocera dorsalis complex</p> <p>Parent</p> <p>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>)</p> <p>NCBI Taxonomy ID</p> <p>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>)</p> <p>is Taxon A an Intraspecies?</p> <p>No</p>	<p>Taxon B</p> <p>Latin Name</p> <p>Bactrocera dorsalis  (<a href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=&lt;sup&gt;^&lt;/sup&gt;Bactrocera dorsalis&lt;sup&gt;^&lt;/sup&gt;#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=<sup>^</sup>Bactrocera dorsalis<sup>^</sup>#gephebase-summary-title</a>)</p> <p>Common Name</p> <p>oriental fruit fly</p> <p>Synonyms</p> <p>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 &amp; White, 2005; Bactrocera philippinensis Drew &amp; Hancock, 1994</p> <p>Rank</p> <p>species</p> <p>Lineage</p> <p>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; Acalyptera; Tephritoidea; Tephritidae; Dacinae; Dacini; Bactrocera; Bactrocera; Bactrocera dorsalis complex</p> <p>Parent</p> <p>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>)</p> <p>NCBI Taxonomy ID</p> <p>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>)</p> <p>is Taxon B an Intraspecies?</p> <p>No</p>
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## GENOTYPIC CHANGE

<p>Ace</p> <p>AcChE; ace; ACE; ace-2; ache; AchE; AChE; CG17907; CHE; dAChE; dmAChE; DmAChE; Dmel\CG17907; Dm_ace; FBgn0000024; I(3)26; I(3)87Ed</p> <p>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>)</p> <p>Belongs to the type-B carboxylesterase/lipase family.</p> <p>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>)</p>	<p>Generic Gene Name</p> <p>Synonyms</p> <p>String</p> <p>Sequence Similarities</p> <p>GO - Molecular Function</p>	<p>UniProtKB Drosophila melanogaster</p> <p>P07140 (<a href="http://www.uniprot.org/uniprot/P07140">http://www.uniprot.org/uniprot/P07140</a>)</p> <p>GenebankID or UniProtKB</p> <p>AAO06900 (<a href="https://www.ncbi.nlm.nih.gov/nucleotide/AAO06900">https://www.ncbi.nlm.nih.gov/nucleotide/AAO06900</a>)</p>
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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  
 I214V + G488S (+ possibly Q643R) 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	Ile	Val	214

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

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 (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  
 I214V + G488S (+ possibly Q643R) 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	Ser	488

#### 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

## RELATED GEPHE

#### Related Genes

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

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*.