GEPHE SUMMARY

Gephebase Gene
Acetylcholinesterase (Ace)

GephelD
GP00000045

Entry Status
Published

Main curator
Martin

PHENOTYPIC CHANGE

Trait Category
Physiology

Trait
Xenobiotic resistance (insecticide)

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

Taxon A

Latin Name
Bactrocera dorsalis

Common Name
oriental fruit fly

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
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; Tephritoidea; Tephritidae; Dacinae; Dacini; Bactrocera; Bactrocera; Bactrocera dorsalis complex

Parent
Bactrocera dorsalis complex () - (Rank: no rank)

NCBI Taxonomy ID
27457

is Taxon A an Infraspecies?
No

Taxon B

Latin Name
Bactrocera dorsalis

Common Name
oriental fruit fly

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
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; Tephritoidea; Tephritidae; Dacinae; Dacini; Bactrocera; Bactrocera; Bactrocera dorsalis complex

Parent
Bactrocera dorsalis complex () - (Rank: no rank)

NCBI Taxonomy ID
27457

is Taxon B an Infraspecies?
No

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

Sequence Similarities
Belongs to the type-B carboxylesterase/lipase family.

GO - Molecular Function
GO:0042803 : protein homodimerization activity
GO:0003990 : acetylcholinesterase activity
GO:0004104 : cholinesterase activity
GO:0043199 : sulfate binding

GO - Biological Process

UniProtKB Drosophila melanogaster
P07140

GenebankID or UniProtKB
AAO06900

GO:0006581 : acetylcholine catabolic process
GO:0001507 : acetylcholine catabolic process in synaptic cleft
GO:0007268 : chemical synaptic transmission
GO:0042426 : choline catabolic process
GO:0042331 : phototaxis

GO - Cellular Component
GO:0005886 : plasma membrane
GO:0005737 : cytoplasm
GO:0031225 : anchored component of membrane
GO:0030054 : cell junction
GO:0043083 : synaptic cleft

Mutation #1
Presumptive Null
No

Molecular Type
Coding

Aberration Type
SNP

SNP Coding Change
Nonsynonymous

Molecular Details of the Mutation
I214V + G488S (+ possibly Q643R)

Experimental Evidence
Candidate Gene

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ile	Val	214

Main Reference
Mutations in the acetylcholinesterase gene of Bactrocera dorsalis associated with resistance to organophosphorus insecticides. (2006)

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
Presumptive Null
No

Molecular Type
Coding

Aberration Type
SNP

SNP Coding Change
Nonsynonymous

Molecular Details of the Mutation
I214V + G488S (+ possibly Q643R)

Experimental Evidence
Candidate Gene

	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)

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
No matches found.
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.